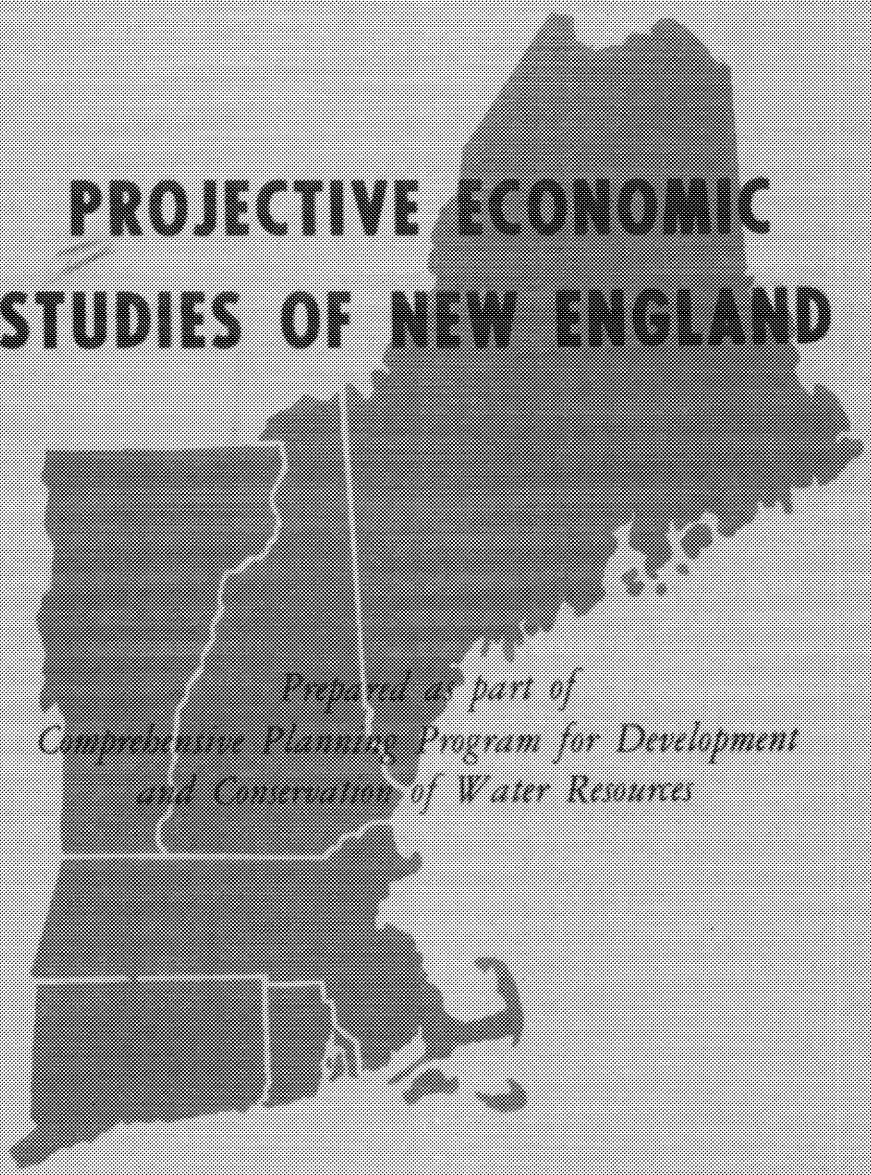
PROJECTIVE ECONOMIC STUDIES OF NEW ENGLAND



Prepared as part of
Comprehensive Planning Program for Development
and Conservation of Water Resources

U.S. ARMY ENGINEER DIVISION, NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MASS.

ARTHUR D. LITTLE, INC. - CAMBRIDGE, MASS.
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13 October 1964

Brig. Gen. P.C. Hyzer
Division Engineer
U.S. Army Engineer Division, New England
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts, 02154

Dear General Hyzer:

We are pleased to submit our report entitled A Projective Economic Study of New England, which represents the first of a series of reports outlining the possible development of the region, its component states, and substate areas. The purpose of these economic studies is to provide a projective underpinning for the comprehensive river basin studies being undertaken by the Corps of Engineers in cooperation with other federal agencies and the New England states.

The work was executed by members of the Regional Economics staff of Arthur D. Little, Inc. Dr. A. George Gols, Senior Staff Economist, was responsible for the development of the methodology and the implementation of the projective framework. He was ably supported by Stanley Warner, Anne Sheehan, Kirkor Bozdogan, and Laurel Lunt. Several industry specialists on the staff of the Management Services Division were consulted in the development of the major manufacturing industry projections.

We also wish to acknowledge the cooperation of Messrs. Robert J. Frazier and George R. Phippen on the river basin project staff, New England Division, Corps of Engineers, and of the members of the Coordinating Committee for the Connecticut River Comprehensive Water Resource Investigations.

We appreciate the opportunity to undertake this challenging assignment and hope that this report, as well as those to follow under the same program of studies, will contribute to a better understanding of the opportunities and the limitations inherent in the development of long-range economic projections at the regional level.

Sincerely yours,

Peter M. Stern
Project Director

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PROJECTIVE ECONOMIC STUDIES OF NEW ENGLAND

PART I THE REGION

PART II THE STATES

PART III SUB-STATE AREAS

APPENDICES

PART I
PART II
PART III

Prepared For the U. S. Army Engineer Division, New England. Corps of Engineers, as Part of Comprehensive Planning Program For Development and Conservation of Water Resources

By Arthur D. Little, Inc.

PROJECTIVE ECONOMIC STUDY OF NEW ENGLAND

PART I

THE REGION

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CHAPTER I - INTRODUCTION

This report presents the results of a projective economic survey of New England designed to furnish guides for appraising future growth in relation to water requirements. It is the first of three reports, the subsequent ones dealing with socio-economic projections of the individual New England states and specified sub-state areas. The long-term demographic and economic projections produced by this study thus serve as a regional framework for the state and sub-state forecasts required in the next round of studies, and as a quantitative guide for planning the comprehensive development of the water and related land resources of the Connecticut River Basin.

1. ORGANIZATION OF THE REPORT

This report is organized with the user in mind. Chapter II presents the projection results; that is, the population, labor force, employment and output figures for the benchmark and terminal years of the 60-year projection period, 1960-2020, for the New England area as a whole. These data will presumably be used by the agencies working together to develop long-term plans for water and related land resources in the region.

Chapter III outlines the methodology adopted for this study and traces the sequence of steps designed to yield projection results that are credible (in view of the very distant projection horizon) and internally consistent, i.e., verified by a number of checks and parallel approaches. This chapter also comments on the assumptions and biases introduced by the national growth projections developed by the Economic Task Group of the Ad Hoc Water Resources Council Staff.

For those who will need to retrace the steps followed in making these projections for New England, Chapter IV gives a description of the operational or "how-to-do-it" procedures, and thus provides the link between the methodology (Chapter III) and the results (Chapter II). For the sake of clarity and conciseness, detailed explanations of these procedures, as well as national growth data and individual industry projections, have been relegated to the Appendices.

2. PROJECTIONS AND THEIR ASSUMPTIONS

Economic projections attempt a view of the future based primarily on present knowledge of foreseeable developments and relationships of the past. Once the strategic assumptions are made, and the projective apparatus is spelled out, the projections follow logically from the assumptions. It should be clear, therefore, that a projection is not a prediction or a prophesy of the future, but rather a forecast of what might occur if a number of specific assumptions regarding the structure and behavior of the economy were, in fact, to materialize.

The assumptions made for this study take their cue from the stipulation by the Corps of Engineers that the economic projections should be based on "the timely availability of water in sufficient quantity and quality to support the projected economy . . ." and "a high level of national employment and activity, no major depressions or wars, and a continuation of the current relative needs of the civilian economy and the national defense."

This stipulation, as well as the national growth projections furnished by the Economic Task Group of the Ad Hoc Water Resources Council Staff, were carefully followed in the working assumptions which guided every step of our economic study. It should also be noted that several specific industry projections (for agriculture, forestry, lumber and wood products, and paper) were prepared independently by the Economic Research Service and the Forest Service, U.S. Department of Agriculture, and were then incorporated into the projection framework presented in this report.

Being an outgrowth of specific assumptions, projections should lend themselves to alterations. As conditions change and new data become available for the nation and for the region, it will be necessary to change the assumptions on which the study is based. Revised projections resulting from a new set of assumptions should then be obtained. In order to facilitate this task, we have been as explicit as possible in our description of the methodology and the implementation of our projective framework.

CHAPTER II - PROJECTION RESULTS

3. INTRODUCTION

The history of New England's economic development follows a pattern similar to that of the United States. The important difference is that the process of transition from an "extractive" to a "processing" and then to a "service" economy started earlier in New England and appears to have been carried beyond the national stage of development. Fifty years ago the manufacturing sector of the region's labor force was twice as large, relatively, as that in the nation's labor force. Today, this sector is still proportionately more important regionally than nationally, but the gap has been closing, and in the future both New England and the nation can expect manufacturing to claim a declining share of their total labor force.

Within this declining share, however, New England has been undergoing a major change in the composition of its manufacturing industries; the textile and leather industries which gave rise to the region's primacy as an industrial center in the 19th century have been replaced, in increasing measure, by the metalworking and metal-using industries with wider-than-regional markets and, in recent years, by a diverse group of industries, i.e. instruments, transportation equipment, electronics, whose common characteristic is their research base and their locational orientation toward centers of professional and technical manpower. Thus, in the future, the service sector, which includes private education and other professional activities giving the region its current competitive advantage over certain other areas in the United States, can be expected to expand and to exceed manufacturing as a source of employment opportunities.

New England's transition within the manufacturing sector has been a forced response to changing competitive conditions. It has proven to be a change that permitted the region to maintain and even expand personal income levels in absolute terms and relative to national levels. The degree of success with which the further adjustment from a predominantly manufacturing to a service economy is carried out will be a prime determinant of the region's economic development in the foreseeable future.

4. POPULATION

The population of New England has been declining in relation to the total population of the United States ever since settlement began to move westward from the Atlantic Seaboard. In 1790, the date of the first census, New England accounted for almost 25 percent of the nation's inhabitants. By 1910, this share had declined to 7.1 percent and in 1960 it stood at 5.8 percent of the nation's population.

The projection of New England's population to the year 2020, shown in Table 1, implies a continued decline in the region's share of the U.S. population, though at a considerably slower rate than in the first half of the twentieth century. Thus, by the year 2020, the region would account for about 5 percent of the nation's population, and its growth rate would no longer trail that of the U.S. as a whole.

This convergence in projected growth rates between the region and the nation is best explained, perhaps, by what we see as the gradual maturing of the more recently developed sections of the country and the concurrent lowering of regional differentials in economic opportunity and environmental amenity. That is the reason why our population projection implicitly assumes that New England will experience a modest measure of net in-migration during at least one of the projection decades and no net out-migration at any time in the next 60 years.

In absolute terms, then, our projection shows a regional population increase from 10.5 million in 1960 to about 25 million in 2020. This increase entails a rise in regional population density from 166 persons per square mile in 1960 (versus 60 in the U.S. as a whole) to almost 400 persons in 2020 (versus 166 in the U.S.).

a. Urban Population. - Since New England has long been more urbanized than the nation, future population growth will be absorbed principally by the ever-expanding suburban rings of New England's metropolitan areas, so that the outward pressure of the growing urban population will be felt primarily in the fringe towns where land use is certain to become more intensive. Thus New England's urban population is projected to reach 22 million persons by 2020, at which time it

TABLE 1

POPULATION OF NEW ENGLAND AND THE UNITED STATES, 1960 - 2020

	New England		United States*		New England as
	Millions	Index	Millions	Index	percent of U.S.
1960	10.51	100	180.7	100	5.8
1970	11.8	113	211.6	117	5.6
1980	13.8	132	254.1	141	5.4
1990	16.2	154	302.8	168	5.3
2000	18.7	178	358.3	198	5.2
2010	21.7	207	424.2	235	5.1
2020	25.2	239	502.0	278	5.0

* includes Alaska and Hawaii

New England -- "Equilibrium" projection, based on adjusted labor force projection which represents the average between the demographic and the economic (regression) projections; for explanation, see pp. 28-36.

U.S. -- Average of Census Bureau's Series II and Series III national projections, as adopted by the Economic Task Group of the Ad Hoc Water Resources Council Staff.

Note: A recently published set of national population projections to the year 2010 offers a range which is lower than the one from which the Economic Task Group selected its national projections as a guide for this study. In the new report (Bureau of the Census, Current Population Reports, Series P-25, No. 286, July 1964), the range for 2010 lies between 437.6 million (Series A) and 321.9 million (Series D). Thus, the national projection series used in this study lies near the top of the Census Bureau's newly computed range.

might account for more than 86 percent of the region's total population, as against 76 percent in 1960 (for details of derivation, see Appendix J).

b. Households. - The size of households* has been decreasing at both national and regional levels in response to a more adequate housing supply and a rising standard of living which has enabled more families to have their own separate dwelling, reduced the number of boarders in private households, and enabled older children to leave their family and set up their own households before marriage.

For New England we have projected a continued trend towards somewhat fewer persons per household (3.33 persons in 2020 versus 3.37 persons in 1960), delayed in the early part of the projection period in response to the sustained high birth rate of the postwar period and the consequent age distribution of the population. The total number of households is therefore projected to increase slightly faster than the population, from over 3 million in 1960 to 4 million in 1980 and to 7½ million in 2020 (see Appendix J for detailed table).

5. LABOR FORCE

New England has traditionally had a large labor force relative to its population size because the age distribution places a larger share of the total population into the working age groups than in the nation as a whole, and because female participation in the labor force in the region has been somewhat higher than nationally in all age groups.

A comparison of U.S. and regional labor force participation rates, by sex, reveals an increase in both rates over the past two decades,

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* By census definition, a household includes all persons who occupy a housing unit, i.e. a house, an apartment or other group of rooms, or a room that constitutes separate living quarters. The occupants of a housing unit may vary from a family of two or more persons to a single individual.

with New England's rate remaining above the national one:

	New England's Participation Rate	U.S. Participation Rate
	(as percent of total population age 14 and over)	
1940		
Male	78.0	79.0
Female	31.1	25.4
Total	54.0	52.2
1950		
Male	77.5	78.9
Female	32.9	29.0
Total	54.2	53.4
1960		
Male	78.1	77.4
Female	37.9	34.5
Total	57.1	55.3

Our regional labor force projection, which represents the average or "equilibrium" between independently derived demographic and economic (i.e. regression) projections,* implies a further increase in participation rates, particularly after 1980, when the anticipated decline in male participation (due to longer schooling and earlier retirement) is expected to be more than balanced by a further rise in female participation (in response to improved economic opportunities for women and the earlier completion of family formation). Thus, New England's total labor force is shown to increase at a slightly faster rate than the population during the latter part of the projection period:

	Total Labor Force		Implied Participation Rate
	Thousands of persons	Index	(As % of population age 14 and over)
1960	4,332	100	57.1
1980	5,620	130	57.2
2000	7,760	179	58.4
2020	10,800	250	59.5

* For explanation of "equilibrium" projection, see pp. 35-36.

6. EMPLOYMENT

A significant change in the industrial structure of the labor force is foreshadowed by the employment projections shown in Table 2. New England has long been known as a center of manufacturing activity -- more than half its labor force was so employed in 1920. In that year the extractive industries (agriculture, forestry, fisheries and mining) still accounted for an important, though declining, share of the labor force (8 percent), and the service industries were just beginning their ascent towards the prominent position (in terms of employment)which they occupy at the present time.

By 1960, employment in manufacturing had declined to less than 35 percent* of the regional labor force and the extractive industries had reached a low employment level of about 2 percent, due principally to the decline in agricultural employment. In the same year, the combined nonmanufacturing and nonextractive industries (comprising construction, trade, transportation, etc., finance, etc., services and government) accounted for more than 50 percent of the labor force.

Starting from the base-year labor force distribution shown in Table 2, the projections point to a further proportional decrease in manufacturing employment (to 23 percent of the regional labor force by 2020) which is indicative of the changing "mix" of manufacturing industries from the labor-intensive to the capital-intensive industries and of increases in the productivity of individual industries. Thus, we project a further absolute decline in employment in New England's traditional textile and leather industries, with a dampening in the historical trend setting in after 1980. The principal growth sectors among the manufacturing industries, as expected, are the metal fabricating and machinery industries of which the electrical machinery industry is seen as the star performer with a 3½-fold increase in employment between 1960 and 2020. By the end of the projection period, according to Table 2, three industries (SIC 34, 35 and 36) will account for almost 50 percent of total employment in

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* It should be noted that these current and projected employment shares are based on absolute numbers expressed in Census of Population terms.

TABLE 2

EMPLOYMENT, LABOR FORCE, AND POPULATION, NEW ENGLAND, 1960-2020
(thousands of persons)*

SIC	Industry	1960	1980	2000	2020
A. (01-09)	Agriculture, Forestry and Fisheries	92.9	88.9	85.2	81.4
	Agriculture[1]	84.3	80.6	76.9	73.1
	Forestry[2]	1.8	1.5	1.5	1.5
	Fisheries	6.8	6.8	6.8	6.8
B. (10-14)	Mining	4.0	3.8	3.8	3.7
C. (15-17)	Contract Construction	214.9	311.0	437.0	625.0
D. (19-39)	Manufacturing	1,479.0	1,700.0	2,090.0	2,550.0
22	Textile Mill Products	125.4	62.6	41.6	31.2
24	Lumber and Wood Products, except Furniture[2]	33.4	25.7	21.8	17.8
26	Paper and Allied Products[2]	72.7	80.4	95.5	109.0
28	Chemicals and Allied Products	34.6	37.1	44.2	56.8
30	Rubber and Miscellaneous Plastic Products	61.6	76.1	89.0	102.0
31	Leather and Leather Products	104.5	88.1	82.7	73.6
33	Primary Metal Industries	55.1	50.0	44.7	39.4
34	Fabricated Metal Products	116.2	136.0	191.0	279.0
35	Machinery, except Electrical	162.1	219.0	269.0	324.0
36	Electrical Machinery	167.4	269.0	407.0	581.0
37	Transportation Equipment	119.2	126.0	126.0	95.8
19,20,21,23,25,27, 29,32,38,39	Other Manufacturing	426.8	533.0	673.0	839.0

Table 2 (Cont'd)

SIC	Industry	1960	1980	2000	2020
E. (40-49)	Transportation, Communications, and Utilities	217.7	174.0	162.0	158.0
F. (50-59)	Wholesale and Retail Trade	673.1	902.0	1,220.0	1,690.0
G. (60- 67)	Finance, Insurance and Real Estate	183.8	305.0	472.0	720.0
H. (70-89)	Services	680.4	1,220.0	1,960.0	3,070.0
I.	Government[3]	309.5	501.0	764.0	1,160.0
J.	Nonclassifiable	179.2	180.0	264.0	389.0
	TOTAL EMPLOYMENT	4,034.5	5,380.0	7,430.0	10,400.0
	Unemployment	193.5	233.0	322.0	450.0
	TOTAL LABOR FORCE[4]	4,331.5	5,620.0	7,760.0	10,800.0
	TOTAL POPULATION	10,510.0	13,800.0	18,700.0	25,200.0

1. Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2. Projected by U.S. Department of Agriculture, Forest Service

3. Government employment in educational services shifted from Services to Government.

4. Includes Armed Forces. In 1960, the Armed Forces are not included in Total Employment, but they are included in Total Labor Force, which accounts for the failure of Total Employment plus Unemployment to add to Labor Force.

* Expressed in Census of Population equivalents.

Note: Components may not add to totals due to rounding. See appendices for more detailed figures.

manufacturing in the region, as against 30 percent in 1960.

Among the important growth sectors in the nonmanufacturing industries, Table 2 lists construction (with a threefold increase during the projection period), finance-insurance-real estate (fourfold increase), government, including government employment in educational services (fourfold increase), and especially the sector encompassing business and private services whose employment is shown to increase by a factor of 4½. Thus, by the year 2020, services alone (SIC group H) will account for a larger absolute employment volume than all of New England's manufacturing industries combined. Employment is expected to grow faster in the services than in any other industry group because of the increasing demand for medical and health services, business and educational services of all types -- as a growing population with a higher per capita income spends a larger share of this income on non-commodity items and amenities. Due to the nature of the service industry, moreover, productivity in this sector is likely to rise at a much slower rate than, say, in the manufacturing sector.

The projected changes in the industrial structure of the regional labor force are summarized in the following tabulation:

Per cent of total labor force

	1960*	1980	2000	2020
Agriculture, Forestry & Fisheries	2.1	1.6	1.1	.8
Mining	.1	.1	.1	.1
Construction	5.0	5.5	5.6	5.8
Manufacturing	34.1	30.3	26.9	23.5
Transportation, Communication, Utilities	5.0	3.1	2.1	1.5
Wholesale & Retail Trade	15.5	16.1	15.8	15.5
Finance, Insurance & Real Estate	4.2	5.4	6.1	6.6
Services	15.7	21.6	25.1	28.0
Government	7.1	8.9	9.8	10.6
Nonclassifiable	4.1	3.2	3.4	3.6
Unemployed	4.5	4.1	4.1	4.1

*Does not add to 100 percent because armed forces are not included in Government employment but are included in Total Labor Force.

For an explanation of the derivation of these projections, including a discussion of the assumptions and rationale underlying the projections of individual manufacturing industries that are regional "export" industries and/or major water-using industries, refer to Chapter IV and the Appendices.

7. OUTPUT

To derive future output levels for five major manufacturing industries,* we projected output in terms of a monetary value, since a physical measure of production is meaningless for most industries because of product composition at the 2-digit level of aggregation. (The U.S. Forest Service followed a similar procedure in preparing its projections of the output of forest products industries.) These output projections, shown in value added terms in Table 3, were used to derive the individual industry employment projections given in Table 2 by applying projected productivity levels (value added per employee) to projected output. A discussion of the derivation of productivity projections can be found in Appendix D.

It can be seen that productivity increases will continue to be very substantial in the chemical and electrical machinery industries (as well as in other industries not shown in this table), each of which is expected to experience more than a tenfold increase in output (in constant dollars of value added) between 1960 and 2020 (Table 3), while employment growth is held back by projected productivity increases (compare with Table 2).

8. PERSONAL INCOME

New England's per capita personal income has always been higher than that of the nation for the following reasons: higher rates of labor force participation, substantial property income, and a larger-than-national share of employment in manufacturing. After 1880, however, the regional trend began converging toward the U.S. trend, and by 1948 the differential

*These manufacturing industries were selected for detailed attention because they were considered to be either important growth industries or major water users in New England.

TABLE 3

OUTPUT IN VALUE ADDED TERMS FOR SELECTED INDUSTRIES,

NEW ENGLAND, 1960-2020
(in millions of 1954 dollars)

SIC	Industry	Output 1960	1980	2000	2020
28	Chemicals and Allied Products	475.0	1,160.0	2,480.2	5,140.0
33	Primary Metals Industries	453.6	614.0	754.0	908.0
35	Machinery, except Electrical	1,214.5	2,210.0	3,390.0	5,150.0
36	Electrical Machinery	1,177.3	2,860.0	6,260.0	13,100.0
37	Transportation Equipment	845.0	1,190.0	1,570.0	1,590.0

SOURCE: For derivation, see Appendices C and D.

Note: Projection figures with more than three digits are rounded.

TABLE 4

PERSONAL INCOME, NEW ENGLAND, 1960-2020

	Total Personal Income		Per Capita Personal Income		New England Per Capita Personal Income as Percent of U.S.
	In Billions of 1954 Dollars	Index (1960=100)	In 1954 Dollars	Index (1960=100)	%
1960	22.6	100	2,150	100	111
1980	46.0	204	3,320	155	116
2000	91.3	404	4,870	227	118
2020	183.0	808	7,260	337	122

SOURCE: For derivation, see pp. 37 ff.

Note: Projection figures with more than three digits are rounded.

had been reduced to 7 percent above the national level. Since that time, the two levels have been diverging slowly, so that by 1960 New England's per capita personal income stood 11 percent above the nation's. Our projection, whose underlying method of derivation and assumptions are traced in Chapter IV, shows regional per capita income, expressed in constant dollars, rising over threefold in the period 1960-2020 (Table 4). The differential between the New England and the national trend is shown to widen, though at a slower rate than in the recent past.

The reason for the divergence can be found, we believe, in the changing composition of New England's occupational (fewer unskilled workers and operatives; more professional and technical workers) and industrial structure (decline of low-wage industries; rise of higher-wage and more capital-intensive industries); in the likelihood that New England's capital resources will continue to finance economic development outside of the region and thus continue to sustain the high proportion of property income; and -- perhaps most important -- in New England's continuing higher-than-national labor force participation rates, for even a slight differential in participation rate can affect the level of per capita income significantly.

CHAPTER III - THE METHODOLOGICAL FRAMEWORK

9. INTRODUCTION

The methodological framework used in this study was designed to accomplish three major objectives:

1. To derive economic and demographic projections which, in form and detail, would be suitable (after their allocation to state and substate areas) for use by the agencies concerned with comprehensive studies of water and related land resource development possibilities in New England's river basins.

2. To produce regional projections that are compatible with the 60-year projections of national economic development prepared by the Economic Task Group of the Ad Hoc Water Resources Council Staff. By setting the pace of national economic development for the next 60 years, these U.S. Government projections are meant to serve as benchmark guides for projections of the New England economy.

3. To develop projections within an analytical system which relies much more heavily on statistical than on judgmental methods of forecasting and embodies a number of checks to insure internal consistency between the various assumptions and the results.

This Chapter sets forth the basic premise as well as the structure upon which the projective framework for this study was built.

10. BASIC PREMISE

In developing the structure, we gave primary consideration to the fact that "national forces clearly dominate economic development throughout the whole of the United States."* This is an important

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* Harvey S. Perloff, Edgar S. Dunn, Jr., Eric E. Lampard, and Richard F. Muth, Regions, Resources, and Economic Growth (Baltimore: The Johns Hopkins Press, 1960), p. 3.

assumption for viewing the future economic development of any region and it is a particularly important one for New England, a region which accounts for a substantial share of the nation's economic activity and whose industries market their products beyond the regional boundaries.

In line with this assumption, we established a direct link between New England's future economic growth and the projected economic progress of the nation as a whole. This means, of course, that the regional projection results are materially influenced by whatever assumptions are made about national rates of growth. In fact, as will be shown later, an optimistic forecast for the nation (based, for example, on an assumption of virtually full employment), filters readily through the structure of the framework and produces correspondingly optimistic projections at the regional level.

The manner in which a region grows relative to the nation depends, of course, on its internal make-up, that is, on its resource endowment, the skills and enterprise of its labor force, the size of its internal market (as determined by income and population), and other factors. These regional characteristics are firmly rooted in history. They are the result of long-established interactions between social and economic forces and are not subject to rapid change. In fact, the remarkable stability, or, more precisely, the very gradual change over time in certain national-regional relationships (e.g., New England's share of the national population, personal income or employment) argues in favor of an extension of these trend relationships.

II. STRUCTURE

The structure of the projection framework consists basically of a system of statistically determined economic relationships embracing the following assumptions:

1. That future levels of economic activity (e.g., employment and income) in the United States will be prime determinants of the future level of economic activity in New England.

2. That the future size of New England's population will be determined by the interaction of demographic factors (fertility, mortality and migration rates) on the one hand and economic forces (employment opportunities) on the other.

3. That future output levels of individual New England industries will be affected by different forces and relationships according to whether an industry is a "base" manufacturing industry, a "non-base" manufacturing industry, or a nonmanufacturing industry. Thus we have assumed that growth in the region's "base" industries (i.e., the major manufacturing industries which "export" substantial quantities of goods to other regions) will depend on their future nationwide performance, which in turn is functionally related to changing national expenditure patterns. Growth in the "non-base" industries (i.e., manufacturing industries which are not considered major exporters from New England) will be linked to the demand for the products of the "base" industries. Finally, growth in the nonmanufacturing industries will depend on the increase in total employment in New England.

The sequential development of the structural links which make up the framework can be traced as follows:

1. New England personal income and nonagricultural employment were functionally related to U.S. personal income and nonagricultural employment. In this way, the projections of New England income and employment are linked to the national projections of income and employment.

2. Labor force projections were derived via two routes -- a demographic population projection and the projection of nonagricultural employment (from Step 1). The results of these two projections were averaged to yield adjusted or "equilibrium" labor force and population projections. The adjusted projections were then checked against implied increases in New England per capita income derived by dividing the personal income projections (from Step 1) by the adjusted population

projections.

3. Projections of output (value added) for major New England exporting industries in the manufacturing sector (the "base" industries) were obtained by relating the New England output of these industries to the national output of these industries. The latter output was in turn related to broad measures of national growth, such as GNP expenditure components or the Federal Reserve Board index of industrial production.

4. Future employment in the "base" industries was obtained by applying projected productivity levels (value added per employee) to the projected value-added series derived in Step 3.

5. A projection of total manufacturing employment in New England was obtained by relating employment levels in the "non-base" industries (i.e., the remaining manufacturing industries) to projected employment levels in the region's "base" industries.

6. The projected total employment in manufacturing (obtained in Step 5) was then expressed as a percentage of projected total nonagricultural employment for each benchmark year. The percentage ratios were checked against an independent projection of the manufacturing percentage share of nonagricultural employment, based on a 60-year historical trend analysis.

7. To insure uniformity in definition among all the employment projections and to facilitate the subregional studies to follow, individual adjustments were made to convert employment projections into Census of Population equivalents.

A somewhat more detailed description of the structural interrelationships of the above steps is given in the attached flow diagram.*

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* The diagram shows that U.S. income, employment and GNP component projections form the basic inputs into the system. These inputs are set in rectangular boxes outlined in either broken or solid lines,

Before dealing with the implementation of the framework, which is the subject of the next chapter, several important features of the framework require further justification.

a. The Regional-National Relationships. - As shown in the flow diagram, the projections of two major growth measures of New England's economy -- nonagricultural employment and personal income -- were derived directly by means of regression relations linking the regional with the national employment and output series. This part of the structure has a three-fold purpose: First, to derive the regional and national growth relationships explicitly and to develop projections based on extensions of these relationships with assumed rates of national growth. Second, to derive independent New England personal income and nonagricultural employment projections which can then be used as checks upon one another. Third, to derive personal income and nonagricultural employment projections for New England which in turn can provide checks on the demographic labor force projection as well as on individual industry employment projections derived from output projections of the "base" industries. The continuing series of checks thus insures consistency among the various components and the projection results.

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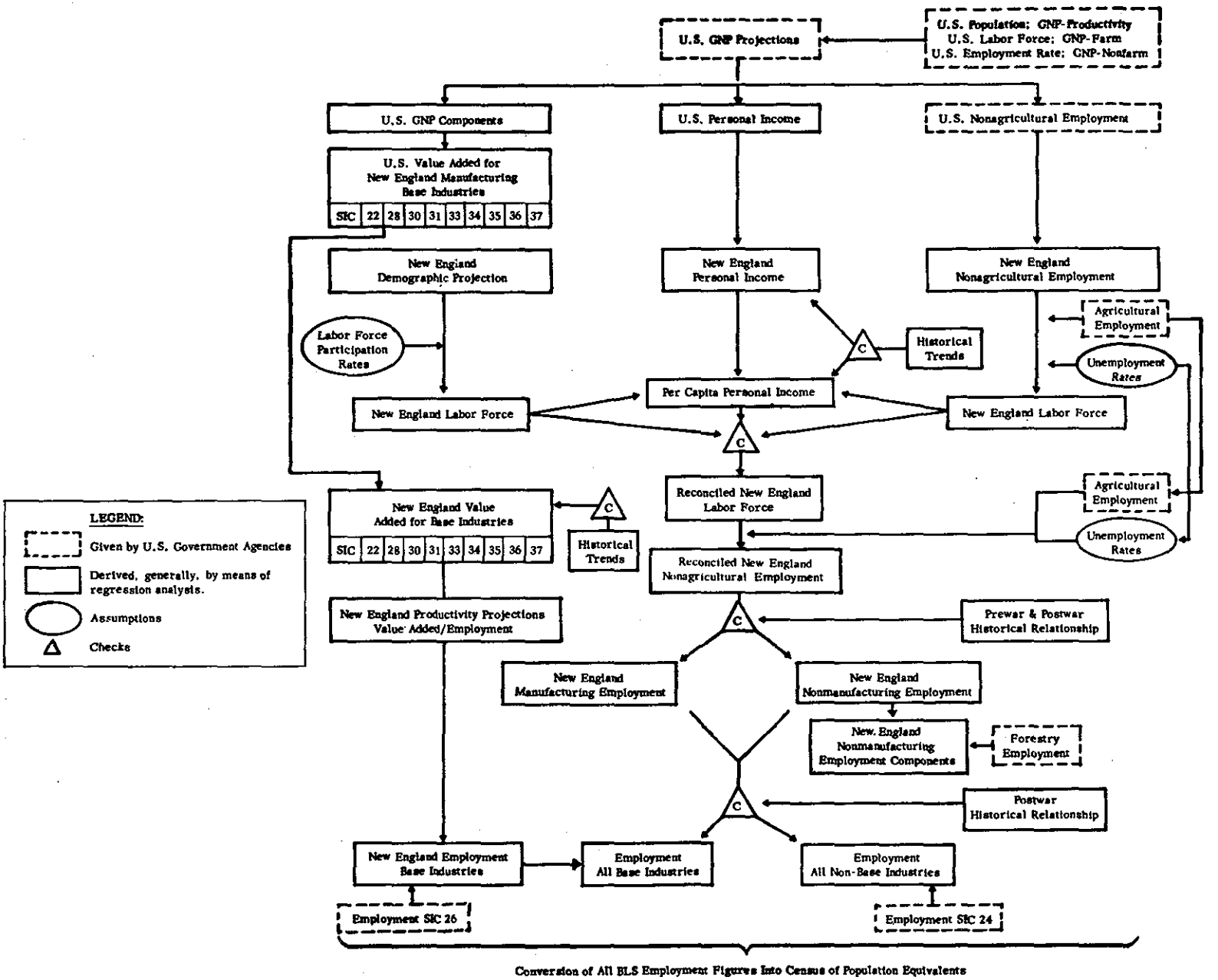
* (cont'd from preceding page)

depending upon whether the inputs were provided by U.S. government agencies or are derivatives of government inputs. The rectangular boxes outlined in solid lines can be either inputs or outputs depending on whether they represent independent or dependent variables in the regression relationships. The lines of flow are marked by arrows indicating the direction in which the factors are related and regressed. For example, U.S. gross national product components constitute a series of independent variables against which U.S. output (i.e., value added) series for individual industries are regressed. The value-added series for U.S. industries, in turn, represent the independent variables against which value-added series for individual New England industries are regressed. The triangular boxes represent points at which independent checks are made, while the oval boxes denote the major assumptions adopted for the study.

In addition to supplying the national growth assumptions which constitute the basic input into the system, the federal agencies also provided independent employment projections for agriculture, forestry, the lumber and wood products industry (SIC 24), and the paper and allied products industry (SIC 26).



FLOW CHART OF NEW ENGLAND PROJECTION FRAMEWORK

As previously noted, the use of U.S. growth rates has the effect of indirectly infusing full employment assumptions into our regional output and employment projections.* The net effect of these full employment assumptions is to raise the projected levels of employment and output in all industries above those which would have been obtained had no such full employment assumptions been made.**

b. Population-Labor Force Reconciliation. - The size of a region's population and labor force at any given time is the cumulative product of three major factors: (1) natural increase (i.e., births minus deaths); (2) net migration (i.e., the number of persons moving into the region minus the number of persons moving out of the region, or vice versa); and (3) labor force participation rates (i.e., the proportion of the population in the labor force).

To give expression to the cumulative interaction of these factors, this study derives the final labor force and population projections by a process of reconciliation, which consists of averaging the labor force estimates derived by a demographic projection with those derived statistically from projections of nonagricultural employment.

This approach has the advantage of explicitly accounting for the mutual interaction between population growth and employment growth, that is, between the supply of labor and the demand for labor. In fact, the difference between the two sets of independent labor force projections for any benchmark year was found to be quite small, i.e. ranging from no difference in 1970 to about five percent in 1990.

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* As will be shown later, New England and U.S. unemployment rates were assumed to be the same in the future. This has the effect of lowering New England unemployment rates in the projection years in the same proportion as United States unemployment rates were reduced in the Economic Task Group's national growth projections.

** The effect of full employment assumptions is especially pronounced in the case of the value-added series for New England's "base" industries. This is so because these values are derived on the basis of both GNP projections and the distribution of GNP expenditure components. Insofar as the component distribution is also affected by the full employment assumptions, the effect of this assumption upon our regional projections is given additional force (see Appendix B dealing with national growth measures).

The derivation of the "equilibrium" (i.e., post-reconciliation) nonagricultural employment projections for New England then provided a control total against which individual industry projections could be checked.

c. Base Industry Projections. - The purpose of deriving "base" industry projections was threefold:

1. To obtain output and employment projections for individual industries which can be linked directly to the national growth of these industries.

2. To derive such projections for a group of industries which can be considered as forming the "base" of New England's economy, i.e., industries which are important exporters from New England to other regions.

3. To derive employment projections for one segment of manufacturing to which the growth of the remaining industries (i.e., the "non-base" industries) could be linked.

The "base" industries identified for this study include the following 10 major two-digit manufacturing industries:

	Industry	SIC
1.	Textile mill products	22
2.	Paper and allied products*	26
3.	Chemicals and allied products	28
4.	Rubber and miscellaneous plastic products	30
5.	Leather and leather products	31
6.	Primary metal industries	33
7.	Fabricated metal products	34
8.	Machinery, except electrical	35
9.	Electrical machinery, equipment and supplies	36
10.	Transportation equipment	37

* This industry was projected independently by the U.S. Forest Service.

These industries were singled out as "base" industries because they are major regional exporters and/or because they are important water-using industries. When measured by criteria of location quotient analysis, all but the primary metals, chemicals, and transportation equipment industries fall into the category of major regional export industries.

Location quotients are a widely used, though rather crude, technique for identifying export industries. The technique is based on the simple notion that if a region specializes in the production of certain commodities, it is presumed to be an exporter of these commodities. This notion is not fully borne out, however, in a region which is as "open" as New England, i.e., a region where almost every manufacturing industry depends to some extent upon extra-regional markets.*

(1) Base Industry Output Projections. - The procedure used in developing output projections for New England's "base" industries entailed the following steps:

1. Derivation of a regression relationship between the value added in each industry at the national level and one of a number of broad measures of national economic activity (e.g., GNP expenditure components, the Federal Reserve Board industrial production index, or the level of defense expenditures).

2. Derivation of a regression relationship between regional value added and national value added for each industry.

3. Projection of the appropriate national economic activity measure.

4. Substitution of the projection derived in Step 3 into the output/national growth measure relationship for each industry to obtain value added for each industry at the national level.

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* For a detailed discussion of the use of location quotients to identify the export industries in this study, see Appendix C.

5. Substitution of national value-added projections into the regional/national value-added regression equation to obtain projections of value added for each New England industry.

The rationale of this procedure is simple: the rate at which the output of major New England exporting industries grows is presumed to depend primarily on the rate at which national markets for this output expand; the expansion of national markets, in turn, is largely a function of how fast the national economy grows and how future expenditure patterns change.

(2) Base Industry Employment Projections. - By dividing output levels for each projection year by projected levels of labor productivity (value added per employee), future levels of employment in each New England industry were derived.

Long-term projections of productivity levels are essentially the result of extrapolating past trends. In order to derive projected productivity growth rates for this study we generally relied on postwar trends in productivity for each of the New England industries. (For a detailed explanation of the procedures used to derive individual productivity estimates, see Chapter IV and Appendix D.)

It is likely, of course, that productivity growth rates for individual industry sectors will change in the future. Indeed for some of the industries projected in this study such an assumption has been made. In general, however, in the absence of specific assumptions or the knowledge of conditions or developments which would tend to alter the long-range tendency for productivity levels to rise, extrapolations of past trends appear to be the most reasonable course to follow.

d. Projections of the Non-Base Industries. - As indicated, our projections of employment in the "non-base" industries, i.e., all the manufacturing industries not classed as export industries, were based on the derivation of a regression relationship between "non-base" industry employment and "base" industry employment.

The primary justification for using this procedure is the remarkably slow change in the shares which the "non-base" and the "base" industries have constituted of total manufacturing employment in New England since the end of World War II. This slow rate of change can be ascribed primarily, we think, to the compositional make-up of both the "non-base" and the "base" industry groups; both groups contain elements of growth, e.g., the electrical machinery and instruments industries, and elements of decline, e.g., the textile and food products industries. Although the forces of growth and decline will continue to affect the components of each group in a different manner in the future, they are not likely to cause significant changes in the relative position of one group to the other.

Another justification for deriving the "non-base" industry projections in the manner outlined above is the assumption, which we believe is reasonable, that the future of the "non-base" industries as a group is more likely to be affected by the expansion of the region's internal markets than by the growth of markets outside of the region.

e. Projection of Manufacturing and Nonmanufacturing Employment. -

As a final consistency check in the framework, we computed the projections of total manufacturing employment (i.e., the sum of "base" and "non-base" industry employment) as a percent of projected nonagricultural employment and compared the result with independently derived manufacturing employment shares.

These independent shares were estimated from trend line extrapolations of the proportions of manufacturing to total nonagricultural employment in New England for the last sixty years.

After agreement between these two shares had been reached, nonmanufacturing employment was derived by subtracting total manufacturing employment from our total nonagricultural employment projections. The major industry components of nonmanufacturing employment were then determined by means of regressing each component series against the total.

12. REGRESSION ANALYSIS AND THE FRAMEWORK

The use of correlation or regression analysis* in this study had only one purpose, i.e., the derivation of forecasting or estimating equations by means of which a "best" set of future estimates could be obtained. Thus, standard tests of statistical reliability, while not disregarded, did not constitute the sole criteria by which equations were chosen. It might be said, in general, that if forecasting is the principal objective of a regression function, then criteria of "goodness of fit" as well as other standard statistical tests "become subservient to the central issue of predictive ability."** (For a more detailed discussion of the problems of regression analysis applicable to this study, see Appendix C.)

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* These terms are used interchangeably in this report.

** Robert Ferber and P.J. Verdoorn, Research Methods in Economics and Business (New York: The Macmillan Company, 1962), p. 101.

CHAPTER IV - IMPLEMENTATION OF THE METHODOLOGICAL FRAMEWORK

A description of the operational or "how-to-do-it" procedures is necessary to provide the link between the methodological framework, as presented in Chapter III, and the results of the projections given in Chapter II. The purpose of this chapter, therefore, is to describe in some detail the operational procedures required to implement the methodological framework.

The operational process can be divided into the following phases: (a) Derivation of "equilibrium" labor force and population projections for New England, by reconciling the demographic projections of the population and the labor force with the economic projections of the labor force; (b) Projection of output and employment levels in each of New England's "base" industries, and projection of employment levels in the "non-base" industries as a group, resulting in projections of total manufacturing employment in New England; (c) Reconciliation of the manufacturing employment projections obtained in Phase (b) with manufacturing employment "aggregate" projections derived through an analysis of long-term trends of the manufacturing/nonagricultural employment relationship in New England; (d) Adjustment of "base" and "non-base" industry employment projections to achieve consistency with the reconciliation or "equilibrium" manufacturing employment levels; and (e) Derivation of employment projections for New England's nonmanufacturing industry sectors.

13. *DERIVATION OF "EQUILIBRIUM" LABOR FORCE AND POPULATION PROJECTIONS*

This section is subdivided into four parts: the demographic projection of the population and labor force; the economic projection of the labor force; reconciliation of the labor force projections obtained via these two routes and derivation of an "equilibrium" projection; and an external check upon the "equilibrium" projection via an independently obtained personal income projection for New England.

a. The Demographic Projection of Population and Labor Force. - The purpose of the demographic projection is to provide an independent estimate of the future population of New England from which estimates

of the future supply of labor can be derived. The demographic projection thus provides the regional model's supply element to be subsequently reconciled with the regression-derived demand element in order to achieve an adjusted or "equilibrium" population projection for the region.

(1) Population. - The method used for the independent projection is known as the component or cohort-survival method. It is widely used because of two important advantages over alternative projection methods. First, it permits separate empirical assessments of the three components of population change -- fertility, mortality, and migration -- for the specific population under consideration. Second, because these components all vary with age and sex, it utilizes age-sex distributions in its procedures. Operationally, the sequence is as follows: beginning with the known age-sex groupings of a base-year population, we add estimated numbers of future births, subtract estimated numbers of future deaths, and either add or subtract estimated numbers of in- or out-migrants to generate the projection.

The assumptions made for projecting each of the three components of population change in New England are set forth below:

(a) Births. - The national experience during the last two decades has made the variability of the fertility component abundantly clear to everyone. Since there are no satisfactory guides to long-term trends in the population's reproductive characteristics and since the maintenance of a link with projected national growth rates is a basic objective of this study, we decided to follow the assumptions underlying the national population projections adopted by the Economic Task Group of the Ad Hoc Water Resources Council Staff with only slight variations. Using the 1960 age-specific birth rates for New England as a point of departure, we assumed that projected regional gross reproduction rates would lie halfway between the Series II and Series III gross reproduction rates* used

* The gross reproduction rate is the total number of female births, at given age-specific birth rates, to a woman surviving the childbearing years.

by the Census Bureau for its national population projections.*

(b) Deaths. - The mortality, or survival, factor is the most stable of the components of population change. For the New England projection, we followed the age-specific mortality assumptions used by the Census Bureau in its national projections.

(c) Migration. - The migration factor is more variable and more difficult to measure than the other two components whenever projections for sub-national regions are required. Whereas national patterns of migration are regulated by restrictive laws which tend to hold volume of movement to a fairly stable level, migration across regional boundaries is totally unregulated; it ebbs and flows in response to varying local conditions. Because the inherent uncertainties are so great, the selection of migration assumptions is always more or less arbitrary.

For New England we assumed that net migration (i.e., the difference between total in- and out-migration) would be zero during the projection period. Historical changes in migration volumes are shown below:

Net Migration, New England, 1870-1960
(Thousands of persons)

	New England		Rate per 1000 Population at Start of Decade
	Lee[1]	Census[2]	
1870 - 1880	+141		+ 40.4
1880 - 1890	+403		+100.4
1890 - 1900	+494		+105.1
1900 - 1910	+496		+ 88.7
1910 - 1920	+298		+ 45.5
1920 - 1930	+ 28		+ 3.8
1930 - 1940	- 43		- 5.3
1940 - 1950		+101	+ 12.0
1950 - 1960		+ 23	+ 2.5

1. Everett L. Lee, Ann Ratner Miller, Carol P. Brainerd and Richard A. Easterlin, Population Redistribution and Economic Growth, 1870-1950, Table P-1.

2. U.S. Bureau of the Census, Series P-25, No. 227.

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* Bureau of the Census, Illustrative Projections of the Population of the United States, by Age and Sex, 1960-80, Series P-25, No. 187, 1958, as adjusted for actual age-sex distribution in Census of 1960.

It can be seen that net migration has become an insignificant component of regional population change since 1920, except for the 1940's, when wartime requirements brought out-migration from the region to a virtual standstill and Connecticut's immediate postwar growth contributed to substantial in-migration. Thus, our assumption of "no migration" for the projection period, while somewhat arbitrary, has a basis in recent history and postulates for the future a balance between out-migration (predominantly from Northern New England) and in-migration (predominantly to the major metropolitan areas of Southern New England and the continued overspill of the metropolitan New York population into Southwestern Connecticut).*

(2) Labor Force. - The demographic labor force projection was derived from the population projection by applying participation rates appropriate to New England. We used national participation rates projected by the Bureau of Labor Statistics in Special Labor Force Report No. 24, and adjusted them to agree with the New England participation rates obtained from the 1960 Census of Population. The New England labor force participation rates, which have been historically above the national rates due primarily to higher rates of female participation, are projected to increase slowly beginning in 1970, thus reflecting further increases in female participation and the "full employment" stipulation of the national growth projections.

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* The above migration assumption was made subject to change pending the derivation of economic (regression) projections of the total labor force. On page 35, where the process of adjusting the demographic and economic forecasts is described, mention is made of the effect which the "equilibrium" projection of New England's population would have on the assumption of "no net migration" which was adopted here for the demographic forecast.

Labor Force Participation Rates, New England, 1940-2020
(As percent of population age 14 and over)

	Participation Rate Derived for Demographic Projection of Labor Force[1]		Participation Rate Implicit in "Equilibrium" Labor Force Projection[2]
1940		54.0	
1950		54.2	
1960		57.1	
1970	57.0		57.0
1980	57.2		57.2
1990	57.2		57.8
2000	58.5		58.4
2010	59.7		58.9
2020	59.7		59.5

1. BLS projection of national participation rates adjusted to New England rate obtained from 1960 Census.

2. See table, p. 35.

b. Regression (Economic) Projections of Labor Force. - The demographic projection of New England's labor force, described in the preceding section, and the economic projections of the labor force discussed here constitute the two independent projection routes from which an "equilibrium" projection of the regional labor force is finally obtained.

The economic (demand) projections of the labor force were derived by relating New England's nonagricultural employment to U.S. nonagricultural employment by means of least-squares regression, and adding to the resulting New England nonagricultural employment projection the independently projected level of agricultural employment in the region* plus the number of unemployed persons. This process involved the following basic steps:

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* Agricultural employment projections supplied by the U.S. Department of Agriculture.

1. New England nonagricultural employment* was related by least-squares regression to U.S. nonagricultural employment,* using Bureau of Labor Statistics establishment payroll data for the period 1939-1962.** An equation which included "time" as an additional variable, as shown below, was found to give a better fit than one without the "time" variable:

$$\text{New England} = 466.8 + \underset{(0.0051)}{0.07197}\,(\text{U.S.}) - \underset{(5.00)}{30.85}\,(\text{time}),$$

where:

time, 1939 = 1, 1940 = 2, etc.

U.S. = U.S. nonagricultural employment,

$R^2 = .976$.

Projections of U.S. nonagricultural employment made by the Economic Task Group of the Ad Hoc Water Resources Council Staff were then substituted into the regression equation to obtain New England nonagricultural employment projections.***

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* Including armed forces, forestry and fisheries employment.

** U.S. Department of Labor, Bureau of Labor Statistics, Employment and Earnings Statistics for States and Areas, 1939-1962, and Employment and Earnings for the United States, 1909-1962.

***Prior to substituting them into the regression equation, the Task Group's U.S. projections, which include the armed forces, had to be converted from Bureau of Labor Statistics (BLS) household survey terms into BLS establishment payroll equivalents, in order to conform to the historical data used in the regression. For 1960, it was found that the BLS household survey total for U.S. nonagricultural employment was equal to 114.73 percent of a similar total in BLS establishment payroll terms. Thus, we lowered the Task Group's projections of U.S. nonagricultural employment by 14.73 percent in order to express them in BLS establishment payroll equivalents. To ascertain the historical validity of this conversion factor, we analyzed the relationship between the two data sources for the period 1955-1961, and found that, on the average, the BLS household survey data equaled 114.7 percent of the BLS establishment payroll data.

These New England projections, expressed in Bureau of Labor Statistics establishment payroll terms, were then converted into Census of Population equivalents.*

2. The independent projections of New England agricultural employment supplied by the U.S. Department of Agriculture** were first converted into Census of Population equivalents,*** and then added to the New England nonagricultural employment projections, expressed in Census of Population equivalents, to obtain New England's total employment.

3. Assuming an unemployment rate of 4.15 percent,**** New England's total employment projections were divided by 95.85 percent to yield total labor force projections, which implicitly include the number of persons in the armed forces (Table 5).

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* We assumed that the equivalent Census of Population total would be 5.34 percent higher than the BLS establishment payroll total. This conversion factor was derived by averaging the 1950 and 1960 differentials between the two data sources.

** U.S. Department of Agriculture, Economic Research Service, Resource Development Economics Section (January 1964). These projections were interpolated to estimate New England's agricultural employment in the intervening years, i.e., 1970, 1990, and 2010.

*** The U.S.D.A. projection results had been expressed in terms of full-time equivalent farm employment based on variable work-year estimates of the Bureau of Labor Statistics. We converted them into Census of Population equivalents by first expressing these agricultural employment projections in index terms (1960 = 100), and then multiplying New England's 1960 agricultural employment total obtained from the 1960 Census of Population by this index series.

**** This rate is based on an assumption that the future regional unemployment rate will equal the national rate chosen by the Economic Task Force, as converted from BLS terms (4.5 percent of labor force) into Census of Population equivalents (4.15 percent). This assumption can be justified by the fact that the historical differential between New England and U.S. unemployment rates has been diminishing and that it was negligible in 1960.

TABLE 5

ECONOMIC PROJECTIONS OF NEW ENGLAND's LABOR FORCE
(Thousands of Persons)

Year	A New England Nonagricultural Employment (N.E. Regressed on U.S.)	B Converted into Census of Population Equivalents	C Projected Agricultural Employment (U.S.D.A.)*	D Total Employment (B + C)	E Assumed Unemployment	F Total Projected Labor Force (D + E)
1960 (Actual)	3,707.3	3,950.4	84.3	4,034.7	193.5	4,331.5
1970	4,340.0	4,570.0	82.4	4,660.0	202.0	4,860.0
1980	5,130.0	5,400.0	80.6	5,490.0	238.0	5,720.0
1990	6,020.0	6,340.0	78.7	6,420.0	278.0	6,700.0
2000	7,070.0	7,440.0	76.9	7,520.0	326.0	7,850.0
2010	8,360.0	8,810.0	75.0	8,880.0	383.0	9,270.0
2020	9,920.0	10,450.0	73.1	10,500.0	456.0	11,100.0

* Arthur D. Little, Inc. adjustments of independently derived U.S. Department of Agriculture projections.

Note: Components may not add to totals due to rounding. See appendices for more detailed figures.

c. Reconciliation of Demographic and Economic Projections of Labor Force and Derivation of "Equilibrium" Projections of Labor Force and Population. - As previously mentioned, we view the future level and structure of New England's employment, labor force, and population as the result of the interaction between the supply of labor, as determined by demographic forces at work in the region, and the demand for labor, as determined by the region's economic development potential. By balancing supply against demand, therefore, we obtained the final or "equilibrium" labor force levels in the region by an averaging process.

New England "Equilibrium" Labor Force Projections *
(Thousands of Persons)

Years	Demographic	Economic	"Equilibrium"
1960 (Actual)	4,332	4,332	4,332
1970	4,850	4,860	4,850
1980	5,510	5,720	5,620
1990	6,370	6,700	6,540
2000	7,670	7,850	7,760
2010	9,150	9,270	9,210
2020	10,700	11,000	10,800

These "equilibrium" labor force projections were then used to derive "equilibrium" population projections for New England. The new population projections imply the following alterations in our original assumptions for the demographic projection: (1) that during the decade 1970-1980, New England will experience the net in-migration of slightly more than 200 thousand persons, or two persons per year per 1000 average population during the decade; and (2) that regional labor force participation rates during the period 1990-2020 will be slightly higher than those assumed in the demographically-derived labor force projection on page 31. (For the difference between the "equilibrium" projection and the original demographic projection of the population, see Table 6.)

The "equilibrium" labor force projection obtained above was also used to derive an adjusted or "equilibrium" projection of New England non-agricultural employment. This was done by subtracting projected unemployment

* Note: Projection figures with more than three digits are rounded.

TABLE 6

COMPARISON OF DEMOGRAPHIC AND "EQUILIBRIUM" LABOR FORCE AND POPULATION PROJECTIONS FOR NEW ENGLAND

Year	Labor Force (Thousands of persons)			Population (Millions of persons)		
	Demographic (1)	"Equilibrium" (2)	Difference (2) - (1)	Demographic (3)	"Equilibrium" (4)	Difference (4) - (3)
1960 (Actual)	4,332	4,332	0	10.51	10.51	0
1970	4,850	4,850	0	11.8	11.8	0
1980	5,510	5,620	110	13.6	13.8	.2
1990	6,370	6,540	170	15.9	16.2	.3
2000	7,670	7,760	90	18.4	18.7	.3
2010	9,150	9,210	60	21.4	21.7	.3
2020	10,700	10,800	100	24.8	25.2	.4

Note: Projection figures with more than three digits are rounded.

(at 4.15 percent of the projected labor force) and projected agricultural employment (as provided by the U.S. Department of Agriculture) from the "equilibrium" labor force total for each of the projection years.

d. Personal Income Projections as a Check on the "Equilibrium" Labor Force and Population Projections. - To obtain an independent check on the "equilibrium" labor force and population projections derived above, it was decided to prepare a separate projection of New England's total personal income. Then, by dividing the projected levels of personal income by our projected "equilibrium" population, implied future levels of per capita personal income for the region were determined. When judged in the light of historical continuity and in relation to national income trends, these regional measures were found to be consistent and reasonable, thus providing an important internal check upon the credibility of the projection framework.

The following procedure was followed in deriving our income projections. First, we obtained per capita personal income projections for the nation as a whole by dividing our U.S. personal income projection by the projected U.S. population. Second, we determined the per capita personal income implications of our "equilibrium" population projection by dividing our New England personal income projection by our "equilibrium" population projection. In the third and final step, we compared the U.S. and New England per capita personal income levels as projected for consistency and historical continuity. A more detailed account of these procedures follows:

(1) Projections of U.S. Personal Income, Population and Per Capita Personal Income. - To obtain a U.S. personal income projection we related personal income to gross national product (GNP). Two regression equations were fitted by least-square methods to the annual data in billions of constant 1954 dollars for the period 1929-1960*,

* Historical GNP series from Survey of Current Business (July 1963), p. 14 and Economic Report of the President, 1963, p. 174; U.S. personal income series from Economic Report of the President, 1963, p. 178 and p. 190.

one of which included "time" as an additional variable. The equation without the "time" variable, as shown below, was found to give the better fit:

$$\text{U.S. Personal Income} = \underset{(2.2890)}{9.2132} + \underset{(0.0078)}{0.7721}\ (\text{GNP})$$

$$R^2 = .997$$

A GNP projection based on the assumption of an average annual growth rate of 3.85 percent between 1959-1961 and 1980 and 3.6 percent thereafter*, was then substituted into the regression equation to yield U.S. personal income for each projection year.

U.S. per capita personal income for each projection year, in constant 1954 dollars, was then determined by dividing the projected personal income levels by the projected population of the U.S. as given by the Economic Task Group of the Ad Hoc Water Resources Council Staff.**

(2) Projections of New England Total and Per Capita Personal Income. - To derive New England personal income, we related regional personal income to U.S. personal income. Two least-squares regression equations were fitted to annual data, in billions of dollars, for the period 1929-1962***, one of which included "time" as an additional variable. The equation without the "time" variable, as shown below, was found to give the better fit:

$$\text{New England Personal Income} = \underset{(0.055)}{1.6370} + \underset{(0.0003)}{0.0607}\ (\text{U.S. Personal Income})$$

$$R^2 = .999$$

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* The growth rate assumptions are those of the Economic Task Group.

** The Task Group's population projection available for 1980, 2000 and 2020, represents an average of the Census Bureau's Series II and Series III projections. We estimated population levels for intervening years (i.e. 1970, 1990, 2010) by interpolation.

*** Since implicit price deflators for personal income do not exist at the regional level, current dollar data series were used; the effect of this usage on the results of the equation is negligible. New England personal income series were obtained from the following sources: (1) 1929-1956: U.S. Department of Commerce, Personal Income by States since 1929, A Supplement to the Survey of Current Business (1956); (2) 1956-1962: Survey of Current Business series.

Projections of U.S. personal income were then substituted into the regression equation to obtain New England personal income for each projection year, expressed in constant 1954 dollars.

New England per capita personal income levels implied by our "equilibrium" population projections were then derived by dividing the projected personal income total by the projected "equilibrium" population.

(3) Comparison of U.S. and New England Per Capita Personal Income Projections. - A comparison of projected U.S. per capita personal income levels with the New England per capita personal income levels implied by our "equilibrium" population projection is shown in the following table:

Years	U.S. Per Capita Personal Income	New England "Implied" Per Capita Personal Income	New England As Percent of U.S.
	(in 1954 dollars)		
1960	1,939	2,150	110.9
1970	2,389	2,730	114.2
1980	2,875	3,320	115.6
1990	3,424	3,990	116.5
2000	4,122	4,870	118.2
2010	4,929	5,920	120.0
2020	5,938	7,260	122.2

It can now be seen that the "implied" per capita personal income projection for New England provides an independent check on our "equilibrium" labor force and population projections in two distinct ways: (1) it is shown to be consistent with projected trends in national per capita income, and (2) it bears out the recent historical trend in the rise of regional relative to national per capita income levels.

14. DERIVATION OF OUTPUT (VALUE ADDED) AND EMPLOYMENT PROJECTIONS FOR THE INDIVIDUAL BASE INDUSTRIES AND FOR THE NON-BASE INDUSTRY TOTAL

a. Base Industry Projections. - As listed on page 22, ten industries in New England have been identified as major exporters from the region and/or major water-using industries. For nine of these, we derived

independent projections of output and employment using Census of Manufactures and Annual Survey of Manufactures data covering the postwar period 1947-61. The remaining "base" industry, Paper and Allied Products, was projected independently by the U.S. Forest Service. Before considering each of the industry forecasts in detail, the basic features and rationale of our approach to the projection of individual industry output and employment levels should be made clear.

(1) The Industry Output Projections. - In this study, industry output is measured in value added terms. This measure of output was chosen for two major reasons: (1) the availability of value added data at the regional level for 2-digit and 3-digit industry categories*; and (2) the suitability of this measure for deriving productivity estimates specific to the industry.

Data on value added for each industry were adjusted for changes in Standard Industrial Classification codings and deflated by appropriate price indices to obtain consistent output series measured in constant 1954 dollars.

In developing our industry output projections, two considerations were of particular importance: First the dependency of base industry growth on national growth, and second, the extent to which the regional composition of each industry differs from its national composition. Thus it was desirable that our projection approach reflect the national orientation of these industries yet preserve their compositional identity at the regional level.

Achieving such a balance between regional and national characteristics was not thought to be feasible within a single, uniformly applied framework. Instead the method of projecting output was varied to accommodate those features peculiar to each industry.

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* By contrast, the other measure of output (i.e., value of shipments) used in Census of Manufactures reports is generally not recorded at the 2-digit level because of problems of double-counting created by intra-industry shipments.

The resulting differences in approach divide the industry output projection into three major types:

a. For two of the "base" industries, Textiles (SIC 22) and Leather (SIC 31), the regional composition of the industry, in terms of 3-digit SIC components, closely parallels the national composition. Consequently, the future output of these industries will depend principally on the overall national growth of the industries and on the degree to which changes in New England's share of national output follow historical trends. Relative to these factors, differences in regional growth due to differences in industry composition can reasonably be expected to be small. We therefore projected the U.S. output for the textile and leather industries at the total, 2-digit SIC level, and then determined New England output from a regression equation relating New England to the U.S.

b. For five other "base" industries, Chemicals (SIC 28), Rubber and Plastics (SIC 30), Fabricated Metals (SIC 34), Nonelectrical Machinery (SIC 35), and Electrical Machinery (SIC 36), a second approach was adopted. Each of these industries has a regional structure which includes significant amounts of all the national 3-digit components, but in differing proportions. To take account of such differences in composition, each 3-digit component was projected separately at the U.S. level. The sum of these projections was then checked against independent projections at the 2-digit level. (Both the 3-digit and 2-digit projections were derived from regression equations using GNP expenditure components or the Federal Reserve Board index of industrial production as independent variables.)

   The New England share of each 3-digit component was then separately projected by regression analysis in order to build into the regional projections differences in growth rates and differences in percentage composition at the 3-digit level. Again, two independent projections of New England's share at the 2-digit level were computed as checks on the sum of the

3-digit projections.

c. For the remaining two "base" industries, Primary Metals (SIC 33) and Transportation Equipment (SIC 37), special procedures were required. Each of these industries has a New England composition bearing little resemblance to the industry's national composition.

Transportation Equipment in New England is composed primarily of submarine, aircraft engine, and helicopter production -- the automotive components so important to the industry nationally are negligible here. Thus, rather than relate the New England output of transportation equipment to the industry's national output, it was projected by relating it to New England's share of prime military contracts.

In the case of Primary Metals, the ferrous industry components in New England are considerably less important than they are nationally, while certain of the nonferrous components are absent from the New England composition. For this reason, U.S. projections were made only for those 3-digit components of the industry which are present in New England. An allocation of each projected U.S. component was computed for New England on the basis of individual shares determined by regression analysis. No attempt was made to relate New England and the U.S. at the 2-digit level due to the major compositional differences.

(2) The Industry Employment Projections. - Employment for each base industry was projected by applying independent projections of productivity (measured in value added per employee) to our projections of output. Thus, an explanation of how we measured and projected labor productivity must precede the description of our derivation of employment projections.

Our decision to measure productivity in terms of value added per employee in developing historical series stems from a number of considerations: First, it was felt that the industry productivity projections should be specific to the New England region, since many of the industries have

a distinctive regional composition. In this respect, the best data for New England in the required industry detail is provided by the Census (or Annual Survey) of Manufactures in terms of value added and number of employees. Second, the alternative of measuring productivity in man-hour terms would involve the mixing of data sources and necessitate the projection of manhours for each industry -- each of which would easily result in empirical errors greater than the expected gains in conceptual accuracy. Third, the use of net output (value added) rather than gross output explicitly accounts for changes in the proportion of intermediate products consumed in production, yielding productivity estimates which are more appropriate for projecting labor input requirements. And finally, the measurement of productivity in value added per employee as derived from the Census (and the Annual Surveys) of Manufactures yields employment projections which are consistent with our industry output projections.

To obtain value added in constant dollars, implicit price indexes were derived for each 2-digit "base" industry from a weighted average of Bureau of Labor Statistics wholesale price indexes appropriate to the 3-digit components of the industry.* After deflation, 2-digit value added was divided by 2-digit employment; the resulting productivity series was expressed as an index on a 1960 base.

Each of the productivity indexes obtained above was then fitted by least-squares regression to an exponential equation of the form, $Y = a(1 + r)^t$, where "Y" is the index of value added per employee, "t" is time, "a" is the index value of productivity at time $t = 0$, and "r" is the average annual rate of productivity increase.** Fitting such an equation and substituting in future values for (t) provides a projection of productivity which assumes a constant annual average rate of increase. This constant annual rate may be thought of as a "best" estimate of the average historical rate reflected in the value added per employee series.

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* In deriving productivity estimates, neither value added nor employment were revised for SIC changes. To do so would have added the unnecessary step of applying the same percentage adjustments to both numerator and denominator of the productivity ratio.

** In order to fit the productivity relationship by linear regression methods, a transformation of the equation from exponential to linear form is required. This was done by taking logarithms of both sides of the equation, yielding the transformation, $\log Y = a' + b'(t)$, where "a'" is now the log of "a" and "b'" is the log of $(1 + r)$.

The productivity index projections obtained above for each "base" industry were checked against other historical U.S. and New England productivity data. In some cases the projections were referred to industry experts to determine if specific conditions of the industry in New England warrant the projected rates.

The productivity index projections derived in this manner were found acceptable for four of the nine "base" industries, namely, Rubber and Plastics, Leather, Fabricated Metals, and Transportation Equipment. The remaining five industry productivity projections were not accepted for either of two reasons:

a. In the case of two industries, Textiles and Chemicals, the projected rates as derived from the postwar data were judged to be too high to be sustainable over the next 60 years. For these industries new equations were fitted which assume that the current rate of productivity increase will taper off over the projection period.

b. In the case of the remaining industries, Primary Metals, Nonelectrical Machinery and Electrical Machinery, no satisfactory regression relationship could be established. The productivity index series for each of these industries revealed a high level of sensitivity to cyclical disturbances. The tendency for output in these industries to decline by greater percentage amounts than employment during recession periods produces sharp fluctuations in productivity which obscure the long-run trends. For these industries a constant annual average rate of productivity increase was projected on the basis of historical rates of increase between periods of relatively full employment.

The productivity index projections obtained above, together with the output (value added) projections, determined the future employment requirements for each "base" industry. More explicitly, each industry's value added projections were expressed as an index on a 1960 base and divided year by year by the industry's projections of value added per employee, also expressed as an index. The result was an index of projected employment

which was converted to thousands of employees in BLS establishment payroll terms and later to Census of Population equivalents.

(3) Statistical Procedures. - As with other stages of the study, least-squares regression analysis plays a primary role in deriving the industry output and employment projections. For the precise form of the regression equations derived and their statistical significance, see Appendices C and D. For a brief discussion of the meaning of least-squares regression and some of the special problems inherent in its application to economic data, refer to the introduction to Appendix C.

Each industry presents its own problems in developing accurate historical data. Value added, productivity, and employment series involve such matters as revision for changes in industry definitions, development of appropriate price deflators, and the estimation of data withheld under disclosure requirements. These problems are considered in detail in the Appendices. In addition, it should be kept in mind that the following summaries of the findings and methodology for each of the "base" industries are not intended to provide the detail necessary for reconstructing the computation of the projections -- that degree of specification is provided in the Appendices. The purpose here is to review the major assumptions and procedures applied to each industry and present the projections of output and employment in the context of their historical trends.

The output (value added) projections for the "base" manufacturing industries in the United States and in New England are presented in Tables 7 and 8. Individual "base" industry projections for New England are discussed in the subsequent pages, and projected employment is shown for each such industry in Table 9.

(4) SIC 22 - Textile Mill Products. The textile industry has occupied a major though declining position in New England's economy. In 1947 it still employed more persons than any other 2-digit manufacturing industry in New England and produced 24 percent of the country's total textile output.* Since 1947, however, employment and output in New England

* Based on value added data.

TABLE 7

VALUE ADDED, UNITED STATES, 1960 - 2020
(in millions of 1954 dollars)

SIC	Industry	1960	1970	1980	1990	2000	2010	2020
22	Textiles	5,728	7,270	9,380	11,700	15,200	18,700	23,200
26	Paper	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.
28	Chemicals	13,971	23,900	37,600	56,400	83,400	121,000	175,000
30	Rubber	3,783	6,190	9,640	14,300	20,900	29,900	43,100
31	Leather	1,743	2,060	2,520	2,970	3,680	4,350	5,130
33	Primary Metals	9,303	12,500	14,900	17,100	19,200	21,200	23,400
34	Fabricated Metals	8,981	11,800	15,500	20,600	27,900	37,800	52,100
35	Non-Electrical Machinery	11,502	18,100	25,500	32,600	43,600	58,000	78,000
36	Electrical Machinery	11,337	18,000	28,200	42,400	62,900	91,300	133,000
37	Transportation Equipment	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.

n.c. - not computed by Arthur D. Little, Inc.

Note: Projection figures with more than three digits are rounded.

TABLE 8

VALUE ADDED, NEW ENGLAND, 1960 - 2020
(in millions of 1954 dollars)

SIC	Industry	1960	1970	1980	1990	2000	2010	2020
22	Textiles	819	913	1,030	1,140	1,330	1,500	1,690
26	Paper	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.
28	Chemicals	475	746	1,160	1,720	2,480	3,580	5,140
30	Rubber	548	841	1,230	1,740	2,490	3,500	4,970
31	Leather	527	599	718	837	1,020	1,200	1,400
33	Primary Metals	454	549	614	682	754	828	908
34	Fabricated Metals	767	926	1,210	1,620	2,230	3,060	4,270
35	Nonelectrical Machinery	1,215	1,750	2,210	2,730	3,390	4,160	5,150
36	Electrical Machinery	1,177	1,870	2,860	4,250	6,260	9,040	13,100
37	Transportation Equipment	845	968	1,190	1,430	1,570	1,610	1,590

n.c. - not computed by Arthur D. Little, Inc.

Note: Projection figures with more than three digits are rounded.

TABLE 9

EMPLOYMENT IN "BASE" INDUSTRIES, NEW ENGLAND
(expressed in Census of Population terms)
(thousands of persons)

	Textiles	Paper*	Chemicals	Rubber	Leather	Primary Metals	Fabricated Metals
1960	125.4	72.7	34.6	61.6	104.5	55.1	116.2
1970	86.6	76.1	35.3	70.3	93.1	54.9	122.0
1980	62.6	80.4	37.1	76.1	88.1	50.0	136.0
1990	48.1	87.3	39.6	81.3	82.4	46.7	157.0
2000	41.6	95.5	44.2	89.0	82.7	44.7	191.0
2010	35.6	102.0	52.0	95.0	78.3	42.3	231.0
2020	31.2	109.0	56.8	102.0	73.6	39.4	279.0

	Non-Electrical Machinery	Electrical Machinery	Transportation Equipment	Total Base
1960	162.1	167.4	119.2	1018.8
1970	199.0	216.0	120.0	1070.0
1980	219.0	269.0	126.0	1140.0
1990	241.0	329.0	131.0	1240.0
2000	269.0	407.0	126.0	1390.0
2010	295.0	487.0	113.0	1530.0
2020	324.0	581.0	95.8	1690.0

* As supplied to Arthur D. Little, Inc. by U.S. Forest Service in Census of Population terms.

Note: Components may not add to totals due to rounding. See appendices for more detailed figures.

have been declining both relatively and absolutely. By 1962 employment was less than one-half its 1947 level, while New England's share of national output had declined to 14 percent. The decline in employment was accelerated, moreover, by substantial increases in productivity resulting from high levels of investment in new equipment and machinery during the postwar period.

As seen below, the structure of the textile industry at both the New England and U.S. levels is dominated by components closely linked to the apparel industry. The industrial use of textiles is both small and declining, reflecting the substitution of paper and plastics for such uses as packaging and automobile interiors.

SIC 22
INDUSTRY COMPOSITION, 1958
(percent distribution of value added)

SIC	Industry Components	New England	United States
221	Broad Woven Fabric Mills, Cotton	9.8	22.2
222	Broad Woven Fabric Mills, Man-made Fiber and Silk	8.1	9.6
223	Broad Woven Fabric Mills, Wool (including Dyeing and Finishing)	21.0	6.9
224	Narrow Fabrics and Other Small-wares Mills: Cotton, Wool, Silk, etc.	7.7	2.9
225	Knitting Mills	10.0	22.7
226	Dyeing and Finishing Textiles, except Wool Fabrics and Knit Goods	13.3	9.4
227	Floor Covering Mills	2.6	5.4
228	Yarn and Thread Mills	11.5	10.6
229	Miscellaneous Textile Goods	16.0	10.3
	TOTAL PERCENT	100.0	100.0

*Our projection of U.S. value added for textiles is based on a projection of the Federal Reserve Board's textile index to the year 2000 prepared by Resources for the Future, Inc.** We modified this projection

* Hans H. Landsberg, Leonard L. Fischman and Joseph L. Fisher, Resources in America's Future (Baltimore: Johns Hopkins Press for Resources for the Future, Inc., 1963), p. 562, median projection.

slightly, first by adjusting for the differential between the RFF median population projection and the Economic Task Group's population projection to maintain the same per capita output relationship, and second by extrapolating the projection to 2010 and 2020. This modified index of physical output was then used to expand the 1960 U.S. value added in textiles on the assumption that physical output and value added will grow at the same rate.

The resulting projections of U.S. textile value added are presented in Table 7. As is evident from this table, national textile output is expected to increase 4-fold by the year 2020; this compares with a projected 8.8-fold increase in GNP and a 2.8-fold projected increase in population. The 1960-70 projected increase of 25 percent in U.S. value added is only slightly below the 1950-60 increase of 27 percent.

We believe this projection to be a reasonable reflection of the major factors that will influence the demand for textile products. It assumes that per capita textile consumption increases with increases in per capita income but at a lesser rate, or, as economists put it, that the income demand for textiles is inelastic. Historical data show that per capita textile consumption has actually declined slightly over the last ten years. This decline in the face of rising per capita income is probably due to the combined impact of a number of transitory influences. The liberalizing of our trade policies in the 1950's brought sharp increases in the level of imports to over six times the 1947 volume; at the same time exports diminished. Over the next decade, however, the rate at which imports will penetrate U.S. markets is likely to taper off, reaching a more stable import-export balance. A second set of important influences has been the declining fiber content in clothing, the introduction of longer-lasting synthetic fibers, and changes in the age structure of the population toward greater proportions of children and the aged, both of which use less fiber than young adults. These influences also appear to be by and large transitory. For these reasons we feel that the assumption that per capita textile consumption will begin to rise somewhat with increases in per capita personal income is not over-optimistic. New England's

share of textile value added was projected as a dampened function of time, by least-squares regression (see Table 8). This reflects the assumption that the historical rate at which New England's share has been falling will diminish in the projection period. Thus, in contrast to the 24 to 14 percent fall in share between 1947 and 1962, New England's share is projected to decline to 12.6 percent of the U.S. in 1970 and then to 10.9 percent in 1980.

To project textile employment, projection of textile productivity was required. A regression obtained by fitting an exponential function to deflated New England value added per employee, as derived from Census of Manufactures data for the period 1947-61, yielded a projected constant rate of productivity increase of 4.76 percent per year. While this was an accurate reflection of the gains made in the 1947-61 period,it was judged by industry experts to be an unsustainable long-run rate. This judgment was based on the fact that a large portion of delayed plant and equipment replacement was undertaken in the postwar period under the stimulation of liberalized government write-off policies, and that a considerably lower rate of capital replacement will be required in the future.

Two equations implying diminishing rates of productivity increase were fitted to the data and an average of the projections obtained from these equations was adopted. This yielded a rate of productivity increase that declined from 4.73 percent in the 1960-1970 decade to 2.48 percent in the 2010-2020 decade. The overall average annual rate was 3.73 percent.

Projected value added divided by projected productivity gave projected employment. These projections are provided in Appendix A. Employment is expected to decline by 29 percent in the 1960-70 decade, compared with a 53 percent decline in the 1950-60 decade. Projected employment continues to decline after 1970 but at a rapidly diminishing rate. However, this decline is attributable primarily to continued increases in levels of productivity and only to a lesser extent to New England's declining share of the industry.

(5) SIC 28: Chemicals and Allied Products. - The region's chemical industry is relatively small, both in comparison with the U.S. chemical industry and in the context of employment in all other industries in New England. For the most part, it is made up of a large number of specialty manufacturers who were established in response to the needs of the shoe and textile industries. Since the decline of the latter two industries in the past fifteen years, the New England chemical industries built around them have had to gear their talents to produce new products for new customers.

Because of strong compositional differences, we did not functionally relate the New England chemical industry to the national industry at the 2-digit level. The table below illustrates the disparities in industrial structure between the New England and the U.S. chemical industries.

SIC 28

INDUSTRY COMPOSITION, 1958

(percent distribution of value added)

SIC	Industry Component	New England	United States
281	Basic Industrial Chemicals	14.9	34.0
282	Plastics, Synthetic Rubber and Fibers	19.8	15.4
283	Drugs	13.4	17.5
284	Cleaning and Toilet Goods	33.7	16.1
285	Paints and Varnishes	6.5	5.9
286	Gum and Wood Chemicals		
287	Agricultural Chemicals	11.7	11.1
289	Other Chemical Products		
	Total Percent	100.0	100.0

Thus, Cleaning and Toilet Goods (SIC 284) is the most important industry component in New England, while Basic Industrial Chemicals is the dominant component nationally. To overcome problems resulting from differences in the industrial composition, we projected New England industries on a 3-digit basis by means of regression relations and from our projections of 3-digit industries at the national level.

We projected value added in national 3-digit industries from their relationship with relevant GNP components. For example, our estimates of future value added in Drugs (SIC 283) were based on projected personal

consumption expenditures for medical care, whereas value added in Cleaning and Toilet Goods was related to projections of personal consumption expenditures on personal care and general cleaning.

We computed New England value added in each 3-digit industry from U.S. value added projections for that industry by applying projected shares of New England to the U.S. These shares were obtained from regressions of historical shares against the log of time in order to effect dampened extensions of past rates of change.

The productivity estimates obtained for the chemical industry by fitting the exponential form of the equation described in the introduction to this section were judged by industry specialists to be excessive for a 60-year projection. To dampen the postwar historical rate of increase, a multiple regression equation of the form $Y = a + b(t) + c(t^2)$ was fitted to the data. The resulting productivity projections decline from a 4.25 percent annual average rate of increase in the 1960-70 decade to a 2.73 percent rate in the 2000-2020 decades. The overall average rate of increase is thus projected to be 3.20 percent in contrast to the postwar rate of increase of 4.78 percent.

The projections of employment obtained from the projections of output and productivity result in a doubling of persons employed in the industry in New England by 2020, compared with a 25 percent increase in the 1950-60 period.

(6) SIC 30: Rubber and Miscellaneous Plastics Products. -

Rubber and Plastics Products is one of the fastest growing industries in the U.S. and New England. At the present time, the industry has a relatively high concentration in New England. In the future, we expect the New England industry to grow less rapidly than the U.S. industry and New England's share of the industry to decline accordingly. This is in keeping with historical trends.

The 3-digit composition of the rubber industry for New England and

the U.S. is indicated below:

SIC 30

INDUSTRY COMPOSITION, 1958
(percent distribution of value added)

SIC	Industry Component	N.E.	U.S.
301	Tires and Inner Tubes		
302	Rubber Footwear	33.8*	41.2
303	Reclaimed Rubber		
306	Fabricated Rubber Products, not Elsewhere Classified	38.6	30.4
307	Miscellaneous Plastics Products	27.5	28.3
	TOTAL PERCENT	100.0	100.0

* Information on individual 3-digit New England industries in this group was not available.

The most significant factor in the structure of both the regional and national industries is the growing importance of the plastics products component. Between 1947 and 1960, the plastics share of the industry more than doubled. By 2020 we expect plastics to account for over one-half of the industry.

We projected value added in the New England 2-digit industry as a function of value added in the U.S. 2-digit industry since the two are similar in structure. Our projections of the U.S. 2-digit industry on the other hand are the sum of 3-digit industry component projections. The national industry was projected at a 3-digit level because the component industries in SIC 30 are related to different economic factors. For example, we related Tires and Inner Tubes (SIC 301) to motor vehicle production, Rubber Footwear (SIC 302) to population, and Plastics (SIC 307) to consumer expenditures on durable goods.

The projection of productivity necessary to convert value added into employment was derived by fitting the exponential equation described earlier to the historical productivity series developed for the rubber and plastics industry of New England. A projected constant annual average rate of productivity increase of 2.78 percent was obtained and accepted. Dividing projected value added by the projections of productivity (defined in terms of value added per employee) yielded projected employment. These

employment projections indicate a continued expansion in rubber and plastics employment in New England at a rate in keeping with the 15 percent increase recorded by the industry between 1950 and 1960.

(7) SIC 31: Leather and Leather Products. - The leather products industry in New England has a larger share of the industry's national output than does any other New England 2-digit manufacturing industry. This share has also been remarkably stable, remaining at about 30 percent since 1947.

The New England composition of the industry, as outlined in the table below, closely parallels the industry's national composition. The dominant component of the industry for both New England and the nation is Footwear, Except Rubber (SIC 314).

SIC 31

INDUSTRY COMPOSITION, 1958
(percent distribution of value added)

SIC	Industry Component	N.E.	U.S.
311	Leather Tanning and Finishing	15.0	14.5
312	Industrial Leather Belting and Packing	0.8	1.9
313	Boot and Shoe Cut Stock and Findings	9.5	5.2
314	Footwear, except Rubber	66.8	60.4
315	Leather Gloves and Mittens	0.1	1.4
316	Luggage	1.5	5.1
317	Handbags and Other Personal Leather Goods	5.8	9.9
319	Leather Goods, not Elsewhere Classified	0.4	1.6
	TOTAL PERCENT	100.0	100.0

Leather industry output was projected in a manner similar to that used for textiles. A projection of the Federal Reserve Board leather industry index of physical output made by Resources for the Future* was adjusted slightly to maintain its per capita growth rate implication, and then extrapolated to the years 2010 and 2020. This index was then applied to U.S. value added in the leather industry (expressed in 1954 dollars) to obtain future national value added levels.

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* Landsberg et al, op. cit., p. 562 and 518, median projection.

The resulting projections of national output grow at about the same rate as population, reflecting the high dependency of the industry upon the growth in footwear demand. The introduction of new synthetic shoe leathers (i.e. Corfam, etc.) may result in a relative decline of the Leather Tanning and Finishing Industry (SIC 311) which accounts for about 15 percent of the industry's total output.

A regression of New England value added in leather against U.S. value added determined New England's future share of the industry. This share is projected to decline very slightly during the projection period.

Employment in the New England leather industry has undergone a small decline in the postwar period. This decline has been due to productivity increases since, as previously noted, the industry's share of national output has been stable. The projection of future productivity to obtain future employment was based on fitting an exponential form of the regression equation described in the introduction to this section. The resulting constant annual average rate of productivity increase of 2.18 percent was accepted as a reasonable long-term projection. The employment projection implied by the value added and productivity projections indicates a continued moderate decline in New England's employment in the industry as output per employee continues to rise faster than the demand for leather products.

(8) SIC 33: Primary Metals. - The primary metals industry has been a small and declining industry in the New England region. Between 1947 and 1961 employment declined by 25 percent. We expect this decline to continue in the projection period. Unlike the national industry which is dominated by iron and steel, the New England industry is concentrated in certain of the nonferrous components. Nonferrous Rolling and Drawing (SIC 335) is especially important, accounting for over one-half of the region's primary metal output. The special structure of the industry in New England is indicated in the table below.

SIC 33

INDUSTRY COMPOSITION, 1958
(percent distribution of value added)

SIC	Industry Component	N.E.	U.S.
331	Steel Rolling and Finishing	17.5	55.4
332	Iron and Steel Foundries	7.5	10.8
333	Primary Nonferrous Metal	.1	7.4
334	Secondary Nonferrous Metal	1.8	1.5
335	Nonferrous Rolling and Drawing	60.0	16.6
336	Nonferrous Foundries	4.9	4.5
339	Primary Metals, not Elsewhere Classified	8.3	3.9
	TOTAL PERCENT	100.0	100.0

National value added for Primary Metals was projected at the 3-digit levels as follows:

(1) The ferrous components (SIC's 331 and 332) were combined and regressed against total durable goods, using a logarithmic form of equation to reflect the declining portion of steel input to durable goods;

(2) Nonferrous Rolling and Drawing (SIC 335) was regressed against total durable goods plus private construction using a logarithmic form of equation; and

(3) Primary Metals, not Elsewhere Classified (SIC 339) was also related to durable goods by a logarithmic form of equation.

A New England share for each of the above components was then projected by relating historical changes in share to the logarithm of time. These percentage shares were applied to the U.S. components to obtain New England value added. The remaining 3-digit components are small in New England and have been declining; by 1970 and thereafter they are expected to be negligible.

After computing future output in the New England primary metals industry we found employment by applying future productivity estimates.

The projection of productivity for primary metals was complicated by strong cyclical disturbances in the historical series. For this eason productivity was estimated from the 1947-49 to 1959-61 period average annual rate of increase. This constant rate of 1.53 percent per year, when applied to New England value added projections, yields

projections of employment for the region which decline at a rate comparable to the industry's historical decline.

(9) SIC 34: Fabricated Metals. - In 1960 the fabricated metals industry accounted for about 3 percent of New England's total employment. Our estimate for 2020 indicates that the industry will show little change in its share of total New England employment.

At the national level, output for this industry is projected to grow less rapidly than the economy as a whole. The New England industry, in turn, is projected to grow at a slightly lower rate than the U.S. industry, as is borne out by past historical trends.

To reflect the varying demand factors which influence this industry, we dealt with individual 3-digit components in our analysis. Thus, we projected each 3-digit U.S. industry as a function of an appropriate GNP expenditure component or the Federal Reserve Board index of industrial production. For example, we related Metal Containers (SIC 341) to consumer expenditures on nondurable goods and Structural Metal Products (SIC 344) to construction expenditures. After determining the historical relationship of national 3-digit components to our broad measures of national growth, we projected the national industries on the basis of projected national growth.

By relating each New England 3-digit industry to its national 3-digit counterpart, we projected the regional industry as a function of the national industry's growth. The advantages of linking the regional industry to the national one at the 3-digit level is amply illustrated by the table below, in which a comparison of the regional and U.S. structure of the metal fabricating industry is provided.

SIC 34

INDUSTRY COMPOSITION, 1958
(percent distribution of value added)

SIC	Industry Component	N.E.	U.S.
341	Metal Containers	1.1	6.4
342	Cutlery, Hand Tools and Hardware	32.4	13.7
343	Plumbing and Nonelectric Heating	2.3	7.4
344	Structural Metal Products	13.2	28.5
345	Screw Machine Products and Bolts	16.9	8.9
346	Metal Stampings	9.7	11.9
347	Coating, Engraving and Allied Services	5.3	4.7
348	Fabricated Wire Products	4.3	5.1
349	Miscellaneous Fabricated Metal Products	14.6	13.3
	TOTAL PERCENT	100.0	100.0

It can be seen that New England's industry specializes more in light industry components such as Cutlery (SIC 342) and Screw Machine Products (SIC 345), while the national industry shows a greater concentration in such categories as Structural Metal Products (SIC 344).

We derived the New England/national growth relationship by regressing each New England 3-digit industry share of the respective U.S. industry against the log of time.

To translate value added into employment requirements, a projection of productivity was determined by fitting an exponential equation to the industry's historical productivity series. A projected annual average rate of productivity increase of 1.31 percent resulted. Applying this rate to the value added projections yielded projections of employment which indicate that the industry's employment in New England will double over the next 60 years.

(10) SIC 35: Nonelectrical Machinery. - The nonelectrical machinery industry is an old and relatively stable industry in New England, accounting for a significant share of the region's manufacturing employment. The composition of the industry, as shown below, is highly concentrated at the regional level in the industrial machinery sectors (SIC's 354, 355, and 356).

SIC 35

INDUSTRY COMPOSITION, 1958
(percent distribution of value added)

SIC	Industry Components	N.E.	U.S.
351	Engines and Turbines	10.5	8.6
352	Farm Machinery and Equipment	0.3	8.8
353	Construction and Mining Machinery	1.5	16.6
354	Metalworking Machinery	14.7	16.6
355	Special Industry Machinery	18.1	10.8
356	General Industrial Machinery	14.5	15.6
357	Office, Computing and Accounting Machinery	2.9	7.8
358	Service Industry Machinery	7.0	7.4
359	Miscellaneous Machinery	7.1	7.7
	TOTAL PERCENT	100.0	100.0

The regional components of the industry have not grown equally. For example, Agricultural Machinery (SIC 352), Metalworking Machinery (SIC 354) and Service Industry Machinery (SIC 358)have experienced absolute declines in value added, whereas Engines and Turbines (SIC 351) and Miscellaneous Machinery (SIC 359) have exhibited substantial growth. The growth of the remaining components has varied depending on the time period selected.

Projections of value added were made for each of the 3-digit components to reflect both the differences in New England/U.S. composition and the differences in growth rates among the components. The independent variables to which the industry's components were related varied considerably. For example, Construction and Mining Machinery (SIC 353) was related to construction expenditures, whereas Office, Computing and Accounting Machinery (SIC 357) was related to the fabricated metals industry. In several instances, projections were obtained by fitting a dampened, i.e., logarithmic relationship, rather than a linear one to reflect the judgment of industry specialists. For the industry as a whole, the sum of the separate U.S. 3-digit projections yielded a growth rate for the industry which parallels the projected growth of GNP up to 1980 and then continues at a slightly slower rate.

The expected expansion of the industry in New England was derived from projections of New England's share of each 3-digit component regressed against the log of time. In every instance the 3-digit New England/U.S. shares were projected to decline slightly. This reflects

the fact that even for those 3-digit components which have been growing in New England, their U.S. counterparts have been growing faster. The result is an overall decline in New England's share of the nonelectrical machinery industry from 10.6 percent in 1960 to 6.6 percent in 2020. This represents a slower rate of decline than was experienced in the 1947-60 period.

An adequate projection of productivity could not be derived by regression analysis. The industry is one in which the levels of value added reflect much greater sensitivity to cyclical disturbances than do the levels of employment, with the consequence that long-term trend movements are obscured. Because of this, we projected future increases in productivity on the basis of the average annual rate for the period 1947-49 to 1959-60. The 1.15% increase per year which thus resulted provided the productivity index by which employment was derived.

The continued increases in the level of employment projected for this industry secure its rank as a major employer in the New England region, although its first place position has already been yielded to the rapidly expanding electrical machinery industry.

(11) SIC 36: Electrical Machinery. - Electrical Machinery is a burgeoning industry in both New England and the U.S. Our projections indicate that the New England industry as well as the national industry will grow at nearly the same rate in the future, i.e., New England's share of the U.S. industry will remain approximately the same.

In terms of employment, Electrical Machinery represented the largest single manufacturing industry in New England in 1960, accounting for a little over 4 percent of New England's total employment. Over the projection period this share is expected to rise by more than 25 percent, with the industry thus accounting for about 5½ percent of total New England employment by 2020.

For the industry we projected each 3-digit category at the U.S. level as a function of an appropriate GNP expenditure component or the Federal Reserve Board industrial production index. For New England, in turn, we projected each 3-digit industry component on the basis of the New England industry's share of the U.S. as a function of the log of

time. This yielded projections of output which reflect dampened rates of historical changes in New England's share of the U.S. The necessity for relating the New England industry to the U.S. at a 3-digit level is highlighted by the differences in the structure of the industry in New England and in the U.S., as illustrated below.

SIC 36

INDUSTRY COMPOSITION, 1958
(percent distribution of value added)

SIC	Industry Component	N.E.	U.S.
361	Electric Transmission and Distribution Products	16.0	11.4
362	Electric Industrial Apparatus	4.0	12.7
363	Household Appliances	9.6	15.9
364	Lighting and Wiring Devices	15.9	10.4
365	Radio & TV Receiving Equipment	3.0	7.4
366	Communication Equipment	23.9	20.4
367	Electronic Components		
369	Electrical Products, not elsewhere Classified	27.5	21.9
	TOTAL PERCENT	100.0	100.0

The table shows that New England has a relatively higher concentration in Electric Transmission Products (SIC 361) and Lighting and Wiring Devices (SIC 364) than the national industry in which the concentration is greater in Electrical Industrial Apparatus (SIC 362), Household Appliances (SIC 363) and Radio and Television Receiving Equipment (SIC 365).

Having estimated the growth of future output in the New England and U.S. electrical machinery industries, estimates of future productivity were applied to obtain our industry employment projections. As with the primary metals industry and the nonelectrical machinery industry, the historical productivity data proved to be highly sensitive to cyclical distrubances. Therefore productivity was projected at the average annual rate which prevailed between the relatively full employment years of 1947 and 1960. This rate, equalling 1.90 percent, was used to translate the value added projections into projections of employment requirements. The results indicate that the industry's recently acquired position as the region's largest manufacturing employer will be maintained throughout the projection period. In the next 60 years the electrical machinery industry should be to New England what the textile industry was 40 years ago.

(12) SIC 37: Transportation Equipment. - The transportation equipment industry in New England can be identified as primarily a defense-oriented industry. As the table below indicates, over 90 percent of the value added in New England's SIC 37 is in aircraft and shipbuilding. Motor vehicles, although very important in the industry nationally, are of little significance in New England.

SIC 37

INDUSTRY COMPOSITION, 1958
(percent distribution of value added)

SIC	Industry Component	N.E.	U.S.
371	Motor Vehicles and Equipment	6.2	44.2
372	Aircraft and Parts	68.2	45.3
373	Ship and Boat Building	24.4	7.0
374	Railroad Equipment	--	2.1
375	Motorcycles and Bicycles	1.3	0.3
379	Miscellaneous (Mobile Homes, etc.)	--	1.1
	TOTAL PERCENT	100.0	100.0

For this reason, the transportation equipment industry was not projected as a share of the national industry. Instead, the projection of value added was derived from the following major assumptions:

(1) That value added in the industry as found in New England depends to a large extent on defense expenditures;

(2) That defense expenditures will increase absolutely but decline as a percent of GNP from about 8 percent in 1970 to about 4 percent in 2020;

(3) That the proportion of total defense expenditures going to the transportation equipment industry (currently about 46 percent) will remain constant;

(4) That prime military contracts provide a good index of total defense expenditures; and

(5) That New England's share of total prime military contracts will decline from present levels to a level that approximates New England's share of the total population of the U.S. in the year 2020.

In 1960 New England's share of prime military contracts was 10.1 percent. We expect this share to decline gradually to New England's

projected population share of 5.0 percent by the year 2020. At the same time, defense spending as a proportion of GNP is also expected to decline relatively. The combination of these two factors serves to dampen the projected rates of increase in output and employment in the New England transportation equipment industry relative to the postwar period.

Productivity was projected to increase at a constant average rate of 1.36 percent per year, based on a regression which fitted an exponential function to New England value added per employee in the industry. The employment projection obtained by dividing projected value added by projected productivity results in the maintenance of current employment levels in the industry up to approximately the year 1990; thereafter the rate of growth in output falls below the rate of growth in productivity and New England's employment in the industry begins to decline to a level in 2020 that is about one-quarter below the 1960 level.

b. "Non-Base" Industry Projections. - The sum of the nine "base" manufacturing industry employment projections described above, together with the projection of employment for Paper and Allied Products made by the U.S. Forest Service, determined total employment for the ten "base" industries in each projection year. To arrive at "non-base" manufacturing industry employment as a total, we first derived the following regression relationship from Bureau of Labor Statistics employment data for the years 1947-1963:

$$Y = \underset{(.0030)}{.7087} - \underset{(.0032)}{.0241} \log (t) ,$$

$$R^2 = .723,$$

where Y is the ratio of total "base" employment to total manufacturing employment. The projection of the "base"/manufacturing employment share by the substitution of future values for (t) results in a slowly declining "base"/manufacturing relationship.

As we already noted in Chapter III (pp. 24-25), the balancing forces which are likely to affect the components of the "base" and "non-base" industry groupings appear to justify the projected stability of this relationship. Once total "base" employment and the ratio of "base" to total manufacturing employment are established, total manufacturing employment can be determined.

15. DERIVATION OF "EQUILIBRIUM" MANUFACTURING EMPLOYMENT PROJECTIONS FOR NEW ENGLAND

It will be recalled that Section 13 dealt with the derivation of New England's "equilibrium" labor force and population projections, where the supply of labor (given by a demographic projection) was balanced against the demand for labor (given by economic projections). In Section 14, we described the procedures involved in making value added and employment projections for New England's "base" industries and employment projections for the "nonbase" industries as a group. By summing the "base" and "nonbase" employment levels, we obtained New England's total manufacturing employment, expressed in Bureau of Labor Statistics employment terms. The purpose of this section is to explain the derivation of "equilibrium" employment projections for the individual "base" industries as well as "equilibrium" manufacturing employment projections for New England.

As emphasized in Chapter III, our overall projective methodology derives its consistency from the existence of many internal checks at all levels. Of pivotal importance in arriving at final employment projections for New England, therefore, is the existence of an internal consistency check on the "implied" percentage relationships between New England's manufacturing and nonagricultural employment projections. In summary form, this internal consistency check and the subsequent derivation of an "equilibrium" projection for each "base" industry and for manufacturing employment involved the following basic steps: First, we expressed New England's manufacturing employment for each projection year (obtained as the sum of "base" and "nonbase" industry employment) as a percent share of New England's total nonagricultural employment (derived by relating New England's nonagricultural employment to U.S. nonagricultural employment).* Second, and as an independent check on these "implied" share projections, we projected the ratio of New England's manufacturing employment to total nonagricultural employment, on the basis of a curvilinear regression relation using employment data for the past six decades, 1900-1960. In the third and final step, we compared the "implied" share projections with those obtained in the second step.

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* See derivation of the economic projections of New England's labor force, pp. 31-32.

Having found remarkably close agreement between the shares for each benchmark year, we used the "implied" percentage relationship projections to derive "equilibrium" employment projections for the "base" industries, as well as "equilibrium" employment projections for the manufacturing sector as a whole. These three general steps are explained below in greater detail.

a. Projected Relationship between New England's Manufacturing Employment and Nonagricultural Employment "Implied" by our Base-Nonbase Employment Projections. - Shown below are the "implied" projected percentage relationships between New England's manufacturing employment, obtained via the "base"-to-manufacturing employment regression relationship, and New England's nonagricultural employment, both expressed in Bureau of Labor Statistics employment data terms.

Years	New England's total Mfg. employment (000)	New England's Total Non-agric. Employment (000)	Manuf. Employment as % of Non-agric. Empl. (%)
1960 (actual)	1,451.8	3,707.3	39.2
1970	1,570.0	4,340.0	36.1
1980	1,710.0	5,130.0	33.3
1990	1,870.0	6,020.0	31.1
2000	2,080.0	7,070.0	29.4
2010	2,280.0	8,360.0	27.3
2020	2,540.0	9,920.0	25.6

Note: Projection figures with more than three digits are rounded.

b. Check on Implied Relationship between New England's Manufacturing and Nonagricultural Employment Projections. - As an independent check on the "implied" relationship between New England's manufacturing and nonagricultural employment projections, we separately projected for New England the manufacturing-to-nonagricultural employment ratio or percentage relationship, by regressing the percentage relationship series derived from employment data for the period 1900-1960* against "time"

* The data for this regression was obtained from Perloff, Dunn, Lampard, and Muth, Regions, Resources and Economic Growth (Baltimore: The Johns Hopkins Press, published for Resources for the Future, Inc., 1960), Appendices. The RFF series was derived from Census of Population labor force data. Appendix Table A in that volume provides a state-by-state breakdown of total labor force into major industry sectors. New England historical data was obtained by summing the data given for the six New England states.

in the form of the hyperbolic equation shown below:

$$\frac{\text{New England Manufacturing Employment}}{\text{New England Nonagricultural Employment}} = \frac{1}{1.2605 + 0.1527\ (\text{time})}$$

$$(0.1300)\quad(0.0200)$$

time, 1900 = 1, 1910 = 2, etc. $R^2 = .850$

Since the projected percentage relationship between manufacturing and nonagricultural employment given by this equation is based on Census of Population definitions of employment, we converted the projection results for each projection year into Bureau of Labor Statistics employment share terms in order to make them comparable.

c. Derivation of "Equilibrium" Employment Projections for New England's "Base" Industries and Derivation of "Equilibrium" Manufacturing Employment

The "implied" percentage relationship between New England's manufacturing employment levels (obtained via the projected "base"-to-manufacturing employment regression relationship) and the nonagricultural employment projections are compared below with the percentage relationship projected through a hyperbolic regression equation as described above:

Years	"Implied" Relationship (Mfg. Empl. as % of Non-Agricultural Employment)	Regression Relationship (Mfg. Empl. as % of Non-Agricultural Employment)
1960 (actual)	39.2	39.2
1970	36.1	36.6
1980	33.3	34.4
1990	31.1	32.4
2000	29.4	30.6
2010	27.3	29.0
2020	25.6	27.6

Given the methodological differences by means of which these relationships are finally projected, and given the fact that one approach represents the integration of highly disaggregated projections whereas

the other represents a highly aggregated level of projection, it is quite remarkable that the results should agree so closely.

Since this independent check on the "implied" percentage relationship between the manufacturing and nonagricultural employment projections resulted in reasonable and consistent estimates, we further used these "implied" percentage relationships to derive "equilibrium" manufacturing employment projections for both the "base" and the "nonbase" industries. Because of the purely definitional problems involved, this last process will be explained in terms of a step-by-step description.

First, we multiplied the "implied" percentage relationships as projected between manufacturing and nonagricultural employment by New England's "equilibrium" nonagricultural employment, expressed in BLS employment terms,* in order to obtain new manufacturing employment projections.

Second, we multiplied these new manufacturing employment projections by the "base"-to-manufacturing employment regression relationships** in order to obtain new "base" employment totals, expressed in BLS employment terms.

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* Since the "implied" percentage relationships between manufacturing and nonagricultural employment projections are based on BLS employment definitions, we had to convert our "equilibrium" nonagricultural employment projections from Census of Population terms into BLS employment terms. The "equilibrium" nonagricultural employment totals were initially obtained simply by subtracting "unemployment" and "agricultural employment" from our "equilibrium" labor force projections.

** Because of its immediate relevance to this discussion, the regression relationship between "base" employment and total manufacturing employment is given below for each projection year. For a detailed explanation of its derivation, refer to the latter part of Section 14 of this chapter.

Years	New England's Total Employment in "Base" Industries Divided By Total Manufacturing Employment
1960 (actual)	.6787
1970	.6754
1980	.6718
1990	.6691
2000	.6669
2010	.6652
2020	.6637

Third, we compared the new "base" employment total thus obtained for each projection year with the "base" employment total that had been obtained by summing the individual employment projections for each "base" industry, as explained on pp. 42 ff. of this chapter. Then, the individual employment projections for each decade were constrained so that their sum would equal the new "base" employment total.

Next, we converted the "base" employment total for each decade and the individual "base" industry employment levels from BLS employment terms into Census of Population equivalents. This process encompassed the following three sub-steps: (1) multiplying the total "base" employment (in BLS terms) by the 1960 Census/BLS manufacturing employment ratio (1.0189); (2) multiplying each "base" industry's employment (in BLS terms) by the Census/BLS employment ratio for that industry in 1960; and (3) constraining the sum of (2) to equal (1). These employment projections represent our final or "equilibrium" projections in Census of Population equivalents for the "base" industries individually and for total "base" manufacturing employment as a whole.

In the fifth and final step, the "equilibrium" "base" employment total for each decade was divided by the projected "base"-to-total manufacturing employment regression relationships, in order to arrive at new manufacturing employment totals for New England, expressed in Census of Population terms. These manufacturing employment totals represent our "equilibrium" manufacturing employment projections for New England.

"Equilibrium" employment in New England's "nonbase" manufacturing industries as a group can then be obtained for each projection year as a residual, by deducting the "equilibrium" employment total for all "base" industries from the "equilibrium" manufacturing employment total. These final or "equilibrium" projection results are given in Chapter II for the years 1960, 1980, 2000, and 2020, and in Appendix A for all other years.

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* This was accomplished by multiplying the percentage distribution of the individual "base" industry employment projections by the new "base" employment total.

16. DERIVATION OF NONMANUFACTURING EMPLOYMENT PROJECTIONS FOR NEW ENGLAND

So far in this Chapter we have dealt with the derivation of "equilibrium" labor force and population projections for New England, projections of employment and output levels for "base" industries and employment projections for "nonbase" industries as a group, the derivation of the share of manufacturing employment as a percent of "equilibrium" total nonagricultural employment in New England, and the subsequent adjustment of the "base" and "nonbase" employment projections to achieve consistency with the "equilibrium" manufacturing projections. In this section, we explain the operational procedures involved in deriving employment projections for New England's major nonmanufacturing industries. The projections of employment in agriculture and forestry, supplied by the U.S. Department of Agriculture, are presented in Appendices F and G, and our projections of regional employment in mining and fisheries are detailed in Appendix E.

Derivation of New England employment projections for the six major nonmanufacturing sectors (i.e., construction; transportation, communications, utilities; wholesale and retail trade; finance, insurance, real estate; services; and government) involved two basic steps:

1. We determined the "equilibrium" and employment total for the combined six sectors by deducting the following from New England's "equilibrium" labor force projection: "equilibrium" manufacturing employment; unemployment; the independently projected employment levels in agriculture, forestry, fisheries and mining; and nonclassifiable employment.

2. Through least-squares regression equations employment levels in each of the six nonmanufacturing sectors were related to total employment in the nonmanufacturing industries. The projections obtained by substituting total nonmanufacturing employment into these equations were converted into index form (1960 = 100), and, when applied to New England's 1960 Census of Population employment levels in each of the corresponding nonmanufacturing sectors,

yielded Census of Population employment equivalents.

The separate employment projections obtained in Step 2 were then each expressed as a percent share of their combined total for each projection year. This percent breakdown was finally used to apportion New England's "equilibrium" employment total for all six sectors among the component sectors in each projection year.

a. Derivation of New England's "Equilibrium" Employment Total for the Combined Major Nonmanufacturing Sectors. - A control total for each projection year for New England's "equilibrium" employment in the combined six nonmanufacturing sectors was obtained as follows:

Given: New England's "equilibrium" labor force, in Census of Population terms

Minus: (a) "Equilibrium" manufacturing employment, in Census of Population terms (See Section 15 of this Chapter);

(b) Unemployment (4.15 percent of New England's "equilibrium" labor force);

(c) Independent projections of employment in the following nonmanufacturing industry sectors:

(1) Agriculture (supplied by U.S. Department of Agriculture and converted from BLS full-time equivalent employment terms into Census of Population terms)

(2) Forestry employment (supplied by U.S. Department of Agriculture in Census of Population terms)

(3) Employment in fisheries (Arthur D. Little, Inc., projections given in Census of Population terms)

(4) Mining employment (Arthur D. Little, Inc., projections, given in Census of Population terms.)

(d) Nonclassifiable employment (5.00 percent of New England's "equilibrium" nonagricultural-nonmanufacturing employment total.

Equals: New England "equilibrium" employment total for the combined six major nonmanufacturing sectors, for each projection year, expressed in Census of Population terms.

b. Regression Projections of New England's Employment in Each Major Nonmanufacturing Sector. - In order to derive initial employment projections for each of New England's major nonmanufacturing sectors, expressed in Census of Population terms, the following procedure was adopted:

a. Employment in each major sector (e.g., construction, trade, services and miscellaneous,* etc.) was related to total employment in all six sectors through least-squares regression equations fitted to Bureau of Labor Statistics employment data for the period 1947-61.** Six regression equations were thus obtained, as described in detail in Appendix I.

b. New England's projected "equilibrium" employment in all nonmanufacturing-nonagricultural industry sectors (expressed in Bureau of Labor Statistics employment terms***) was then substituted

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* "Miscellaneous" includes employment in forestry, fisheries, mining and the nonclassifiable sector.

** U.S. Department of Labor, Bureau of Labor Statistics, New England Regional Office, Employment in New England, 1947-1961 (November 1962).

*** For each projection year, this total was obtained as follows:

Given: New England's "equilibrium" labor force, in Census of Population terms (converted into BLS employment terms -- refer to listing of conversion factors in Appendix K)

Minus: (1) New England's "equilibrium" manufacturing employment in BLS employment terms (see p. 69).
(2) New England's agricultural employment (supplied by U.S. Department of Agriculture in BLS full-time equivalent employment terms -- refer to Appendix F).
(3) Unemployment (4.50 percent of total labor force, in BLS employment terms. As discussed on page 33, the Census of Population equivalent of this unemployment rate is 4.15 percent).

Equals: New England's total "equilibrium" employment in all nonmanufacturing-nonagricultural industry sectors, expressed in BLS employment terms.

into each equation in order to obtain projected employment levels in each of the six sectors (expressed in BLS terms).

c. The employment projections were then converted into index form (1960 = 100).

d. The growth indexes were multiplied by New England's base year (1960) employment total in each of the six major sectors, obtained from the 1960 Census of Population, in order to express our regression projections in Census of Population terms.*

e. A percentage distribution of these components in each projection year was then computed to distribute the "equilibrium" total obtained in Step 1 for the combined six nonmanufacturing sectors.

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* Two points should be noted here:

(1) The growth indexes for the "services and miscellaneous" sector are applied to "services" employment as given in the Census of Population. It will be recalled that the Bureau of Labor Statistics definition of "services and miscellaneous" covers employment in forestry, fisheries, mining and nonclassifiable employment. Thus, we have implicitly assumed that the projected growth rates for "services and miscellaneous" are equally applicable to "services" employment.

(2) The 1960 Census of Population gives a breakdown of "educational services" employment into "private" and "government". Our definition of government employment for New England, therefore, includes government employees in "educational services." Likewise, our definition of "services" employment excludes government employees in "educational services."

PROJECTIVE ECONOMIC STUDY OF NEW ENGLAND

PART II

THE STATES

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August 16, 1965

Brigadier General Robert R. Ploger
Division Engineer
U.S. Army Engineer Division, New England
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts

Dear General Ploger:

We are pleased to transmit our research report Projective Economic Study of the States in New England. This report, the second of three, outlines the potential development of each of the New England states. The first and third consider the New England region as a whole, and the sub-state areas, respectively. These reports are designed to provide projections of socio-economic measures that can serve as guides for the comprehensive New England river basin studies being undertaken by the Corps of Engineers in cooperation with other federal agencies and the New England states.

This report was prepared by members of the Regional Economics staff of Arthur D. Little, Inc. Mr. Stanley Warner and Dr. George Gols were responsible for the development of the research methodology and the implementation of the projective framework. They were skillfully assisted by a research team comprised of Kirkor Bozdogan, Laurel Prussing, Anne Sheehan, and Ann Heckel. Several industry specialists and other senior staff analysts of the Management Services Division were consulted in the development of the major industry projections.

The project team also wishes to acknowledge the cooperation of Messrs. Robert J. Frazier and George R. Phippen on the River Basin Project staff, New England Division, Corps of Engineers, and of the members of the Coordinating Committee for the Connecticut River Comprehensive Water Resources Investigations.

Valuable cooperation was also extended to us by the heads and staff members of the planning and development agencies as well as the labor departments of the six New England states.

Arthur D. Little, Inc.

August 16, 1965

Brigadier General Robert R. Ploger
Division Engineer

We greatly appreciate the Corps of Engineers' giving us the opportunity to perform this challenging assignment. We hope that this report will contribute to a better understanding of the opportunities and the limitations involved in developing long-range economic projections at the regional level.

Sincerely yours,

A. George Gols
Project Director

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PROJECTIVE ECONOMIC STUDY OF THE STATES IN NEW ENGLAND

CHAPTER I - INTRODUCTION

This is the second in a series of three studies which project socio-economic growth in the New England region. These projections are intended to serve as quantitative guidelines for the U.S. Army Corps of Engineers and other federal agency studies that deal with the comprehensive development planning of the water and related land resources of the Connecticut River Basin. The first report, titled Projective Economic Study of New England, presented long-range demographic and economic projections for the New England region as a whole. That report provided the basis for the projections of individual New England states, shown in this report. The state projections will, in turn, provide the control totals for the derivation of projections of employment and population for sub-state areas, which will be presented in the third report of this series.

1. OBJECTIVES AND REQUIREMENTS

The primary objective of the three projective studies is to develop employment, output, and population growth forecasts. For this purpose, the specific forecast requirements at the state level encompassed projections of population, number of households, personal income, and employment for each of the six New England states for the years 1980, 2000, and 2020. Specific employment forecasts were also required for the following individual industry categories:

	Industry Group	Standard Industrial Classification Code
(a)	Resource Industries Fisheries and Mining	A09B
(b)	Manufacturing Industries	D
i	SIC groups 28,33,35,36,37	
ii	All other groups in division D except groups 24 and 26	
(c)	Service industries	CEFGHIJ

The following manufacturing industry groups, which have large water requirements, were singled out for individual projections:

(a)	Chemicals and Allied Products	(SIC 28)
(b)	Primary Metals Industries	(SIC 33)
(c)	Machinery, except Electrical	(SIC 35)
(d)	Electrical Machinery	(SIC 36)
(e)	Transportation Equipment	(SIC 37)

In addition, output and employment projections for other industry sectors having large water requirements such as Agriculture (SIC 01 through 07), Forestry (SIC 08), Lumber and Wood Products (SIC 24) and Paper and Allied Products (SIC 26), were prepared independently by the Economic Research Service and by the Forest Service of the U.S. Departmane of Agriculture, and were incorporated into the projection framework presented in this report. Whenever the framework used in this study provided projections in greater detail than was specified in the requirements stated above, such additional information was also included in the report.

2. ORGANIZATION OF THE REPORT

This report follows essentially the pattern of organization established in the Projective Economic Study of New England report. Chapter II presents the projection results, that is, the population, employment, and output figures for each state for the benchmark and terminal years of the sixty-year projection period, 1960-2020.

Chapter III outlines the methodology used to derive the results and traces the sequence of steps designed to yield projections which are consistent a) with those developed for New England as a whole, and b) within the projective framework used for deriving the individual state forecasts.

The Appendices provide detailed discussions and support data for the steps described in Chapter III, and include a complete set of tables containing historical and projection figures.

3. PROJECTIONS AND FORECASTS

As pointed out in Projective Economic Study of New England, Chapter I, economic projections are conditional forecasts based on present knowledge of foreseeable developments and on historical relationships. The forecasts are conditional in the sense that they

follow logically from the use of certain basic assumptions within a specified projective framework.

The fundamental assumptions pertinent to this study have already been stated in our first report. Further assumptions will become evident as we describe the nature of the methods used to derive state projections in this report.

CHAPTER II - PROJECTION RESULTS

4. INTRODUCTION

The future economic development of the New England states contains elements of both continuity and diversity. These are evident from the projection results presented in Tables 1 through 15 of this chapter. The projections have been derived through implementing the methodological framework described in Chapter III. In this chapter we shall discuss in broad terms some of the major trends and changes that have been projected for each of the six New England states.

5. PROJECTIONS OF INDIVIDUAL STATES

a. Massachusetts. - If gauged in broad measures of population, total income, and personal income, Massachusetts has in the past accounted for approximately half of all of New England's economic activity and is projected to continue to maintain its share. As shown in Tables 1, 7, and 13 through 15, our projections indicate the following changes in some of the major dimensions of the state's socio-economic structure:

(1) Population. - The population of Massachusetts has remained fairly stable in relation to the total population of New England over the last 60 years. In 1900, for example, approximately 50 percent of New England's inhabitants lived in Massachusetts. By 1940, this share had risen to 51 percent, and in the last two decades has dropped back to approximately 50 percent.

The projected increase in Massachusetts' population from approximately 5 million to 7 million between 1960 and 1980 and to 13 million by 2020 (see Table 1) implies virtually no change in the state's share of New England population during the next two decades and only a slight rise to approximately 51 percent by 2020 (see Table 15). Thus, by 2020, the number of inhabitants in Massachusetts will have risen to a level approximately as high as New England's projected 1980 population. Correspondingly, Massachusetts' urban population is projected to increase from approximately 4 million to 12 million between 1960 and 2020, at which time the urban population will comprise approximately 90 percent of Massachusetts' total population as compared to 83 percent in 1960. The number of households is expected to expand at almost the same rate as population over the next two decades and slightly faster thereafter, reflecting in the first period a delay in the projected trend toward fewer persons per household (see Tables 1 and 7, and Appendix F).

(2) Employment. - As shown in Table 1, a significant change in the industrial structure of the state's labor force is forecast. The most dramatic changes projected are embodied in the decrease in the proportion of manufacturing jobs from approximately 35 percent to 25 percent of total employment between 1960 and 2020, and the rise in the share of service industry employment from approximately 63 percent to 75 percent of total employment over the same period. As pointed out in Projective Economic Study of New England, Chapter II, these structural transformations in the demand for labor can be attributed to two factors: the more rapid rate of productivity increase in manufacturing compared with services and the continuing tendency of consumers to spend a greater proportion of their income on services.

Within the manufacturing sector, our projections point to a greater than proportional gain in employment in Electrical Machinery and Non-electrical Machinery, as well as in Fabricated Metals, and to a continuation in the absolute declines of employment (though at a diminishing rate) in Textiles, and Leather. By 2020, the Metal Working and Machinery sectors alone are expected to provide more than half of all employment in manufacturing.

(3) Output.- Output projections, derived in constant dollar value-added terms for five major water-using industries, are shown in Table 14. The method by which these projections were obtained is explained in Appendix H. It is quite evident that the 13-fold expansion in the level of output projected for the Electrical Machinery industry between 1958 and 2020 overshadows even the substantial output gains forecast for the other industries.

(4) Personal Income. - Per capita income levels in Massachusetts have always been higher than average per capita income levels in New England as a whole. In large measure this is attributable to the predominance of high-wage industries in the state's manufacturing and service sectors and the relatively small size of the low-wage primary resource sector (see Appendix G). Another contributing factor is the somewhat higher wage levels which seem to be maintained within given industries in Massachusetts as compared with the same industries in the other New England states.

Our projections (see Table 13), for which the assumptions and underlying method of derivation are outlined in Chapter III, point toward a more than eight-fold increase in the level of personal income of Massachusetts between 1960 and 2020. This implies a more than three-fold increase in the state's per capita income level, which almost equals the rate of gain indicated for the New England region as a whole.

b. Connecticut. - In terms of volume, Connecticut's economic activity ranks second after Massachusetts' among the New England states. Connecticut provided approximately one-fourth of New England's employment

in 1960. During the last twenty years, Connecticut was also the fastest-growing New England state in employment, population and personal income. Our projections, (Tables 2, 8, and 13 through 15), indicate a further slight increase in Connecticut's share of these major economic factors. Connecticut will continue to be the second largest state, but will cede to New Hampshire its position as the fastest-growing state in New England.

(1) Population. - From 1900 to 1960 the growth rate of Connecticut's population exceeded not only that of all the New England states, but that of the United States as well. Connecticut's share of New England's population increased from 16 percent in 1900 to 24 percent in 1960. Historically, Connecticut's population growth rate has been gradually tapering to the national average. Our projections, given in Tables 2 and 8, reflect this trend. Tables 2 and 15 also show that Connecticut's population will grow at a rate only slightly higher than the rest of New England's population over the next sixty years. In absolute terms, Connecticut's population will increase two and one-half times during the projection period, i.e., from 2.5 million persons in 1960 to roughly 6.5 million in 2020. By far the greatest increase will be in urban population which will increase from 78 percent of total population in 1960 to 88 percent by 2020. The number of households will increase at a slightly higher rate after 1980, reflecting a projected trend toward fewer persons per household (see Appendix F).

(2) Employment. - Similar to other states the most significant trend in the projections for Connecticut is the decline in the proportion of manufacturing jobs relative to total employment and the concurrent increase in service industry employment (see Tables 2 and 8). In Connecticut, manufacturing employment is expected to decline from 40 percent of total employment in 1960 to 25 percent by 2020, while service industry employment will rise from 58 percent in 1960 to 75 percent in 2020. Employment in the primary resource industries, Agriculture and Mining, will decline both relatively and absolutely, and by 2020 will account for less then one percent of total employment as opposed to nearly two percent in 1960.

Within the manufacturing sector, Transportation Equipment (largely aircraft and shipbuilding), which enjoyed tremendous growth in employment during the war and post-war period 1940-1960 (increasing its share of total manufacturing from 5 percent to 17 percent), will decline steadily in share to 7.2 percent by 2020, i.e., somewhat above its 1950 share of 6.6 percent. In absolute terms, up to the year 2000, the number of employees will approximately equal the 1960 employment -- roughly 70,000 -- and will then decline to 47,000 by 2020[1/]. Three industries,

1/ The leveling off and eventual decline in employment in this industry is consistent with and reflects for the most part the two major assumptions made in Projective Economic Study of New England: 1) that the rate of increase in U.S. government defense expenditures would slacken appreciably during the coming decades and 2) that New England's share of these expenditures would decline.

Fabricated Metals, Non-electrical Machinery and Electrical Machinery, which provided 38 percent of manufacturing employment in 1960, will provide 53 percent of manufacturing employment in 2020. The number of employees in these three industries will increase from 153,000 in 1960 to 347,000 in 2020. Chemicals and Rubber and Plastics Products will have slightly declining shares of manufacturing employment although the number of employees in each will increase. Textile employment will decline considerably both relative to other industries and in absolute terms.

(3) Output.- Output projections (expressed as value added in constant dollars) are given for five significant water-consuming industries in Table 14. In Connecticut, the value of output in 2020 will be greatest in Electrical Machinery, followed by Non-electrical Machinery and Chemicals. The fastest-growing output in Connecticut will be in the Chemical Industry, in which output in 2020 will be fourteen times as great as that in 1958. Electrical Machinery will experience a nine-fold increase in output over this period while the increase in other machinery output will be five-fold.

(4) Personal Income. - In total personal income, Connecticut ranks second among the New England states, while in per capita personal income Connecticut is well ahead of other New England states and the national average. This is due to the relatively high concentration of high-wage manufacturing industries, such as Transportation Equipment, Primary Metals, Non-electrical Machinery, Electrical Machinery and Chemicals, and also to relatively high-wage service industries.

For individual manufacturing industries, Connecticut's wages are generally the highest in New England. Projections of per capita personal income and total personal income are given in Table 13. Connecticut continues to have the highest per capita income in New England throughout the projection period. The relative concentration of high-wage industries in Connecticut's projected industrial structure is a continuing, although diminishing, factor in maintaining the state's lead over the rest of New England in per capita income.

c. Maine. - Although it is the largest of the six New England states in terms of area, Maine now ranks third in population and employment and fourth in personal income. In part, this reflects the fact that the primary resource industries, e.g., Fisheries and Agriculture, continue to employ a proportionately greater share of the state's labor force than in most other New England states.

(1) Population. - Maine's population, which approximated the million mark in 1963, is projected to increase at a slower rate than that of New England as a whole. Thus by 1980, the projections show that the inhabitants of Maine will comprise approximately 8 percent of New England's total population -- down from 9 percent in 1960 -- and about 6 percent in 2020 (see Table 15). This will place Maine's 2020 population of approximately 1.5 million, somewhat below that of New Hampshire and Rhode Island (see

Appendix F), and implies a continuation of the net migration of population out of the state, although at somewhat lessening rates.

With a 1960 population density of approximately 31 persons per square mile (see Appendix F, Table F-2) -- i.e., less than half the population density of New England -- and with a lower level of urbanization than that which prevails elsewhere in the region, urbanization in Maine is projected to proceed at a considerably slower rate than in the other New England states. Thus by 2020, the urban population is forecast to comprise about two-thirds of the total population. Nevertheless this is only somewhat less than the proportion of urban population in all of New England in 1960. We project a 63 percent increase in the number of households in Maine by 2020, which represents a slightly higher rate of growth for households than for population for reasons analogous to those indicated in the case of Massachusetts.

(2) Employment.- Much of the migration of population from Maine to other areas of the country appears to stem from the fact that employment opportunities in the state are growing at a slower pace than the labor force. This is a reflection of the fact that nearly one-quarter of the employment is concentrated in industries such as Agriculture, Textiles, Leather, and Lumber, where increases in the volume of employment have been either minimal or absent.

These factors also condition the future growth prospects for the Maine economy. Thus, the rate of growth of employment in Maine over the next 60 years is projected to be lower than that of New England. Nevertheless, the decrease in the proportion of some of the traditional slow-growth components in the industry structure, together with the growing importance of the service sector as a source of employment opportunities, will help to shape a sounder foundation for the long-range employment prospects in Maine (see Tables 3 and 9).

(3) Output. - Output as measured in value-added terms (constant dollars) is projected to rise fastest in Maine's Electrical Machinery and Chemical industries. This will occur largely as a result of rising levels of productivity in these industries and the influx of new firms into the state. Other industries for ehich significant production gains are forecast are Non-electrical Machinery and Paper Products.

(4) Personal Income.- By 2020 personal income in Maine is projected to rise to five times its 1960 level, or from 1.6 billion dollars to 8.7 billion dollars as measured in constant 1954 dollars, while personal per capita income will more than triple.

d. Rhode Island. - Although accounting for only eight to nine percent of New England's total economic activity over the past twenty years, Rhode Island is one of the most heavily industrialized, densely

populated, and highly urbanized states in New England and the nation. The projected decline in Rhode Island's share of total New England economic activity over the next half century can be explained in part by Rhode Island's present high level of economic development. As shown in Tables 4, 10, and 13 through 15, some of the major changes forecast for Rhode Island are these:

(1) Population. - Although Rhode Island's population grew faster than New England's over the 1900-1960 period, population growth since 1940 in Rhode Island has slackened so that the state's share of New England population has declined slightly from about 8.5 percent to 8.2 percent during the last two decades. Rhode Island's share of New England population is projected to continue to diminish throughout the projection period, and will approximate 7 percent by 2020. However, this growth rate will still double the number of inhabitants of Rhode Island over the next half century (see Table 10), and raise the state's population density from about 800 persons per square mile in 1960 to nearly 1800 persons per square mile by 2020 (see Appendix F, Table F-2). With urban residents representing about 86 percent of Rhode Island's population in 1960, the state is the most urbanized of the New England states (see Appendix F, Table F-2). It is forecast that Rhode Island will maintain this position throughout the projection period. The population of Rhode Island is thus expected to rise from approximately 860,000 to 1.8 million between 1960 and 2020; this will give Rhode Island the lowest of the population growth rates projected for the six New England states. The number of households in Rhode Island is projected to increase at a somewhat slower rate until 1980, and then at a somewhat faster rate until 2020.

(2) Employment. - In keeping with the trends projected for New England as a whole, manufacturing employment in Rhode Island, as a share of total employment, is projected to continue its historic decline and will fall from 39 percent to 25 percent of total employment between 1960 and 2020. Thus, by the end of the projection period, the share of total employment represented by manufacturing employment will have dropped to approximately half of what it had been in the 1930's. On the other hand, service industries are expected to take up the slack by increasing their share of the work force from 59 percent to 75 percent.

Within the manufacturing sector, rates of increase in employment are projected to be largest in Fabricated Metals and in Electrical Machinery. In absolute terms, employment increases are expected to be sizeable also in the Rubber and Plastics and in the Non-electrical Machinery industries.

(3) Output. - As shown in Table 14, output in the major water-consuming industries (as measured in 1954 constant dollar, value-added terms) is projected to grow most rapidly in the Chemical and Electrical Machinery industries. Nevertheless, by 2020, output volumes are in many instances likely to be below the individual output level recorded for

Connecticut or Massachusetts in 1958.

(4) Personal Income. - With respect to total personal income and per capita income, Rhode Island is projected to rank third throughout the projection period. In terms of growth, our projections show an approximately seven-fold increase in the level of Rhode Island's total personal income between 1960 and 2020 as compared with the eight-fold increase projected for Massachusetts and Connecticut. Per capita personal income levels are projected to rise approximately three-fold by 2020.

e. New Hampshire. - For the last twenty years New Hampshire has ranked fifth among New England states in major economic measures, accounting for roughly 6 percent of the region's employment. Our projections of New Hampshire's economic activity in the next sixty years show it to be the fastest growing-state in New England (see Tables 5, 11, and 13 through 15).

(1) Population. - From 1900 to 1950 New Hampshire had a lower rate of population growth than the rest of New England. This trend was reversed during the 1950-1960 decade because of net in-migration largely in response to an acceleration in the state's industrial expansion. Our projections indicate that New Hampshire's population will increase at a rate faster than that of other New England states. This forecast is consistent with projections of higher-than-average industrial growth. Thus, New Hampshire's share of New England population will rise from 5.8 percent to 6.9 percent between 1960 and 2020. New Hampshire's population will almost triple over the next sixty years, rising from 0.6 million in 1960 to 1.7 million in 2020. Urban population will also expand rapidly, increasing from 58 percent of total population in 1960 to 67 percent in 2020. The number of households will grow at very nearly the same rate as population.

(2) Employment. - We expect New Hampshire's share of New England employment to rise from 5.8 percent in 1960 to 6.9 percent in 2020 (see Table 15). The state will move from its current fifth place to fourth in New England employment. Although New Hampshire certainly will be far from equaling Massachusetts or Connecticut in terms of absolute levels of employment by 2020, the increase in its employment share will refle the fastest rate of growth of any of the six states during the next sixty years.

Within New Hampshire, as in the other five states, manufacturing's share of total employment will significantly decline, and the share of service industries will increase. In addition, there will be declines in the primary resource industries, Agriculture and Mining, relative to total employment (see Tables 5 and 11). The state's share of New England manufacturing employment, however, will increase from 6.3

percent in 1960 to 6.8 percent in 2020.

The Leather industry has long been a dominant component of New Hampshire's manufacturing sector, accounting for 22 percent of manufacturing employment in the sixties. In the projected structure of New Hampshire manufacturing in 2020, Electrical Machinery is forecast to account for 30 percent of manufacturing employment, supplanting Leather as the most important industry. Non-electrical Machinery (14 percent) and Paper (9 percent) will be in second and third place. Leather is projected to drop to fourth place, accounting for less than 9 percent of total employment. During the projection period the fastest-growing industry will be Electrical Machinery. Actual employment in manufacturing will almost double in New Hampshire, from 93,000 in 1960 to 174,000 in 2020. Employment in the Leather industry will decline from 21,000 in 1960 to 15,000 in 2020, while levels of employment in Electrical Machinery will grow from 9,000 in 1960 to 53,000 in 2020.

(3) Output. - Output projections (in 1954 dollars) for major water-using industries in New Hampshire indicate a twenty-three-fold increase in Electrical Machinery, from $55.5 million in 1958 to $1.3 billion in 2020 (see Table 14). The other four industries listed will also grow, but less dramatically than Electrical Machinery.

(4) Personal Income - Total personal income in New Hampshire is projected to grow more rapidly than that of New England as a whole largely because of population growth rather than increases in per capita income (see Table 13). New Hampshire's per capita income was $1,824 in 1960 (in 1954 dollars), and is expected to rise at almost the same rate as that of other New England states. By 2020 it will, however, still be below the New England average.

f. Vermont. - The history of Vermont's economic development follows a course similar to that of other New England states. The important difference is that in Vermont the pace of transition from an "extractive" to a "processing" and then to a "service" economy has proceeded more slowly than in other New England states.

Thus, Vermont's resource industries (principally Agriculture and Mining) still employ a disproportionately large share of the state's work force, compared with resource industries of other New England states. In this respect, moreover, the gap between Vermont and other New England states has widened rather than narrowed over the last three decades. Although this factor will continue to exert a somewhat dampening influence on Vermont's future industrial growth, significant changes in the state's socio-economic structure are forecast.

(1) Population. - Over the last sixty years Vermont has had the lowest rate of population growth of any of the six New England states.

In fact, over the last decade Vermont's population increased only about 3 percent, compared with 13 percent for New England and 18 percent for the nation. Our projections point toward a continued (but slight) decline in Vermont's future share of New England population (see Table 15). Nevertheless, the projections still point toward a doubling of Vermont's population between 1960 and 2020 (see Tables 6 and 12) and also imply a slow-down in past rates of out-migration. The population growth also implies more than a doubling in the state's average population density (see Appendix F, Table F-2) and increased urbanization as the share of residents living in urban areas increases from approximately 38 percent to 55 percent of the total population. The number of households is projected to increase at only a slightly higher rate than population.

(2) Employment. - Vermont's share of total New England employment declined slightly from approximately 4.1 percent to 3.5 percent between 1940 and 1960. Our projections indicate a slowing-down of this trend so that by 2020 Vermont's employment will acount for approximately 3.3 percent of New England's total work force. Absolute levels of employment will nevertheless more than double. A large part of the growth in manufacturing employment is projected to emerge in the metal working and paper industries. The greatest number of new job opportunities will arise, however, in the service industry sector where levels of employment will grow almost three-fold between 1960 and 2020 (see Tables 6 and 12).

(3) Output. - For the five major water-using industries for which output projections were derived, production levels will rise most rapidly in the Machinery industries. Relatively small output increases are forecast for the Primary Metals and Transportation Equipment industries.

(4) Personal Income. - Between 1960 and 1980, personal income in Vermont is projected to more than double, and by 2020, it is expected to attain approximately 5 times the 1960 level. Given Vermont's projected rate in personal income and population, per capita income levels are indicated to rise somewhat faster than average per capita income levels for New England.

TABLE 1

EMPLOYMENT, POPULATION, HOUSEHOLDS, MASSACHUSETTS, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A. (01-09)	Agriculture, Forestry, and Fisheries	26.147	24.5	23.1	21.8
(01-07)	Agriculture 1/	22.118	20.9	19.5	18.2
08	Forestry 2/	.532	.5	.5	.5
09	Fisheries	3.497	3.1	3.1	3.1
B. (10-14)	Mining	1.213	1.1	1.1	1.1
D. (19-39)	Manufacturing	709.268	827.0	1040.0	1310.0
22	Textile Mill Products	52.336	25.3	16.5	12.2
24	Lumber and Wood Products, except Furniture 2/	5.915	3.4	2.3	1.8
26	Paper and Allied Products 2/	34.055	33.8	35.4	39.5
28	Chemicals and Allied Products	18.293	19.5	22.7	28.7
30	Rubber and Miscellaneous Plastics Products	34.028	40.8	47.1	53.2
31	Leather and Leather Products	56.488	45.2	40.6	35.0
33	Primary Metal Industries	21.366	18.3	16.5	14.6
34	Fabricated Metal Products	50.426	60.3	85.4	125.0
35	Machinery, except Electrical	66.030	87.1	107.0	130.0
36	Electrical Machinery	110.288	174.0	268.0	387.0
37	Transportation Equipment 3/	32.553	36.2	35.1	32.8
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	227.490	283.0	360.0	451.0
C. (15-17), E.-J. (40-99)	Service Industries 4/	1263.684	1810.0	2640.0	3930.0
	TOTAL EMPLOYMENT	2000.312	2660.0	3700.0	5260.0
	TOTAL POPULATION	5148.578	6770.0	9270.0	12740.0
	Urban	4302.530	5890.0	8320.0	11700.0
	Rural	846.048	879.0	946.0	1040.0
	HOUSEHOLDS	1534.732	2000.0	2730.0	3830.0

1/ Based on projections furnished by U. S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U. S. Department of Agriculture, Forest Service.
3/ Includes employment in U. S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A. Table A-1.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 2

EMPLOYMENT, POPULATION, HOUSEHOLDS, CONNECTICUT, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry, and Fisheries	18.143	17.0	16.0	14.9
(01-07)	Agriculture 1/	17.770	16.6	15.6	14.5
08	Forestry 2/	.183	.3	.3	.3
09	Fisheries	.190	.1	.1	.1
B.(10-14)	Mining	1.135	.8	.8	.7
D.(19-39)	Manufacturing	406.785	474.0	564.0	660.0
22	Textile Mill Products	16.461	8.5	5.6	4.3
24	Lumber and Wood Products, except Furniture 2/	1.838	1.2	.8	.7
26	Paper and Allied Products 2/	8.188	7.4	7.7	9.2
28	Chemicals and Allied Products	12.070	12.9	15.9	20.8
30	Rubber and Miscellaneous Plastics Products	16.152	20.4	23.7	26.8
31	Leather and Leather Products	2.538	2.2	2.2	2.0
33	Primary Metal Industries	24.620	23.3	20.6	18.0
34	Fabricated Metal Products	52.001	59.4	81.8	118.0
35	Machinery, except Electrical	64.563	88.9	108.0	129.0
36	Electrical Machinery	36.890	55.2	75.9	100.0
37	Transportation Equipment 3/	69.833	72.5	72.2	47.4
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	101.631	122.0	150.0	184.0
C.(15-17), E.-J.(40-99)	Service Industries 4/	584.376	906.0	1350.0	1990.0
	TOTAL EMPLOYMENT	1010.439	1400.0	1930.0	2660.0
	TOTAL POPULATION	2535.234	3530.0	4840.0	6450.0
	Urban	1985.567	2940.0	4190.0	5700.0
	Rural	549.667	584.0	648.0	752.0
	HOUSEHOLDS	752.736	1030.0	1430.0	1950.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-2.

TABLE 3

EMPLOYMENT, POPULATION, HOUSEHOLDS, MAINE, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	20.378	20.1	19.7	19.3
(01-07)	Agriculture[1/]	17.444	16.9	16.5	16.1
08	Forestry[2/]	.471	.2	.2	.2
09	Fisheries	2.463	3.0	3.0	3.0
B.(10-14)	Mining	.286	.4	.4	.4
D.(19-39)	Manufacturing	109.906	116.0	130.0	142.0
22	Textile Mill Products	14.923	7.7	5.3	4.0
24	Lumber and Wood Products, except Furniture[2/]	14.673	13.3	11.7	9.4
26	Paper and Allied Products[2/]	18.552	22.6	28.7	31.7
28	Chemicals and Allied Products	1.072	1.1	1.2	1.6
30	Rubber and Miscellaneous Plastics Products	1.127	1.9	2.5	3.2
31	Leather and Leather Products	22.530	20.7	20.7	19.4
33	Primary Metal Industries	.401	.6	.6	.5
34	Fabricated Metal Products	1.812	2.1	2.9	4.0
35	Machinery, except Electrical	2.834	4.0	4.9	5.9
36	Electrical Machinery	2.370	6.0	8.2	12.0
37	Transportation Equipment[3/]	8.165	7.7	7.0	4.9
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	21.447	28.4	36.3	45.8
C.(15-17), E.-J.(40-99)	Service Industries[4/]	200.014	269.0	360.0	477.0
	TOTAL EMPLOYMENT	330.584	406.0	510.0	640.0
	TOTAL POPULATION	969.265	1130.0	1340.0	1550.0
	Urban	497.114	637.0	824.0	1010.0
	Rural	472.151	489.0	514.0	538.0
	HOUSEHOLDS	280.355	323.0	387.0	458.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-3.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 4

EMPLOYMENT, POPULATION, HOUSEHOLDS, RHODE ISLAND, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	4.081	3.5	3.0	2.4
(01-07)	Agriculture[1/]	3.406	2.9	2.4	1.8
08	Forestry[2/]	.094	.1	.1	.1
09	Fisheries	.581	.5	.5	.5
B.(10-14)	Mining	.133	.1	.1	.1
D.(19-39)	Manufacturing	124.639	133.0	158.0	192.0
22	Textile Mill Products	28.022	14.1	9.4	7.1
24	Lumber and Wood Products, except Furniture[2/]	.448	.2	.2	.1
26	Paper and Allied Products[2/]	2.104	2.1	3.0	3.8
28	Chemicals and Allied Products	2.203	2.5	3.0	4.0
30	Rubber and Miscellaneous Plastics Products	7.333	8.8	10.1	11.5
31	Leather and Leather Products	1.387	1.3	1.4	1.2
33	Primary Metal Industries	6.778	5.8	5.1	4.6
34	Fabricated Metal Products	7.281	8.4	12.3	18.6
35	Machinery, except Electrical	10.884	15.9	18.6	21.6
36	Electrical Machinery	6.801	11.0	15.9	21.9
37	Transportation Equipment[3/]	3.738	3.6	3.4	3.0
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	46.660	59.0	75.2	94.5
C.(15-17), E.-J.(40-99)	Service Industries[4/]	188.419	261.0	380.0	573.0
	TOTAL EMPLOYMENT	317.272	397.0	541.0	767.0
	TOTAL POPULATION	859.488	1050.0	1390.0	1860.0
	Urban	742.897	926.0	1270.0	1740.0
	Rural	116.591	126.0	118.0	114.0
	HOUSEHOLDS	257.335	315.0	416.0	568.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-4.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 5

EMPLOYMENT, POPULATION, HOUSEHOLDS, NEW HAMPSHIRE, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry, and Fisheries	7.283	7.1	6.8	6.5
(01-07)	Agriculture 1/	6.949	6.8	6.5	6.2
08	Forestry 2/	.247	.2	.2	.2
09	Fisheries	.087	.1	.1	.1
B.(10-14)	Mining	.204	.2	.2	.2
D.(19-39)	Manufacturing	93.185	110.0	141.0	174.0
22	Textile Mill Products	12.430	6.4	4.4	3.4
24	Lumber and Wood Products, except Furniture 2/	5.729	4.1	3.6	3.0
26	Paper and Allied Products 2/	7.521	10.0	13.7	16.3
28	Chemicals and Allied Products	.501	.6	.7	1.0
30	Rubber and Miscellaneous Plastics Products	2.111	3.1	4.3	5.5
31	Leather and Leather Products	20.937	18.1	17.2	15.4
33	Primary Metal Industries	1.416	1.4	1.4	1.3
34	Fabricated Metal Products	2.498	2.9	4.3	6.7
35	Machinery, except Electrical	10.576	14.9	19.8	25.1
36	Electrical Machinery	9.369	19.7	34.0	52.6
37	Transportation Equipment 3/	4.510	5.3	7.9	7.2
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	15.587	23.6	29.9	36.6
C.(15-17), E.-J.(40-99)	Service Industries 4/	133.772	212.0	342.0	533.0
	TOTAL EMPLOYMENT	234.444	329.0	490.0	714.0
	TOTAL POPULATION	606.921	853.0	1240.0	1730.0
	Urban	353.766	545.0	809.0	1160.0
	Rural	253.155	308.0	434.0	573.0
	HOUSEHOLDS	180.020	247.0	363.0	518.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-5

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 6

EMPLOYMENT, POPULATION, HOUSEHOLDS, VERMONT, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry, and Fisheries	16.857	16.7	16.6	16.5
(01-07)	Agriculture[1/]	16.586	16.5	16.4	16.3
08	Forestry[2/]	.246	.2	.2	.2
09	Fisheries	.025	.0	.0	.0
B.(10-14)	Mining	1.034	1.2	1.2	1.2
D.(19-39)	Manufacturing	35.385	44.3	56.9	70.3
22	Textile Mill Products	1.234	.6	.4	.2
24	Lumber and Wood Products, except Furniture[2/]	4.774	3.5	3.2	2.8
26	Paper and Allied Products[2/]	2.283	4.5	7.0	8.9
28	Chemicals and Allied Products	.451	.5	.7	.7
30	Rubber and Miscellaneous Plastics Products	.829	1.1	1.3	1.4
31	Leather and Leather Products	.630	.6	.6	.6
33	Primary Metal Industries	.556	.6	.5	.4
34	Fabricated Metal Products	2.167	3.2	4.7	6.8
35	Machinery, except Electrical	6.249	8.5	10.7	13.2
36	Electrical Machinery	1.722	3.0	5.2	8.0
37	Transportation Equipment	.424	.6	.8	.5
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	14.066	17.6	21.8	26.8
C.(15-17), E.-J.(40-99)	Service Industries[3/]	88.320	130.0	184.0	259.0
	TOTAL EMPLOYMENT	141.596	192.0	259.0	347.0
	TOTAL POPULATION	389.881	509.0	663.0	841.0
	Urban	149.921	236.0	343.0	459.0
	Rural	239.960	273.0	320.0	381.0
	HOUSEHOLDS	110.732	145.0	190.0	241.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes Contract Construction, Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-6

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 7

INDEX OF EMPLOYMENT, POPULATION, HOUSEHOLDS, MASSACHUSETTS, 1960-2020

(1960 = 100.00)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry, and Fisheries	100.00	93.70	88.35	83.37
(01-07)	Agriculture[1/]	100.00	94.49	88.16	82.29
08	Forestry[2/]	100.00	93.98	93.98	93.98
09	Fisheries	100.00	88.65	88.65	88.65
B.(10-14)	Mining	100.00	90.68	90.68	90.68
D.(19-39)	Manufacturing	100.00	116.54	146.04	184.75
22	Textile Mill Products	100.00	48.34	31.53	23.31
24	Lumber and Wood Products, except Furniture[2/]	100.00	57.48	38.88	30.43
26	Paper and Allied Products[2/]	100.00	99.25	103.95	115.99
28	Chemicals and Allied Products	100.00	106.60	124.09	156.89
30	Rubber and Miscellaneous Plastics Products	100.00	119.90	138.42	156.34
31	Leather and Leather Products	100.00	80.02	71.87	61.96
33	Primary Metal Industries	100.00	85.65	77.23	68.33
34	Fabricated Metal Products	100.00	119.58	169.36	248.68
35	Machinery, except Electrical	100.00	131.91	162.20	196.12
36	Electrical Machinery	100.00	157.86	242.64	350.54
37	Transportation Equipment[3/]	100.00	111.20	107.82	100.76
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	100.00	124.23	158.03	198.29
C.(15-17), E.-J.(40-99)	Service Industries[4/]	100.00	143.29	209.01	311.03
	TOTAL EMPLOYMENT	100.00	133.12	185.04	263.15
	TOTAL POPULATION	100.00	131.52	180.06	247.51
	Urban	100.00	136.97	193.48	271.96
	Rural	100.00	103.88	111.85	123.18
	HOUSEHOLDS	100.00	130.06	178.12	249.69

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-1.

TABLE 8

INDEX OF EMPLOYMENT, POPULATION, HOUSEHOLDS, CONNECTICUT, 1960-2020

(1960 = 100.00)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry, and Fisheries	100.00	93.70	88.19	82.13
(01-07)	Agriculture 1/	100.00	93.42	87.79	81.60
08	Forestry 2/	100.00	163.94	163.94	163.94
09	Fisheries	100.00	52.63	52.63	52.63
B.(10-14)	Mining	100.00	70.48	70.48	61.67
D.(19-39)	Manufacturing	100.00	116.47	138.67	162.12
22	Textile Mill Products	100.00	51.64	34.02	26.12
24	Lumber and Wood Products, except Furniture 2/	100.00	65.29	43.53	38.08
26	Paper and Allied Products 2/	100.00	90.38	94.04	112.36
28	Chemicals and Allied Products	100.00	106.88	131.73	172.33
30	Rubber and Miscellaneous Plastics Products	100.00	126.30	146.73	165.92
31	Leather and Leather Products	100.00	86.68	86.68	78.80
33	Primary Metal Industries	100.00	94.64	83.67	73.11
34	Fabricated Metal Products	100.00	114.23	157.30	226.15
35	Machinery, except Electrical	100.00	137.69	166.81	199.65
36	Electrical Machinery	100.00	149.63	205.75	271.35
37	Transportation Equipment 3/	100.00	103.81	103.38	67.87
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	100.00	119.94	147.59	180.74
C.(15-17), E.-J.(40-99)	Service Industries 4/	100.00	154.95	231.31	340.48
	TOTAL EMPLOYMENT	100.00	138.26	191.26	263.72
	TOTAL POPULATION	100.00	139.15	190.86	254.46
	Urban	100.00	148.25	211.05	287.04
	Rural	100.00	106.26	117.91	136.76
	HOUSEHOLDS	100.00	137.06	189.39	258.42

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-2.

TABLE 9

INDEX OF EMPLOYMENT, POPULATION, HOUSEHOLDS, MAINE, 1960-2020

(1960 = 100.00)

SIC	INDUSTRY	1960	1980	2000	2020
A. (01-09)	Agriculture, Forestry, and Fisheries	100.00	98.64	96.67	94.71
(01-07)	Agriculture[1]	100.00	96.88	94.59	92.30
08	Forestry[2/]	100.00	42.46	42.46	42.46
09	Fisheries	100.00	121.80	121.80	121.80
B. (10-14)	Mining	100.00	139.86	139.86	139.86
D. (19-39)	Manufacturing	100.00	105.64	118.28	129.57
22	Textile Mill Products	100.00	51.60	35.52	26.80
24	Lumber and Wood Products except Furniture[2/]	100.00	90.64	79.74	64.06
26	Paper and Allied Products[2/]	100.00	121.82	154.70	170.87
28	Chemicals and Allied Products	100.00	102.61	111.94	149.25
30	Rubber and Miscellaneous Plastics Products	100.00	168.59	221.83	283.94
31	Leather and Leather Products	100.00	91.88	91.88	86.11
33	Primary Metal Industries	100.00	149.63	149.63	124.69
34	Fabricated Metal Products	100.00	115.89	160.04	220.75
35	Machinery, except Electrical	100.00	141.14	172.90	208.18
36	Electrical Machinery	100.00	253.16	345.99	506.33
37	Transportation Equipment[3/]	100.00	94.30	85.73	60.01
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	100.00	132.42	169.25	213.55
C.(15-17), E.-J.(40-99)	Service Industries[4/]	100.00	134.54	180.14	238.68
	TOTAL EMPLOYMENT	100.00	122.72	154.39	193.44
	TOTAL POPULATION	100.00	116.23	138.04	159.70
	Urban	100.00	128.18	165.82	203.19
	Rural	100.00	103.65	108.80	113.90
	HOUSEHOLDS	100.00	115.14	138.04	163.29

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-3.

TABLE 10

INDEX OF EMPLOYMENT, POPULATION, HOUSEHOLDS, RHODE ISLAND, 1960-2020

(1960 = 100.00)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry, and Fisheries	100.00	85.76	73.51	58.81
(01-07)	Agriculture 1/	100.00	85.14	70.46	52.85
08	Forestry 2/	100.00	106.38	106.38	106.38
09	Fisheries	100.00	86.06	86.06	86.06
B.(10-14)	Mining	100.00	75.19	75.19	75.19
D.(19-39)	Manufacturing	100.00	106.47	126.45	153.96
22	Textile Mill Products	100.00	50.32	33.55	25.34
24	Lumber and Wood Products except Furniture 2/	100.00	44.64	44.64	22.32
26	Paper and Allied Products 2/	100.00	99.81	142.59	180.61
28	Chemicals and Allied Products	100.00	113.48	136.18	181.57
30	Rubber and Miscellaneous Plastics Products	100.00	120.01	137.73	156.83
31	Leather and Leather Products	100.00	93.73	100.94	86.52
33	Primary Metal Industries	100.00	85.57	75.24	67.87
34	Fabricated Metal Products	100.00	115.37	168.93	255.46
35	Machinery, except Electrical	100.00	133.79	156.51	181.76
36	Electrical Machinery	100.00	161.74	233.79	322.01
37	Transportation Equipment 3/	100.00	96.31	90.96	80.26
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	100.00	126.45	161.17	202.53
C.(15-17), E.-J.(40-99)	Service Industries 4/	100.00	138.41	201.78	304.06
	TOTAL EMPLOYMENT	100.00	125.16	170.48	241.84
	TOTAL POPULATION	100.00	122.39	161.34	216.12
	Urban	100.00	124.61	170.78	234.73
	Rural	100.00	108.24	101.21	97.52
	HOUSEHOLDS	100.00	122.37	161.66	220.57

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-4.

TABLE 11

INDEX OF EMPLOYMENT, POPULATION, HOUSEHOLDS, NEW HAMPSHIRE, 1960-2020

(1960 = 100.00)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry, and Fisheries	100.00	97.49	93.37	89.25
(01-07)	Agriculture[1/]	100.00	97.86	93.54	89.22
08	Forestry[2/]	100.00	80.97	80.97	80.97
09	Fisheries	100.00	114.94	114.94	114.94
B.(10-14)	Mining	100.00	98.04	98.04	98.04
D.(19-39)	Manufacturing	100.00	118.15	151.53	186.83
22	Textile Mill Products	100.00	51.49	35.40	27.35
24	Lumber and Wood Products except Furniture[2/]	100.00	71.57	62.84	52.37
26	Paper and Allied Products[2]	100.00	132.96	182.16	216.73
28	Chemicals and Allied Products	100.00	119.76	139.72	199.60
30	Rubber and Miscellaneous Plastics Products	100.00	146.85	203.69	260.54
31	Leather and Leather Products	100.00	86.45	82.15	73.55
33	Primary Metal Industries	100.00	98.87	98.87	91.81
34	Fabricated Metal Products	100.00	116.09	172.14	268.21
35	Machinery, except Electrical	100.00	140.89	187.22	237.33
36	Electrical Machinery	100.00	210.27	362.90	561.43
37	Transportation Equipment[3/]	100.00	117.52	175.17	159.65
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	100.00	151.41	191.83	234.81
C.(15-17), E.-J.(40-99)	Service Industries[4/]	100.00	158.48	255.58	398.66
	TOTAL EMPLOYMENT	100.00	140.50	209.05	304.59
	TOTAL POPULATION	100.00	140.46	204.72	284.91
	Urban	100.00	153.91	228.65	326.77
	Rural	100.00	121.66	171.28	226.42
	HOUSEHOLDS	100.00	136.98	202.03	287.69

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-5

TABLE 12

INDEX OF EMPLOYMENT, POPULATION, HOUSEHOLDS, VERMONT, 1960-2020

(1960 = 100.00)

SIC	INDUSTRY	1960	1980	2000	2020
A. (01-09)	Agriculture, Forestry, and Fisheries	100.00	99.07	98.48	97.88
(01-07)	Agriculture 1/	100.00	99.48	98.88	98.28
08	Forestry 2/	100.00	81.30	81.30	81.30
09	Fisheries	100.00	0.00	0.00	0.00
B. (10-14)	Mining	100.00	116.05	116.05	116.05
D. (19-39)	Manufacturing	100.00	125.19	160.80	198.67
22	Textile Mill Products	100.00	48.62	32.41	16.21
24	Lumber and Wood Products except Furniture 2/	100.00	73.31	67.03	58.65
26	Paper and Allied Products 2/	100.00	197.11	306.61	389.84
28	Chemicals and Allied Products	100.00	110.86	155.21	155.21
30	Rubber and Miscellaneous Plastics Products	100.00	132.69	156.82	168.88
31	Leather and Leather Products	100.00	95.24	95.24	95.24
33	Primary Metal Industries	100.00	107.91	89.93	71.94
34	Fabricated Metal Products	100.00	147.67	216.89	313.80
35	Machinery, except Electrical	100.00	136.02	171.23	211.23
36	Electrical Machinery	100.00	174.22	301.97	464.58
37	Transportation Equipment	100.00	141.51	188.68	117.92
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	100.00	125.12	154.98	190.53
C. (15-17) E.-J. (40-99)	Service Industries 3/	100.00	146.63	208.45	293.59
	TOTAL EMPLOYMENT	100.00	135.39	182.77	245.28
	TOTAL POPULATION	100.00	130.63	170.15	215.63
	Urban	100.00	157.35	228.85	306.36
	Rural	100.00	113.94	133.48	158.94
	HOUSEHOLDS	100.00	130.68	171.40	217.91

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

Source: Appendix A, Table A-6.

TABLE 13

PERSONAL INCOME, NEW ENGLAND STATES, 1960-2020

TOTAL PERSONAL INCOME

(In billions of 1954 dollars)

	1960	1980	2000	2020
Massachusetts	11.3	22.8	45.7	93.4
Connecticut	6.4	13.3	26.7	53.0
Maine	1.6	3.0	5.2	8.9
Rhode Island	1.6	3.1	6.0	11.9
New Hampshire	1.1	2.4	5.1	10.5
Vermont	0.6	1.4	2.6	4.9
New England	22.6	46.0	91.3	183.0

PER CAPITA PERSONAL INCOME

(In 1954 dollars)

	1960	1980	2000	2020
Massachusetts	2,199	3,370	4,930	7,330
Connecticut	2,502	3,770	5,520	8,220
Maine	1,641	2,660	3,890	5,750
Rhode Island	1,907	2,950	4,330	6,410
New Hampshire	1,824	2,820	4,110	6,070
Vermont	1,647	2,750	3,920	5,830
New England	2,150	3,320	4,870	7,260

Source: Appendix G, Table G-1 and G-2.

TABLE 14

PROJECTIONS OF OUTPUT (VALUE ADDED) FOR MAJOR WATER-USING INDUSTRIES, NEW ENGLAND STATES, 1958-2020

(in millions of 1954 dollars)

		1958*	1980	2000	2020
SIC 28	Chemicals and Allied Products				
	New England	375.9	1150	2480	5140
	Connecticut	126.5	369	824	1750
	Maine	5.4	16	35	70
	Massachusetts	219.8	689	1450	2950
	New Hampshire	3.0	10	22	45
	Rhode Island	17.7	58	125	262
	Vermont	3.5	14	30	62
SIC 33	Primary Metal Industries				
	New England	465.3	614	754	908
	Connecticut	216.7	297	361	432
	Maine	1.6	2	3	3
	Massachusetts	163.2	209	258	312
	New Hampshire	14.0	14	19	24
	Rhode Island	66.4	87	106	128
	Vermont	3.4	5	7	9
SIC 35	Machinery, except Electrical				
	New England	1005.6	2210	3390	5150
	Connecticut	404.1	911	1390	2110
	Maine	11.1	12	18	33
	Massachusetts	457.6	960	1470	2230
	New Hampshire	49.0	125	205	326
	Rhode Island	50.0	118	172	250
	Vermont	33.8	80	126	195
SIC 36	Electrical Machinery				
	New England	1005.9	2860	6260	13100
	Connecticut	302.9	727	1510	2910
	Maine	5.5	57	108	224
	Massachusetts	607.9	1730	3880	8250
	New Hampshire	55.5	228	573	1310
	Rhode Island	25.0	91	192	390
	Vermont	9.1	27	68	156
SIC 37	Transportation Equipment				
	New England 1/	858.0	1190	1570	1590
	Connecticut 1/	586.5	798	1060	953
	Maine 1/	42.9	56	67	68
	Massachusetts 1/	214.7	308	404	524
	New Hampshire 1/	.7	2	3	4
	Rhode Island 1/	6.3**	15	21	26
	Vermont	6.9**	12	17	17

For footnotes, see following page.

1/ Since the Census of Manufactures value-added figures do not account for output produced in U.S. Government-owned installations, the value-added figures shown here for the Transportation Equipment industry do not include output produced in U.S. Government shipyards.

* 1958 New England value-added total for each industry, expressed in millions of 1954 dollars, was derived by deflating the respective industry value-added totals by appropriate price indexes, as explained in detail in Projective Economic Study of New England, Appendix C.

1958 state value-added totals for each industry, expressed in millions of 1954 dollars, were obtained by allocating the deflated New England total to each state on the basis of each state's percent share of the New England value-added total in current dollars. This method was used because of the lack of reliable price indexes for individual industries at the state level.

** Since value-added data were not available for Rhode Island and Vermont due to disclosure regulations, a special method was adopted in approximating their 1958 value-added totals for this industry, expressed in millions of 1954 dollars. The two states together comprised 1.54 percent of New England's total value added in 1958 in this industry, amounting to $13.3 million.

We apportioned this amount among the two states on the basis of their respective shares of Bureau of Labor Statistics employment data reported in 1958. We then expressed the resulting value-added estimates as percents of the 1958 total. Finally, we applied these percent shares (Rhode Island: 0.73%, Vermont: 0.81%) to the New England 1958 value-added total (in millions of 1954 dollars), in order to obtain their respective value-added totals for 1958 in constant 1954 dollars (i.e., Rhode Island $6.3 million, Vermont $6.9 million).

Source: Appendix H, Table H-1.

TABLE 15

STATE PERCENT SHARES OF IMPORTANT PROJECTED ECONOMIC INDICATORS

	Employment in Industries						
	Primary Resource	Manu-facturing	Total Commodity	Service	Total	Population	Personal Income
1960							
Connecticut	19.90	27.50	27.03	23.77	25.05	24.12	28.01
Maine	21.32	7.43	8.28	8.14	8.19	9.22	7.03
Massachusetts	28.24	47.95	46.74	51.40	49.58	48.99	50.00
New Hampshire	7.73	6.30	6.39	5.44	5.81	5.78	4.89
Rhode Island	4.35	8.43	8.18	7.66	7.86	8.18	7.24
Vermont	18.46	2.39	3.38	3.59	3.51	3.71	2.83
New England	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1980							
Connecticut	19.27	27.81	27.37	25.24	25.95	25.49	28.98
Maine	22.10	6.82	7.60	7.50	7.53	8.14	6.48
Massachusetts	27.56	48.52	47.44	50.47	49.46	48.93	49.67
New Hampshire	7.83	6.46	6.54	5.91	6.12	6.16	5.16
Rhode Island	3.91	7.79	7.59	7.27	7.38	7.60	6.76
Vermont	19.33	2.60	3.46	3.61	3.56	3.68	2.95
New England	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2000							
Connecticut	18.88	27.05	26.71	25.70	26.00	25.82	29.29
Maine	22.58	6.23	6.90	6.85	6.86	7.14	5.67
Massachusetts	27.19	49.66	48.74	50.22	49.79	49.47	50.09
New Hampshire	7.87	6.77	6.82	6.50	6.59	6.63	5.55
Rhode Island	3.48	7.56	7.39	7.23	7.28	7.40	6.57
Vermont	20.00	2.73	3.44	3.50	3.48	3.54	2.83
New England	100.00	100.00	100.00	100.00	100.00	100.00	100.00
2020							
Connecticut	18.33	25.88	25.63	25.63	25.63	25.63	29.01
Maine	23.15	5.59	6.15	6.15	6.15	6.15	4.88
Massachusetts	26.91	51.41	50.63	50.63	50.63	50.63	51.17
New Hampshire	7.87	6.83	6.87	6.87	6.87	6.87	5.74
Rhode Island	2.94	7.53	7.38	7.38	7.38	7.38	6.53
Vermont	20.80	2.76	3.34	3.34	3.34	3.34	2.67
New England	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Source: Appendix A

CHAPTER III - METHODOLOGICAL FRAMEWORK

6. INTRODUCTION

Chapter II has presented the projections of population and economic activity for the six New England states. This chapter describes the basic objectives and structure of the methodology used in deriving those projections.

In shaping a methodological framework which would forecast the changing distribution of employment, population, and personal income among the New England states, we gave primary attention to the following objectives:

1. The forecasts for the six New England states should be consistent with (i.e., add up to) the projections made for the New England region as a whole (see Projective Economic Study of New England). This suggests that the forecasting method be focused on the allocation among the states of each of the variables to be projected.

2. The forecasting framework should have built into it a high degree of internal consistency. By this we mean that the distributions of employment, output, population, and personal income among the states should not be derived independently of one another. Rather, the interdependency and mutually determining nature of these variables should be recognized through appropriate linkages in the structure of the analytical framework. Meeting this objective minimizes the possibility of deriving results which are contradictory.

3. The methodological framework should also take into account some of the important comparative advantages and disadvantages for industrial location present in each of the six New England states. Further, it should recognize that the importance of certain locational advantages varies from industry to industry, and over time.

4. The level of sophistication of the projection method should be in keeping with the availability and quality of New England data. For example, changes in new capital expenditures might be a more sensitive measure of the changing location patterns of New England manufacturing industries than changes in employment. However, because the Census of Manufactures provides new capital expenditure data on a suitably disaggregated basis for only a few years and because the information provided by reporting firms is of uncertain consistency, we believe that it is advisable not to base the projection framework on this measure.

Rather, the method employed in this report links the relative growth pattern of individual New England states to certain fundamental determinants that govern the long-range growth of regional investment. These determinants we feel, are embodied in factors such as the relative size of internal markets, the available labor supply in individual states, the forces of inertia which impede the industrial relocation process, the proximity and accessibility of production centers to national markets, and the cost advantages of producing in one state rather than another.

In keeping with the requirements imposed by the above objectives we weighed the relative merits of several methodological approaches. The projection framework which finally emerged represents no single standardized approach. Instead, its structure includes elements of location factor theory, regression analysis, inter-industry linkages of the input-output type, and ratio analysis. The structure of this framework is analyzed below: first we consider its basic outline and then we examine the rationale of some of its key characteristics.

7. THE METHODOLOGICAL FRAMEWORK IN OUTLINE

1. Each state's economy was viewed as being composed of two major employment sectors: (a) the commodity sector, comprising the resource or primary industries (agriculture, forestry, fisheries, and mining) plus all of the manufacturing or secondary industries; and (b) the noncommodity or service sector, which includes all the remaining tertiary employment areas, such as wholesale and retail trade, government, and construction. A more detailed breakdown of the composition of these two major sectors is shown in Table 16.

2. The growth of these two sectors in each state's economy was related to the state's population on the premises (a) that employment growth in the commodity sector determines the state's population growth; and (b) that employment growth in the noncommodity or service sector is a function of population growth in the state.

3. The first task, then, was to project employment in the commodity sector. A careful projection of the commodity sector is important in light of its key role in determining projections of total employment, population, output of selected industries, and personal income. Consequently, for the years 1970 and 1980 the percentage distribution among states of each industry component of the commodity sector, shown in Table 16, was projected by three independent methods: first by location theory, then by regression analysis, and finally by ratio analysis. Of these three projections of a state's percentage share of a given component, the median (i.e., middle) projection was adopted. (The median shares

TABLE 16

THE DIVISION OF TOTAL EMPLOYMENT INTO MAJOR SECTORS AND COMPONENTS WITHIN THE METHODOLOGICAL FRAMEWORK

Commodity Sector

- Resource Industries
  - Agriculture 1/
  - Forestry 2/
  - Fisheries
  - Mining
- Manufacturing Industries
  - "Base" Industries 5/
    - Chemicals and Allied Products 4/
    - Primary Metal Products 4/
    - Machinery, except Electrical 4/
    - Electrical Machinery 4/
    - Transportation Equipment 4/
    - Textiles
    - Rubber and Plastic Products, nec.
    - Leather and Leather Products
    - Paper and Allied Products 2/
  - "Non-base" Industries 5/
    - Lumber and Wood Products 2/
    - All other Manufacturing Industries

Noncommodity or Service Sector 3/

- Transportation, Communication and Utilities
- Wholesale and retail trade
- Finance, insurance, and real estate
- Services
- Government
- Construction
- Non-classifiable

1/ Projections provided by U.S. Department of Agriculture, Economic Research Service.
2/ Projections provided by U.S. Department of Agriculture, Forest Service.
3/ Projections made only for the service sector as a whole.
4/ Major water-using industries in the manufacturing sector for which output (value added) projections were derived.
5/ The distinction made between "base" and "non-base" manufacturing industries in the study of New England as a whole has no methodological significance for this report, since virtually all commodity industries are likely to be "base" or regional export industries at the state level. However, this dual grouping is preserved since it determines the extent to which the commodity sector can be disaggregated in the state projections.

of each commodity sector component were then adjusted slightly to add to 100 percent.)[1/]

4. For the projection years after 1980 the state shares of each component of the commodity sector were projected by the following regression relationship:

$$\text{State share component } i = a + b \log(\text{time}),$$

using the 1947-1963 historical shares plus the 1970 and 1980 median shares determined above as data inputs.

Thus, to summarize, projections for the commodity sector are made in two stages. In the first stage, shorter-range projections are made which reflect not only the historical trends in component shares, but in addition take into account variables which explicitly recognize the impact of such factors as wage differentials, transport costs, and economies of large scale operation on the regional location decisions made by individual industries. In the second stage, longer-range projections to the year 2020 are made by a regression analysis in which the shorter-range projections for 1970 and 1980 are combined with the historical data. As a result, modifications in historical trends and, in some instances, turning points in trends emerge which could not have been forecast had only the historical trend data been used.

5. To facilitate a more accurate determination of trend relationships our analysis was carried out using Bureau of Labor Statistics employment data by state. Subsequently, the share projections obtained for each of the two-digit manufacturing components were converted into Census of Population equivalents, on the basis of the 1960 relationships between the BLS and Census of Population figures.

The following exceptions to the above procedure for forecasting the commodity sector employment should be noted: (a) projections of agricultural employment were supplied to us by the U.S. Department of Agriculture in full-time man-year equivalents (see Appendix D); these we converted to Census of Population terms; (b) projections of employment in forestry and in two manufacturing industries, Lumber and Wood Products (SIC 24) and Paper Allied Products (SIC 26), were provided by the U.S. Forest Service in Census of Population terms (see Appendix E); (c) the projections for the Fisheries and Mining industries were made by a separate analysis (see Appendix C); and (d) the projections for the Transportation Equipment industry (SIC 37) were based on special regression methods.

1/ For a fuller discussion of the commodity industry projections for 1970 and 1980, see Section 8b of this chapter.

6. The above projections of each component of the commodity sector were made in terms of the component's percentage distribution among the six New England states. To obtain employment in absolute terms, the projected percentage distributions were multiplied by the New England control totals found in our first report, Projective Economic Study of New England. Summing the absolute employment projections gave total commodity employment in each state.

7. To obtain projections of population on the basis of the projections of commodity employment, the analysis was again carried out in percentage distribution terms using the following expression:

$$\text{State's \% of N.E. Pop.} = \text{State's \% of N.E. Commodity Employment} \times \left[\frac{\text{State's \% of N.E. Population}}{\text{State's \% of N.E. Commodity Employment}}\right]^{*}$$

Thus, the equation relates a state's share of New England population to its share of New England commodity employment, modified by an adjustment factor. The adjustment factor represents a projection (denoted by the asterisk) of the extent to which a given state's share of population has been above or below its share of commodity employment in the past.[2/] Once each state's share of population was determined by the equation, the shares of the six states were adjusted slightly to add to 100 percent. The procedure was repeated for each projection year. In this way, the changing distribution of commodity employment over the projection period generates a changing distribution of population.

8. Given the distribution of population among states, the distribution of noncommodity or service sector employment was projected by the equation:

$$\text{State's \% of N.E. Noncommodity Employment} = \text{State's \% of N.E. Population} \times \left[\frac{\text{State's \% of N.E. Noncommodity Employment}}{\text{State's \% of N.E. Population}}\right]^{*}$$

The interpretation of this equation is analogous to the interpretation of the equation used in determining population shares. The equation for noncommodity employment states that a state's share of noncommodity or service employment equals its share of population -- modified by an adjustment factor (which projects the extent to which each state's noncommodity employment share has been greater or less than its population share historically). Employment in the noncommodity sector was thus projected as a total only.

2/ Historical values for the state shares of commodity employment, noncommodity employment, and population over the last three decades, and the projected values of the adjustment factor are presented in Appendix I, Tables I-1 and I-2. See also the discussion on Page 35.

9. Projections of output were also required for five manufacturing industries designated as major water users (see Table 14). To accomplish this we multiplied the state employment projections for these industries by the state productivity projections for the industries. Two constraints had to be taken into account in this approach: (a) the state productivity differentials for each industry must be consistent with the average industry productivity projections for the region as a whole, and (b) the combined output projections obtained must equal the New England control totals established in our first report.

10. Personal income for each state was projected by a two-stage approach. In the first stage, for the period 1960 through 1980, the following equation was used:

$$\text{State's \% of N.E. Personal Income} = \text{State's \% of Employment in Nonresource Industries} \times \text{Average Manufacturing Wage Differential Adjustment Factor}$$

That is, the distribution among states of total employment in all but the primary resource industries weighted by differences among states in the overall manufacturing wage rate determined the distribution of personal income.[3/] (The assumption was made that the overall wage differentials of the manufacturing sector were representative of the differentials for nonresource employment as a whole.) In the second stage, covering the period after 1980, a different equation was used:

$$\text{State's \% of N.E. Personal Income} = \text{State's \% of N.E. Population} \times \frac{\text{State's \% of 1980 N.E. Personal Income}}{\text{State's \% of 1980 N.E. Population}}$$

In this equation, a state's share of personal income is made to depend on its projected share of population adjusted by the extent to which its share of personal income was greater or less than its share of population in 1980. The change in approach after 1980 was dictated by the difficulty in making reasonable assumptions about average wage differentials beyond a 20-year horizon. To conform with the personal income measures used in our study of New England as a whole, the state projections of personal income were made in billions of 1954 dollars.

11. As a final step in the projection framework, past demographic relationships were used to determine the urban and rural components of population and the number of households for each of the New England states.

We have deferred most of the discussion of the rationale of the methodological framework in order to set forth a clear and unified description of its structure. In the section which follows we will consider the justification for some of the key premises and hypotheses adopted -- both in terms of their basis in regional economic theory and in terms of their historical validity.

3/ This equation for determining state personal income level is a slight simplification of the one used; for the precise formulation, see Appendix G.

8. KEY ELEMENTS OF THE METHODOLOGICAL FRAMEWORK AND THEIR RATIONALE

Within the methodological framework two elements are of particular importance in shaping the projection results. These concern (a) the relationship between commodity employment, population, and noncommodity employment; and (b) the method for projecting commodity industry employment.

a. The Relationship Between Commodity Employment, Population, and Noncommodity Employment. - At the center of the methodological framework is the causal linkage by which the growth of population is made to depend upon the growth of employment in the commodity sector. This relationship is based on the fact that the smaller a region, the less its population growth will be determined by demographic factors such as the region's birth and death rates and the more it will depend on the growth or contraction of employment opportunities in the region relative to other regions. With regions of the areal size of the individual New England states, changes in population depend largely on changes in the rates of migration; rates of migration, in turn, are primarily determined by changes in employment opportunities.

However, to hold that there is only a one-way street of causality moving from changes in employment opportunities to changes in population ignores the mutually determining, interrelated nature of population and employment. Even in a small region the growth of population in itself creates certain types of employment opportunities. One means of accounting for such interrelatedness is to construct a forecasting model based upon a set of simultaneous relationships. Such models, however, generally have structural rigidities which make them inappropriate for long-range forecasting. To avoid a rigid structure and yet recognize the interdependence of population and employment, we adopted an approach which divides employment into two major sectors, the commodity sector and the noncommodity sector.

Employment opportunities in the commodity sector are determined by a large number of factors ranging from natural resource endowments to wage rates to transportation networks to market potentials. Population, to the extent that it affects labor supply, represents one such factor but by no means the only or dominant one. This is especially true for New England where the states are sufficiently small so that the greater part of the manufacturing and resource industry employment in any individual state is oriented toward markets outside the state.

The reverse, however, is generally true for the relation between noncommodity employment and population. Employment in retail and wholesale trade, transportation, communication and utilities, construction, and services (narrowly defined) is predominantly geared to serve local market needs within a state. The same is true, of course, for employment in state and local government, and, to a lesser extent, for employment in

finance, insurance, and real estate. The geographic distribution of the employment in these sectors is thus best reflected by the distribution of population.

The distinction that has been made between commodity and noncommodity employment and their relationship to population is, of course, not a rigid one. The possibility of feedback effects, running counter to the principal direction of causality, should be recognized in the projection framework. These feedback effects may occur at either link in the commodity-population-noncommodity sequence. First, population growth may have some feedback effect on the growth of commodity employment. Some components of the commodity industries may sell in predominantly local markets (for example, the bakery and dairy components of the food industry), and in this respect may be more akin to the noncommodity industries. Also, all the commodity industries may be affected by population to the extent that individual firms are conscious of the overall conditions of labor supply for a given state. To account for these effects we included total manufacturing employment, lagged by one decade, as one of the location factors to be used in projecting individual manufacturing industries.4/ Total manufacturing employment lagged by one decade provides an approximate reflection of current population, since changes in manufacturing employment play a large role in determining changes in population. By the use of a lagged variable, feedback effects can be introduced without resorting to simultaneous equation relationships.

The second type of feedback effect may occur at the link between population and noncommodity employment. A portion of noncommodity employment in each state may be related to markets outside the state. Examples of such "exporting" service industries are the banking, medical, and educational employment sectors in Massachusetts, the insurance industry in Connecticut, and the recreational industries in all states, especially those in the northern New England states.

Since projections for the separate components of the noncommodity sector are not required, a change in the growth of exported services which is greater or less than the change implied by population is significant only to the extent that it results in a change in total noncommodity employment. One might expect, for example, that due to the relative importance of recreational services in the three northern New England states, the share of these states in total service employment would exceed its share of total population. Yet for the 1940, 1950, and 1960 decades, the reverse is true. Maine, New Hampshire, and Vermont have all had a somewhat lower proportion of New England service employment than their

4/ We assumed, however, that a state's employment in the resource industries is largely independent of a feedback influence from the state's population.

proportion of New England population. However, the gap has been narrowing over the last three decades, indicating that services have been gaining in their position relative to population. This trend in the changes of relative shares is maintained throughout the projection period by means of an adjustment factor in the equation which projects noncommodity or service employment (see item 8 in the methodological outline given above and Appendix I.) Thus feedback effects of the second type are also recognized, but in a more implicit way.

So far, we have considered the economic rationale of the linkage between commodity employment, population, and noncommodity or service employment. But it is equally important to ask to what extent this linkage is supported by historical data. In general, the support for both aspects of the linkage is very good. Over the past three decades there have been only three instances in which a change in a state's commodity employment share was not accompanied by a parallel change in population.[5] (The exceptions occurred in Massachusetts during the 1940-1950 decade and in Rhode Island and New Hampshire in the 1930-1940 decade; each of these exceptions is understandable when viewed in the context of the war or depression period in which it occurred.) In the case of the relationship between noncommodity employment and population, parallel increases or decreases occur in each state in each year without exception. In addition, the discrepancies in distribution among states between commodity employment and population on the one hand and population and noncommodity employment on the other hand were found to diminish systematically over time. This constitutes strong evidence for rejecting the possibility that the close correlations between these major components are the result of chance.

b. The Method for Projecting Commodity Employment. - As noted in the outline described above, the manufacturing industries, which account for the major share of commodity industry employment, were projected in a two-stage approach. In the first stage shorter-range projections, covering the 20-year period 1960-1980, were developed via three different techniques. Intensive forms of analysis which can be used for the shorter time horizon are not applicable to a 60-year time span. The longer-range projections were obtained by using the shorter-range results to modify the post-war trend in these manufacturing industries in a regression analysis.

The three techniques used to derive the shorter-range projections were ratio analysis, regression analysis, and location theory. Of these, the first two are straightforward. Ratio analysis assumes that the distribution of an industry among states which prevailed in 1960

5/ A comparison of the historical shares of population, commodity employment, and noncommodity employment for each New England state is presented in Appendix I, Table I-1.

will also prevail in 1970 and 1980.[6] Thus the projected overall growth or decline of a state's manufacturing employment is a reflection of the extent to which the composition of industry in the state is weighted in favor of New England's faster- or slower-growing industries.

The regression approach projects changes in the percent shares of individual manufacturing industries for 1970 and 1980 on the basis of the 1947 to 1963 trend in these shares. A dampening of the historical rate of change is assumed, however, by regressing each state's share of each industry against the logarithm of time. By this method the projected overall growth or decline of a state is a result of both the favorable or unfavorable bias that may exist in the composition of the industry and the extent to which that composition is changing based on historical trends.

The third approach, the location theory approach, was used in order to offer an alternative to the use of purely historical trends in industry shares. Instead, this approach examines the location of industries in terms of the more important economic variables which enter into its location decisions. In order to implement this approach we first framed operational definitions of the location determining variables to be considered and then compiled data for the New England states consistent with these definitions. In the following paragraphs we offer a closer examination of the structure of the location theory approach and its economic rationale.

For each of the individual manufacturing industry categories shown in Table 16, six location factors were identified:[7] (1) the state distribution of the industry employment in the previous census year; (2) the distribution of manufacturing employment in the previous census year; (3) industry wage differentials among states; (4) a market accessibility factor; (5) special factors for some industries representing buyer-supplier linkages between industries; and (6) a residual trend factor. The meaning and measurement of each of these factors is discussed below:

(1) The distribution among states of the industry in the previous decade. - There are strong reasons why industries tend to remain located where they are, so that changes in distribution which do occur from decade to decade are generally gradual. These reasons relate to the life expectancy of capital equipment, economies of scale within the

6/ At the working level the 1959-60-61 employment average was used to determine the percent distribution among states.

7/ In the case of the nonbase industries (excluding Lumber and Wood Products), the location factors were developed for the industry group as a whole. For industries for which no location factors were developed, see Item 5 in the outline of the methodology presented earlier in this chapter.

industry, and inertia in the absence of compelling reasons to move. Since investment in plant and equipment by most manufacturing firms represents a fairly long-term commitment, not many firms will be in a position to consider relocation in each decade. For this reason, then, we would expect a measure of stability in the distribution of an industry. But in addition, firms which rebuild, expand or move into a given area may do so in part because there are generally economies in an industry which accrue to a concentration of firms over and above those which they realize individually. (Such economies are generally referred to as economies of scale external to the firm but internal to the industry.) For example, firms of the jewelry industry may tend to remain concentrated in and near Rhode Island in order to share in the economies of maintaining a skilled labor pool and of attracting input suppliers to the region. Finally, simple inertia is often a factor militating against a firm's quick response to changes in the economic climate. Many firms have an established set of supply, marketing, and banking relationships which they are reluctant to lose by moving.8/ Noneconomic amenity factors may reinforce this attitude.

(2) The distribution of manufacturing employment in the previous decade. - Manufacturing employment is a relevant factor in explaining employment shifts in a particular industry for both explicit and implicit reasons. Explicitly, manufacturing employment indicates the size of a state's industrial labor pool and the extent to which the production and marketing economies offered in the more industrialized regions are likely to be realized. The implicit linking of the distribution among states of each industry to the distribution of manufacturing employment helps to take account of the many factors which are significant in influencing the distribution of all industries. Examples of such common factors are business tax differentials among states, land value differentials (to the extent that differences among states stand out above intra-state differences), and differences in the general availability and cost of capital. The importance of these factors to the decision as to which state to locate in is a matter of some debate, but to the extent that they are important we expect their impact to be more or less uniform among industries at the two-digit SIC grouping.

(3) Industry wage differentials among states. - Wage differentials among the six New England states are quite significant. For the nine manufacturing industries projected by location theory, Bureau of Labor

8/ Inertia considerations may be particularly relevant for industries in which small firms are an important segment of the industry. One study indicates that even when the small firm does relocate it generally "restricts (its) thinking to a location within a 20 to 40 mile radius at most." (See William N. Kinnard, Highways as a Factor in Small Manufacturing Plant Location Decisions, University of Connecticut, 1961, p. 4.

Statistics hourly earnings data reveal that wage rates in nearly every instance are highest in Connecticut and lowest in one of the three northern states. Massachusetts wage rates in these industries are usually very close to those in Connecticut, while Rhode Island's rates are usually at the average level for the region.

The importance of wage differentials in the location decisions of an industry depends upon the importance of labor costs in the industry's total costs. For industries such as Textiles and Leather in which labor costs constitute 40 percent to 45 percent of value added[9/] a high sensitivity to variations in wage rates is likely. By contrast, for an industry such as the Chemical industry where labor costs account for only 22 percent of value added, wage differentials are likely to be of lesser importance in shaping location decisions. In general, wage differentials proved to be a more useful factor to explain historical shifts in employment in precisely those industries in which labor costs represented a large portion of an industry's value of output (measured in value-added terms).

To employ wage differentials as a location factor two computational steps were necessary: (a) a projection of the differentials was required; and (b) the differentials had to be translated into a form which could be expressed as a percent distribution among states. To project wage differentials we looked at the 1947-1963 trend in wage differentials in each industry. For this 16-year period we found that the differentials among the six New England states have remained virutally constant in each of the industries to be projected. In a few instances the differentials have even widened slightly. Based on this finding we assumed that the wage differentials in 1970 and 1980 would be the same as the 1959-1963 average differentials. To express the wage differentials in a percent distribution form, we used the differentials as weights to modify the distribution of a given industry in the previous decade. Section 2 of Appendix B provides a fuller discussion of the derivation of the wage differential factor.

(4) The market accessibility factor. - Another set of considerations affecting the spatial distribution of an industry among states relates to the availability of industrial sites within the state, the adequacy of the state's transport network, and the average distance from the state to major metropolitan markets. An increasing number of manufacturing concerns are resolving these issues through reference to the nation's network of limited access highways. These highways have played an increasing role in determining the spatial distribution of new plant construction. They open up sites which can meet the land requirements

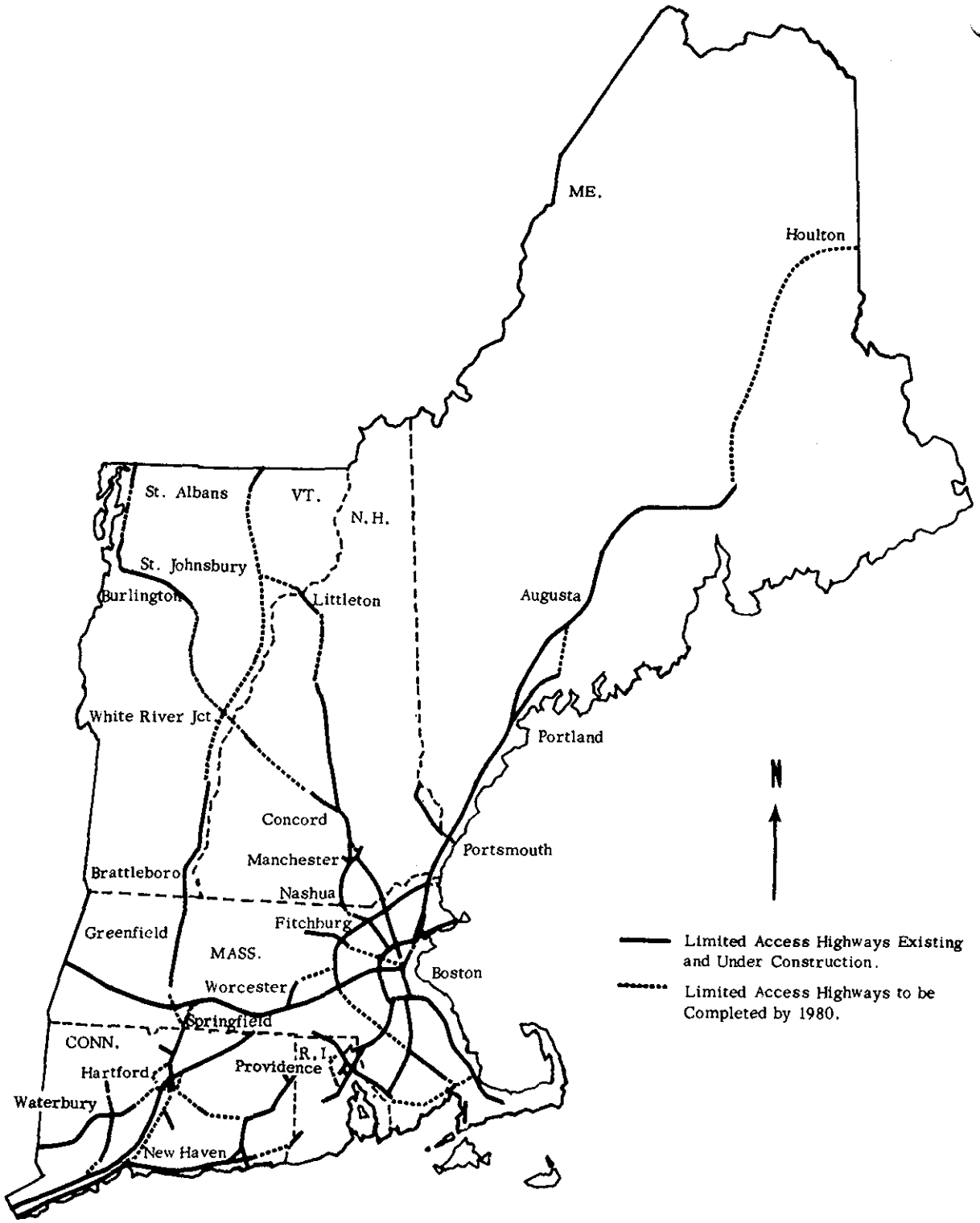
9/ Value added includes most of the important categories of cost except the cost of purchased materials. While total sales might be a better base from which to determine the relative importance of labor costs, figures for total sales are not available at a two-digit SIC level due to problems of double counting. However, the use of value added is not likely to be misleading for industries within the manufacturing sector.

imposed by single-story plant architecture, the needs for increased parking space, and the desire for a higher ratio of land area to building area for esthetic reasons -- considerations which are increasingly difficult to meet in congested urban areas. Limited access highways are of particular importance as a location factor in New England where light industry is predominant and is strongly oriented toward truck transport. One measure, then, of each state's potential industrial attractiveness is the extent of its limited access highway network. The network of both existing and planned limited access highways for the New England region is shown in Figure 1. The significance of limited access highways as a location factor is shown in Figure 2. It highlights how the development of industrial parks in Massachusetts has been influenced by the state's network of limited access highways.

However, the mileage of limited access highways within a state cannot account for another important locational consideration -- the distance from industrial sites to major markets. Since this consideration is likely to be of importance in making location decisions, we weighted each state's percentage share of limited access highway mileage by the average distance from the state's important cities to two major market centers: Boston and New York. The distribution of the limited access highway mileage weighted by average distances to major markets was named the market accessibility factor. In order to project this factor for 1970 and 1980, we defined 1970 limited access highway mileage as the mileage completed in 1964 plus mileage now under construction, and 1980 mileage as 1970 mileage plus other proposed interstate highways. The market distance weights were of course the same in all years. In testing the significance of the market accessibility factor in explaining historical changes in the distributions of industries our results were similar to those obtained for the wage factor. The better explanations of historical shifts were obtained in those industries for which a priori economic considerations suggested a likely correlation with highway networks (e.g., Electrical Machinery, and Rubber and Plastics). A more detailed account of the calculation of the market accessibility factor is presented in Appendix B.

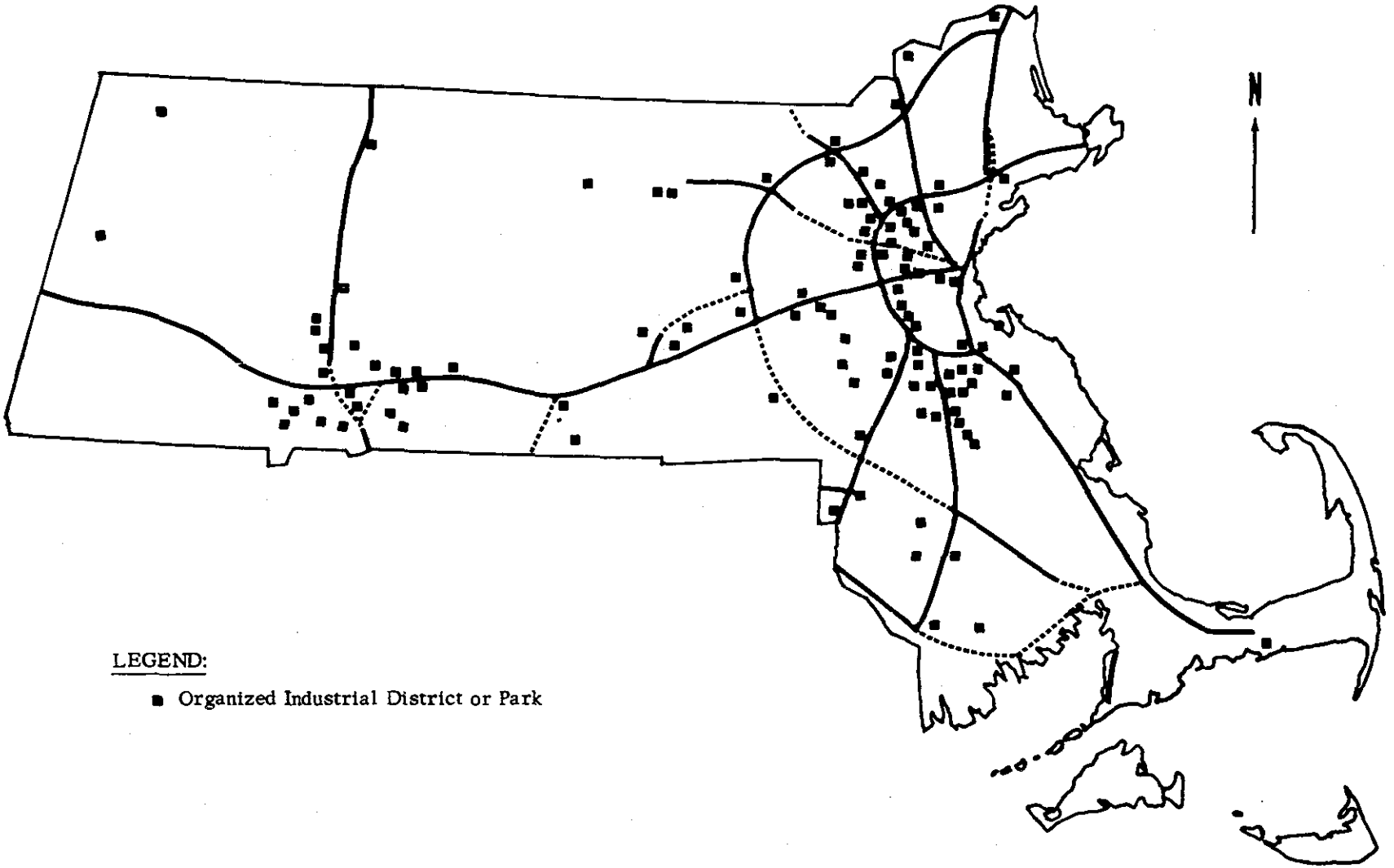
(5) Special factors reflecting buyer-seller linkages. - For two industries a special factor was substituted for the total manufacturing employment factor. In one, Primary Metals (SIC 33), the combined distribution of Fabricated Metals (SIC 34), Non-electrical Machinery (SIC 35), Electrical Machinery (SIC 36), and Transportation Equipment (SIC 37), was used, in order to reflect the supplier relationship of Primary Metals to these industries. In the other, Non-electrical Machinery, the distribution of Fabricated Metals was used to reflect the capital input of machinery to metal fabricators.

(6) Residual trend factor. - After using the above five factors in concert to explain historical shifts in the regional distribution of employment within individual industries, a residual change remained to



Source: For derivation see Appendix B.

FIGURE 1 NEW ENGLAND'S LIMITED ACCESS HIGHWAY NETWORK



Source: Figure 1 and Massachusetts Department of Commerce

FIGURE 2 LOCATION OF INDUSTRIAL PARKS IN RELATION TO LIMITED ACCESS HIGHWAYS, PLANNED OR COMPLETED IN MASSACHUSETTS

be accounted for. For these industries, we included a sixth factor which was defined as the percent distribution of the changes in employment over the previous decade. Such a factor is an implicit reflection of the net impact of the numerous other factors affecting the location of an industry for which quantifiable measures are difficult to formulate.

These, then, are the six factors which form the basis of the location theory approach. Each is defined in terms of a percent distribution among the six New England states. We first decided which combination of factors was appropriate for projecting a particular industry. Then, we divided the projected total New England employment for that industry into portions reflecting the factor weights. Each factor was used to distribute a portion of the New England total among the six states. The size of the portion to be distributed by any factor reflected the weight assigned to the factor.

The factors used to project each industry and the weights assigned to them are presented in Table 17. Each industry's location factor weights are those which were found by experimentation to provide the best simulation of the 1950 to 1960 change in the distribution of the industry's employment among states. The weight of the residual trend factor was diminished by half in each decade, with the reduction compensated by a corresponding increase in the weight of the distribution of the industry in the previous decade. The weights of the other factors were held constant in each decade.

As already noted, the location-factor approach was just one of three methods used to project the distribution of industry employment in 1970 and 1980; ratio analysis and regression analysis were the other two. Together these three methods defined a range of projection results which was judged economically plausible by industry specialists for each industry. Because point estimates rather than range estimates were required, the middle projection values were selected as the most reasonable indicators of future share trends. In actual fact, the state-by-state employment shares derived for each industry by the three projection methods did not vary dramatically. A typical example of the results is shown for the Electrical Machinery industry in Table 18 where the selected shares have been underlined.

While the range of the projection shares derived for 1970 and 1980 was generally relatively small, the selection of a particular share value did influence the longer-range projections derived for the benchmark years, 2000 and 2020. Finally, it should be noted that, in the selection of the medium share for each industry, the three projection methods were represented with about equal frequency.

TABLE 17

WEIGHTING OF LOCATION FACTORS IN PROJECTING EMPLOYMENT IN THE COMMODITY INDUSTRIES

(in percent)

SIC		Distribution of the Industry in the Previous Decade	Distribution of Manufacturing Employment in the Previous Decade	Wage Factor	Market Accessibility Factor	Special Factors	Residual Trend Factor	All Factors
22	Textile Mill Products	52.5	2.5	40	2.5	--	2.5	100.00
28	Chemicals and Allied Products	77	4	5	5	--	9	100.00
30	Rubber and Miscellaneous Plastics Products	52	13	14	16	--	5	100.00
31	Leather and Leather Products	50	2.5	43	2.5	--	2	100.00
33	Primary Metal Industries	80	--	15	2.5	2.5*	--	100.00
34	Fabricated Metal Products	75	10	10	5	--	--	100.00
35	Machinery, except Electrical	71	--	10	5	10**	4	100.00
36	Electrical Machinery	50	10	10	10	--	20	100.00
	All other manufacturing 1/	77.5	2.5	15	2.5	--	2.5	100.00

1/ Excluding Lumber and Wood Products, and Paper and Allied Products.

* Combined distribution of employment in Fabricated Metals (SIC 34), Non-electrical Machinery (SIC 35), Electrical Machinery (SIC 36), and Transportation Equipment (SIC 37).

** Distribution of Employment in Fabricated Metals (SIC 34).

TABLE 18

ALTERNATIVE PROJECTIONS OF STATE EMPLOYMENT SHARES FOR THE ELECTRICAL MACHINERY INDUSTRY, 1980[1/]

	Ratio Analysis	Regression Analysis	Location Factor Analysis
Massachusetts	62.4%	64.3%	56.2%
Connecticut	24.2	20.0	23.1
Maine	0.8	1.2	3.5
Rhode Island	3.9	3.4	5.3
New Hampshire	6.6	8.8	8.8
Vermont	2.1	2.3	3.0
New England	100.0%	100.0%	100.0%

---- denotes the selected median projection shares for each state. These median projections were subsequently adjusted slightly to add to 100 percent.

1/ The projected shares are based on Bureau of Labor Statistics data. Because the employment projections were later converted to Census of Population equivalents, the median shares obtained in BLS terms do not agree exactly with the final distribution of the industry.

PROJECTIVE ECONOMIC STUDY OF NEW ENGLAND

PART III

SUB-STATE AREAS

Arthur D. Little, Inc.

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August 16, 1965

Brigadier General Robert R. Ploger
Division Engineer
U.S. Army Engineer Division, New England
Corps of Engineers
424 Trapelo Road
Waltham, Massachusetts

Dear General Ploger:

We are pleased to transmit our research report Projective Economic Study of Sub-State Areas in New England. This report completes a series of three studies which outline the potential development of the New England region. The first report, entitled A Projective Economic Study of New England, presents projections of socio-economic growth measures for New England as a whole; the second report, Projective Economic Study of the States in New England, presents projections for the individual states.

The purpose of these studies is to provide projections of economic growth that can serve as quantitative guides for the comprehensive New England river basin studies being undertaken by the Corps of Engineers in cooperation with other federal agencies and the New England states.

For each study, those methods of analysis have been adopted which seem most appropriate in view of the data limitations found at the various research levels -- regional, state, and sub-state -- and most realistic in view of the especially long (sixty year) projection period. Methodologically, our approach has thus been necessarily an eclectic one, drawing upon techniques of analysis that have been developed in the field of regional economics and upon the research experience of various staff analysts of Arthur D. Little, Inc.

The research work in this last report was carried out principally by Laurel Prussing with support from Stanley Warner. They were assisted by other staff analysts and industry specialists of Arthur D. Little, Inc. Dr. A. George Gols had overall responsibility as director of the project.

Arthur D. Little, Inc.

August 16, 1965

Brigadier General Robert R. Ploger
Division Engineer

We wish to thank Messrs. Robert J. Frazier and George Phippen on the River Basin staff, New England Division, Corps of Engineers, and the members of the Coordinating Committee for the Connecticut River Comprehensive River Water Resources Investigation for the advice and cooperation extended to us during the course of these studies. The cooperation we received from the members of various state planning agencies and state departments of labor is also gratefully acknowledged.

On behalf of the professional staff who conducted this series of the studies, I wish to express our thanks for providing us with this challenging assignment and for your confidence in our organization.

Sincerely yours,

A. George Gols
Project Director

/scb

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CHAPTER I - INTRODUCTION

1. PURPOSE AND SCOPE

a. Purpose of the Study. - This report, which presents long-range projections of economic development in sub-state areas[1/] of New England, is the last in a series of three projective economic studies of the New England region. The first report, Projective Economic Study of New England, provided long-range demographic and economic projections for the New England region as a whole, and furnished the framework from which projections of economic activity in individual New England states were derived. The state projections were reported in Projective Economic Study of the States in New England, which, in turn, provides the control totals on which the subarea projections are based. The subarea report, like the state and regional reports, has the objective of providing projections of economic growth to serve as guidelines to the U. S. Army Corps of Engineers in planning the long-range development of water resources in river basins of New England -- primarily the Connecticut and Saint John river basins.

b. Scope of Analysis. - The analysis at the subarea level includes projections of population, total employment, and employment by selected major industry groups (including major water-using industries -- SIC 28, SIC's 35 and 36 combined, and SIC 37) for the benchmark years 1980, 2000, and 2020 for all seventeen sub-state areas. In general, these projections involve an allocation of the state projections of total population (both the urban and rural components) and employment in various industry groups, e.g., fishing, mining, service, and specified manufacturing industries, among the designated sub-state areas. The projections also incorporate independent sub-state allocations of employment in lumber, paper, forestry, and agriculture, furnished by the Forest Service and the Economic Research Service of the U. S. Department of Agriculture.

c. Organization of the Report. - The organization of this report is similar to that of the first two reports. Chapter II presents the projection results for the benchmark years 1980, 2000, and 2020 and a brief description of each subarea's economic and geographic characteristics. Chapter III describes the methods used in deriving projections consistent within each subarea and with the state and regional totals. The Appendices provide more detailed results and also discussions of the methods used by the U. S. Department of Agriculture in deriving its projections.

1/ The terms sub-state area and subarea are used interchangeably throughout this report to mean the sub-state areas as defined in Section 2 of this chapter.

2. APPROACH: DELINEATION OF SUB-STATE AREAS

A total of seventeen sub-state areas (see Figure 1 and Table 1) were adopted by the U. S. Army Corps of Engineers for apportioning the projections developed for five of the six New England states. The sixth state, Rhode Island, was not subdivided. Except in one instance, where a single county was adopted, sub-state areas comprise two or more counties. There are three sub-state areas each in Connecticut, Vermont, and Maine; and four each in Massachusetts and New Hampshire.

The pattern of these sub-state areas is a product of efforts to:

1) identify major concentrations of population and economic activity;

2) provide a useful areal arrangement for data in river basin studies -- primarily the Connecticut and Saint John studies currently underway; and

3) minimize the problems of data availability and high costs that would arise by subdividing the region into a large number of smaller areas.

Using the economic projections apportioned to this areal pattern and data separately derived on water use, engineers and planners will estimate water resource needs in, for example, the Connecticut River Basin, and in areas outside the basin which make the principal demands on the basin resources.

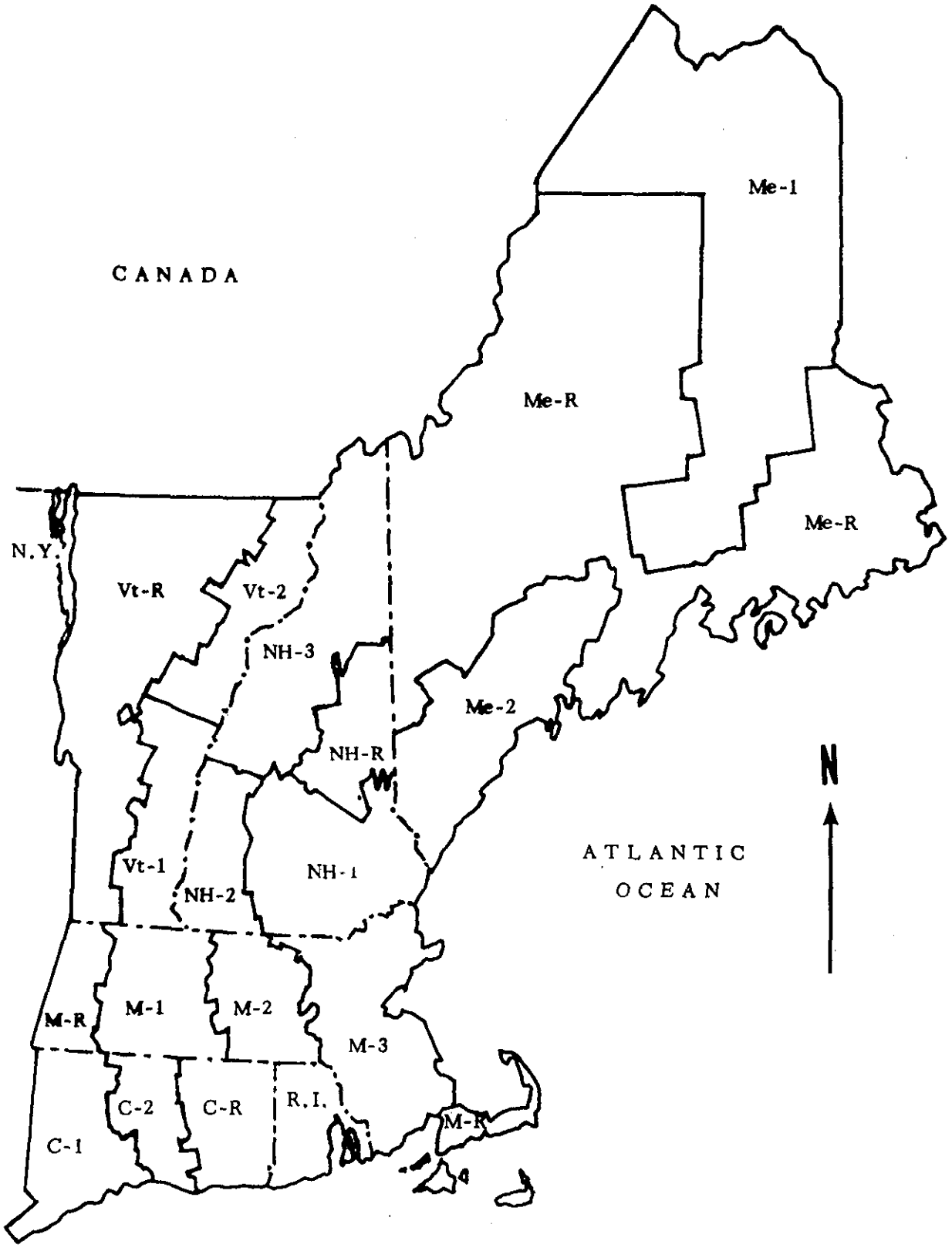

FIGURE 1 OUTLINE MAP OF SUB-STATE AREAS IN NEW ENGLAND

TABLE 1

SUB-STATE AREA DESIGNATION

STATE	SUB-STATE AREAS	COUNTIES INCLUDED
Massachusetts	M-1	Franklin, Hampshire, and Hampden
	M-2	Worcester
	M-3	Essex, Middlesex, Suffolk, Norfolk, Bristol, and Plymouth
	M-R	Remainder of State
Connecticut	C-1	Litchfield, New Haven, and Fairfield
	C-2	Hartford and Middlesex
	C-R	Remainder of State
Maine	Me-1	Aroostook and Penobscot
	Me-2	Kennebec, Androscoggin, Sagadahoc, Cumberland, and York
	Me-R	Remainder of State
New Hampshire	NH-1	Strafford, Rockingham, Merrimack, and Hillsboro
	NH-2	Cheshire and Sullivan
	NH-3	Grafton and Coös
	NH-R	Remainder of State
Vermont	Vt-1	Windsor and Windham
	Vt-2	Essex, Caledonia, and Orange
	Vt-R	Remainder of State

CHAPTER II - PROJECTION RESULTS:

ECONOMIC PROFILES OF SUB-STATE AREAS

3. INTRODUCTION

This Chapter describes each of the seventeen New England subareas and discusses significant economic trends, both historical and projected. The projections are based on the method outlined in Chapter III.

4. MASSACHUSETTS SUBAREAS

a. M-1: Counties of Franklin, Hampden, and Hampshire (Table 2)

(1) Geography. - M-1, predominantly rural in the northern half and highly industrialized in the south, is bisected by the Connecticut River from its northern border with New Hampshire and Vermont to its southern border with Connecticut. The cities of Springfield, Holyoke, and Chicopee, situated on the banks of the Connecticut River, originally developed as manufacturing and commercial centers because of their access to water power and trade routes. Today, this metropolitan complex forms the industrial and urban center of western Massachusetts.

(2) Population. - Although population density in M-1 is about half of that of the state, urban residents make up approximately the same proportion of total population as in the state (see Table 7), reflecting the concentration of population in a few urban centers.

During the last two decades, the rate of population growth in this subarea has been similar to that in the state, with the result that the subarea's share of state population has remained at about 11 percent.

The projections indicate that population growth in M-1 will continue to keep pace with that in the state. Total population in the subarea is thus expected to reach the one million mark by the year 2000. Following the pattern of other subareas, urban population will expand somewhat more rapidly than total population, increasing from about 80 percent of total subarea population in 1960 to approximately 90 percent by 2020 (see Table 7).

(3) Employment. - Historically, this subarea's economic structure has been similar to that of the state, except for a somewhat higher proportion of employment in slow-growth industries (see Table D-1, Appendix D). In manufacturing, Nonelectrical Machinery (SIC 35), Paper and Allied Products (SIC 26), Fabricated Metals (SIC 34), Textiles (SIC 22), and Printing and Publishing (SIC 27) are the principal employers.

During the last decade, M-1 experienced marked employment gains in the Chemical industry (SIC 28) despite modest growth in the industry

at the state level. The subarea's rate of growth in chemicals was fifteen times that of the state, reflecting primarily the expansion of a few large firms producing plastics and resins. In Transportation Equipment (SIC 37) employment also expanded more rapidly in M-1 than in the state. Electrical Machinery, however, lost employment, in sharp contrast to state-wide gains in the industry. On balance, the subarea's total employment grew somewhat less rapidly than total state employment during the 1950-1960 decade.

As projected, total employment in M-1 will grow at about the same rate as employment in the state. Manufacturing industries in which subarea employment will expand more rapidly than state employment include Paper and Chemicals. In keeping with trends throughout New England, anticipated growth in service industries will exceed that in commodity industries. Within the commodity sector, primary resource industries (Agriculture, Forestry, Fisheries, and Mining) will experience absolute employment declines, while employment in manufacturing will grow absolutely, but diminish relative to total subarea employment.

b. M-2: Worcester County (Table 3)

(1) Geography. - This one-county subarea occupies the eastern uplands of Massachusetts, a plateau region with many lakes and streams. Economically M-2 is focused on the Worcester Metropolitan Area, which in 1960 accounted for more than half of the subarea's total employment.

(2) Population. - During the past twenty years population in M-2 has grown at about the same rate as state population. In 1960, about 600 thousand persons, or approximately one-tenth of the state population, resided in M-2.

Within the Standard Metropolitan Statistical Areas of Worcester and Fitchburg-Leominster, population growth during the last decade occurred primarily in the suburbs. The increase in the city of Fitchburg proper was less than one percent, while the city of Worcester experienced an eight percent decline. Overall, urban population expanded less rapidly in this subarea than in the state as a whole.

In the future, population growth in M-2 is anticipated to keep pace with that in the state, and the number of urban residents is expected to increase as a proportion of total population.

(3) Employment. - M-2, with 47 percent of its total employment in manufacturing, is the most highly industrialized subarea in Massachusetts. Within manufacturing, nearly half of all jobs in 1960 were concentrated in four industries -- Nonelectrical Machinery, Textiles, Fabricated Metals, and Primary Metals.

Because of a relatively high proportion of jobs in slow-growth industries (see Appendix D), employment over the last decade expanded

less rapidly than in the state. Nevertheless, it is difficult to generalize about the employment impact of this subarea's economic structure. For example, some industries which have grown in the state -- Primary Metals and Electrical Machinery -- have declined in the subarea; whereas the Other Nondurables industry group decreased in the state, but increased substantially in M-2. The net effect of these changes has been a slight decline in the subarea's total manufacturing employment, in contrast to modest state-wide growth.

The projected employment levels indicate a continued but slower decline in the subarea's share of state manufacturing employment and an increase in the absolute number of manufacturing jobs. While manufacturing employment is anticipated to decrease as a percent of total employment, M-2 will nevertheless remain the most industrialized subarea in Massachusetts.

Employment in service industries is expected to grow more rapidly than either subarea manufacturing employment or state-wide service employment. Thus, growth in service industry jobs will tend to offset the subarea's declining share of manufacturing and enable the subarea to maintain a fairly constant share of state employment.

c. M-3: Counties of Essex, Middlesex, Suffolk, Norfolk, Bristol, and Plymouth (Table 4)

(1) Geography. - M-3, composed of six counties in eastern Massachusetts, is the industrial and commercial heart of New England. In contrast to the hilly western part of the state, this subarea is for the most part coastal plain.

M-3 is part of the Atlantic metropolitan belt. Boston, the largest city in New England and the capital of Massachusetts, is a cultural, commercial, industrial, and financial center. Other major urban centers and focal points of industrial activity are Lawrence, Haverhill, and Lowell in the north, and Brockton, New Bedford, and Fall River in the south.

(2) Population. - Measured in terms of population, M-3 is the largest New England subarea. In 1960, nearly four million people resided in this area, compared with five million in the state and eleven million in the entire six-state region. Population density is the highest in New England, exceeding one thousand persons per square mile.

With nearly 88 percent of its population classified as urban, M-3 is the most urbanized subarea in Massachusetts. Although the population of the Standard Metropolitan Statistical Areas of Boston, Brockton, Fall River, Lawrence-Haverhill, Lowell, and New Bedford grew between 1950 and 1960, the central cities, with the exception of Brockton, experienced population declines.

Our projections indicate that population in M-3 will grow at about the same rate as state population. Urban population is expected to approach 96 percent of total population by 2020 (see Table 7).

(3) Employment. - Compared with the state, the employment pattern of M-3 has centered somewhat less on manufacturing and somewhat more on service industries, particularly Insurance, Education, Medical Services, and Government. Manufacturing employment is concentrated mainly in Electrical Machinery (especially in the Boston area), Apparel (in the Boston, Fall River, and New Bedford areas), Leather (primarily in Essex County), and Food and Kindred Products (in the Boston area).

During the last decade, M-3 continued to experience a sharp drop in Textile employment. However, the loss of nearly 50 thousand Textile jobs was more than compensated by gains in other industries, notably Electrical Machinery, with an increase of 47 thousand jobs, and Fabricated Metals, with an increase of 12 thousand jobs. On balance, manufacturing employment grew somewhat more rapidly in this subarea than in the state.

During the same period, service employment grew somewhat less rapidly in M-3 than in the state (see Table D-2). In particular, the subarea's share of state-wide employment in Wholesale and Retail Trade, and Finance, Insurance, and Real Estate declined somewhat. Although all the service components grew less rapidly in M-3 than in the state, these activities still account for a larger percent of total employment in M-3 than in the rest of Massachusetts.

The projections indicate a nearly-constant 75 percent share of total state employment for M-3. While services will out-pace manufacturing in employment growth, they are expected to grow somewhat more slowly in M-3 than in the state. Employment growth in manufacturing, however, will slightly exceed that projected for the state. This is due largely to the growth of Machinery and Electrical Machinery, which will account for roughly 30 percent of M-3 manufacturing employment by 1980 and 40 percent by 2020.

d. M-R (Remainder of State): Counties of Berkshire, Barnstable, Dukes, and Nantucket (Table 5)

(1) Geography. - M-R, the remainder of Massachusetts, is comprised of two economically and geographically distinct areas. The first, Berkshire County, occupies the extreme western part of Massachusetts, while the second, which includes the Cape Cod peninsula (Barnstable County) and the island counties of Dukes and Nantucket, is situated in the southeastern part of the state.

Mountainous Berkshire County, encompassing the Berkshire Hills, the Hoosac Range, and part of the Taconic Range, is a center for winter and summer recreation activities. Pittsfield, the largest city, is the manufacturing center of Berkshire County.

In contrast, the eastern part of M-R features a low and sandy terrain, with many miles of ocean beaches. Its economy is almost wholly dependent on tourism, although Otis Air Force Base, on Cape Cod, plays a significant role in Barnstable County's economy.

(2) Population. - M-R as a whole accounts for only four percent of the state's population. Both parts of the subarea are less densely populated and less urbanized than the other areas of the state. In the west, the population of Berkshire County increased less rapidly than state population over the last decade. The city of Pittsfield, in contrast to many larger urban centers, experienced population growth during this period.

Population in the eastern portion of M-R increased more rapidly than state population. Part of this was due to the establishment of Otis Air Force Base. The influx of many retired persons has also contributed to the population growth, and has given this part of the subarea a relatively large proportion of persons in older age groups. (It should be remembered that because of a high incidence of vacation-home ownership, the summer population of Cape Cod and the neighboring islands is considerably greater than the year-round population.)

Our forecasts indicate that the growth of both urban and total population in M-R will continue to exceed that in the state. But since the difference in growth rates is not large, the subarea will remain the the least urbanized and least densely populated in the state.

(3) Employment. - More than 40 percent of Berkshire County's employment is in manufacturing, while in the Cape Cod area only seven percent are employed in this sector. Nearly half of total manufacturing employment in Berkshire County is in Electrical Machinery. The county has ten percent of the state's employment in this industry, compared with only three percent of total manufacturing. Agriculture is also more important in Berkshire County than in most of Massachusetts.

Because of a strong dependence on recreation activities, the economy of Cape Cod and the Islands has a higher proportion of service employment than most other New England subareas. About 88 percent of total employment is in services. Agriculture, Forestry, and Fisheries also account for a higher share of total employment in the eastern part of M-R than in the rest of the state.

Between 1950 and 1960 total employment in Berkshire County grew less rapidly than that in the rest of the state. Employment in Electrical Machinery actually declined somewhat, despite rapid state-wide growth (see Appendix D, Table D-2). However, total employment in the eastern part of M-R grew faster than in the state -- largely because jobs in the service industries increased two and one half times faster than service employment in the state.

Our projections for M-R indicate that manufacturing and service employment will expand somewhat more rapidly than in the state. Within

manufacturing, Machinery and Electrical Machinery will be the fastest-growing industries, accounting for over half of total manufacturing employment throughout the projection period.

TABLE 2

EMPLOYMENT AND POPULATION IN MASSACHUSETTS SUBAREA M-1, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	4.6	3.8	3.5	3.3
(01-07)	Agriculture 1/	4.5	3.7	3.3	3.1
08	Forestry 2/	0.1	0.1	0.2	0.2
09	Fisheries	--	--	--	--
B.(10-14)	Mining	0.2	0.1	0.1	0.1
D.(19-39)	Manufacturing	84.2	94.9	113.0	136.0
24	Lumber and Wood Products, except Furniture 2/	1.2	0.3	0.4	0.6
26	Paper and Allied Products 2/	11.0	12.1	13.9	16.0
28	Chemicals	4.9	6.3	7.3	9.2
35 & 36	Machinery and Electrical Machinery	16.9	23.1	28.7	35.7
37	Transportation Equipment	4.6	4.8	4.6	4.1
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	45.6	48.4	57.6	70.8
C.(15-17), E.-J.(40-99)	Service Industries 4/	130.0	191.0	284.0	428.0
	TOTAL EMPLOYMENT	219.0	290.0	400.0	568.0
	TOTAL POPULATION	587.4	757.0	1010.0	1370.0
	Urban	465.2	626.0	866.0	1200.0
	Rural	122.2	131.0	149.0	176.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. *See Appendix A for more detailed figures.*

TABLE 3

EMPLOYMENT AND POPULATION IN MASSACHUSETTS SUBAREA M-2, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	3.2	3.2	3.0	2.8
(01-07)	Agriculture 1/	3.2	3.1	2.9	2.7
08	Forestry 2/	--	0.1	0.1	0.1
09	Fisheries	--	--	--	--
B.(10-14)	Mining	0.1	--	--	--
D.(19-39)	Manufacturing	106.2	124.0	150.0	186.0
24	Lumber and Wood Products, except Furniture 2/	0.9	0.8	0.5	0.3
26	Paper and Allied Products 2/	5.6	5.8	5.8	6.1
28	Chemicals	1.4	2.1	2.5	3.2
35 & 36	Machinery and Electrical Machinery	22.7	31.6	42.0	55.0
37	Transportation Equipment	1.1	1.3	1.2	1.2
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	74.5	81.8	98.4	121.0
C.(15-17), E.-J.(40-99)	Service Industries 4/	118.6	174.0	259.0	392.0
	TOTAL EMPLOYMENT	228.1	301.0	413.0	581.0
	TOTAL POPULATION	583.2	762.0	1030.0	1410.0
	Urban	421.6	581.0	823.0	1160.0
	Rural	161.6	181.0	209.0	244.0

1/ Based on projections furnished by U.S. Department of Agriculutre, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 4

EMPLOYMENT AND POPULATION IN MASSACHUSETTS SUBAREA M-3, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	15.7	14.9	14.1	13.4
(01-07)	Agriculture 1/	12.3	12.0	11.3	10.6
08	Forestry 2/	0.4	0.3	0.2	0.2
09	Fisheries	3.0	2.6	2.6	2.6
B.(10-14)	Mining	1.0	0.8	0.8	0.8
D.(19-39)	Manufacturing	493.8	573.0	729.0	931.0
24	Lumber and Wood Products, except Furniture 2/	3.7	1.9	1.0	0.6
26	Paper and Allied Products 2/	14.6	13.4	13.5	15.7
28	Chemicals	11.7	10.5	12.2	15.5
35 & 36	Machinery and Electrical Machinery	124.6	189.0	280.0	393.0
37	Transportation Equipment 3/	26.5	29.8	28.9	27.2
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 4/	312.7	329.0	393.0	479.0
C.(15-17), E.-J.(40-99)	Service Industries 5/	963.8	1370.0	1970.0	2910.0
	TOTAL EMPLOYMENT	1474.3	1960.0	2720.0	3860.0
	TOTAL POPULATION	3756.1	4930.0	6780.0	9340.0
	Urban	3295.5	4500.0	6360.0	8940.0
	Rural	460.6	433.0	416.0	401.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals, due to rounding. See Appendix A for more detailed figures.

TABLE 5

EMPLOYMENT AND POPULATION IN MASSACHUSETTS SUBAREA M-R, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	2.6	2.6	2.5	2.3
(01-07)	Agriculture 1/	2.1	2.1	2.0	1.8
08	Forestry 2/	--	--	--	--
09	Fisheries	0.5	0.5	0.5	0.5
B.(10-14)	Mining	--	0.1	0.1	0.1
D.(19-39)	Manufacturing	25.0	34.9	44.2	56.4
24	Lumber and Wood Products, except Furniture 2/	0.3	0.3	0.4	0.3
26	Paper and Allied Products 2/	2.8	2.5	2.2	1.7
28	Chemicals	0.3	0.6	0.7	0.9
35 & 36	Machinery and Electrical Machinery	12.1	18.0	24.3	32.2
37	Transportation Equipment	0.4	0.4	0.4	0.4
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	9.1	13.1	16.2	20.9
C.(15-17), E.-J.(40-99)	Service Industries 4/	51.2	79.8	124.0	192.0
	TOTAL EMPLOYMENT	78.9	117.0	171.0	251.0
	TOTAL POPULATION	221.8	318.0	446.0	620.0
	Urban	120.2	184.0	273.0	398.0
	Rural	101.6	134.0	172.0	222.0

1/ Based on Projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 6

MASSACHUSETTS SUBAREA PERCENT SHARES OF IMPORTANT ECONOMIC INDICATORS, 1950-2020

		Primary Resource Employment 1/	Manufacturing Employment	Total Commodity Employment 2/	Service Employment	Total Employment	Urban Population	Total Population
1950	M-1	17.6	12.5	12.8	10.0	11.1	10.1	10.8
	M-2	12.7	15.8	15.6	9.2	11.7	10.3	11.7
	M-3	59.5	67.8	67.3	77.1	73.2	76.7	73.5
	M-R	10.2	3.9	4.3	3.7	3.9	2.9	4.0
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1960	M-1	17.4	11.9	12.1	10.3	11.0	10.8	11.4
	M-2	12.1	15.0	14.9	9.4	11.4	9.8	11.3
	M-3	60.9	69.6	69.3	76.3	73.7	76.6	73.0
	M-R	9.6	3.5	7.7	4.0	3.9	2.8	4.3
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1980	M-1	15.5	11.5	11.6	10.5	10.9	10.6	11.2
	M-2	12.8	14.9	14.9	9.6	11.3	9.9	11.2
	M-3	61.3	69.4	69.1	75.5	73.4	76.4	72.9
	M-R	10.4	4.2	4.4	4.4	4.4	3.1	4.7
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2000	M-1	15.0	10.9	10.9	10.7	10.8	10.4	11.0
	M-2	12.7	14.5	14.5	9.8	11.2	9.9	11.1
	M-3	61.8	70.3	70.2	74.8	73.4	76.4	73.1
	M-R	10.5	4.3	4.4	4.7	4.6	3.3	4.8
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2020	M-1	14.9	10.4	10.5	10.9	10.8	10.3	10.8
	M-2	12.5	14.2	14.	10.0	11.0	9.9	11.0
	M-3	62.2	71.1	70.9	74.2	73.4	76.4	73.3
	M-R	10.4	4.3	4.4	4.9	4.8	3.4	4.9
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Details may not add to totals because of rounding.

1/ SIC A and B
2/ SIC A, B, and D

TABLE 7

MASSACHUSETTS SUBAREA URBANIZATION AND POPULATION DENSITY

	URBANIZATION (Urban Population as a Percent of Total Population)					POPULATION DENSITY (Persons per Square Mile)				
YEAR	M-1	M-2	M-3	M-R	STATE	M-1	M-2	M-3	M-R	STATE
1950	78.5	74.8	88.1	61.5	84.4	274	360	1,148	127	596
1960	79.2	72.3	87.7	54.2	83.6	316	385	1,251	149	655
1970	80.9	74.2	89.4	56.0	85.2	354	434	1,410	177	739
1980	82.7	76.3	91.2	57.9	87.0	408	503	1,640	213	861
1990	84.0	78.0	92.5	59.6	88.4	472	585	1,930	253	1,010
2000	85.3	79.8	93.9	61.3	89.8	547	681	2,260	299	1,180
2010	86.2	81.1	94.3	62.7	90.7	638	795	2,650	353	1,380
2020	87.2	82.6	95.7	64.3	91.8	741	928	3,110	415	1,620

NOTE: Projection figures with more than three digits are rounded.

5. CONNECTICUT SUBAREAS

a. C-1: Counties of Litchfield, New Haven, and Fairfield (Table 8)

(1) Geography. - C-1, situated in western Connecticut, is as diverse a region as can be found in New England. The semi-mountainous northern half exemplifies scenic beauty; resorts, parks, forests, and farms dot the Litchfield Hills, an extension of the Berkshires. In the less hilly south, an industrial belt stretches along the Naugatuck River Valley and down the coast to New York City. Within this belt lie the major cities of Waterbury, New Haven, and Bridgeport. The coastal area provides summer recreation centers and is well known for wealthy residential communities with a New York commuter population.

(2) Population. - The population of C-1 is projected to remain at roughly three-fifths of the state total, a share which the subarea has maintained for the last thirty years. From a 1960 population of 1.4 million, we project increases to 2.0 million by 1980 and 3.7 million by 2020. The greatest gains will occur in urban population, which is expected to grow from 84 percent of total subarea population in 1960 to 90 percent in 1980 and 95 percent in 2020. This subarea has always been the most highly urbanized in Connecticut and our projections indicate that it will remain so (see Table 12).

(3) Employment. - Over the last three decades C-1 has accounted for approximately three-fifths of total state employment. The projections indicate that the subarea will maintain this share in the future (see Table 11). Like the state, the subarea's total employment is expected to grow somewhat faster than its population, reflecting a generally higher rate of female participation in the labor force. Employment growth in the service industries is forecast to outpace that in commodity industries. Service employment is expected to grow from 58 percent of total employment in 1960 to 65 percent by 1980 and 74 percent by 2020, closely approximating the state average. Employment in resource industries will continue to decline, largely because of diminishing agricultural employment opportunities.

Throughout C-1, even in the northern part, manufacturing has traditionally been an important source of employment. The subarea's diversified manufacturing base is similar in structure to that of the state. In 1960, the most important industries were Fabricated Metals, Nonelectrical Machinery, Electrical Machinery, Transportation Equipment (predominantly aircraft), Primary Metals, Apparel, and Printing and Publishing. From 1950 to 1960 the subarea experienced a modest increase in Fabricated Metals employment despite a state-wide decline for that industry. Employment in Nonelectrical Machinery, and Printing and Publishing grew more slowly than in the state as a whole, while that in Electrical Machinery and Transportation Equipment grew more rapidly. Employment levels declined in both Primary Metals and Apparel. (For a detailed description of 1950-1960 growth patterns, see Appendix D, Table D-3).

The employment projections indicate that Machinery and Electrical Machinery will be the fastest-growing manufacturing industries. Together they will account for approximately one-third of subarea manufacturing employment throughout the projection period. Transportation Equipment employment is expected to grow somewhat until 1990 and decline thereafter. Employment in Fabricated Metals is projected to continue to expand, while that in Primary Metals will decline.

b. C-2: Counties of Hartford and Middlesex (Table 9)

(1) Geography. - C-2, situated within the southern part of the Connecticut River Valley, contains some of the state's richest cropland. The soil is fine-grained loam, free of the boulders that characterize the glaciated uplands. The city of Hartford, which is the state capital and the largest city in Connecticut, dominates the subarea. Although the Connecticut River is navigable from the ocean up to Hartford, no sizeable cities have developed below Middletown or at the mouth of the river. All major urban areas are clustered in the central part of the subarea.

(2) Population. - The total population of C-2 is approximately one-half that of C-1, but the population density is somewhat greater (Table 12). Our projections indicate a continuation of these relationships. The number of persons residing in C-2 is projected to increase from 0.8 million in 1960 to 1.1 million by 1980 and 2.1 million by 2020. As in other subareas, the greatest increase will occur in urban population, which is expected to grow from 79 percent of total population in 1960 to 84 percent by 1980 and 89 percent by 2020.

(3) Employment. - For the past three decades C-2 has accounted for roughly one-third of Connecticut's total employment. This share does not change appreciably over the projection period. The service sector, because of the concentration of the insurance industry, has traditionally accounted for a higher percentage of employment than in other subareas of the state. This differential is expected to persist throughout the projection period, although the projections portend significant increases in service employment in all subareas.

In the primary resource sector, comprising mostly agriculture, employment has been declining steadily. By 1960, employment in agriculture accounted for less than two percent of total subarea employment. Tobacco, which is still the predominant crop, is projected to become insignificant within the next two decades because of rising production costs.

When compared with the state, C-2 has had a relatively favorable industrial structure. The most important manufacturing industries in 1960 were Transportation Equipment, Nonelectrical Machinery, Fabricated Metal Products, and Electrical Machinery. Between 1950 and 1960 the Transportation Equipment industry, primarily the aircraft industry, was the fastest growing manufacturing sector, with an employment increase of 126 percent. By 1960, employment in Transportation Equipment slightly

exceeded that in Nonelectrical Machinery, formerly the largest manufacturing employer in the subarea.

It is interesting to note that in spite of this dramatic growth, the subarea's share of state employment in Transportation Equipment actually declined from 64 percent in 1950 to 49 percent in 1960, reflecting even more rapid growth of the industry in other subareas. The projections indicate a slackening in the future growth rate of this industry, largely as a result of a tapering off in the level of defense expenditures. Consequently, while C-2 is projected to maintain roughly one-half of state employment in Transportation Equipment throughout the projection period, the industry's proportion of subarea manufacturing employment will decline from 25 percent in 1960 to less than 15 percent by 2020.

Between 1950 and 1960, employment in Nonelectrical Machinery grew faster in C-2 than in the state, while employment in Electrical Machinery declined slightly in the subarea but grew in the state as a whole. The projections indicate that the two industries combined will be the fastest growing segment of manufacturing. Together they will account for approximately one-half of the subarea's manufacturing employment by 2020.

c. C-R (Remainder of State): Counties of Tolland, Windham, and New London (Table 10)

(1) Geography. - C-R, the easternmost Connecticut subarea, is the most rural of the three. Its cities are relatively small: New London and Groton, located near the mouth of the Thames River, have important Naval, Coast Guard, and shipbuilding installations; Willimantic and Norwich are manufacturing centers.

(2) Population. - Of the three Connecticut subareas, C-R is the smallest in population, averaging approximately 12 percent of the state population for the last thirty years. With less than half as many persons per square mile as the state, the subarea also has the lowest population density (Table 12). The projected population levels imply a continuation of the subarea's historical share of state population and the relationship of the subarea's population density to that of the state. While C-R is expected to remain the least urbanized Connecticut subarea, its urban population is nevertheless projected to rise from 49 percent of total population in 1960 to 52 percent by 1980 and 56 percent by 2020.

(3) Employment. - C-R has historically accounted for one-tenth of Connecticut employment, a share maintained by our projections. In addition to civilian workers, military personnel are an important segment of the labor force.

Agriculture, accounting for over four percent of total employment in 1960, is more important in C-R than in the rest of Connecticut. However, agricultural employment has been declining, and is expected to continue to decline over the projection period.

Employment in the service industries is projected to grow more rapidly than total employment, as it has historically. Traditionally, service employment in C-R has been relatively less significant than in the rest of the state, and this difference is projected to continue.

Manufacturing has a somewhat greater share of total employment in C-R than in the rest of the state. Although manufacturing's share of total employment will decline during the projection period, the decline will be slower than that in the state as a whole.

In spite of a higher-than-average proportion of employment in industries that declined at the state level, manufacturing employment in C-R grew faster than that in any other subarea during the last decade (see Table 11 and Appendix D). Between 1950 and 1960 C-R increased its share of every manufacturing industry except Electrical Machinery.

Generally the state's growing industries grew more rapidly in C-R than in the state as a whole, and declining industries declined less rapidly, or in some cases, not at all. For example, in 1950 C-R was heavily dependent on the textile industry, which accounted for 20 percent of total employment and half of manufacturing employment within the subarea. The other major industries were Transportation Equipment, accounting for ten percent of manufacturing employment, Fabricated Metal Products with seven percent, and Apparel and Electrical Machinery, each with five percent. By 1960, the textile industry in C-R had fewer than one-half the number of employees it had in 1950; however, it had declined even more rapidly in the rest of the state. The Apparel industry had also declined in C-R, but less rapidly than in the other subareas. During the same period, employment in Transportation Equipment (primarily submarine construction) more than quadrupled and the industry became the largest single manufacturing employer by 1960. Fabricated Metal Products and Primary Metals also grew in the face of a statewide decline.

Our projections indicate that manufacturing employment will expand faster in C-R than in the state as a whole. The Machinery and Electrical Machinery industries are expected to set the fastest pace, followed by Chemicals (primarily pharmaceuticals). However, Transportation Equipment will experience a decline in employment, mainly due to anticipated cutbacks in submarine construction.

TABLE 8

EMPLOYMENT AND POPULATION IN CONNECTICUT SUBAREA C-1, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	7.0	6.4	6.0	5.6
(01-07)	Agriculture 1/	6.8	6.3	5.9	5.5
08	Forestry 2/	0.1	0.1	0.1	0.1
09	Fisheries	--	--	--	--
B.(10-14)	Mining	0.8	0.5	0.5	0.4
D.(19-39)	Manufacturing	232.6	272.0	324.0	384.0
24	Lumber and Wood Products, except Furniture 2/	0.9	0.5	0.4	0.3
26	Paper and Allied Products 2/	3.2	2.9	3.3	4.3
28	Chemicals	7.5	8.3	9.8	12.1
35 & 36	Machinery and Electrical Machinery	55.9	79.9	103.0	129.0
37	Transportation Equipment 3/	20.8	23.5	23.8	15.6
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 4/	144.3	157.0	184.0	223.0
C.(15-17), E.-J.(40-99)	Service Industries 5/	334.1	513.0	764.0	1120.0
	TOTAL EMPLOYMENT	574.6	792.0	1090.0	1510.0
	TOTAL POPULATION	1433.8	1990.0	2730.0	3660.0
	Urban	1210.5	1790.0	2540.0	3450.0
	Rural	223.3	202.0	190.0	205.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 9

EMPLOYMENT AND POPULATION IN CONNECTICUT SUBAREA C-2, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	6.3	5.7	5.0	4.4
(01-07)	Agriculture[1]	6.2	5.6	4.9	4.2
08	Forestry[2]	0.1	0.1	0.1	0.1
09	Fisheries	--	--	--	--
B.(10-14)	Mining	0.2	0.2	0.2	0.2
D.(19-39)	Manufacturing	125.7	151.0	174.0	192.0
24	Lumber and Wood Products, except Furniture[2]	0.7	0.5	0.3	0.3
26	Paper and Allied Products[2]	2.2	2.0	2.3	2.6
28	Chemicals	2.3	2.3	2.7	3.4
35 & 36	Machinery and Electrical Machinery	41.0	56.8	71.2	87.7
37	Transportation Equipment[3]	33.9	39.0	39.1	25.7
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing[4]	45.6	50.1	58.8	72.1
C.(15-17), E.-J.(40-99)	Service Industries[5]	187.5	297.0	447.0	661.0
	TOTAL EMPLOYMENT	319.8	453.0	626.0	858.0
	TOTAL POPULATION	778.4	1120.0	1540.0	2050.0
	Urban	618.4	928.0	1330.0	1830.0
	Rural	160.0	192.0	209.0	227.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 10

EMPLOYMENT AND POPULATION IN CONNECTICUT SUBAREA C-R, 1960-2020

(Thousnads of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	4.9	4.8	4.8	4.8
(01-07)	Agriculture 1/	4.7	4.7	4.7	4.7
08	Forestry 2/	--	--	--	--
09	Fisheries	0.1	0.1	0.1	0.1
B.(10-14)	Mining	0.1	0.1	0.1	0.1
D.(19-39)	Manufacturing	48.4	51.3	65.9	83.9
24	Lumber and Wood Products, except Furniture 2/	0.2	0.2	0.1	0.1
26	Paper and Allied Products 2/	2.8	2.5	2.1	2.3
28	Chemicals	2.2	2.3	3.4	5.3
35 & 36	Machinery and Electrical Machinery	4.6	7.3	9.9	12.8
37	Transportation Equipment 3/	15.1	10.0	9.3	6.1
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 4/	23.6	29.0	41.1	57.3
C.(15-17), E.-J.(40-99)	Service Industries 5/	62.7	95.5	141.0	207.0
	TOTAL EMPLOYMENT	116.1	152.0	212.0	295.0
	TOTAL POPULATION	323.1	415.0	562.0	739.0
	Urban	156.7	224.0	313.0	420.0
	Rural	166.4	191.0	249.0	319.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance; Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 11

CONNECTICUT SUBAREA PERCENT SHARES OF IMPORTANT ECONOMIC INDICATORS, 1950-2020

		Primary Resource Employment 1/	Manufacturing Employment	Total Commodity Employment 2/	Service Employment	Total Employment	Urban Population	Total Population
1950	C-1	41.2	59.1	57.9	56.6	57.2	61.9	57.3
	C-2	31.5	30.0	30.1	32.6	31.4	30.2	30.2
	C-R	27.3	10.9	12.0	10.8	11.4	7.9	12.5
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1960	C-1	40.4	57.2	56.4	57.2	56.9	61.0	56.6
	C-2	33.8	30.9	31.0	32.1	31.6	31.1	30.7
	C-R	25.8	11.9	12.6	10.7	11.5	7.9	12.7
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1980	C-1	38.7	57.4	56.7	56.7	56.7	60.9	56.5
	C-2	33.0	31.8	31.9	32.8	32.4	31.5	31.7
	C-R	27.7	10.8	11.4	10.5	10.9	7.6	11.8
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2000	C-1	38.9	57.4	56.9	56.5	56.6	60.7	56.5
	C-2	31.2	30.9	30.9	33.1	32.4	31.8	31.9
	C-R	29.3	11.7	12.2	10.4	11.0	7.5	11.6
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2020	C-1	38.9	58.2	57.8	56.4	56.7	60.6	56.7
	C-2	29.2	29.1	29.1	33.2	32.2	32.0	31.8
	C-R	31.3	12.7	13.1	10.4	11.1	7.4	11.5
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Details may not add to totals because of rounding.

1/ SIC A and B
2/ SIC A, B, and D

TABLE 12

CONNECTICUT SUBAREA URBANIZATION AND POPULATION DENSITY

	URBANIZATION (Urban Population as a Percent of Total Population)				POPULATION DENSITY (Persons per Square Mile)			
YEAR	C-1	C-2	C-R	STATE	C-1	C-2	C-R	STATE
1950	84.0	77.5	48.8	77.7	527	545	156	410
1960	84.4	79.4	48.5	78.3	657	698	201	518
1970	87.4	80.8	51.6	81.0	763	828	223	601
1980	89.9	82.9	54.0	83.4	914	1,010	258	720
1990	91.8	84.6	55.1	85.2	1,080	1,200	303	852
2000	93.1	86.4	55.6	86.6	1,250	1,390	350	988
2010	93.6	87.6	56.1	87.4	1,450	1,600	402	1,140
2020	94.4	88.9	56.8	88.3	1,680	1,840	461	1,320

NOTE: Projection figures with more than three digits are rounded.

6. MAINE SUBAREAS

a. Me-1: Counties of Aroostook and Penobscot (Table 13)

(1) Geography. - Me-1, the northernmost Maine subarea, embraces large parts of the drainage areas of the Saint John and Penobscot Rivers. Climate and soil have been favorable to the development of agriculture and forest industries. Indeed, Aroostook County is one of the principal potato-growing areas of the nation, supplying about one-seventh of the country's annual output. Bangor, in southern Penobscot County, is the subarea's largest city and the third largest city in Maine. Situated on the Penobscot River some fifty miles from the Atlantic, Bangor was formerly a port city, but is now chiefly a manufacturing center and the gateway to much of the forest industry of Maine.

(2) Population. - Although population density is lower than in the state as a whole, urbanization in Me-1 equals that of the state (see Table 17). During the 1950-1960 period, total population in Me-1 grew somewhat more rapidly than state population. Part of this was due to the influx of personnel to the subarea's military bases. However, with the closing of Dow Air Force Base and cut-backs at other military installations, population in Me-1 is expected to grow somewhat more slowly than state population during the projection period. The subarea's population is anticipated to remain at slightly less than one-fourth of the state's population (see Table 16). In absolute terms, the total population of Me-1 is estimated to increase from 232 thousand persons in 1960 to 272 thousand by 1980 and 373 thousand by 2020.

(3) Employment. - The predominantly rural character of Aroostook County, where agricultural employment exceeds manufacturing employment, is offset by the industrial character of the more heavily populated Penobscot County. Thus Me-1 as a whole has more than twice as many employees in manufacturing as in agriculture. Moreover, while the number of manufacturing jobs has grown over the past thirty years, farm employment has steadily declined. Resource-oriented industries such as Paper (SIC 26), and Lumber and Wood Products (SIC 24) form the backbone of manufacturing activity and account for over one-half of manufacturing employment. Paper alone engages over one-third of the manufacturing employees. Other industries important to the area's economy are Food (SIC 20) and Leather (SIC 31). Service employment has a somewhat higher share of total employment in this subarea than in the rest of the state, due largely to employment in a major hospital.

During the last decade, total employment in Me-1 grew almost twice as fast as that in the rest of the state. Most of this growth occurred in the subarea's manufacturing sector, which grew eight times faster than the state's (see Appendix D, Table D-4). The industries primarily responsible for this expansion were Paper and Food Processing.

The projections indicate further declines in farm employment and continued increases in manufacturing and services. The Paper industry will continue to be the dominant manufacturing employer. However, the fastest growing component of the manufacturing sector will be the Machinery industries, in which employment is expected to more than triple during the projection period, increasing from only five percent of manufacturing employment in 1960 to ten percent by 2020.

b. Me-2: Counties of Kennebec, Androscoggin, Sagadahoc, Cumberland, and York (Table 14)

(1) Geography. - Me-2, located in southern Maine, has a coastline with many bays and estuaries and an inland terrain interspersed with lakes and fast-flowing streams. The economy is largely centered on eleven cities of over ten thousand inhabitants, including the two Standard Metropolitan Statistical Areas of Portland and Lewiston-Auburn. Portland, the largest city in Maine, is the commercial and industrial center of the state.

(2) Population. - Nearly half of Maine's population resides in Me-2. The subarea is the most urbanized in Maine and has a population density of 138 persons per square mile -- over four times as great as the state average, but somewhat lower than the New England average. Between 1950 and 1960, population in Me-2 increased at about the same rate as state population.

The projections indicate a slightly faster population growth for Me-2 than for the state. Thus the subarea's share of state population will increase from 50 percent in 1960 to 51 percent in 1980 and 53 percent in 2020. Me-2 will remain the most densely populated and the most highly urbanized subarea in Maine. However, since the state of Maine is expected to experience slower population growth than New England as a whole, this subarea's growth will be less than that of the six-state region.

(3) Employment. - In 1960, Me-2 accounted for slightly more than half of total state employment. Historically Me-2 has had a higher proportion of its employment in manufacturing than the state as a whole, but this differential is shrinking. Compared with the state, Me-2 has a smaller proportion of its employment in Agriculture, Forestry, and Fisheries, but about the same proportion in the service sector. As in the rest of the state, agricultural employment has declined in Me-2, but these declines have been relatively less drastic than those in the state as a whole.

The projections indicate further increases in the subarea's share of agricultural employment up to 1980 and a constant share thereafter. The relative increase stems from rising demand for agricultural produce in southern New England, where fewer acres are cultivated each year.

In the manufacturing sector, the industries with the greatest number of employees are Leather, Textiles, Transportation Equipment, Paper,

and Food. Between 1950 and 1960, manufacturing employment declined in this subarea in spite of state-wide increases. The primary reason was the loss of 10 thousand jobs in Textiles. Employment decreases were also notable in Nonelectrical Machinery, and Lumber and Wood Products. In spite of the decline in manufacturing employment, total employment increased because of growth in service jobs.

Our projections indicate further declines in manufacturing employment through 1970, but some growth thereafter. The two fastest-growing components will be the Machinery and Paper industries (see Table 14). Employment in Transportation Equipment (primarily shipbuilding), a large part of manufacturing in 1960, is expected to decline over the projection period, and as a result, total employment growth will keep pace with that of the state.

c. Me-R (Remainder of State): Counties of Oxford, Franklin, Somerset, Piscataquis, Waldo, Lincoln, Knox, Hancock, and Washington (Table 15)

(1) Geography. - Me-R, the remainder of the state, encompasses over half of the land area of Maine. Extending from the western border of the state to the Atlantic Coast, Me-R is larger than Massachusetts, Connecticut, and Rhode Island combined. The rocky upland region to the west is an extension of the White Mountains of New Hampshire. Much of the land is not level enough for cultivation and the soil is poor. Second growth timber covers substantial portions. The eastern portion of Me-R is coastal plain where most of the nation's blueberries are grown. Coastal fisheries supply lobster and other seafoods to the Atlantic market. All urban places have populations of fewer than 10,000 persons, and much of the northern part of the subarea lacks paved roads.

(2) Population. - With fifteen persons per square mile, Me-R is the least densely populated subarea in all New England. Population has grown more slowly in Me-R than in the rest of Maine for the last thirty years. Between 1950 and 1960, the subarea's population actually declined, mainly because of diminishing employment opportunities in Agriculture, Forestry, and Fisheries. The projections for Me-R indicate that population will grow, but at a slower pace than in the state. Urban population will increase more rapidly than total population, but Me-R is expected to remain about half as urbanized as the state (see Table 17).

(3) Employment. - Nearly 38 percent of total employment in Me-R is in manufacturing--a higher proportion than that in the rest of Maine. The proportion of manufacturing employment has been increasing for the last thirty years. Me-R also has a relatively high proportion of its employment in Agriculture, Forestry, and Fisheries, but these activities have been steadily declining. The proportion of subarea employment in services, although growing, is still significantly lower than that in the other two subareas; in 1960 Me-R had 53 percent of its total employment in services as compared with 66 percent in Me-1 and 62 percent in Me-2.

The two largest industrial employers are Lumber and Wood Products, and Paper -- together these industries account for nearly half of manufacturing employment. Other important industries are Leather, Food, and Textiles. During the last decade, manufacturing employment in Me-R expanded three times as rapidly as in the state (see Appendix D, Table D-4). However, employment in the two largest industries, Lumber and Paper, declined, even though the rest of the state registered modest gains. The growth of the manufacturing sector was due mainly to increases in Leather, the third largest industry, and a number of small but rapidly growing industries such as Electrical Machinery, Nonelectrical Machinery, Chemicals, and Printing and Publishing.

Total employment is expected to grow at a slower pace in Me-R than in the rest of the state because of expected declines in the important Lumber and Paper industries. The most rapidly growing manufacturing industry in our forecast is Machinery and Electrical Machinery, which by 2020 will be second only to Paper in number of employees. Employment growth in the service industries will be somewhat higher than in manufacturing, but somewhat lower than the growth of service employment in the rest of the state.

TABLE 13

EMPLOYMENT AND POPULATION IN MAINE SUBAREA Me-1, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	6.8	6.0	5.8	5.4
(01-07)	Agriculture[1/]	6.6	5.9	5.8	5.4
08	Forestry[2/]	0.1	0.1	--	--
09	Fisheries	--	--	--	--
B.(10-14)	Mining	--	--	--	--
D.(19-39)	Manufacturing	16.5	21.2	23.6	27.7
24	Lumber and Wood Products, except Furniture[2/]	2.7	3.6	3.7	3.1
26	Paper and Allied Products[2/]	5.9	7.7	8.1	10.6
28	Chemicals	0.1	0.1	0.1	0.1
35 & 36	Machinery and Electrical Machinery	0.8	1.5	2.0	2.7
37	Transportation Equipment	0.4	0.6	0.6	0.6
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing[3/]	6.6	7.8	9.2	10.6
C.(15-17), E.-J.(40-99)	Service Industries[4/]	45.0	64.8	86.7	115.0
	TOTAL EMPLOYMENT	68.3	92.0	116.0	148.0
	TOTAL POPULATION	232.4	272.0	320.0	373.0
	Urban	118.8	154.0	197.0	243.0
	Rural	113.6	118.0	123.0	130.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone; Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 14

EMPLOYMENT AND POPULATION IN MAINE SUBAREA Me-2, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	5.7	6.1	5.8	5.8
(01-07)	Agriculture 1/	5.0	5.3	5.0	5.0
08	Forestry 2/	--	--	--	--
09	Fisheries	0.7	0.8	0.8	0.8
B.(10-14)	Mining	0.1	0.1	0.1	0.1
D.(19-39)	Manufacturing	60.8	61.0	69.8	75.6
24	Lumber and Wood Products, except Furniture 2/	3.0	1.8	1.5	1.3
26	Paper and Allied Products 2/	6.5	9.3	13.9	14.3
28	Chemicals	0.3	0.4	0.4	0.4
35 & 36	Machinery and Electrical Machinery	3.3	5.7	7.5	10.3
37	Transportation Equipment 3/	6.7	5.8	5.1	3.0
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 4/	41.0	38.1	41.5	46.4
C.(15-17), E.-J.(40-99)	Service Industries 5/	108.9	148.0	198.0	262.0
	TOTAL EMPLOYMENT	175.4	215.0	274.0	344.0
	TOTAL POPULATION	480.4	579.0	702.0	818.0
	Urban	315.6	406.0	530.0	650.0
	Rural	164.8	174.0	172.0	168.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 15

EMPLOYMENT AND POPULATION IN MAINE SUBAREA Me-R, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	7.9	8.0	8.0	8.1
(01-07)	Agriculture[1/]	5.8	5.7	5.6	5.7
08	Forestry[2/]	0.3	0.1	0.1	0.2
09	Fisheries	1.8	2.2	2.2	2.2
B.(10-14)	Mining	0.2	0.3	0.3	0.3
D.(19-39)	Manufacturing	32.7	33.9	36.6	39.2
24	Lumber and Wood Products, except Furniture[2/]	9.0	7.9	6.5	5.0
26	Paper and Allied Products[2/]	6.2	5.6	6.7	6.8
28	Chemicals	0.6	0.6	0.7	1.1
35 & 36	Machinery and Electrical Machinery	1.2	2.8	3.6	5.0
37	Transportation Equipment	1.1	1.4	1.4	1.4
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing[3/]	14.6	15.6	17.7	19.9
C.(15-17), E.-J.(40-99)	Service Industries[4/]	46.1	56.4	75.6	100.0
	TOTAL EMPLOYMENT	86.9	98.6	120.0	148.0
	TOTAL POPULATION	256.4	275.0	316.0	357.0
	Urban	62.6	77.8	97.4	117.0
	Rural	193.8	197.0	219.0	241.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 16

MAINE SUBAREA PERCENT SHARES OF IMPORTANT ECONOMIC INDICATORS, 1950-2020

		Primary Resource Employment[1/]	Manufacturing Employment	Total Commodity Employment[2/]	Service Employment	Total Employment	Urban Population	Total Population
1950	Me.-1	32.0	12.5	17.3	21.6	19.7	19.9	22.3
	Me.-2	25.6	59.3	51.0	54.3	52.8	65.6	49.4
	Me.-R	42.4	28.2	31.7	24.1	27.5	14.5	28.3
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1960	Me.-1	32.7	15.0	17.8	22.5	20.6	23.9	24.0
	Me.-2	28.0	55.3	51.0	54.4	53.1	63.5	49.6
	Me.-R	39.3	29.7	31.2	23.1	26.3	12.6	26.4
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1980	Me.-1	29.4	18.3	20.0	24.1	22.7	24.2	24.2
	Me.-2	30.0	52.5	49.2	54.9	53.0	63.6	51.4
	Me.-R	40.6	29.2	30.8	21.0	24.3	12.2	24.4
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2000	Me.-1	29.1	18.2	19.7	24.1	22.8	23.9	23.9
	Me.-2	29.4	53.7	50.4	54.9	53.6	64.3	52.4
	Me.-R	41.0	28.1	29.9	21.0	23.6	11.8	23.7
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2020	Me.-1	27.5	19.4	20.4	24.1	23.1	24.1	24.1
	Me.-2	30.1	53.1	50.3	54.[illegible]	53.8	64.4	52.8
	Me.-R	42.4	27.5	29.3	21.0	23.1	11.5	23.1
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Details may not add to totals because of rounding.

1/ SIC A and B
2/ SIC A, B, and D

TABLE 17

MAINE SUBAREA URBANIZATION AND POPULATION DENSITY

	URBANIZATION (Urban Population as a Percent of Total Population)				POPULATION DENSITY (Persons per square mile)			
YEAR	Me-1	Me-2	Me-R	STATE	Me-1	Me-2	Me-R	STATE
1950	46.1	68.6	26.9	51.7	20	131	15	30
1960	51.1	65.7	24.4	51.3	23	139	15	31
1970	53.4	66.8	26.7	53.4	23	150	15	33
1980	56.6	70.0	28.3	56.6	27	168	16	36
1990	59.5	73.2	29.7	59.5	29	185	17	40
2000	61.6	75.5	30.8	61.6	31	203	18	43
2010	63.5	77.6	31.8	63.5	34	219	19	46
2020	65.3	79.5	32.6	65.3	36	237	21	50

7. NEW HAMPSHIRE SUBAREAS

a. NH-1: Counties of Merrimack, Hillsboro, Rockingham, and Strafford (Table 18)

(1) Geography. - Much of the recent growth of NH-1 is better understood when viewed against the pattern of development in the neighboring Boston area. Although to characterize this part of New Hampshire as a "suburb" of the Boston area would be drawing the point too sharply, the growth in NH-1 nevertheless reflects the "spillover" effects of growth in Massachusetts -- a phenomenon that can be expected to become increasingly important as the population density of the Boston region (subarea M-3) increases from its present 1,250 persons per square mile to 3,100 per square mile by 2020. The expansion of military installations and state university educational facilities in NH-1 has also fostered economic growth.

Most of New Hampshire's important cities are located in NH-1. Three of these, Nashua, Manchester, and Concord, lying along the Merrimack River, have for many years formed the backbone of economic activity in this subarea. Over the 1950-1960 decade, however, the growth of these cities was slow, ranging from a 12.8 percent increase in population in Nashua to a 3.6 percent increase in Concord. Meanwhile, a second line of cities -- Portsmouth, Dover, Somersworth, and Rochester -- lying along the lower Maine border experienced more rapid growth, with population increases ranging from 15.6 percent to 37.7 percent over the past decade. As noted below, these differences in the pattern of urban growth reflect in large part the changing industrial structure of the subarea.

(2) Population. - In 1960 NH-1 accounted for 66.7 percent of New Hampshire's total population. This percentage share has been increasing steadily since 1930, when it was 62 percent, and it is projected to continue to increase, but at a dampened rate, reaching 68.2 percent of total state population by 2020 (Table 22).

Within NH-1, population growth has not been uniform. In recent years Rockingham County, situated in the southeastern corner of the state, has been growing at a very rapid rate. Between 1950 and 1960 its population increased 41 percent, making it the third-fastest-growing county in New England.1/ By contrast, the percentage increase in the population of Merrimack County was considerably below the state rate of increase, reflecting the relatively slow growth of the Concord and Manchester industrial centers.

1/ The fastest-growing county in New England between 1950 and 1960 was Tolland County, Connecticut, with a 53.7 percent increase in population. The second-fastest-growing was Barnstable County, Massachusetts, with a 50.2 percent increase, due largely to the establishment of Otis Air Force Base.

As its large share of the state's total population might suggest, the NH-1 subarea is the most urbanized of the state's four subareas. In 1960, 66.2 percent of the subarea's population was urban; by 2020 71.6 percent is projected to be urban (Table 23).

(3) Employment. - Employment opportunities in this subarea have been growing at a faster rate than in the state as a whole and are expected to continue their lead. Pacing this growth have been substantial increases in the service and manufacturing sectors; between 1950 and 1960 services added 18 thousand jobs to the subarea's total employment. While manufacturing added 8 thousand jobs. Employment in the primary resource industries (Agriculture, Forestry, Fisheries, and Mining) declined by 4 thousand jobs during the same period.

Within the NH-1 manufacturing sector, six two-digit industries account for over 75 percent of all manufacturing employment. These are:

	1960 Employment (1,000)	Percent of Mfg. Employment
Leather (estimated)	19.7	30.2
Electrical Machinery	9.1	13.9
Textiles	8.8	13.5
Nonelectrical Machinery	4.5	6.9
Transportation Equipment	4.4	6.8
Lumber, Wood, and Furniture	3.8	5.8

Leather has traditionally been the largest manufacturing employer in NH-1. Since the middle 1950's this industry maintained a relatively constant employment level in NH-1 despite a moderate but steady decline for New England as a whole. In the meantime, however, the subarea's Electrical and Nonelectrical Machinery industries have experienced vigorous growth -- a more-than-tenfold increase in the last ten years. By 2020, Electrical and Nonelectrical Machinery employment will have expanded to approximately four times the 1960 level. The Machinery group, with 47 percent of total employment, will then be the subarea's largest industrial employer.

Thus the industrial base of NH-1 is changing and will continue to change significantly. Leather, Textiles, and Lumber still account for more than 50 percent of the subarea's manufacturing employment. But, by 1980, if not before, employment in these industries will have been surpassed by employment in the Machinery and Transportation Equipment industries.

b. NH-2: Counties of Cheshire and Sullivan (Table 19)

(1) Geography. - Bounded by NH-1 on the east and the Connecticut River on the west, NH-2 is in several ways a contradiction. Viewed in terms of its geography, this rolling, wooded, two-county region presents a predominantly pastoral-recreational image. There are but two major urban centers, Keene and Claremont, and each of these has a population of less than 20,000. Yet, viewed in terms of its economic activity, NH-2 has the highest percentage of total employment in manufacturing of any of the New Hampshire subareas -- 42.3 percent. In fact, the ratio of manufacturing employment to total employment exceeds not only that found in New Hampshire as a whole, but also that in most Connecticut and Massachusetts subareas. It is also interesting to note that while the population is distributed rather uniformly throughout NH-2, a substantial amount of the manufacturing activity is concentrated in a few large firms.2/

(2) Population. - NH-2 currently contains 11.8 percent of the state's population. This share has been quite stable over the last 20 years and is projected to change little. The population density and degree of urbanization of the subarea are slightly below state levels both historically and in the projection years.

(3) Employment. - As noted earlier, NH-2 has a higher proportion of its total employment engaged in manufacturing activity than other New Hampshire subareas. It also ranks lowest among the New Hampshire subareas in the proportion of total employment in the service sector. The lower proportion of service activity occurs in all service industries, ranging from wholesale and retail trade to government.

Within the manufacturing sector, Nonelectrical Machinery stands out as a major employer. Engaging 30.5 percent of the subarea's manufacturing workers in 1960, it is to NH-2 what Leather is to NH-1. Textiles, (primarily woolens) ranks second in importance, with 16.3 percent of manufacturing employment. Most of the remaining 53.2 percent of the subarea's manufacturing employment is divided between four or five industries of about equal size. Thus, while the Nonelectrical Machinery industry is prominent, the manufacturing base of NH-2 is fairly diverse.

Nevertheless, the greater part of growth in manufacturing in NH-2 will be generated by the machinery industries. By 2020 machinery will account for over 50 percent of the subarea's manufacturing activity.

2/ These features were also found to be characteristic of several of the northern subareas of Maine, Vermont, and New Hampshire. Thus such subareas tend to have a higher-than-average ratio of manufacturing employment to total employment and, at the same time, an unusually high proportion of this employment is concentrated in a few large firms.

This projected growth presumes both the expansion of firms already located in the subarea and the influx and growth of new firms.

c. NH-3: Counties of Grafton and Coös (Table 20)

(1) Geography. - NH-3, situated in northern New Hampshire, contains more than one-third of the state's land area but less than one-sixth of the state's population. A considerable portion of NH-3 lies within the White Mountain National Forest; even the remaining part is mountainous, often not easily accessible by automobile or truck.

The largest city, Berlin, situated on the Androscoggin River just above the White Mountain National Forest, forms the center for much of the manufacturing activity. Throughout the subarea, recreation-related activity is prominent. The rugged topography discourages farming, although some dairy farming still persists.

(2) Population. - NH-3 has exhibited the slowest population growth of the four New Hampshire subareas and is expected to remain slowest in growth over the projection period. The subarea's present 14.2 percent share of state population is projected to decline to 12.5 percent by 2020. Population density is 24 persons per square mile -- less than one-half that of the state and one-sixth that of the NH-1 subarea. The subarea's degree of urbanization is low, but not as low as the density figures might suggest; forests occupy much of the land area, and in the rest, the population tends to concentrate in small urban places along river valleys.

(3) Employment. - The attractiveness of NH-3 for both summer and winter recreation provides an important source of employment within the region. While the Census of Population is taken in April, and therefore misses the seasonal peaks in recreation-oriented employment, its reported employment for the service sector (broadly defined) nevertheless reveals the relatively great importance of this industry to NH-3. Of the subarea's total employment, 61 percent is in the service sector, compared with 57 percent for the state as a whole. However, over the past twenty years the subarea's share of service employment has been steadily declining. Thus, in spite of the growth of recreation-related activity, it appears that the demand for services by the indigenous population has not grown as rapidly as in New Hampshire's southern areas. Such a pattern of growth is consistent with the lower per capita incomes and lesser urbanization of NH-3. The projections for service employment moderate the historical decline in the subarea's share of the state. Whereas 1940 to 1960 witnessed a decline from 17 percent to 14 percent of New Hampshire service employment, the subarea's share is projected to decline to 12 percent by 1980 and level off at that value thereafter. However, while service employment will at first grow at a slower rate than in the state, this does not mean that service employment will not expand within NH-3. As with all the New England subareas, service employment will account for a steadily increasing share of total employment, and will account for 74 percent of NH-3's total employment by 2020.

Paper, Rubber, and Textiles dominate the manufacturing sector. Together these industries employ over 75 percent of those working in manufacturing. The machinery industry is small, but has been growing. It is projected to be a growth industry for NH-3, although it will not be as prominent in this subarea as in the southern part of the state. Paper is projected to be a major source of employment growth after 1980; by 2020 it will have contributed approximately 40 percent of the total increase in manufacturing employment. Rubber and Textiles have in the past been sources of moderate growth for the subarea -- a fact which, in the case of Textiles, provides an interesting contrast to the New England trend. Individual projections for these industries have not been made. Implicitly, however, our projections for the industry group "Other Manufacturing" include the expected growth of these two industries. In summary, the manufacturing sector of NH-3 is highly concentrated in a few industries, and while these industries will remain the primary sources of growth, a greater diversification of the manufacturing base is expected to take place.

d. NH-R (Remainder of State): Counties of Belknap and Carroll (Table 21)

(1) Geography. - Bounded by the White Mountains on the north and Lake Winnipesaukee on the south, NH-R encompasses 14 percent of New Hampshire's land area. The terrain is characteristically mountainous; together with the substantial area encompassed by the White Mountain National Forest, the Ossipee Mountains and Squam Mountains highlight the region's rugged image. Numerous lakes and ponds, formed by the glacial diversion of streams, intersperse the area. As such a terrain suggests, both summer and winter recreation activities are important to the subarea's economy.

(2) Population. - The permanent population of NH-R has been growing at a slower rate than that of the state. In fact, between 1950 and 1960 Carroll county was the only county in New Hampshire whose population actually declined. Projections for NH-R indicate that the subarea's population will increase from 45 thousand in 1960 to 63 thousand in 1980 and 132 thousand in 2020. The rate of increase implied by these figures is quite close to that projected for the state as a whole. NH-R is the least urbanized of New Hampshire's subareas; only 39.4 percent of its population resides in urban places. The only city with over 10,000 persons is Laconia, with a population of 15,300 in 1960.

(3) Employment. - Reflecting largely the importance of tourism to the region, the proportion of the subarea's total employment contained in the service sector -- 64.6 percent -- is the highest of all New Hampshire subareas. The projections for the service sector indicate that the NH-R subarea will continue to lead in this respect, but that the gap relative to other subareas will tend to narrow.

Employment in manufacturing is limited to a few industries: Lumber, Wood and Furniture, with 17.0 percent; and Textiles, with 14.1 percent.

Although the subarea's manufacturing employment is projected to grow faster than that of any other New Hampshire subarea, this rate of growth will not be sufficient to alter the fact that NH-R has the lowest proportion of its total employment in manufacturing.

TABLE 18

EMPLOYMENT AND POPULATION IN NEW HAMPSHIRE SUBAREA NH-1, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	3.9	3.8	3.6	3.4
(01-07)	Agriculture 1/	3.8	3.7	3.5	3.3
08	Forestry 2/	--	--	--	--
09	Fisheries	0.1	0.1	0.1	0.1
B.(10-14)	Mining	0.1	0.1	0.1	0.1
D.(19-39)	Manufacturing	65.1	76.4	97.8	120.0
24	Lumber and Wood Products, except Furniture 2/	2.5	1.4	1.2	1.1
26	Paper and Allied Products 2/	2.1	4.3	5.8	6.1
28	Chemicals	0.3	0.4	0.5	0.7
35 & 36	Machinery and Electrical Machinery	13.5	24.6	38.9	56.9
37	Transportation Equipment 3/	4.4	5.2	7.8	7.1
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 4/	42.3	40.5	43.6	48.3
C.(15-17) E.-J.(40-99)	Service Industries 5/	88.5	146.0	235.0	366.0
	TOTAL EMPLOYMENT	157.7	226.0	336.0	490.0
	TOTAL POPULATION	404.8	579.0	847.0	1180.0
	Urban	268.0	410.0	601.0	845.0
	Rural	136.8	169.0	246.0	335.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 19

EMPLOYMENT AND POPULATION IN NEW HAMPSHIRE SUBAREA NH-2, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	1.1	1.1	1.1	1.1
(01-07)	Agriculture[1/]	1.1	1.1	1.1	1.1
08	Forestry[2/]	--	--	--	--
09	Fisheries	--	--	--	--
B.(10-14)	Mining	--	--	--	--
D.(19-39)	Manufacturing	12.1	14.1	17.3	21.6
24	Lumber and Wood Products, except Furniture[2/]	1.0	0.7	0.7	0.5
26	Paper and Allied Products[2/]	1.2	1.2	1.2	1.6
28	Chemicals	0.1	0.1	0.1	0.2
35 & 36	Machinery and Electrical Machinery	3.8	6.0	8.8	12.2
37	Transportation Equipment	--	--	--	--
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing[3/]	6.0	6.1	6.5	7.1
C.(15-17) E.-J.(40-99)	Service Industries[4/]	15.3	24.3	39.1	61.0
	TOTAL EMPLOYMENT	28.6	39.4	57.5	83.7
	TOTAL POPULATION	71.4	101.0	145.0	202.0
	Urban	34.3	53.8	79.3	115.0
	Rural	37.1	47.3	65.6	87.1

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 19

EMPLOYMENT AND POPULATION IN NEW HAMPSHIRE SUBAREA NH-2, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	1.1	1.1	1.1	1.1
(01-07)	Agriculture[1/]	1.1	1.1	1.1	1.1
08	Forestry[2/]	--	--	--	--
09	Fisheries	--	--	--	--
B.(10-14)	Mining	--	--	--	--
D.(19-39)	Manufacturing	12.1	14.1	17.3	21.6
24	Lumber and Wood Products, except Furniture[2/]	1.0	0.7	0.7	0.5
26	Paper and Allied Products[2/]	1.2	1.2	1.2	1.6
28	Chemicals	0.1	0.1	0.1	0.2
35 & 36	Machinery and Electrical Machinery	3.8	6.0	8.8	12.2
37	Transportation Equipment	--	--	--	--
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing[3/]	6.0	6.1	6.5	7.1
C.(15-17) E.-J.(40-99)	Service Industries[4/]	15.3	24.3	39.1	61.0
	TOTAL EMPLOYMENT	28.6	39.4	57.5	83.7
	TOTAL POPULATION	71.4	101.0	145.0	202.0
	Urban	34.3	53.8	79.3	115.0
	Rural	37.1	47.3	65.6	87.1

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 20

EMPLOYMENT AND POPULATION IN NEW HAMPSHIRE SUBAREA NH-3, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	1.6	1.6	1.5	1.5
(01-07)	Agriculture 1/	1.5	1.5	1.5	1.5
08	Forestry 2/	0.1	0.1	--	--
09	Fisheries	--	--	--	--
B.(10-14)	Mining	--	--	--	--
D.(19-39)	Manufacturing	10.6	12.9	16.7	20.9
24	Lumber and Wood Products, except Furniture 2/	1.5	1.5	1.2	0.9
26	Paper and Allied Products 2/	4.3	4.5	6.4	8.2
28	Chemicals	0.1	0.1	0.1	0.1
35 & 36	Machinery and Electrical Machinery	0.7	1.3	2.0	2.9
37	Transportation Equipment	--	--	--	--
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	4.1	5.6	7.3	8.8
C.(15-17) E.-J.(40-99)	Service Industries 4/	19.0	25.4	40.9	63.8
	TOTAL EMPLOYMENT	31.1	39.9	59.4	86.2
	TOTAL POPULATION	86.0	109.0	157.0	216.0
	Urban	36.1	56.6	92.8	144.0
	Rural	49.9	52.5	64.5	71.7

1/ *Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.*
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 21

EMPLOYMENT AND POPULATION IN NEW HAMPSHIRE SUBAREA NH-R, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	0.7	0.6	0.6	0.5
(01-07)	Agriculture[1/]	0.6	0.5	0.5	0.4
08	Forestry[2/]	0.1	0.1	0.1	0.1
09	Fisheries	--	--	--	--
B.(10-14)	Mining	--	--	--	--
D.(19-39)	Manufacturing	5.4	6.7	9.1	11.5
24	Lumber and Wood Products, except Furniture[2/]	0.8	0.5	0.5	0.5
26	Paper and Allied Products[2/]	--	--	0.3	0.4
28	Chemicals	--	--	--	--
35 & 36	Machinery and Electrical Machinery	1.9	2.8	4.1	5.7
37	Transportation Equipment	0.1	0.1	0.1	0.1
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing[3/]	2.6	3.3	4.0	4.8
C.(15-17) E.-J.(40-99)	Service Industries[4/]	11.0	16.8	27.2	42.3
	TOTAL EMPLOYMENT	17.1	24.2	36.8	54.4
	TOTAL POPULATION	44.7	63.1	93.7	132.0
	Urban	15.3	23.8	36.0	51.9
	Rural	29.4	39.3	57.7	79.7

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 22

NEW HAMPSHIRE SUBAREA PERCENT SHARES OF IMPORTANT ECONOMIC INDICATORS, 1950-2020

		Primary Resource Employment 1/	Manufacturing Employment	Total Commodity Employment 2/	Service Employment	Total Employment	Urban Population	Total Population
1950	NH-1	55.5	69.7	67.6	65.2	66.3	75.1	64.1
	NH-2	14.2	13.3	13.5	10.8	12.1	10.3	12.2
	NH-3	20.9	11.8	13.1	15.3	14.3	9.8	15.7
	NH-R	9.4	5.2	5.8	8.7	7.3	4.8	8.0
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1960	NH-1	40.7	69.9	68.7	66.2	67.2	75.8	66.7
	NH-2	11.8	13.0	13.2	11.4	12.2	9.7	11.8
	NH-3	15.7	11.4	12.1	14.2	13.3	10.2	14.2
	NH-R	6.8	5.7	6.0	8.2	7.3	4.3	7.4
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1980	NH-1	54.0	69.4	68.4	68.7	68.6	75.4	67.9
	NH-2	15.5	12.8	13.0	11.4	12.0	9.8	11.9
	NH-3	21.9	11.7	12.3	12.0	12.1	10.4	12.8
	NH-R	8.6	6.1	6.3	7.9	7.3	4.4	7.4
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2000	NH-1	54.1	69.3	68.6	68.7	68.6	74.3	68.1
	NH-2	16.1	12.3	12.4	11.4	11.8	9.8	11.7
	NH-3	21.3	11.8	12.5	12.0	12.1	11.5	12.7
	NH-R	8.5	6.5	6.5	7.9	7.5	4.4	7.5
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2020	NH-1	53.2	69.0	68.4	68.7	68.6	73.1	68.2
	NH-2	16.5	12.4	12.6	11.4	11.7	9.9	11.7
	NH-3	22.1	12.0	12.4	12.0	12.1	12.5	12.5
	NH-R	8.2	6.6	6.6	7.9	7.6	4.5	7.6
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Details may not add to totals because of rounding.

1/ SIC A and B

2/ SIC A, B, and D

TABLE 23

NEW HAMPSHIRE SUBAREA URBANIZATION AND POPULATION DENSITY

	URBANIZATION (Urban Population as a Percent of Total Population)					POPULATION DENSITY (Persons per Square Mile)				
YEAR	NH-1	NH-2	NH-3	NH-R	STATE	NH-1	NH-2	NH-3	NH-R	STATE
1950	67.5	48.3	35.8	34.7	57.5	118	52	24	32	59
1960	66.2	48.1	42.0	34.2	58.3	140	57	24	33	67
1970	69.0	51.0	47.2	36.3	61.5	163	66	27	39	78
1980	70.8	53.2	51.9	37.7	63.9	201	81	31	47	95
1990	71.2	54.2	55.7	38.2	64.8	248	98	37	59	116
2000	71.0	54.8	59.0	38.4	65.1	293	116	45	70	138
2010	71.8	56.2	63.4	39.2	66.5	347	136	52	83	163
2020	71.6	56.8	66.9	39.4	66.9	409	161	61	98	192

8. VERMONT SUBAREAS

a. Vt-1: Counties of Windsor and Windham (Table 24)

(1) Geography. - Bounded by the Green Mountains on the west and the Connecticut River on the east, Vt-1 contains approximately one-fifth of the state's land area and population. Brattleboro, Bellows Falls, and Springfield, all on or near the Connecticut River, are the largest communities. The main river valley and its tributary river valleys support some farming. Arable land is generally scarce, however, and agricultural activity is largely restricted to dairying and the production of poultry and eggs, with hay as the principal field crop. The region's scenic uplands, characteristic of much of the Vermont landscape, make tourism a major activity.

(2) Population. - Over the past 20 years the subarea's rate of growth has been approximately equal to that of the state. During the projection period, its population is expected to increase somewhat faster than that of the state, from about 72 thousand in 1960 to approximately 99 thousand by 1980 and to 170 thousand by 2020.

In 1960, approximately 35 percent of the subarea's population was urban, compared with roughly 39 percent for the state as a whole. The subarea's urban population is projected to grow at a somewhat faster rate than that of the state, and by 2020 the proportion of persons living in urban places should equal about 55 percent.

(3) Employment. - Agriculture employed one-fourth of the subarea's work force in the 1930's. Since then, employment in this sector has declined to only 8 percent of total subarea employment. Further reductions, although less drastic, are projected to occur throughout the forecast period.

Nonelectrical Machinery has traditionally been the subarea's largest single manufacturing industry, employing approximately 41 percent of the manufacturing work force. The industry is presently concentrated in five or six large machine tool firms located in the towns of Springfield and Windsor. The industry has grown by more than 50 percent during the last decade, and our projections indicate that, in combination with Electrical Machinery, it will account for more than half of the expected employment growth in the subarea's manufacturing sector. Part of that growth will result from the expansion of firms already in the area. Further expansion is forecast to come from the Electrical Machinery industry, which presently is concentrated in the western Vt-R subarea, but is expected to become more evenly distributed throughout the state.

The second largest industry, Lumber and Wood Products, engages about 15 percent of the manufacturing work force. Employment in this industry has been declining, however, and by 2020 its percent share of manufacturing employment will have fallen to about one third of the 1960 level.

In contrast, Paper and Allied Products, an industry which is now relatively small in the subarea, will grow in importance after 1980 and by 2020 will account for about 11 percent of manufacturing employment.

Manufacturing as a whole will expand faster in Vt-1 than in the state; thus, the subarea's share of Vermont manufacturing employment will rise from 25 percent in 1960 to nearly 28 percent by 2020.

Employment in the broadly-defined service category currently represents about 60 percent of the subarea's total. This proportion will have increased to 70 percent by 2020. The rate at which service employment is projected to expand is approximately the same as that projected for the state as a whole.

b. Vt-2: Counties of Essex, Caledonia, and Orange (Table 25)

(1) Geography. - Vt-2 consists of three counties in northeastern Vermont. The northern portion is mountainous and sparsely settled forest land. The hilly upland, although not suitable for intensive farming, supports some 15 percent of the state's dairy production. Saint Johnsbury is the manufacturing and trade center of Vt-2. With the completion of Interstate Highway 91, during the next decade, new economic opportunities will develop.

(2) Population. - Over the past 20 years there has been a general decrease in the number of people living in Vt-2, induced in large part by the declines in farming activity. In the future, however, the decline in agricultural employment will be offset by gains in manufacturing and service employment, reversing the downward drift of population levels. Even in the later decades, however, the subarea's rate of population growth will not equal that of the state. Consequently, the subarea's share of state population will continue to diminish from about 12 percent in 1960 to approximately 10 percent by 2020.

The Vt-2 is the least urbanized Vermont subarea. Of the total 1960 population, only about 15 percent lived in urban places, as compared with about 39 percent for the state as a whole. While some increases in urbanization are expected, residents of rural areas will continue to make up more than four-fifths of the subarea's population. By 2020, population density will still be less than 50 persons per square mile.

(3) Employment. - As noted above, the decrease in farming employment in Vt-2 has been significant. In 1960 there were four thousand fewer persons employed in agriculture than thirty years ago. This decline has more than offset the modest increases in employment witnessed in other industries. The projections for agriculture reveal a leveling off in absolute employment levels, but a continuing relative decline.

Manufacturing has been expanding more rapidly in Vt-2 than in the state (Table 27). Leading this growth were industries such as Apparel,

Printing and Publishing, and Nonelectrical Machinery. Employment in the Lumber, Wood, and Furniture group, accounting for approximately 30 percent of the subarea's manufacturing employment, remained relatively stable during the last two decades despite a 20 percent decline at the state level. The projections for Vt-2 indicate that its manufacturing employment will continue to grow at a slightly faster rate than the state's. Of the industries for which individual projections have been made, Paper and Allied Products and Machinery will be important contributors to growth.

As a result of its low degree of urbanization, the subarea's share of state service employment has tended to be less than its share of state population. The projections for service employment in Vt-2 show that services relative to population will continue to lag behind the state.

c. Vt-R (Remainder of State): Counties of Franklin, Orleans, Grand Isle, Chittenden, Lamoille, Washington, Addison, Rutland, and Bennington (Table 26)

(1) Geography. - Vt-R, comprising nine western Vermont counties, contains almost 60 percent of the state's land area, and nearly 70 percent of its population. Three cities, with Burlington by far the largest, have populations exceeding 10 thousand. Spanning the length of the state from north to south, Vt-R displays a checkered pattern of activity with industrial and recreational centers interspersed among farming communities. The Green Mountain National Forest occupies much of the land area in the south.

(2) Population. - Historically, Vt-R has accounted for a stable 70 percent of the state's population. In the long run, relatively little change in this share is expected. In 1960, 273 thousand persons resided in Vt-R; by 2020, the number is projected to rise to nearly 600 thousand persons.

At present, approximately 43 percent of the Vt-R population resides in urban centers, compared with about 39 percent for the state as a whole. The projections indicate that Vt-R will continue to be the most highly urbanized of the three Vermont subareas (see Table 28).

(3) Employment. - Agriculture, though declining, is still an important source of employment in this subarea. The northwestern counties of Addison, Chittenden, and Franklin, encompass a large area along the Lake Champlain lowland which is suitable for farming. Dairying is the principal farming activity and hay the most common field crop. Agricultural employment is projected to drop from 12 percent of the subarea's total employment in 1960 to less than 3 percent in 2020.

Manufacturing in Vt-R is diversified. During the past 20 years, its share of state manufacturing employment has been relatively constant. A slight decline in this share is envisioned during the projection period, due in large part to modest employment cutbacks in individual industries.

More important, however, Vt-R has a relatively higher proportion of slow-growth industries than the state, so that the subarea's share of manufacturing employment will decline (see Appendix D).

Service employment in Vt-R is comparatively higher than in the remainder of the state. This reflects both the importance of recreation-related employment and the relatively high degree of urbanization. The projections indicate that up to 1980, service employment in Vt-R will grow at a somewhat faster rate than in the state as a whole.

TABLE 24

EMPLOYMENT AND POPULATION IN VERMONT SUBAREA Vt-1, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	2.2	2.1	1.9	1.8
(01-07)	Agriculture 1/	2.2	2.0	1.8	1.7
08	Forestry 2/	--	0.1	0.1	0.1
09	Fisheries	--	--	--	--
B.(10-14)	Mining	--	--	--	--
D.(19-39)	Manufacturing	8.8	12.0	15.5	19.4
24	Lumber and Wood Products, except Furniture 2/	1.4	1.0	0.9	0.8
26	Paper and Allied Products 2/	0.4	0.8	1.5	2.1
28	Chemicals	0.1	0.1	0.1	0.1
35 & 36	Machinery and Electrical Machinery	3.6	5.4	7.5	10.0
37	Transportation Equipment	--	--	--	--
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	3.3	4.7	5.5	6.4
C.(15-17), E.-J.(40-99)	Service Industries 4/	16.5	24.4	34.7	48.9
	TOTAL EMPLOYMENT	27.6	38.5	52.2	70.1
	TOTAL POPULATION	72.3	99.1	132.0	170.0
	Urban	25.5	43.4	66.2	92.8
	Rural	46.8	55.7	65.4	77.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 25

EMPLOYMENT AND POPULATION IN VERMONT SUBAREA Vt-2, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	2.8	2.7	2.7	2.7
(01-07)	Agriculture[1/]	2.8	2.7	2.7	2.7
08	Forestry[2/]	--	--	--	--
09	Fisheries	--	--	--	--
B.(10-14)	Mining	0.1	0.1	0.1	0.1
D.(19-39)	Manufacturing	4.2	5.3	6.9	9.2
24	Lumber and Wood Products, except Furniture[2/]	0.5	0.4	0.5	0.4
26	Paper and Allied Products[2/]	0.5	1.0	1.4	2.5
28	Chemicals	0.1	0.1	0.1	0.1
35 & 36	Machinery and Electrical Machinery	1.0	1.0	1.4	1.9
37	Transportation Equipment	--	--	--	--
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing[3/]	2.1	2.9	3.5	4.3
C.(15-17) E.-J.(40-99)	Service Industries[4/]	9.0	11.3	16.1	22.7
	TOTAL EMPLOYMENT	16.1	19.5	25.9	34.6
	TOTAL POPULATION	44.9	52.4	66.6	83.8
	Urban	6.8	9.1	12.3	15.6
	Rural	38.1	43.3	54.3	68.2

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding.

TABLE 26

EMPLOYMENT AND POPULATION IN VERMONT SUBAREA Vt-R, 1960-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1960	1980	2000	2020
A.(01-09)	Agriculture, Forestry and Fisheries	11.8	11.9	12.0	12.1
(01-07)	Agriculture 1/	11.6	11.8	11.9	12.0
08	Forestry 2/	0.2	0.1	0.1	0.1
09	Fisheries	--	--	--	--
B.(10-14)	Mining	0.9	1.1	1.1	1.1
D.(19-39)	Manufacturing	22.4	27.0	34.5	41.7
24	Lumber and Wood Products, except Furniture 2/	2.9	2.1	1.8	1.6
26	Paper and Allied Products 2/	1.4	2.7	4.1	4.3
28	Chemicals	0.3	0.4	0.5	0.5
35 & 36	Machinery and Electrical Machinery	3.4	5.1	7.0	9.3
37	Transportation Equipment	0.4	0.6	0.8	0.5
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	14.0	16.2	20.3	25.6
C.(15-17) E.-J.(40-99)	Service Industries 4/	62.9	93.7	133.0	188.0
	TOTAL EMPLOYMENT	98.0	134.0	181.0	243.0
	TOTAL POPULATION	272.7	358.0	465.0	587.0
	Urban	117.6	183.0	265.0	351.0
	Rural	155.1	175.0	201.0	236.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2/ Projections and 1960 estimates furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance and Real Estate; Services; Government; and Nonclassified.

-- Fewer than 50 persons.

NOTE: Components may not add to totals due to rounding. See Appendix A for more detailed figures.

TABLE 27

VERMONT SUBAREA PERCENT SHARES OF IMPORTANT ECONOMIC INDICATORS, 1950-2020

		Primary Resource Employment 1/	Manufacturing Employment	Total Commodity Employment 2/	Service Employment	Total Employment	Urban Population	Total Population
1950	Vt-1	14.1	25.0	20.1	18.4	19.2	15.9	18.4
	Vt-2	17.6	11.5	14.3	11.1	12.5	5.4	12.5
	Vt-R	68.3	63.5	65.6	70.5	68.3	78.7	69.1
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1960	Vt-1	12.5	24.9	20.8	18.7	19.5	17.1	18.5
	Vt-2	16.3	11.8	13.3	10.1	11.3	4.5	11.5
	Vt-R	71.2	63.3	65.9	71.2	69.2	78.4	70.0
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1980	Vt-1	11.8	27.0	22.6	18.9	20.1	18.4	19.4
	Vt-2	16.0	12.0	13.2	8.7	10.2	3.9	10.3
	Vt-R	72.2	61.0	64.2	72.4	69.7	77.7	70.3
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2000	Vt-1	10.8	27.2	23.3	18.9	20.1	19.3	19.8
	Vt-2	16.1	12.1	13.2	8.7	10.0	3.6	10.1
	Vt-R	73.1	60.7	63.6	72.4	69.9	77.1	70.1
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0
2020	Vt-1	10.1	27.6	24.1	18.9	20.2	20.2	20.2
	Vt-2	15.7	13.0	13.6	8.7	10.0	3.4	10.0
	Vt-R	74.2	59.4	62.3	72.4	69.8	76.4	69.8
	State	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Details may not add to totals because of rounding.

1/ SIC A and B
2/ SIC A, B, and D

TABLE 28

VERMONT SUBAREA URBANIZATION AND POPULATION DENSITY

	URBANIZATION (Urban Population as a Percent of Total Population)				POPULATION DENSITY (Persons per Square Mile)			
YEAR	Vt-1	Vt-2	Vt-R	STATE	Vt-1	Vt-2	Vt-R	STATE
1950	31.4	15.6	41.6	36.4	40	24	47	41
1960	35.4	15.2	43.1	38.5	41	23	49	42
1970	38.7	16.0	46.2	41.5	47	24	55	47
1980	43.8	17.4	51.2	46.3	56	27	65	55
1990	47.5	18.2	54.6	49.5	65	31	74	63
2000	50.3	18.5	56.9	51.7	75	34	84	72
2010	52.6	18.6	58.4	53.3	85	38	94	81
2020	54.6	18.6	59.8	54.6	97	43	106	91

CHAPTER III - METHODOLOGY

9. INTRODUCTION

This Chapter describes the method used to derive long-range employment and population projections for the seventeen New England subareas delineated in Chapter I. Before outlining the sequence of steps, however, we shall briefly set forth certain of the broad principles and criteria governing the projection procedures.

10. CRITERIA OBSERVED IN DESIGNING A SUBAREA PROJECTION FRAMEWORK

The methodological framework was designed to:

1) provide a logical and consistent extension of the projection framework and results established in the preceding regional and state reports;

2) establish an operational framework that allows for limitations in statistical information at the subarea level;

3) implement a method of analysis adapted to the special features of small-area economies; and

4) provide an allocation procedure both flexible enough to incorporate independent projections and suitable to accomplish a substantial number of allocations in a systematic manner.

The second and third objectives led to some divergence from the projection methods employed in the preceding two reports. The divergence consists in the omission of the "export-import" or "base and non-base" industry and "location-factor analysis" concepts used in the regional and state studies.

The methods used for projecting economic activity at the subarea level differ from those used for deriving regional and state projections because sufficiently detailed employment data at the county level covering an adequate period of time is lacking. Thus, the method had to be tailored to the availability of information for county-delineated subareas. Moreover, from a theoretical standpoint, the use of the "export and import" or "base and non-base" industries concept at the subarea level is not suitable, since subareas tend to be more dependent upon economic activity outside of the area (by means of inter-regional trade linkages) than upon inter-industry trade relationships within the area. Thus, our analysis focuses primarily on the study of the growth relationships between subareas and states rather than on a study of the comparative growth patterns of individual employment sectors within a subarea.

11. THE PROJECTION FRAMEWORK

The projection framework is best described in terms of the following basic assumptions:

1) Changes in the economic activity of a subarea are related to the course of economic development at the state level.

2) The historical growth relationships between employment at the subarea and state levels of particular industry sectors provide the principal, though not exclusive, guidelines to judging the future growth prospects of individual subarea employment sectors.

3) The growth of subarea population is predominantly a function of the growth of employment opportunities in the subarea.

4) Subarea projections must be reasonable in the light of what industry specialists and regional economists know about the forces that are shaping the fundamental growth patterns of particular industries in the subareas.

5) In measures such as labor force participation rates and urbanization, subareas will tend to approach state levels during the projection period.

6) Subarea projections have a relatively lower predictive reliability than those derived for the state and the region, and the level of reliability varies directly with the size (population or employment) of the subarea, and inversely with the length of the projection period.

12. IMPLEMENTATION OF THE PROJECTION FRAMEWORK

The projection of a specific subarea's share of a particular activity generally followed these lines: the method of least squares was used to determine the trend line expressing each subarea as a function of the state historically. Subarea projections were obtained by substituting projected state economic activity in the trend equation. We then tested the reasonableness of the subarea projections by means of a number of consistency checks described in the last part of this chapter.

If the subarea projections appeared consistent with developments foreseen by industry specialists, we accepted the subarea-to-the-state trend relationship implied by the equation up to 1980. After 1980, subarea percent shares of each industry were kept constant. Therefore, any changes in the overall economic position of the subarea relative to that of the state after 1980 reflect differences in industrial structure. This means that the subareas with the most favorable industrial mix (in terms of growth potential) will be the fastest growing. Conversely, subareas

with a relatively high proportion of declining and/or slow-growth industries will lag behind. (For a detailed analysis of each subarea's structural changes during the 1950-1960 period, see Appendix D.)

When trend analysis produced implausible projections, we relied on alternative methods. In the case of industrial employment, we drew upon the judgment of industry experts in determining the growth prospects of individual industries from a detailed analysis of the product mix of specific firms in the subarea. In the case of urban and rural population, we worked within a framework of consistency checks, examining, for example, the relationships between population and employment, and between urban population and population density.

13. PRELIMINARY ALLOCATION OF STATE PROJECTIONS AMONG SUBAREAS BY TREND ANALYSIS

Trend equations based on the method of least squares were advantageous since they yielded projections in usable form and provided a systematic allocation procedure for all subareas. Using historical data (primarily for the 1940 to 1960 period) we obtained equations expressing employment or population in each subarea as a function of that in the state. The equations were of the form

$$y_{ij} = a_{ij} + b_{ij}x_j$$

where, for example, y_{ij} is subarea i employment in industry j, x is state employment in industry j, and a_{ij} and b_{ij} are coefficients which indicate whether a particular subarea grows more or less rapidly than the state. If the sum of the subarea industry employment equals the state employment in the industry historically,1/ the use of state projections in the equations will yield subarea projections which add to the state for each projection year.2/ Thus, the preliminary projections derived from trend analysis were consistent with the state totals.

Equations relating each subarea and state were derived for the following population and employment sectors:

1) Total Population
2) Urban Population
3) Mining (SIC 10-14)
4) Chemicals (SIC 28)
5) Machinery and Electrical Machinery (SIC 35 and 36)
6) Transportation Equipment (SIC 37)
7) All Other Manufacturing (SIC 19,20,21,22,23,25,27,29,30, 31,32,33,34,38, and 39)

1/ See Footnote 5, Table A-1, Appendix A.
2/ It can be shown that the sum of the a_{ij} coefficients will equal zero in this case and the sum of the b_{ij} coefficient will equal one. This was useful in checking the equations.

8) Services (SIC major sectors C,E,F,G,H,I and Nonclassified)

Population and employment data by county were gathered from the following sources:

1) The Census of Population, 1930, 1940, 1950, and 1960;
2) The Census of Manufactures, 1939, 1947, 1954, and 1958;
3) County Business Patterns, 1953, 1956, 1959 and 1962; and, when possible,
4) State Departments of Employment Security, for selected years between 1950 and 1963.

The compiled data for subareas, both in terms of absolute employment and in terms of subarea percent shares of the state's employment, indicated the relation of the historical trend in each subarea to that of the state for individual industries as well as for larger economic aggregates. Although the various data sources frequently list different absolute numbers of employees because of variations in definitions and coverage, the use of a number of sources gave greater insight into the distribution of employment among subareas.

In an attempt to determine foreseeable changes in historical trends, we also compiled subarea information on new plant construction from data on Area Redevelopment Administration loans, published by the U.S. Department of Commerce, and from data on new plant locations, published in the Industrial Development and Manufacturers Record and The New Englander.

The equations derived by the method of least squares quantified growth trends of subareas relative to states over the last two or three decades. The equations were suitable for projection purposes only when the historical relationships between subareas and states were changing gradually and no foreseeable changes in trend could be independently determined. In industries where the distribution of employment among subareas had changed markedly, the limitations of trend analysis became apparent in that the computed trend line did not fit the historical data well and was therefore not suitable for making projections. In such cases alternative projection methods were used.

14. CHECKS ON THE HISTORICAL CONSISTENCY OF INDIVIDUAL INDUSTRY PROJECTIONS

We compared subarea projections in each industry, first, with past trends in actual employment within the subarea, and second, with the subarea's historical percent share of state employment. Projections which were judged unreasonable in either respect were rejected. Alternative projections were derived by methods outlined in the following section.

15. SPECIAL INDUSTRY STUDIES

a. Chemicals, Machinery, and Transportation Equipment. - Within the manufacturing sector we made separate subarea employment projections for three major water-using industry groups. These included Chemicals (SIC 28),

Nonelectrical and Electrical Machinery (SIC 35 and 36 combined) and Transportation Equipment (SIC 37).[3/] A total of fifteen separate analyses were required to distribute these three industries within each of five New England states.

The first step, as noted in the previous section, was to use trend equations to obtain allocations of state projections to subareas which then were checked for historical consistency. We then asked two questions: first, when the composition of an industry varies significantly from one subarea to another in a state, are the differences in growth potential implied by such variation adequately reflected in the trend projections? Second, can industry specialists tell us anything about the future of these industries in each of the subareas which would lead us to reject or modify the projections? Viewed in this context, ten of the fifteen initial allocations of industry employment were accepted. The five rejected were: (1) Chemicals in Massachusetts, (2) Machinery in Maine, (3) Machinery in New Hampshire, (4) Transportation Equipment in Maine, and (5) Transportation Equipment in Connecticut.

Three factors account for the inadequacy of the trend approach in the five cases noted. First, in each instance the composition of the industry within the state varies substantially from one subarea to another. For example, the Chemical industry in central and western Massachusetts is highly concentrated in plastics; by contrast, in the eastern part of the state the character of the industry is still strongly conditioned by its historic role of supplying special industrial chemicals to such traditional industries as Textiles and Leather.

A second factor which distinguishes the five exceptions noted is the frequency with which a few large firms dominate the industry within a subarea. In Connecticut's Transportation Equipment Industry several very large aircraft plants are of major importance to two of the subareas, and the third subarea is dominated by the manufacture of submarine vessels. In Maine, this industry is concentrated in a few shipbuilding enterprises in the southern Me-2 subarea. In such circumstances, it is not surprising that extrapolation of historical trends proved inadequate. If just one firm has in the past either closed down or made a major expansion, a trend line fitted through the historical data may multiply this event beyond reasonable expectation in the projections.

A third factor relates to the problem of interdependence between adjacent subareas. With the region of analysis reduced to one of a few counties, the problem of people living in one subarea but working in another is sometimes significant. For example, over half of the persons

3/ Projections for two other manufacturing industries, Lumber and Wood Products (SIC 24) and Paper and Allied Products (SIC 26), were made by the U. S. Forest Service.

employed in Electrical Machinery in the Me-2 subarea commute to plants located in New Hampshire. Thus the future employment of a subarea, as defined in Census residency terms, may depend upon the growth or decline of establishments outside the subarea.

For the five cases characterized by the problems just noted, we made judgmental projections to replace the trend results. Our procedure was as follows:

1) We identified the major firms in the industry in each of the state's subareas, together with the types of product made and the approximate number of persons employed.

2) We asked industry specialists to evaluate the relative growth potentials of the industry in each subarea, taking into consideration both the general growth trends for each of the product components of the industry and knowledge of special circumstances affecting individual establishments.

3) We compiled a list of announcements of major plant closings or expansions reported over the past few years in several New England publications.

4) Using the information obtained in the preceding steps, we made judgmental projections of the most likely future distribution of the industry among subareas. In doing so, we focused upon the 1970 and 1980 projections for which the detailed information we had gathered was most relevant. For the projection years after 1980, we held the relative distribution of the industry among subareas constant at the 1980 levels.4/

It should be noted that the procedure just outlined for projecting the five exceptions to the trend approach was also applied to several of the industry allocations for which the trend projections were accepted, in order to obtain a better confirmation of the results.

b. All Other Manufacturing (SIC 19,20,21,22,23,25,27,29,30,31,32 33,34,38, and 39). - The projections for this industry group incorporate individual projections of Textiles (SIC 22), Primary Metals (SIC 33), and Fabricated Metals (SIC 34), since historical data on these industries were available at the subarea level and because individual projections of

4/ Two minor exceptions to the principle of holding shares constant at the 1980 levels were made. For the Transportation Equipment Industry in Connecticut we extended the projections to 1990 before holding the shares constant. For the same industry in Maine, we held the absolute level of employment in two of the subareas constant after 1980 and obtained employment in the remaining subarea by implication from the projected state total. Both exceptions were made to obtain a more uniform growth trend in the absolute employment projections.

employment had been derived at the state level for these industries. The remaining industries were projected as a group, either because of the lack of data on individual industries at the subarea level, or to conform to the industry grouping in the state projections.

c. Projections of Subarea Employment in Fisheries and Mining

(1) Fisheries. - Since nearly all of the fishing activity occurs in the coastal regions of the states, the allocation of state employment projections among subareas was markedly simplified -- all New Hampshire fisheries employment was allocated on this basis to NH-1; for Vermont, no allocation was made, since fisheries employment is negligible.

In the Census of Population, fisheries employment at the county level is grouped with that of forestry. Thus we used data from the U.S. Bureau of Commerical Fisheries to determine the percent distribution of subarea fishing employment in 1960, and then used this distribution to allocate the state projections among subareas in Maine, Massachusetts, and Connecticut.

(2) Mining. - In Vermont, Maine, and Connecticut we accepted the trend projections for mining since they seemed to correspond well with the trends in the subarea percent distribution of mining employment in the Census of Minerals for 1954 and 1958. We modified the Massachusetts and New Hampshire projections slightly to correspond more closely to the percent distribution of mining employment in the Census of Minerals.

16. INCORPORATION OF INDEPENDENT PROJECTIONS OF FORESTRY, LUMBER AND WOOD PRODUCTS, PAPER, AND AGRICULTURE

Employment projections provided by the U.S. Forest Service for Forestry, Lumber and Wood Products, and Paper were directly added into our projection results for the manufacturing sector. (For a summary of the Forest Service Report, see Appendix B.)

Employment projections provided by the Economic Research Service, U.S. Department of Agriculture, (see Appendix C) were first converted to Census of Population equivalents and then incorporated into our framework. We multiplied the projected subarea employment percent distributions by a factor equal to the ratio of the 1960 Census of Population share to the 1960 Department of Agriculture employment share. The projected subarea shares in each state were then constrained to add up to 100 percent and multiplied by the projected state employment totals to get the agricultural employment projections shown in Chapter II.

17. CONSISTENCY TESTS FOR PROJECTIONS OF MAJOR ECONOMIC SECTORS AND METHODS FOR REVISION.

Once we had arrived at a satisfactory set of projections for each industry, we tested the implications for major economic sectors for historical consistency by the eight important ratios discussed below, and

made revisions when necessary.

a. Ratio of Employment to Population. - We compared the historical ratio of employment to population for each subarea with the ratios implied for the future, using employment as the sum of that projected in individual industries and future population from trend projections. The comparison of the employment-population ratio in the subarea to that of the state was an effective means of evaluating subarea population projections with respect to those of employment. Inconsistencies became apparent if the subarea ratio was diverging from the state ratio. In such cases, we revised our population projections on the assumption that, other things being equal, the subarea ratio of employment to population will approach the state ratio over time.

However, "other things" may not be equal, and for several reasons the subarea relationship of employment to population may differ from that in the state. Relatively high proportions of school-age children, retired or unemployed persons, or members of the armed forces may lower the employment-population relationship of a subarea. The first three factors are obvious but the armed forces component is purely the result of the Census of Population definition, which includes military personnel on station as part of the labor force data but excludes them from employment figures.

In revising the projected population distribution on the basis of employment shares, we took historical differences between subarea and state ratios of employment to population into account. For subareas which differed significantly from the state historically, we found the reason and incorporated it into our projection method. For example, in a sparsely populated subarea, a large military base might lower the apparent ratio of employment to population. In such cases, we found that the addition of military personnel to employment figures yielded an historical ratio of employment to population which was close to that of the state. Therefore, for projection purposes we estimated the subarea excess of "non-employed" in 2020, added it to the employment projection and assumed that the ratio of this figure to population would equal the state ratio. If we had assumed that all subareas would have the state ratio of employment to population in 2020, then population would have been underestimated in subareas with high concentrations of persons not counted in employment data.

In the state report, the ratio of employment to population is the same for all states in 2020. In all states this ratio increases over the projection period (largely because of an increase in labor force participation envisaged for women), but since the 1960 ratios varied among states, some have greater increases than others. The subarea ratios of employment to population also increase over time, although they are not all equal in 2020 because of the particular adjustments made for "non-employed" persons.

b. Ratio of Commodity Industry Employment to Population. - We computed subarea historical and projected ratios of commodity employment[5] to

[5] The sum of employment in primary resource industries and manufacturing.

population and compared them with historical and projected state ratios. Historically we found significant variation among subarea ratios, indicating that the distribution of subarea population was not closely related to that of commodity employment. Thus, unlike the state report, we used total employment rather than commodity employment to estimate population. In the state report, all states have the same relationship of commodity employment to population in 2020, and this ratio is less than the 1960 state ratios, indicating the relative decline of commodity industries. At the subarea level, we also have declines in the ratio of projected commodity employment to population, but the subarea ratios do not equal those of the states in 2020. Comparisons of the projected subarea ratios and the state ratios indicate the differential rate of relative decline in commodity industries among subareas, i.e., although commodity employment will decline in relative importance within all subareas, it will still be more significant in some subareas than in others throughout the projection period.

c. Ratio of Service Industry Employment to Population. - We found no strict historical relationship between service employment and population at the subarea level, so we projected services independently (subarea employment as a function of state employment) to 1980 and held the subarea percent shares constant thereafter. Service employment helped determine the population distribution, since population was estimated as a function of total employment.

We compared subarea projected ratios of service employment to population with the historical ratios and found them to be consistent. In all subareas, projected service employment continues to grow at a faster rate than population. We checked the projected trends in the relationship of the subarea ratios of service employment to population with the state ratios and found them to be consistent with historical trends, i.e., while service employment will become increasingly important in all subareas, it will be more important in some than in others over the entire projection period.

d. Ratio of Manufacturing Employment to Total Employment. - Comparisons of projected and historical subarea ratios of manufacturing employment to total employment indicate that our projections bear out the historical trend toward relatively less manufacturing employment. Subarea projected ratios do not converge to the state ratios since we expect differences in the relative importance of manufacturing among subareas.

e. Ratio of Service Employment to Total Employment. - Our projections indicate increases in the proportion of service employment in all subareas. Again, some subareas will have a relatively higher concentration of service employment than others.

f. Population Density. - Our projections of the number of persons per square mile are consistent with historical trends. Population density is projected to increase in all subareas, and, as in the past, will continue to vary significantly among subareas.

Although population density was used to estimate urban population in the State report, we found very little relationship between the two at the subarea level. (See Paragraph h, Ratio of Relative Density to Relative Urbanization, below.)

g. Ratio of Urban Population to Total Population. - We computed the historical ratios of urban to total population. Preliminary subarea urban population projections based on least squares trend lines were then checked for consistency with population projections based on employment (see Paragraph a). In general, urban population projections based on the extrapolation of historical trends proved unsatisfactory. For the most part this is due to changes in Census definitions.

Since the least squares trend lines usually proved unsatisfactory for projecting subarea urban population, we used an alternative method based on two assumptions:

1) Urbanization (urban population as a percent of total population) will increase in all subareas throughout the projection period.

2) Subarea urbanization will either approach state urbanization over time or retain a constant relationship to the state figure, but will not decline relative to state urbanization.

All revised projections of urban population were checked for historical consistency with respect to absolute numbers of persons and subarea percent shares of state urban population.

h. Ratio of Relative Density to Relative Urbanization. - We define "relative density" as the ratio of subarea population density to that in the state. Similarly, relative urbanization is the ratio of subarea urbanization (urban population as a percent of total population) to state urbanization. Historical ratios of relative density to relative urbanization showed little relationship between population density and urbanization. A mountainous subarea may have thickly settled valleys so that most of the population lives in urban areas. However, when subarea population is compared with the entire land area, density may be quite low. For this reason, no attempt was made to relate urbanization to density at the subarea level.

PROJECTIVE ECONOMIC STUDY OF NEW ENGLAND

APPENDICES TO PART I

THE REGION

PROJECTIVE ECONOMIC STUDY OF NEW ENGLAND

APPENDICES

Appendix

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APPENDIX A

PROJECTIONS OF EMPLOYMENT, LABOR FORCE, POPULATION, OUTPUT AND PERSONAL INCOME BY DECADE, 1960 - 2020

TABLE A-1

EMPLOYMENT, LABOR FORCE AND POPULATION, NEW ENGLAND, 1960-2020
(thousands of persons*)

SIC		Industry	1960	1970	1980	1990	2000	2010	2020
A.	(01-09)	Agriculture, Forestry, and Fisheries	92.9	90.7	88.9	87.0	85.2	83.3	81.4
		Agriculture[1]	84.3	82.4	80.6	78.7	76.9	75.0	73.1
		Forestry[2]	1.8	1.5	1.5	1.5	1.5	1.5	1.5
		Fisheries	6.8	6.8	6.8	6.8	6.8	6.8	6.8
B.	(10-14)	Mining	4.0	3.9	3.8	3.8	3.8	3.7	3.7
C.	(15-17)	Contract Construction	214.9	263.9	310.8	365.4	437.1	525.8	625.3
D.	(19-39)	Manufacturing	1,479.0	1,589.6	1,703.6	1,857.1	2,085.6	2,302.6	2,548.6
	22	Textile Mill Products	125.4	86.6	62.6	48.1	41.6	35.6	31.2
	24	Lumber and Wood Products, except Furniture[2]	33.4	28.7	25.7	24.2	21.8	19.7	17.8
	26	Paper and Allied Products[2]	72.7	76.1	80.4	87.3	95.5	102.0	109.4
	28	Chemicals and Allied Products	34.6	35.3	37.1	39.6	44.2	52.0	56.8
	30	Rubber and Miscellaneous Plastic Products	61.6	70.3	76.1	81.3	89.0	95.0	101.6
	31	Leather and Leather Products	104.5	93.1	88.1	82.4	82.7	78.3	73.6
	33	Primary Metal Industries	55.1	54.9	50.0	46.7	44.7	42.3	39.4
	34	Fabricated Metal Products	116.2	121.6	136.3	157.3	191.4	231.1	279.1
	35	Machinery, except Electrical	162.1	199.3	219.3	240.5	268.8	294.9	324.2
	36	Electrical Machinery	167.4	215.5	269.0	328.6	406.8	487.2	581.2
	37	Transportation Equipment	119.2	120.3	125.9	130.6	126.4	112.8	95.8
	19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	426.8	487.9	533.1	590.5	672.7	751.7	838.5

TABLE A-1
(cont'd)

EMPLOYMENT, LABOR FORCE AND POPULATION, NEW ENGLAND, 1960-2020
(thousands of persons*)

SIC		Industry	1960	1970	1980	1990	2000	2010	2020
E.	(40-49)	Transportation, Communications, & Utilities	217.7	192.0	173.8	164.5	162.4	160.8	157.8
F.	(50-59)	Wholesale and Retail Trade	673.1	789.4	902.0	1,037.2	1,216.5	1,438.0	1,686.5
G.	(60-67)	Finance, Insurance, and Real Estate	183.8	240.2	304.6	378.5	471.6	588.8	720.5
H.	(70-89)	Services	680.4	932.1	1,215.5	1,540.9	1,948.9	2,460.2	3,039.7
I.		Government[3]	309.5	401.8	500.9	614.8	759.4	940.3	1,144.5
J.		Nonclassified	179.2	149.0	180.0	216.5	263.6	322.4	388.8
		TOTAL EMPLOYMENT	4,034.5	4,652.6	5,383.9	6,265.7	7,434.1	8,825.9	10,396.8
		Unemployment	193.5	201.4	233.1	271.3	321.9	382.1	450.2
		TOTAL LABOR FORCE[4]	4,331.5	4,854.0	5,617.0	6,537.0	7,756.0	9,208.0	10,847.0
		TOTAL POPULATION	10,510.0	11,840.0	13,840.0	16,170.0	18,740.0	21,720.0	25,170.0

1. Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2. Projected by U.S. Department of Agriculture, Forest Service.
3. Government employment in educational services is shifted from Services to Government.
4. Includes Armed Forces. In 1960, the Armed Forces are not included in Total Employment but are included in Total Labor Force, which accounts for the failure of Total Employment plus Unemployment to add to Labor Force.

* Expressed in Census of Population equivalents.

TABLE A-2

PERSONAL INCOME AND PER CAPITA PERSONAL INCOME IN NEW ENGLAND, 1960 - 2020

Years	Population (millions of persons)	Personal Income (billions of 1954 dollars)	Per Capita Personal Income (in 1954 dollars)**
1960	10.51	22.6	2,150
1970	11.84	32.3	2,728
1980	13.84	46.0	3,324
1990	16.17	64.5	3,989
2000	18.74	91.3	4,872
2010	21.72	128.5	5,916
2020	25.17	182.6	7,255

** For a comparison with U.S. per capita personal income projections, see p. 39 of the report.

TABLE A-3

VALUE ADDED BY SELECTED INDUSTRIES, NEW ENGLAND, 1960-2020

(in millions of 1954 dollars)

SIC	Industry	1960 (actual)	1970	1980	1990	2000	2010	2020
22	Textile Mill Products	819	913	1,025	1,141	1,331	1,497	1,693
26	Paper & Allied Prods.	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.	n.c.
28	Chemicals & Allied Products	475	746	1,156	1,716	2,484	3,575	5,143
30	Rubber and Misc. Plastic Products	548	841	1,227	1,739	2,489	3,497	4,973
31	Leather & Leather Products	527	599	718	837	1,023	1,196	1,400
33	Primary Metal Industries	454	549	614	682	754	828	908
34	Fabricated Metal Products	767	926	1,213	1,621	2,225	3,057	4,265
35	Machinery, except Electrical	1,215	1,752	2,206	2,734	3,385	4,159	5,151
36	Electrical Machinery	1,177	1,866	2,864	4,247	6,262	9,036	13,125
37	Transportation Equipment	845	968	1,191	1,432	1,571	1,612	1,592

n.c. = Not computed by Arthur D. Little, Inc.

APPENDIX B

PROJECTIONS OF NATIONAL DATA: Gross National Product, FRB Industrial Production Index, and U.S. Personal Income

PROJECTIONS OF NATIONAL DATA: GROSS NATIONAL PRODUCT, FRB INDUSTRIAL PRODUCTION INDEX, AND U.S. PERSONAL INCOME

1. SUMMARY

It is estimated that Gross National Product in 1954 prices* will approach $1900 billion by 2000 and $3850 billion by 2020. This indicates an 8.75-fold increase over 1960 ($440 billion). The major assumption in this projection is that no major wars or depressions will occur in the intervening years and that high employment levels will prevail. Table B-1 shows the actual GNP figures for the post-war period, including 1957, the last year of substantially full employment, and the projections by decades, 1970 through 2020.

U.S. personal income, meanwhile, is expected to increase from $350 billion in 1960, in 1954 prices, to nearly $1480 billion by 2000 and about $2980 billion by 2020. This indicates an 8.5-fold increase between 1960 and 2020 -- a rate of growth that is slightly lower than that projected for GNP.

The Federal Reserve Board industrial production index, which increased by 66.2 percent between 1947 and 1960, is projected to increase slightly over ten-fold between 1960 and 2020. This reflects a continued decline in the ratio of the GNP to the FRB index.

The tabulation below summarizes the comparative growth of the gross national product, U.S. personal income, and the FRB industrial production index:

(1960 = 100.0)

	1960	1970	1980	1990	2000	2010	2020
Gross National Product	100.0	146.1	212.3	302.3	432.2	612.9	874.9
U.S. Personal Income	100.0	144.3	208.5	296.0	421.6	596.9	851.0
FRB Industrial Prod. Index	100.0	150.9	225.0	328.7	482.4	693.5	1003.7

* 1954 prices were used to preserve consistency with the historical series published by the U.S. Department of Commerce.

TABLE B-1

REAL GROSS NATIONAL PRODUCT BY MAJOR TYPE OF PRODUCT AND PURCHASER, U. S. PERSONAL INCOME, AND FRB INDUSTRIAL PRODUCTION INDEX

(GNP and U. S. Personal Income in billions of $ at 1954 prices)

	1929	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961	1962	PROJECTIONS* 1970	1980	1990	2000	2010	2020
GROSS NATIONAL PRODUCT	181.8	282.3	293.1	292.7	318.1	341.8	353.5	369.0	363.1	392.7	400.9	408.6	401.3	428.6	439.9	447.7	474.8	642.7	934.0	1330.0	1901.3	2696.0	3848.7
1. Durable goods	30.8	55.8	55.4	51.9	65.3	74.6	75.1	80.8	71.6	83.1	84.9	85.5	71.7	82.9	84.2	81.3	91.0	141.4	212.9	309.9	444.9	633.6	912.2
Personal consumption expenditures	14.9	23.3	24.6	26.3	32.1	29.2	28.5	33.1	32.4	39.6	38.0	38.5	35.5	41.0	42.2	41.5	45.6	62.3	93.4	135.7	195.8	277.7	400.3
Producers' durable equipment	11.1	21.7	22.8	19.8	21.3	22.0	21.8	22.5	20.8	22.5	25.0	24.6	19.4	21.4	22.7	21.0	23.8	38.6	56.0	79.8	114.1	161.8	230.9
Government purchases	0.7	3.6	4.4	5.3	5.6	13.3	20.9	21.8	17.7	14.7	15.4	17.0	16.2	16.6	14.3	16.3	16.5	30.2	52.3	83.8	133.1	202.2	307.9
Net exports	1.5	5.7	2.8	2.8	2.1	3.0	2.7	2.4	3.2	3.4	3.8	4.3	2.9	1.0	3.0	2.8	2.6	10.3	11.2	10.6	1.9	-8.1	-26.9
Change in business inventories	2.6	1.5	0.8	-2.4	4.3	7.1	1.2	1.0	-2.5	3.0	2.7	1.0	-2.4	3.0	2.1	-0.3	2.6						
2. Nondurable goods	64.7	107.5	112.3	110.5	112.3	117.1	121.8	126.9	125.9	133.8	136.5	137.9	139.8	145.9	148.8	151.9	158.1	201.2	277.4	379.1	521.0	722.5	1012.2
Personal consumption expenditures	65.3	105.3	105.1	106.3	109.2	111.2	115.0	118.3	119.3	125.4	130.3	132.6	133.3	138.7	141.4	143.3	147.8	185.7	255.0	347.1	479.2	665.9	931.4
Government purchases	1.1	2.3	4.8	6.0	2.4	3.9	6.2	10.8	6.6	6.4	4.6	4.3	7.1	6.4	6.9	7.1	9.3	10.3	15.9	25.3	38.0	56.6	84.7
Net exports	-2.1	1.5	-1.0	-0.6	-2.2	-0.6	-0.9	-1.8	-0.9	-1.1	-0.2	0.3	-1.4	-2.1	-0.5	-0.5	-1.2	5.1	7.5	6.7	3.8	0.0	-3.9
Change in business inventories	0.4	-1.6	3.5	-1.2	2.9	2.6	1.5	-0.5	0.9	3.1	1.8	0.7	0.8	2.9	1.1	2.0	2.2						
3. Services	60.3	94.7	97.2	100.7	105.0	114.2	119.8	122.5	124.1	130.2	135.5	141.2	145.2	151.4	158.8	165.3	174.4	228.8	340.0	493.4	724.4	1040.6	1497.1
Personal consumption expenditures	48.0	67.0	69.6	71.7	75.5	78.2	80.8	83.7	86.3	91.0	96.0	100.1	104.4	109.2	114.5	118.9	124.3	169.0	248.4	355.1	509.6	722.5	1031.5
Government purchases	11.5	26.9	27.4	28.5	29.1	36.2	39.7	40.4	39.0	40.4	40.7	41.9	42.5	43.3	45.0	46.5	49.7	61.7	92.5	135.7	205.3	304.6	446.4
Net exports	0.8	0.8	0.2	0.4	0.4	-0.2	-0.6	-1.6	-1.3	-1.3	-1.1	-0.8	-1.7	-1.0	-0.7	0.0	0.4	-1.9	-0.9	2.7	9.5	13.5	19.2
4. Construction	26.1	24.3	28.2	29.7	35.4	36.0	36.9	38.8	41.6	45.6	43.9	44.0	44.5	48.3	48.1	49.2	51.4	71.3	103.7	147.6	211.0	299.3	427.2
Private construction	20.9	19.9	22.7	22.3	27.4	26.0	26.0	27.6	29.7	33.9	32.3	31.8	31.1	34.4	34.4	34.7	36.7	50.8	70.1	97.1	133.1	180.7	246.3
Government construction	5.2	4.4	5.5	7.3	8.0	9.9	10.9	11.2	11.9	11.7	11.6	12.2	13.5	13.9	13.8	14.5	14.7	20.6	33.6	50.5	77.9	118.6	180.9
1. Personal consumption expenditures	123.1	195.6	199.3	204.3	216.8	218.5	224.2	235.1	238.0	256.0	264.3	271.2	273.2	288.9	298.1	303.6	317.6	417.1	596.8	837.9	1184.5	1666.1	2363.1
2. Gross private domestic investment	35.0	41.5	49.8	38.5	55.9	57.7	50.4	50.6	48.9	62.5	61.7	58.1	49.0	61.7	60.2	57.5	65.2	102.2	140.1	188.9	247.2	326.2	434.9
3. Net exports of goods and services	0.2	8.0	2.0	2.6	0.2	2.2	1.2	-0.9	1.0	0.9	2.5	3.8	-0.2	-2.1	1.7	2.3	1.8	0.6	2.8	8.0	15.2	21.6	30.8
4. Government purchases of goods and services	18.5	37.2	42.1	47.2	45.1	63.3	77.7	84.3	75.3	73.2	72.3	75.5	79.3	80.1	79.9	84.3	9.2	122.8	194.3	295.2	454.4	682.1	1019.9
U. S. PERSONAL INCOME	149.5	230.8	237.7	236.2	255.3	266.8	278.4	291.2	289.8	306.5	318.3	324.2	325.2	340.9	350.3	360.8	376.2	505.4	730.4	1036.9	1477.0	2090.8	2981.0
FEDERAL RESERVE BOARD INDUSTRIAL PRODUCTION INDEX (1957 = 100)	38	65	68	64	74	81	84	91	85	96	99	100	93	105	108	109	117	163	243	355	521	749	1084

NOTES: (1) Gross National Product data sources:

(a) Years 1929-1955: U. S. Income and Output 1958, Table I-2, p. 118 and Table VII-6, p. 224; also, Economic Report of the President, 1963, p. 174 for years 1929-1956;

(b) Years 1956-1962: Survey of Current Business (July, 1963), Table 4, p. 14 and Table 65, p. 37.

(2) U. S. Personal Income data sources: Economic Report of the President, 1963, p. 178 and 190 for years 1929-1960; and Economic Report of the President, 1964, p. 214 and p. 224 for years 1961 and 1962. Total personal income series are deflated by using implicit price deflators for gross national product.

(3) Federal Reserve Board Industrial Production Index:

Total industrial production index, covering all manufacturing and mining industries and utilities, derived from (a) Economic Almanac, 1962, p. 151 and 158; (b) Business Statistics, 1961, pp. 14-16; and (c) Federal Reserve Bulletin (July, 1962). The FRB Industrial production index is projected on the basis of the relationship between that index and GNP during the 1929-1962 period. The long-run relationship between GNP and the FRB index, as measured by the ratio of GNP to the FRB index, has generally been a declining one, ranging from 4.4 to 4.1 during the postwar period. The GNP/FRB index ratio is projected to decrease to 3.6 by the end of the projection period.

* Parts may not add up to total due to rounding and statistical discrepancies.

2. GROSS NATIONAL PRODUCT PROJECTIONS

Gross national product projections, in 1954 prices, are based on the assumption of an average annual growth rate of 3.85 percent between 1959-1961 and 1980 and 3.6 percent thereafter. These growth rate assumptions are those of the Economic Task Group of the Ad Hoc Water Resources Council Staff, and reflect higher rates of employment than those prevailing in 1959-1961. Under these assumptions, the gross product of the economy, as measured by GNP , more than doubles between 1960 and 1980, while real gross product per capita increases by about 50 percent.*

* Computations and projections of the Economic Task Group (Gross National Product in 1954 dollars)

Item	Unit	Average 1959-61	Medium Level Projection 1980	2000	2020
Population	Mil.	180.8	254.0	358.0	502.0
Labor Force	"	73.1	104.0	147.3	206.2
Employment	"	68.9	99.8	140.6	196.9
Unemployment	"	4.2	4.7	6.9	9.3
Gross Nat. Product	Bil.	438.9	934.0	1901.3	3848.7
Private nonfarm	"	382.6	836.2	1722.4	3511.5
Agric.	"	21.6	27.1	34.7	45.3
Gov.	"	34.7	70.7	144.2	291.9
Gross Prod. per capita	Dol.	2,428	3,677	5,310	7,667

Economic Task Group of the Ad Hoc Water Resources Council Staff, National Economic Growth Projections 1980, 2000, 2020 (July 1963).

For the purpose of comparing these government-supplied GNP growth rates with projections published by other groups and agencies, we present average annual GNP growth rates derived from ten different sources in Table B-2.

TABLE B-2

AVERAGE ANNUAL GROSS NATIONAL PRODUCT GROWTH RATES, VARIOUS SOURCES

Sources	Entire Period Years	Entire Period % Per Year	Subperiod Years	Subperiod % Per Year
1. NPA	1955/57-2000	3.5	1955/57-1976	4.20
			1976-2000	2.90
2. BDSA	1959-2000	2.94	1959-1980	3.00
			1980-2000	2.81
3. RFF*	1958-2000	3.80	1958-1980	3.87
			1980-2000	3.70
4. Denison	1960-1980	3.33	---	--
5. JEC	1959-1975	5.2		
	1959-1975	4.7	---	--
	1959-1975	4.2		
6. SRI	1955-1975	3.4	1960-1965	3.5
			1965-1970	3.7
			1970-1975	3.6
7. U.S. Dept. of Labor	1955-1970	3.5	1960-1965	3.4
			1965-1970	4.1
8. NPA	1955/57-1970	4.2	1955/57-1965	4.0
			1965-1970	4.6
9. Fortune	1959-1970	4.2	1960-1965	4.2
			1965-1970	4.2
10. OBE	1957-2010	3.1 approx.		
11. ADL	1957-2010	3.3	1957-1980	3.4
			1980-2010	3.2

* Median projection

Sources:

1. National Planning Association studies for the Outdoor Recreation Resources Review Commission, 1961.
2. "Water Resources Activities in the United States," Select Committee on National Water Resources, U.S. Senate, 86th Congress, 1960, Committee Print No. 8; projections prepared by Business and Defense Services Administration.
3. "Water Resources Activities in the United States," Select Committee on National Water Resources, U.S. Senate, 86th Congress, 1960, Committee Print No. 8; projections prepared by Resources for the Future, Inc.

Table B-2 (cont'd)

SOURCES:

4. The Sources of Economic Growth in the U.S. and the Alternatives Before Us, E.F. Denison -- Committee for Economic Development, January 1962.

5. The Potential Economic Growth in the U.S., James W. Knowles -- Joint Economic Committee, Study Paper No. 20, 1960.

6. Production Trends in the U.S. through 1975, Bennar Brown and M. Janet Hansen -- Stanford Research Institute, March 1959.

7. "Manpower -- Challenge of the 1960's" Bureau of Labor Statistics, 1960.

8. Long-Range Projections for Economic Growth: The American Economy --1970, National Planning Association, Planning Pamphlet No. 107, October 1959.

9. "The Market of the Sixties," Fortune Magazine, 1959.

10. Economic Base Survey of the Potomac River Service Area, Office of Business Economics, U.S. Department of Commerce, 1961.

11. Projective Economic Study of the Ohio River Basin, Arthur D. Little, Inc. for Ohio River Division, Corps of Engineers, U.S. Army, 1964.

3. DERIVATION OF GNP COMPONENTS

Table B-1 provides historical and projected values for various GNP components, based upon a rate of growth of GNP of 3.85 percent between 1959-1961 and 1980, and 3.6 percent between 1980 and 2020, or an average of 3.7 percent from 1959-1961 to 2020. Table B-3 shows the percentage distribution of these GNP components. The following steps were followed in deriving these components for the benchmark years:

1. Regression analysis of constant dollar time series data.
2. Judgmental extrapolations and allocations.
3. Comparisons with results published by others -- notably the projection studies of the National Planning Association and the recent Resources for the Future, Inc. projections to the year 2000.*
4. Testing of implications of parameters with indicated GNP growth rates.

Table B-4 lists the regression equations and indicates the time series data used to obtain them. The GNP components were derived as follows:

1. Personal income was related to GNP through least squares regression, using time series data for the period 1929-1940 and 1947-1960, in constant 1954 dollars.
2. Relationship parameters were derived by regressing personal disposable income against personal (pre-tax) income using data for the years 1929-1960 (excluding the war and immediate postwar years, 1940-1946).
3. Future taxes were estimated by subtracting projected disposable income from projected personal income.

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* H.H. Landsberg, W. Fishman and J. Fisher, Resources in America's Future (Johns Hopkins Press, Baltimore, 1963); National Planning Association, Study Report No. 23 to the Outdoor Recreation Resources Review Commission, (Washington, D.C., 1962).

4. Government expenditures as a percentage of GNP were projected to increase at the rate at which taxes as a percentage of GNP are projected to increase.
5. The volume of net exports relative to GNP was assumed to increase at the rate shown in the Resources for the Future projections.
6. Gross private domestic investment was derived as a residual, i.e., total GNP minus consumer expenditures, government expenditures, and net exports.
7. Government expenditures on durables, nondurables, services, and construction were regressed against total government expenditures; consumer expenditures on durables, nondurables, and services were regressed against total consumption expenditures. In both cases, time series data for the years 1947-1960 were used.
8. Total construction expenditures as a percent of GNP were assumed to remain at approximately the 1957-1962 level.
9. Private construction expenditures were derived as the residual of government construction expenditures minus total construction expenditures.
10. Producers' durables expenditures as a percent of GNP were held constant at full employment year levels. Producers' durables constitute a rather constant fraction of GNP over the long term.
11. Adding private construction and producers' durables expenditures and subtracting this total from gross private domestic investment provides net changes in inventories as a residual. Total changes in inventories and net exports were allocated among the various subcategories, i.e., durables, nondurables and services, on the basis of Resources for the Future allocations; they are shown as combined totals under these subgroups.

TABLE B-3

PERCENT DISTRIBUTION OF REAL GROSS NATIONAL PRODUCT BY MAJOR TYPE OF PRODUCT AND PURCHASER

	1929	1957	1958	1959	1960	1961	1962	1970	1980	1990	2000	2010	2020
Total GNP	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Durables	16.9	20.9	17.9	19.4	19.1	18.2	19.1	22.0	22.8	23.3	23.4	23.5	23.7
Personal Consumption Expenditures	8.2	9.4	8.9	9.6	9.6	9.3	9.6	9.7	10.0	10.2	10.3	10.3	10.4
Producers' Durables	6.1	6.0	4.8	5.0	5.2	4.7	5.0	6.0	6.0	6.0	6.0	6.0	6.0
Government Purchases	0.4	4.2	4.1	3.9	3.3	3.7	3.5	4.7	5.6	6.3	7.0	7.5	8.0
Net Exports	0.8	1.1	0.7	0.2	0.7	0.6	0.5	1.6	1.2	0.8	0.1	-0.3	-0.7
Changes in Business Inventories	1.4	0.2	-0.6	0.7	0.3	-0.1	0.5						
Nondurables	35.5	33.7	34.8	34.0	33.8	33.9	33.3	31.3	29.7	28.5	27.4	26.8	26.3
Personal Consumption Expenditures	35.9	32.4	33.2	32.4	32.1	32.0	31.1	28.9	27.3	26.1	25.2	24.7	24.2
Government Purchases	0.6	1.0	1.8	1.5	1.6	1.6	2.0	1.6	1.7	1.9	2.0	2.1	2.2
Net Exports	-1.2	0.1	-0.4	-0.5	-0.1	-0.1	-0.3	0.8	0.8	0.5	0.2	0.0	-0.1
Changes in Business Inventories	0.2	0.2	0.2	0.6	0.2	0.4	0.5						
Services	33.2	34.6	36.2	35.3	36.1	36.9	36.8	35.6	36.4	37.1	38.1	38.6	38.9
Personal Consumption Expenditures	26.4	24.5	26.0	25.5	26.0	26.5	26.2	26.3	26.6	26.7	26.8	26.8	26.8
Government Purchases	6.3	10.3	10.6	10.1	10.3	10.4	10.5	9.6	9.9	10.2	10.8	11.3	11.6
Net Exports	0.5	-0.2	-0.4	-0.3	-0.2	.0	0.1	-0.3	-0.1	0.2	0.5	0.5	0.5
Construction	14.4	10.8	11.1	11.3	11.0	11.0	10.8	11.1	11.1	11.1	11.1	11.1	11.1
Private	11.5	7.8	7.7	8.0	7.8	7.8	7.7	7.9	7.5	7.3	7.0	6.7	6.4
Government	2.9	3.0	3.4	3.3	3.2	3.2	3.1	3.2	3.6	3.8	4.1	4.4	4.7
Total Pers. Cons. Expenditures	70.5	66.4	68.1	67.4	67.8	67.8	66.9	64.9	63.9	63.0	62.3	61.8	61.4
Total Govt. Expenditures	10.2	18.5	19.8	18.7	18.2	18.8	19.0	19.1	20.8	22.2	23.9	25.3	26.5
Total Gross Private Domestic Investment	19.3	14.2	12.2	14.4	13.7	12.8	13.7	15.9	15.0	14.2	13.0	12.1	11.3
Net Exports	.1	1.0	- .1	- .5	.4	.5	.4	0.1	0.3	0.6	0.8	0.8	0.8

Sources: For historical data, see Table B-1. Projections are derived from procedures and equations outlined in this Appendix, and are based on GNP annual rate of growth of 3.85% between 1959-1961 and 1980 and 3.6% between 1980 and 2020.

Parts may not add up to total due to rounding.

TABLE B-4

REGRESSION EQUATIONS USED FOR DERIVING GNP COMPONENTS

EQUATIONS	FORM	DATA USED
1. Personal Income	$Y_p = 9.2132 + 0.7721\ Y_{GNP}$ Y_p = Personal Income Y_{GNP} = GNP t = Time: 1929 = 0	time series: 1929-1940 and 1947-1960 in constant 1954 dollars
2. Disposable Income (or Tax: $Y_p - Y_d$)	$Y_d = 2.8057 + .8380Y_p + .7554t$ Y_d = Disposable Personal Income Y_p = Personal Income t = Time: 1929 = 0	same as above
3. Personal Consumption Expenditures	$C_t = 10.2700 + .8856Y_d + .1444t$ C_t = Total Consumption Expenditures Y_d = Disposable Personal Income t = Time: 1929 = 0	same as above in 1957-1959 dollars*
4. Personal Consumption Expenditure Components		time series: 1947-1960 in 1957-1959 dollars*
Durable Goods	$C_d = -11.2321 + .1737C_t$	
Nondurable Goods	$C_{nd} = 27.9014 + .3835C_t$	
Services	$C_s = -16.7354 + .4430C_t$	
	C_t = Personal Consumption Expenditures (total)	
	C_d = Durable Goods Expenditures	
	C_{nd} = Nondurable Goods Expenditures	
	C_s = Service Expenditures	

Table B-4 (cont'd)

EQUATIONS	FORM	DATA USED
5. Government Expenditure Components		time series: 1947-1960 in 1957-1959 dollars
Durable	$G_d = -7.8119 + .3085G_t$	
Nondurable	$G_{nd} = .0260 + .0834G_t$	
Services	$G_s = 9.1776 + .4307G_t$	
Construction	$G_c = -1.3761 + .1772G_t$	
	G_t = Government Expenditures (total)	
	G_d = Government Expenditures -- durable goods	
	G_{nd} = Government Expenditures -- nondurable goods	
	G_s = Government Expenditures -- services	

* The 1957-1959 constant dollar series is used because of the availability of price indexes to deflate individual commodity and service expenditures (see U.S. Department of Labor, BLS Consumer Price Index (1957-1959=100) Price Indexes for Selected Items and Groups Annual Averages, 1935-1961).

4. PROJECTIONS OF U.S. PERSONAL INCOME

As shown in Table B-4 (Equation 1), U.S. personal income is projected by relating it to GNP through least squares regression, using time series data in constant 1954 dollars for the period 1929-1940 and 1947-1960, excluding the war and immediate postwar years. For regression purposes, personal income time series in current dollars, derived from Economic Report of the President, 1963, p. 190, were deflated by using implict price deflators for gross national product given on page 178 of the same source. Gross national product time series, in constant 1954 dollars, were obtained from Survey of Current Business (July 1963), p. 14, and Economic Report of the President, 1963, p. 174.

As shown in Table B-1, U.S. personal income in constant 1954 dollars is expected to double by 1980, to experience a four-fold increase between 1960 and 2000, and an 8.5-fold increase between 1960 and 2020.

5. FEDERAL RESERVE BOARD INDUSTRIAL PRODUCTION INDEX PROJECTION

The FRB industrial production index increased by 66.2 percent between 1947 and 1960, compared with a 55.8 percent increase in GNP. The ratio of GNP to the FRB index, which has varied between 4.4 and 4.1 during the postwar years, is projected to decline further to 3.6 by the end of the projection period. Thus, the FRB index is shown to rise slightly faster than GNP (see last line of Table B-1).

APPENDIX C

VALUE ADDED PROJECTIONS FOR NEW ENGLAND'S "BASE" MANUFACTURING INDUSTRIES BY LEAST-SQUARES REGRESSION (Including a Discussion of Location Quotients)

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VALUE ADDED PROJECTIONS FOR NEW ENGLAND'S "BASE" MANUFACTURING INDUSTRIES BY LEAST-SQUARES REGRESSION (Including a discussion of Location Quotients)

1. INTRODUCTION

As explained in Chapter III of the report, ten of New England's manufacturing industries were identified as major "exporters" to the rest of the country and the world from the region. The initial identification of the major "export" industries was accomplished by means of a location-quotient analysis, as explained in detail in the last section of this Appendix. For nine of these ten industries, we derived projections of output (value added) through least-squares regression, using Census of Manufactures and Annual Survey of Manufactures data covering the postwar period 1947-1961. The tenth so-called "base" or export industry, Paper and Allied Products, was projected independently by the Forest Service of the U.S. Department of Agriculture (see Appendix G). Here we shall explain the statistical procedures used in making New England value added projections for each of the other nine base or export industries.

In undertaking these individual 2-digit industry projections, we elected to use primarily statistical methods, (i.e. regression or correlation analysis) rather than judgmental methods for two important reasons. First, the industrial composition of each 2-digit manufacturing industry is so diverse and the product composition so varied (e.g., the product composition of the chemical industry ranges from industrial gases to explosives, and that of the nonelectrical machinery industry ranges from engines and turbines to computing and accounting machines) that long-range projections at such a level of detail could not be justified. Second, the heterogeneous product composition of each 2-digit industry makes it mandatory to use output measurement in constant dollars, so that output measurements can then be related to such aggregate growth measures of the economy as the gross national product, the GNP components, the Federal Reserve Board's industrial production

index, and others. Thus, the use of statistical methods in projecting output levels provides a framework within which an industry's output can be related to the projected rate of growth of the economy as a whole, minimizing personal biases inherent in conjectural or speculative extrapolations, yet not avoiding entirely the informed knowledge and judgment of the industry specialist.

Correlation or regression analysis inherently carries the assumption that past relationships between economic time series tend to be carried into the future. While this is admittedly a bold assumption, especially when the length of the historical time series used is much shorter than the projection horizon, the method does not in any way preclude structural changes within the economic system. It only postulates the much weaker constraint that future changes bear out past and present trends.

The use of regression analysis for projective purposes involves three basic issues. They can best be stated as questions: (1) What are the criteria used in the selection of the independent variables? (2) What are the underlying reasons for selecting the form of the regression equation? (3) How significant are the regression relationships?

The first question relates to the logic of the independent variables that are used, be they economic time series or simply "time" as used in most "share" extrapolations. In selecting the independent or explanatory variables, we emphasized economic meaningfulness rather than merely a high degree of correlation. On the other hand, we used "time" as the independent variable when this seemed reasonable both economically and statistically.*

The second question addresses itself to the choice of the form

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* The use of "time" as an independent variable reflects the cumulative and continuing effect of a large number of influences that are supposedly associated with variations in the dependent variable.

of the regression equation. This is a very critical issue in regression analysis insofar as many equations may be successfully fitted to historical data, each yielding completely different and perhaps untenable projection results. In selecting the form of the equation, therefore, certain outside checks for consistency and reasonableness have to be considered in the face of equally satisfactory statistical relationships, and the projective characteristics of the equations must be carefully weighed.*

The third question raises the issue of the degree of significance of a regression relationship for projective purposes. The proper measure of statistical significance depends on the purpose for which the regression relationship is to be used. In economic forecasting, the coefficient of determination (R^2) becomes less important than the standard error of the projected values. A high degree of correlation may indeed be an irrelevant criterion of reliability in making long-range projections, especially when such correlation reflects the in-phase cycle movements of the variables involved.

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* From a statistical point of view, for example, the logarithmic equation is simple and to be commended in many cases. More complicated nonlinear forms, such as the parabola or the Gompertz curve, lose an extra degree of freedom and are more difficult to fit. The parabola has the added disadvantage of reversing direction beyond some value of the independent variable. Thus, when "time" is chosen as the independent variable, the resulting regression procedure may be thought of as a convenient means of extrapolating the historical trend line in Y (the dependent variable).

From an economic point of view, the nonlinear logarithmic form is preferable to a linear form whenever long-range projections of a percentage share are sought. In most instances, linear changes in a percentage share are unsustainable over long periods. For example, a linear projection of the share of manufacturing employment in New England's total nonagricultural employment would result in the disappearance of the manufacturing sector by 2030. Similarly, a linear projection of the share of textile employment in New England's total manufacturing employment would result in negative shares well before the year 2020.

A non-statistical overview of the base manufacturing industry value added projections is presented in Chapter IV of the report. As pointed out, three different approaches were adopted in making value added projections for New England. In the first approach, 2-digit value added projections were made for New England by relating New England's output to national output through a regression equation. Textiles (SIC 22) and Leather and Leather Products (SIC 31) were the industries thus projected. In the second approach, New England's 3-digit value added totals were projected separately and then summed to obtain the 2-digit value added projections for each benchmark year. Five industries were thus treated: Chemicals (SIC 28), Rubber and Plastics (SIC 30), Fabricated Metals (SIC 34), Nonelectrical Machinery (SIC 35), and Electrical Machinery (SIC 36). The third approach required the adoption of special procedures for industries with unique compositional characteristics in New England; Primary Metals (SIC 33) and Transportation Equipment (SIC 37) were projected by means of such special procedures.

In all three cases, national value added projections were made by relating the national output levels of the 2-digit and 3-digit industries to components of the gross national product. The Federal Reserve Board's industrial production index, and other relevant variables. Whereas the first approach described above reflects the compositional <u>similarities</u> of an industry at the regional and national level, the second approach explicitly takes into account the compositional <u>variations</u> between the regional and national industries. The third approach was called for as a result of the extreme compositional differences between an industry's regional and national make-up.

Each industry projection is documented in detail in the sections which follow. The industries are grouped by the methodological approaches used in the development of their projections:

A. Textile Mill Products (SIC 22)

B. Leather and Leather Products (SIC 31)

C. Chemicals and Allied Products (SIC 28)

D. Rubber and Plastics (SIC 30)

E. Fabricated Metal Products (SIC 34)

F. Machinery, except electrical (SIC 35)

G. Electrical Machinery (SIC 36)

H. Primary Metal Industries (SIC 33)

I. Transportation Equipment (SIC 37)

J. Location Quotient Analysis

TABLE C-1

SUMMARY OF VALUE ADDED PROJECTIONS FOR SELECTED MANUFACTURING INDUSTRIES IN THE UNITED STATES AND NEW ENGLAND

COMPARATIVE GROWTH RATES (1960-2020)

(1960=100)

	1960	1970	1980	1990	2000	2010	2020
GROSS NATIONAL PRODUCT	100	146	212	302	432	613	875
FEDERAL RESERVE BOARD Index of Industrial Production	100	151	225	329	482	694	1004
U.S. VALUE ADDED PROJECTIONS:[1]							
SIC 22- Textile Mill Products	100	127	164	205	265	327	404
SIC 28- Chemicals and Allied Products	100	170	269	404	597	864	1255
SIC 30- Rubber and Plastics	100	164	255	377	553	790	1139
SIC 31- Leather and Leather Products	100	118	144	170	211	249	294
SIC 33- Primary Metals Industries	100	134	160	183	206	228	251
SIC 34- Fabricated Metal Products	100	131	173	229	310	421	580
SIC 35- Machinery, Except Electrical	100	157	213	284	379	504	678
SIC 36- Electrical Machinery	100	159	249	374	555	805	1174
SIC 37- Transportation Equipment[2]	-	-	-	-	-	-	-
NEW ENGLAND VALUE ADDED PROJECTIONS:[3]							
SIC 22- Textile Mill Products	100	112	125	139	163	183	207

NOTES: [1]Sum of separate 3-digit value added projections. For each national 2-digit industry, two other sets of value added projections were made. For details, refer to accompanying text.

[2]National value added projections at the 2-digit level were not necessary. See discussion of SIC 37 in this appendix for details.

[3]For some industries, three sets of regional value added projections were made, as follows:

a. Projections derived from linear regression equations of the general form $Y = a + b X$, where X represents the sum of U.S. 3-digit value added series and projections;

b. Projections derived from linear regression equations of the general fo $Y = a + b_1X_1 + b_2X_2$, where X_2 represents "time" as an additional expl tory variable;

c. The sum of separate 3-digit regional value added estimates. For detai refer to accompanying text.

TABLE C-1

w England Value Added Projections: (cont'd)

		1960	1970	1980	1990	2000	2010	2020
	a.	100	157	244	361	530	763	1104
SIC 28- Chemicals and Allied Prod.	b.	100	166	271	420	641	953	1417
	c.	100	157	243	361	523	753	1083
SIC 30- Rubber and Miscl. Plastics		100	154	224	318	455	639	908
SIC 31- Leather and Leather Products		100	114	136	159	194	227	266
SIC 33- Primary Metals Industries		100	121	135	150	166	183	200
	a.	100	126	161	208	276	381	503
SIC 34- Fabricated Metal Products	b.	100	107	136	186	269	391	577
	c.	100	121	158	211	290	399	556
	a.	100	163	220	290	385	510	685
SIC 35- Machinery, Except Electrical	b.	100	149	202	273	377	520	729
	c.	100	144	182	225	279	342	424
	a.	100	158	243	361	532	768	1115
SIC 36- Electrical Machinery	b.	100	156	244	370	559	823	1217
	c.	100	160	255	389	586	858	1260
SIC 37- Transportation Equipment		100	115	141	170	186	191	189

NOTE: [3]For some industries, three sets of regional value added projections were made, as follows:

a. Projections derived from linear regression equations of the general form $Y = a + b X$, where X represents the sum of U.S. 3-digit value added series and projections;

b. Projections derived from linear regression equations of the general form $Y = a + b_1X_1 + b_2X_2$, where X_2 represents "time" as an additional explanatory variable;

c. The sum of separate 3-digit regional value added estimates. For details, refer to accompanying text.

A. TEXTILES (SIC 22)

2. SUMMARY OF METHODOLOGY AND PROJECTIONS

New England 2-digit value-added series were related to national textiles value-added series, which, in turn, were related to a derived FRB*index of industrial production in textiles, as explained below. In general, projected growth in the New England and national textile industries will be much slower than the expected growth in the rest of the economy. While the nation's value added in textiles is expected to increase steadily (four-fold between 1960 and 2020), New England is expected to grow at a slower pace (a 2.5-fold increase between 1960 and 2020), with continued relative decline in the near future and recovery in the latter part of the projection horizon. This anticipated trend is grounded on the observation that many of New England's old textile mills will not long survive, thus causing a continued relative decline for New England, while in the latter part of the projection period the wage differential between New England and the South may be so reduced as to reverse this trend to New England's advantage.

3. NATIONAL VALUE ADDED PROJECTIONS

In most of the "base" industry studies presented in this Appendix, we projected New England's output (value added) via the projected relationship between the regional and national output levels, and we projected national output levels as a function of one or more components of the gross national product. In the textile industry, however, we could find no satisfactory statistical relationship with GNP components. We decided therefore to project the national industry (output) by estimating an index of industrial production in the textile industry. National output levels were then projected by multiplying the base year national value added total (1960) by this production index.

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* Federal Reserve Board. The index is inclusive of all manufacturing industries and utilities.

TABLE C-2

SUMMARY OF U.S. AND NEW ENGLAND VALUE ADDED PROJECTIONS

Textile Mill Products (SIC 22)*

(millions of 1954 dollars)

	1960 (actual)	1970	1980	1990	2000	2010	2020
U.S. Value Added Projections	5,727.5	7,273.9	9,375.9	11,724.2	15,155.0	18,734.7	23,156.3
Index (1960 = 100)	100	127	164	205	265	327	404
New England Value Added Projections	819.0	912.9	1,024.8	1,140.8	1,330.6	1,496.9	1,692.7
Index (1960 = 100)	100	112	125	139	163	183	207
New England as % of United States	14.3	12.6	10.9	9.7	8.8	8.0	7.3

* For all details, refer to accompanying text.

a. Value Added Data Selection and Adjustment - Although only the 1960 national value added total was used in making national value added projections, we had to derive national value added time series for the period 1947-1960. As we will explain later, this was necessary in making value added projections for New England, insofar as New England value added was related to national value added through least-squares regression using value added series in constant dollars for the period 1947-1960. The procedures involved in deriving national value added series in constant 1954 dollars are explained below.

(1) Basic industry value added data at 4-digit industry detail was obtained for the 1947-1962 period from the Census of Manufactures and the Annual Survey of Manufactures series.

(2) The 1947-1957 value added series at 4-digit detail had to be adjusted* so as to account for the changes that occurred in

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* We refer here only to adjustments concerning industrial classification at 4-digit detail. The other type of adjustment, with which we were not concerned, pertains to changes introduced by U.S. Bureau of the Census in the measurement of "value added". In developing our value added series in current dollars, we did not revise our national or regional value added data for years prior to 1956 for this change in measurement. Changes in the measurement of "value added" are summarized below. These changes should not be confused with changes in standard industrial classification.

In all Annual Survey and Census reports up to 1954, value added was derived by subtracting the cost of materials, supplies, containers, fuel, purchased electric energy and contract work from the value of shipments (excluding "merchandizing operations," or the resale of products bought and resold in the same condition and produced by other manufacturing establishments). No adjustments were made for changes in inventories of finished products and work-in-process during the year. In the 1954 Census of Manufactures, value added computed in this manner was shown in all the basic tables. The term "unadjusted" used in Annual Survey of Manufactures and Census of Manufactures refers to such computation of value added.

However, value added totals including value added in merchandising and the net change in work-in-process and finished products inventories, shown for the first time in 1954 in a special industry table in the Summary Statistics Volume, are called "adjusted" value added. In other

standard industrical classification in 1957 and implemented in the 1958 Census of Manufactures.** For this purpose, we used the adjustment factors presented in Supplementary Table 1 (refer to end of this section), which shows the relationship between the "old" and "new"

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* (cont'd)

words, the new measure represented the total value of products shipped, including "merchandizing operations," less the cost of products, materials, containers, supplies, fuel, purchased electric energy and contract work plus the net change in finished products and work-in-process inventories between the beginning and end of the year. The inventory figures were not adjusted for price changes.

"Adjusted" and "unadjusted" value added data became available in the form of both industry and area tables for the first time in 1956. Before this date, "area" value added data (e.g., New England, Ohio, etc.) were compiled on an "unadjusted" basis. For 1954 and 1955, "adjusted" value added data were given only in the special industry summary tables for the U.S. as a whole. The same summary tables also contained an "unadjusted" column for purposes of comparison and other statistical reasons.

** Changes introduced in the 1958 Census of Manufactures in the standard industrial classification of 4-digit industries are essentially based on Executive Office of the President, Bureau of the Budget, Standard Industrial Classification Manual (Washington, D.C.: U.S. Government Printing Office, 1957). The new classification system presents a basic problem in developing value added series for years before and after 1958 that are comparable and consistent in terms of industrial classification. This problem is far more serious than the changes that occurred between 1954 and 1956 in the "measurement" of value added. We therefore resolved to deal with the problem rather than ignore it.

As a consequence of the reclassification, the "old" 4-digit industries were split into various parts, each part assigned to a "new" 4-digit industry group. Untraceable assignments from the "old" 4-digit industries to any of the "new" 4-digit industries were grouped under a category "all other industries" which comprised only a very small segment of the "old" 4-digit industry value added total in 1958.

4-digit industry value totals for the United States in 1958, compiled by using the data given in Appendix C of the 1958 Census of Manufactures volumes. Our basic assumption in using this adjustment table was that the 1958 relationship between the "old" and "new" 4-digit industries would also hold for all pre-1958 years.

(3) After adjustments for SIC changes, the 4-digit value added series (as well as the 3-digit aggregations derived from 4-digit data) were adjusted for price changes by deflating them by appropriate price indexes (1954 = 100.0), expressing them in constant 1954 dollars. These price indexes were derived from the U.S. Bureau of Labor Statistics wholesale price index publications, as show in Supplementary Table 2. An implicit price index (refer to Supplementary Table 3) can then be obtained by dividing the 2-digit value added series (in current dollars) by the deflated 2-digit value added series (obtained by summing the separately deflated 3-digit and 4-digit series).

b. National Value Added Projections - As pointed out above, national value added projections were made by applying to the 1960 national value added total (in constant 1954 dollars) a projected FRB index of industrial production in textiles (refer to Table C-3). The derivation of this production index will now be explained.

Two basic steps were involved in the derivation of FRB industrial production index projections for textiles. First, we obtain projections of the FRB production index per million persons for all benchmark years up to 2000, by dividing the median FRB index projections for textiles by the median population projections, both given in Resources in America's Future*. We estimated 2010 and 2020 by taking an average growth factor in the index per million persons from previous decades

* Hans H. Landsberg, Leonard L. Fischman and Joseph L. Fisher, Resources in America's Future (Baltimore: The Johns Hopkins Press, for the Resources for the Future, Inc., 1963), p. 562 and 518, respectively.

TABLE C-3

TEXTILE MILL PRODUCTS INDUSTRY (SIC 22) - U.S. VALUE ADDED PROJECTIONS

	1950	1960	1970	1980	1990	2000	2010	2020
a. FRB Production Index for textiles (1957 = 100.0)*	99.0	108.8	136	172	211	266	-	-
b. U.S. Population (millions)*	151.7	179.9	208.2	245.4	286.9	331.1	-	-
c. $\frac{a}{b}$: Index per million persons	.6526	.6048	.6532	.7009	.7354	.8034	.8390**	.8762**
d. Economic Task Group U.S. Population Projections (millions)***	151.7	180.7	211.6	254.1	302.8	358.3	424.2	502.0
e. ADL estimate of FRB index of Production (1957 = 100.0)****	99.0	109.3	138.2	178.1	222.7	287.9	355.9	439.9
f. FRB index of production (1960 = 100)	90.6	100.0	127.0	163.7	204.7	264.6	327.1	404.3
g. U.S. Value Added Projections (millions of 1954 $)	4,935.2	5,727.5	7,273.9	9,375.9	11,724.2	15,155.0	18,734.7	23,156.3

* Hans H. Landsberg, Leonard L. Fischman, and Joseph L. Fisher, Resources in America's Future (Baltimore: The Johns Hopkins Press, for the Resources for the Future, Inc., 1963), p. 562 and 518, respectively. Both are median projections.

** Estimated, by taking an average growth factor in the index per million persons from previous decades and applying it to 2000 to get 2010 and then to 2010 to get 2020.

*** U.S. population projections supplied by the Economic Task Group of the Ad Hoc Water Resources Council Staff.

**** Obtained by multiplying figures in rows "c" and "d" for each year.

\- Not available.

and applying it to 2000 to get 2010, and then to 2010 to get 2020 (refer to table C-3). Second, we multiplied these projections of FRB industrial production index per million persons by the U.S. population projections (in millions) supplied by the Economic Task Group of the Ad Hoc Water Resources Council Staff. This resulted in our projections of FRB industrial production index for textiles, which then was applied to the national value added in textiles (SIC 22) in 1960, to determine projections of national value added, expressed in constant 1954 dollars.

As shown in Table C-3 the production index per million persons fell between 1950 and 1960, yet all our projections are based on the assumption of an increase in this ratio in the future. We assumed that per capita textile consumption will increase in the future although it declined in the past decade. Essentially, the argument used in Resources in America's Future is that, other things being equal, per capita textile consumption increases with increases in per capita income (although not as rapidly), and the decline in the ratio of textile production to population* occurs because other factors have not been unaltered in the decade 1950-1960. A combination of changing factors cut into per capita fiber consumption. The future growth of per capita fiber consumption is based on the belief that downward pressure exerted by these factors will not be as strong in the future. Factors influeneing thd downward movement in per capita textile production include lighter fabrics (a pound of fiber output in 1950 is not equivalent to a pound of fiber output in 1960), styles of clothing which require less fiber, longer lasting synthetic fibers, changes in the age structure of the population with a greater proportion of young children and the aged (both groups requiring less fiber than young adults), and replacement of textiles by paper and plastic in industrial uses such as packaging

* The authors of Resources in America's Future did not explicitly compare their production index to population. Apparel consumption measured in "cotton equivalent pounds per clothing expenditure unit" showed only a slight increase from 1950 to 1960. It was this measure that was expected to increase at an accelerating rate. (see p. 107)

and automobile interiors.** Most of the textile output goes to clothing and the decline in fiber per garment and in the weight of fibers will not continue at the same rate as it has in the past. Industrial and household uses of textiles are not expected to expand on a per capita basis, although they will expand absolutely. The expected expansion in per capita fiber consumption depends on the expected increase in apparel per capita due to rising incomes.

4. NEW ENGLAND VALUE ADDED PROJECTIONS

New England value-added projections were made by relating New England's value added through least-squares regression to U.S. value added, using 2-digit value added series in constant 1954 dollars derived for the period 1947-1962.*** An equation which included "time" as an additional variable, as shown below, was found to give a better fit than one without the "time" variable:

** Landsberg, et.al., pp. 106-109.

*** 4-digit value added data were available for New England for only 1947 and 1954. We adjusted the data for these two years for SIC changes, by using Supplementary Table 1. For the intervening years, we adjusted New England's value added data at the 2-digit level only. We found the adjusted 1947 and 1954 data at the 2-digit level as a percent of the unadjusted data, and interpolated to get adjustment factors at the 2-digit level for the intervening years. The net effect of the adjustments for SIC changes was to decrease the unadjusted value added 2-digit series by about 5 percent.

These 2-digit New England value added series were subsequently deflated by derived 2-digit U.S. price index as shown in Supplementary Table 3.

$$\text{New England} = 180.5 + \underset{(0.0400)}{0.2211}\ (\text{U.S.}) - \underset{(4.24)}{45.01}\ (t) \qquad R^2 = .891$$

where:

New England = New England 2-digit value added series in millions of constant 1954 dollars

U.S. = U.S. 2-digit value added series in millions of constant 1954 dollars

t = time (1947 = 1, . . ., 2020 = 74)

New England value added projections were made for the Textile Mill Products Industry (SIC 22) by substituting into the equation the projected U.S. value added totals as shown in Table C-3. New England projections are shown in Table C-2. For historical data and other supplementary information, refer to the Supplementary Tables 1 through 4, which can be found at the end of this section.

SUPPLEMENTARY TABLE 1

ADJUSTMENTS MADE IN PRE-1958 VALUE ADDED SERIES TO ACCOUNT FOR THE 1958 STANDARD INDUSTRIAL CLASSIFICATION CHANGES

New SIC		Composed of Old SIC	% of Old in New
221	2211	2233	99.70
222	2221	2234	99.02
223	2231	2213	99.88
		2216	100.00
		2399	10.27
224	2241	2241	99.84
225	2251	2251	100.00
	2252	2252	100.00
	2253	2253	100.00
	2254	2254	100.00
	2256	2256	100.00
	2259	2255	100.00
		2259	100.00
226	2261	2261	63.13
	2262	2261	25.07
	2269	2261	11.35
227		2271	82.47
		2273	100.00
228	2281	2212	25.75
		2224	76.78
		2271	3.23
	2282	2222	100.00
		2224	0.32
		2299	18.61
	2283	2212	74.00
		2271	14.40
	2284	2223	100.00
229	2291	2291	100.00
	2292	2292	98.70
	2293	2293	100.00
	2294	2294	100.00
	2295	2295	97.29
	2296	2224	20.69
	2297	2211	100.00
	2298	2298	100.00
	2299	2299	81.20

Source: U.S. Bureau of the Census. 1958 Census of Manufactures, any volume, Appendix C.

SUPPLEMENTARY TABLE 2

DERIVATION OF PRICE INDEX FOR THE TEXTILE MILL PRODUCTS INDUSTRY (SIC 22)

SIC Industry			BLS Commodity Wholesale Price Index
221	2211	Broadwoven fabric mills, cotton	0312 Cotton broadwoven goods
222	2221	Broadwoven fabric mills, man-made fiber and silk	0333 Man-made fiber broadwoven goods
223	2231	Broadwoven fabric mills, wool: including dyeing and finishing	0324 Broadwoven wool fabrics
224	2241	Narrow fabrics and other smallwares mills: cotton wool, silk and man-made fiber	Average: 0313 Cotton narrow fabrics 0335 Man-made narrow fabrics
225		Knitting mills	
	2251	full fashioned hosiery mills	Average: 0353 02.03 Nylon women's hosiery branded 0353 05.06 Nylon women's hosiery unbranded
	2252	seamless hosiery mills	0353 15.04 Nylon women's hosiery seamless branded
	2253	knit outerwear mills	Average: 0325 Knit wool outerwear fabrics 0356 Knit outerwear
	2254	knit underwear mills	0355 Underwear and nightwear
	2256	knit fabric mills	Average: 0325 Knit wool outerwear fabrics 0334 Knit goods man-made fibers
	2259	knitting mills n.ec.	Index derived by comparing deflated and undeflated value added sums of SIC 2251, 2252, 2253, 2254 and 2255
226		Dyeing and finishing textiles except wool fabrics and knit goods	Index derived by comparing deflated and undeflated value added sums of all other three digit industries
227		Floor covering mills	1231 Soft surface floor coverings

(Supplementary Table 2 Continued)

SIC Industry			BLS Commodity Wholesale Price Index
228		Yarn and thread mills	
	2281	yarn spinning mills, cotton, man-made fibers and silk	Average: 0311 Cotton yarns 0331 Man-made filament yarns and fibers
	2282	yarn throwing, twisting and winding, cotton, man-made fibers and silk	Index derived by comparing deflated and undeflated value added sums of SIC 2281, 2283 and 2284
	2283	yarn mills, wool, including carpet and rug yarn	0322 Wool yarns
	2284	thread mills	0314 Cotton thread
229		Miscellaneous textile goods	Index derived by comparing deflated and undeflated value added in SIC 2296 and SIC 2298
	2296	tire cord and fabric	0333 41.03 Rayon tire fabric
	2298	cordage and twine	0362 Other miscellaneous textile products

Source: SIC Industry Codes from: Executive Office of The President, Bureau of the Budget, Standard Industrial Classification Manual, 1957.

Wholesale Price Indexes from U.S. Department of Labor, Bureau of Labor Statistics, 1947 and 1948-1960 from individual commodity indexes (unbound), 1961 and 1962 from 1962 Statistical Supplement-Monthly Labor Review

SUPPLEMENTARY TABLE 3

DERIVED PRICE INDEX FOR SIC 22, TEXTILE MILL PRODUCTS
(1954 = 100)

Year	Index
1947	105.1
1949	102.0
1950	107.4
1951	120.0
1952	106.9
1953	103.4
1954	100.0
1955	99.9
1956	99.2
1957	99.0
1958	96.4
1959	98.4
1960	99.2
1961	98.3
1962	99.3

* Found by dividing the U.S. 2-digit value added series (adjusted for SIC changes) by the sum of the separately deflated 3-digit value added series.

SUPPLEMENTARY TABLE 4

TEXTILE MILL PRODUCTS (SIC 22): U.S. AND NEW ENGLAND VALUE ADDED SERIES

(millions of 1954 dollars)

Years	U.S.	New England	New England as Percent of U.S.
1947	4,878.1	1,184.2	24.3
1949	4,453.2	998.9	22.4
1950	4,935.2	1,116.7	22.6
1951	4,356.7	975.2	22.4
1952	4,721.1	1,042.8	22.1
1953	4,978.9	1,004.1	20.2
1954	4,543.4	803.8	17.7
1955	5,098.6	842.9	16.5
1956	5,233.1	852.4	16.3
1957	5,001.9	699.1	14.0
1958	5,040.3	730.5	14.5
1959	5,778.1	863.5	14.9
1960	5,727.5	819.0	14.3
1961	5,722.1	816.2	14.3
1962	6,121.9	857.8	14.0

B. LEATHER AND LEATHER PRODUCTS

5. SUMMARY OF METHODOLOGY AND PROJECTIONS

New England 2-digit value added projections were made by relating New England's 2-digit value added through least squares regression to national value added, using 2-digit value added series in constant 1954 dollars. National value added projections were made by relating national value added to a derived FRB index of industrial production in leather and leather products, as explained below.

In general, projected growth in the New England and national leather and leather products industry will be steady but slower than that of the rest of the economy. While the national value added total is expected to increase 2.9-fold between 1960 and 2020, New England's value added total is anticipated to increase 2.7-fold (refer to Table C-4.)

Our estimates of value added in the national industry are based on estimates of leather and leather products production per capita and on our population projections. We believe the national industry will expand in response to both increases in per capita consumption of shoes and increases in population. Although substitutes for leather are becoming more important, leather may be able to hold its own as a raw material because the price of hides and skins will drop as per capita meat consumption rises faster than per capita consumption of leather products. We expect New England's share of national value added to decline only slightly from its 1960 level of 30%.

6. NATIONAL VALUE ADDED PROJECTIONS

As in the case of the textiles industry, we projected national output (value added) levels in leather and leather products (SIC 31) on the basis of a derived FRB index of industrial production. The derived index for each benchmark year was multiplied by the base year

TABLE C-4

SUMMARY OF U.S. AND NEW ENGLAND VALUE ADDED PROJECTIONS, LEATHER AND LEATHER PRODUCTS (SIC 31)*

(millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
U.S. Value Added	1,742.7	2,063.4	2,516.5	2,971.3	3,682.3	4,344.6	5,125.3
Index (1960 = 100)	100	118	144	170	211	249	294
New England Value Added	526.6	599.3	717.7	836.6	1,022.5	1,195.6	1,399.7
Index (1960 = 100)	100	114	136	159	194	227	266
New England as percent of U.S.	30.2	29.0	28.5	28.2	27.8	27.5	27.3

* For all details, refer to accompanying text.

national value added total* in order to find the projected value added total.

Two basic steps were involved in the derivation of FRB industrial production index projections for the leather and leather products industry. First, we obtained projections of the FRB index per million persons for all benchmark years up to 2000, by dividing the median FRB index projections for leather and leather products by the median population projections, both given in Resources in America's Future.** We estimated 2010 and 2020 by taking an average growth factor in the index per million persons from previous decades and applying it to 2000, to get 2010, and then to 2010 to get 2020. Secondly, we multiplied these projections of FRB industrial production index per million persons by the U.S. population projections (in millions) supplied by the Economic Task Group of the Ad Hoc Water Resources Council Staff. This resulted in our projections of the FRB index of industrial production in leather and leather products (refer to Table C-5).

Landsberg, et al conclude their discussion of leather in Resources in America's Future, by noting that per capita leather consumption will probably decline because of competition from plastics, rubber and textiles.*** Most of the demand for leather is a derived demand from that for shoes. The argument presented by Landsberg et al is that although per capita shoe consumption is expected to rise slightly with

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* As in the case of the textiles industry, value added data at 4-digit detail were obtained from the 1947, 1954, 1958 Census of Manufactures and the Annual Survey of Manufactures series for the period 1947-1962. These series were then adjusted for the standard industrial classification changes that occurred in 1958, and then aggregated into 3-digit series. Appropriate price indexes were subsequently used to deflate these series in order to express them in constant 1954 dollars. When summed for each year, these 3-digit series yielded national 2-digit value added series in constant 1954 dollars.

In order to deflate New England's 2-digit value added series, we found implicit price deflators at the 2-digit level by dividing the national undeflated 2-digit value added series by the deflated 2-digit series.

** Hans H. Landsberg, Leonard L. Fischman and Joseph L. Fisher, Resources in America's Future (Baltimore: The Johns Hopkins Press, for the Resources for the Future, Inc., 1963), p. 562 and 518, respectively.

*** Ibid, p. 111.

LEATHER AND LEATHER PRODUCTS (SIC 31), U.S. VALUE ADDED PROJECTIONS

	1950	1960	1970	1980	1990	2000	2010	2020
FRB Production Index for Leather* (1957 = 100)	91.6	100.4	117	140	166	196	-	-
b. U.S. Population (millions)*	151.7	179.9	208.2	245.4	286.9	331.1	-	-
c. = a/b Index per million persons	.6038	.5581	.5620	.5705	.5786	.5920	.5901**	.5882**
d. Economic Task Group U.S. Population Projections (millions)***	...	...	211.6	254.1	302.8	358.3	424.2	502.0
e. ADL Estimate of the FRB Index of Production for ****Leather (1957=100)	...	...	118.9	145.0	175.2	212.1	250.3	295.3
f. FRB Index of Production for Leather (1960 = 100)	...	100.0	118.4	144.4	174.5	211.3	249.3	294.1
g. SIC 31: U.S. Value Added Projections (millions of 1954 $)...		1,742.7	2,063.4	2,516.5	2,971.3	3,682.3	4,344.6	5,125.3

* Hans H. Landsberg, Leonard L. Fischman, and Joseph L. Fisher, Resources in America's Future, (Baltimore: The Johns Hopkins Press, for the Resources for the Future, Inc., 1963), p. 562 and 518 , respectively. Both are median projections.

** Estimated by taking an average growth factor in the index per million persons from previous decades and applying it to 2000 to get 2010 and then to 2010 to get 2020.

*** U.S. population projections supplied by the Economic Task Group of the Ad Hoc Water Resources Council Staff.

**** Obtained by multiplying figures in rows c and d for each year.

... : Not needed - : Not available

rising per capita income, other raw materials less costly and easier to work with will replace leather. Landsberg et al note that leather prices will decline because per capita meat consumption will rise faster than leather consumption and, thus, create an oversupply of hides and skins. They did not, however, revise their projections in view of this observation.

Our justification for incorporating a slightly rising per capita production of leather in our estimates up to 2000 is the likely price decline of hides and skins. Of course, the price of hides and skins is not the only factor to consider. The irregular shape of hides limits the extent to which automation can be incorporated in the shoe industry. Synthetics have the advantage of uniformity which allows simplification of the cutting operation and a reduction of labor costs. Reconstituted leather with uniform physical properties may be the leather industry's answer to the threat of synthetics. Our projections are based on the assumption that due to likely price declines, leather has a reasonable chance of holding its own.

6. NEW ENGLAND VALUE ADDED PROJECTIONS

New England value added projections were made by relating New England's value added through least squares regression to U.S. value added, using 2-digit value added series in constant 1954 dollars derived for the period 1947-1962.* An equation which did not include "time" as an additional explanatory variable, as shown below, was found to give a better fit than one with the "time" variable:

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* 4-digit value added data were available for New England for only 1947 and 1954 and 1958. The 1947 and 1954 data were adjusted for SIC changes by using the adjustment factors presented in Supplementary Table 5. The data for the intervening years were adjusted at the 2-digit level only. We found the adjusted 1947 and 1954 data at the 2-digit level as a percent of the unadjusted data, and interpolated to get adjustment factors at the 2-digit level for the intervening years. Meanwhile, the value added data for 1958 were in certain cases adjusted for coverage deficiencies.

Adjusted value added series were then deflated by using the appropriate price indexes explained in Supplementary Table 6. In deflating the 2-digit series, a derived 2-digit implicit price index was used.

$$\text{New England} = \underset{(24.5)}{59.9} + \underset{(0.0142)}{0.2614}\ (\text{U.S.}) \qquad R^2 = 0.955$$

where:

New England = New England 2-digit value added series in millions of constant 1954 dollars

U.S. = U.S. 2-digit value added series in millions of constant 1954 dollars.

New England value added projections were made for the Leather and Leather Products Industry (SIC 31) by substituting into the equation projected U.S. value added totals shown in Table C-5. New England projections are shown in Table C-4. Historical and other supplementary data are presented in the supplementary tables.

SUPPLEMENTARY TABLE 5

ADJUSTMENTS MADE IN PRE-1958 VALUE ADDED SERIES TO ACCOUNT FOR THE 1958 STANDARD INDUSTRIAL CLASSIFICATION CHANGES (SIC 31)

New SIC		Composed of Old SIC	% of Old in New
311	3111	3111	100.00
312	3121	3121	100.00
313	3131	3131	100.00
314	3141	3141	100.00
	3142	3142	100.00
315	3151	3151	96.94
		3152	100.00
316	3161	3161	97.30
		3986	6.93
317	3171	3171	99.45
	3172	3172	100.00
		3161	2.69
		3986	93.06
319	3199	3192	100.00
		3199	100.00

Source: U.S. Bureau of the Census, 1958 Census of Manufactures, Appendix C.

SUPPLEMENTARY TABLE 6

DERIVATION OF PRICE INDEX FOR THE LEATHER AND LEATHER PRODUCTS INDUSTRY (SIC 31)

SIC Industry		BLS Commodity Wholesale Price Index*	
311	Leather tanning and finishing	041	Hides and skins
312	Industrial leather belting and packing	0443-01	Belting, industrial
313	Boot and shoe cut stock and findings	042	Leather
314	Footwear, except rubber	043	Footwear
315	Leather gloves and mittens	0442-01.02	Gloves, men's dress
316	Luggage	Average:	
		0441-11.07	Weekend case, women's non-leather
		0441-21.06	Briefcase
317	Handbags and other personal leather goods	044	Other leather products
319	Leather goods not elsewhere classified	044	Other leather products

* U.S. Bureau of Labor Statistics, Wholesale Price Indexes used to deflate the 3-digit value added series.

SUPPLEMENTARY TABLE 7

DERIVED PRICE INDEX FOR THE LEATHER AND LEATHER PRODUCTS INDUSTRY (SIC 31)*
(1954 = 100)

Year	Index
1947	105.4
1949	101.8
1950	107.8
1951	122.4
1952	103.6
1953	104.0
1954	100.0
1955	100.3
1956	105.8
1957	105.5
1958	106.8
1959	121.0
1960	117.3
1961	118.6
1962	120.3

* Found by dividing the U.S. 2-digit value added series (adjusted for SIC changes) by the sum of the separately deflated 3-digit value added series.

SUPPLEMENTARY TABLE 8

LEATHER AND LEATHER PRODUCTS (SIC 31)
U.S. AND NEW ENGLAND VALUE ADDED SERIES
(millions of 1954 dollars)

Year	U.S.	New England	New England as Percent of U.S.
1947	1,478.9	441.4	29.8
1949	1,379.4	425.3	30.8
1950	1,406.3	414.7	29.5
1951	1,225.8	377.6	30.8
1952	1,571.4	492.4	31.3
1953	1,672.5	495.5	29.6
1954	1,674.0	492.4	29.4
1955	1,816.1	534.8	29.4
1956	1,815.5	520.9	28.7
1957	1,831.0	523.0	28.6
1958	1,776.9	536.7	30.2
1959	1,752.2	519.8	29.7
1960	1,742.7	526.6	30.2
1961	1,721.5	514.3	29.9
1962	1,742.7	514.7	29.5

C. CHEMICALS AND ALLIED PRODUCTS (SIC 28)

7. SUMMARY OF METHODOLOGY AND PROJECTIONS

To take account of compositional differences between the regional and national chemicals and allied products industry, the output of each 3-digit component was projected separately at the U.S. level. The sum of these 3-digit projections was then checked in each benchmark year against independent 2-digit output projections. Both the 3-digit and 2-digit national projections were derived from regression equations using components of the gross national product Federal Reserve Board Index of industrial production or other economic series as independent variables. Subsequently, New England's output in each 3-digit component was projected, by first estimating the region's share of national 3-digit output levels through least squares regression, and then multiplying these projected shares by the U.S. 3-digit output levels. The sum of all 3-digit output levels thus derived for New England was checked in each benchmark year against two separate 2-digit New England output projections obtained by relating New England's two-digit output series to the national 2-digit output series through least squares regression equations, one of which included "time" as an additional explanatory variable. In almost all cases, national 2-digit output projections, obtained by summing the separate 3-digit projections were accepted as our final output projections for the industry as a whole. Likewise, at the regional level, the sum of the separate 3-digit output projections comprised our final regional output projections for the industry.

a. National Trends and Projections - The industry's value added as percent of the GNP has been on a slow but steady rise since 1947, increasing from 2.00% in 1947 to 3.24% in 1961. In absolute terms, the industry's value added total has jumped by more than 2.5 times during this short period.

We anticipate a continued and significant growth in the chemical and allied products industry. The national value added total is expected

TABLE C-6

SUMMARY OF U.S. AND NEW ENGLAND VALUE ADDED PROJECTIONS, CHEMICALS AND ALLIED PRODUCTS (SIC 28)*

(in millions of 1954 dollars)

	1960 (Actual)	1970	1980	1990	2000	2010	2020
U.S. Value Added Projections (sum of 3-digit projections)	13,970.5	23,773.6	37,645.2	56,381.1	83,414.4	120,686.1	175,290.9
Index (1960 = 100)	100	170	269	404	597	864	1,255
New England Value Added Projections:							
(1) N.E.=40.5+0.02942(U.S.)	470.8	739.9	1,148.0	1,699.2	2,494.6	3,591.1	5,197.6
Index (1960=100)	100	157	244	361	530	763	1,104
(2) N.E.=-17.3+0.4146(U.S.) - 7.84(t)	470.8	780.2	1,276.9	1,975.3	3,017.7	4,484.5	6,670.1
Index (1960=100)	100	166	271	420	641	953	1,417
(3) SUM of 3-digit projections	475.0	746.0	1,156.0	1,716.1	2,484.2	3,575.2	5,143.2
Index (1960=100)	100	157	243	361	523	753	1,083

*For all details refer to accompanying text.

to increase by about 12.5 times between 1960 and 2020. This is substantially faster than the projected increases in the FRB Industrial Production Index or the Gross National Product. This is, however, quite in keeping with past trends. Between 1947 and 1960, the chemical industry's value added total increased by 2.57 times, compared with the FRB index (1.66 times) and the GNP (1.56 times).

The industry's value added, as percent of the GNP, is expected to increase from 3.18% in 1960 to 4.55% in 2020.

b. New England Trends and Projections - New England's 2-digit value added total in constant dollars has more than doubled between 1947 and 1961, as a result of a steady upward movement. As percent of the total national value added, on the other hand, New England's chemical industry has remained remarkably stable, indicating, if anything, a slight downward trend, while fluctuating between 3 and 4 percent of the national total.

At 3-digit detail, the fastest growing industry has been SIC 282 (fibers, plastics, rubber), which has increased 3.5 times between 1947 and 1960. Others, such as SIC 281 (basic chemicals), SIC 283 (Drugs), and SIC 284 (cleaning and toilet goods) have at least doubled their value added during this period. The combined total of SIC's 286, 287, and 289 has also about doubled. Meanwhile, SIC 285 (paints, varnishes) has increased by only about 40 percent. In absolute terms, we anticipate New England's output (value added) in the chemicals and allied products industry to increase by about ten-fold between 1960 and 2020. In relative terms, New England's share of national value added is anticipated to decline gradually, from 3.4 percent in 1960 to about 2.9 percent in 2020.

8. NATIONAL VALUE ADDED PROJECTIONS

a. Regression Analysis - The regression equations used in making 3-digit and 2-digit industry value added projections for the United States are presented in Table C-7. Value added series for each industry

TABLE C-7

U.S. VALUE ADDED PROJECTIONS, CHEMICALS AND ALLIED PRODUCTS (SIC 28), REGRESSION EQUATIONS

SIC	Industry Title	Regression Equation*	R^2	Percent level of significance (.01 = 1%)**
28	Chemicals and Allied Products	Y=-5427.00+174.71 X (1400.00)(15.78)	.910	Less than .01
		Y=2523.000+39.230X+502.700(time) (28.55) (101.)	.971	" " "
		where: Y=Value Added in millions of 1954 dollars X=FRB industrial production index t=time (1947=1,...,2020=74)		
281	Basic Chemicals	Y=-1723.700+59.964X (384.7) (4.316)	.941	" " "
		where: Y=Value Added in millions of 1954 dollars X=FRB industrial production index		
282	Plastic Materials and Synthetic Resin	Y=-913.900+73.510X (211.7) (6.181)	.921	" " "
		where: Y=Value Added in millions of 1954 dollars X=Personal consumption expenditures on durable goods (GNP component) in billions of 1954 $		
283	Drugs	Y=-1413.30 + 261.55X (120.8) (10.58)	.981	" " "
		where: Y=Value Added in millions of 1954 dollars X=Personal consumption expenditures on medical care		

TABLE C-7 (cont'd)

SIC	Industry Title	Regression Equation	R^2	Percent Level of Significance
284	Soaps, Cleaning Detergents, etc.	Y=-1764.00+395.34X (183.0) (21.98) where: Y=Value Added in millions of 1954 dollars X=Personal Consumption expenditures on personal care and cleaning, in billions of 1954 dollars	.964	Less than .01
285	Paints and Varnishes	Y=376.300+4.174 X +14.760(time) (4.555) (8.12) .886 where: Y=value added in millions of 1954 dollars X=Private and public construction (GNP component) in billions of 1954 dollars t= time (1947=1,...,2020=74)	"	" "
286 287 289	Gum and Wood Chemicals Agricultural Chemicals Miscellaneous Chemicals	Y=-1306.400 + 20.087 X (90.0) (0.742) where: Y=Combined value added in millions of 1954 dollars X=Personal consumption expenditures on nondurable goods (GNP component), in billions of 1954 dollars	.984	" " "

*Variations in the number of significant digits in the equations arise from the fact that, for purposes of convenience in presentation, value added is expressed in millions of dollars while GNP components are expressed in billions of dollars. In our regression analysis, however, these variables were expressed in different units (i.e. tens or hundreds of millions or billions) in order to minimize errors that might otherwise have been introduced by rounding. Estimated variance of the regression coefficients "a" and "b" is given underneath these coefficients in each equation.

**"Percent level of significance" states the probability that such a correlation would arise, by random sampling, from an uncorrelated population. In other words, a 1% level of significance for R (coefficient of correlation) may be interpreted as meaning that there is only one chance in a hundred of getting a value of R as high as that recorded when in fact the variables have zero correlation.

were plotted against a number of explanatory variables to determine which of these is most closely correlated to the particular industry series. Each industry was then regressed on the finally selected explanatory or independent variable. Two types of equations were fitted: (1) a simple linear regression equation of the form $Y = a + bX$, and (2) a multiple regression equation of the form $Y = a + b_1X_1 + b_2X_2$, where X_2 usually represents "time" as an additional explanatory variable.

In some cases several explanatory variables were tried alternatively until an acceptable fit was achieved. In a few instances where the possibility of a nonlinear relationship appeared, semi- or double logarithmic function was tried. In general, however, the best marriage of statistical significance and economic plausibility was obtained from a simple linear relationship.

To derive projections for each decade, projected values of the explanatory variables were substituted into the equations. Thus, two sets of 2-digit value added projections were obtained from the first two equations in Table C-7. The other equations provided projections for the 3-digit industries, which, when summed, each decade, provided a third set of national 2-digit value added projections.

The derivation of the historical data used in the regression analyses, as well as the derivation of the projected values of the explanatory variables, are explained below in detail.

b. Value Added Data Selection and Adjustment

(1) Basic value added data at 4-digit industry detail were obtained from the 1947, 1954, 1958 Census of Manufactures and from the Annual Survey of Manufactures, for the period 1947-1961.*

* In some cases, data were available only up to 1960.

(2) The 4-digit value-added series were then adjusted for standard industrial classification changes that occurred in 1958, by using the adjustment factors given in Supplementary Table 9 (refer to end of this section). This adjustment table was derived from Appendix C of the 1958 Census of Manufactures and serves as a "bridge" between the pre-1958 industrial classification system and the "new" classification system used since 1958. The objective of the adjustment of all pre-1958 value added series was to develop value added series for years before and after 1958 that would be homogeneous and consistent in terms of industrial classification.

(3) Value added series adjusted for SIC changes were then aggregated into 3-digit series, which in turn were deflated by using appropriate wholesale price indexes selectively developed from U.S. Bureau of Labor Statistics publications of wholesale price indexes (refer to Supplementary Table 10).*

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* Wholesale price indexes published by the U.S. Bureau of Labor Statistics do not directly correspond to 3-digit industry breakdowns as given in the Standard Industrial Classification Manual and as used in the Census of Manufacture or Annual Survey reports. Therefore, the first task was to match the 3-digit industries to the wholesale price indexes by using the commodity specifications given for each price index code as the bridge. (See BLS, Wholesale Price Indexes 1960 Specifications for Individual Commodities (June 1963) - A Reprint from BLS Bulletin No. 1376 -). In several instances the same price index provided an acceptable answer. This was due to the fact that some price index codes were large enough, in terms of their commodity specifications, to cover the products of several 3-digit industries. In one or two cases, the products of a 3-digit industry would be scattered over various price index code classifications. In such cases, the price index having a commodity coverage closest to the products of the 3-digit industry in question was picked as the deflator.

The second task involved the derivation of price indexes for one more year, 1961, for each BLS-code that would be used. Since no monthly averages were available for December 1961, the average of the first eleven months was taken as the price index for the entire year.

Thirdly, the price indexes were shifted from a base of 1957-1959 = 100 to a base of 1954 = 100. This was done by simply dividing each series through the particular 1954 index.

U.S. 2-digit value added series, measured in constant 1954 dollars, were then obtained by summing the 3-digit deflated value added series. Following this, a derived 2-digit price index was found by dividing the 2-digit U.S. value added series (adjusted for SIC changes) by the deflated 2-digit value added series.

c. Explanatory Variables: Data Selection and Adjustment - The 2-digit and 3-digit U.S. value added series measured in constant 1954 dollars constitute the dependent variables. In order to obtain a set of independent or explanatory variables to which the dependent variables could be related through least-squares regression, we experimented with as many independent variables as possible for each 3-digit value added series and for the 2-digit value added series, before making a final selection of a set of explanatory variables.

The explanatory variables were drawn from expenditure components of the gross national product (e.g., personal consumption expenditures on nondurable goods), the Federal Reserve Board index of industrial production, and other variables. The GNP components and the FRB index are discussed in Appendix B. We will explain here, therefore, only the derivation of the other explanatory variables (i.e. personal consumption expenditures on personal care, personal consumption expenditures on cleaning and medical care).

(1) Personal consumption expenditures in current dollars were obtained for both categories (i.e. medical care, personal care and cleaning) from U.S. Income and Output, 1958, Table II-4, p. 150 for the years 1947-1955; Survey of Current Business (July 1962), Table 14, p. 14 for the years 1956-1958; and from Survey of Current Business (July 1963), Table 14, p. 20 for the years 1958-1960.

(2) These two expenditure series were then deflated by using selectively developed consumer price indexes applied to specific commodities

comprising each expenditure category.* Consumption expenditures on

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* Personal Consumption Expenditures on Personal Care and Cleaning

This group of personal consumption expenditures is composed of cleaning, dyeing, pressing, etc. (commodity code 2-5-0), shoe cleaning and repair, laundering in establishments, barbershops and beauty parlors, toilet articles and cleaning and polishing preparations.

Specific time series for each of these items have been developed and each series deflated by appropriate consumer price indexes. A list of these price indexes is given below for the corresponding expenditure item.

Expenditure Item	Data Source and Price Index Used
(1) Cleaning, pressing, alterations storage	BLS, Consumer Price Index, "Dry Cleaning and Pressing," p. 4-5
(2) Shoe cleaning and repair	Same, "Shoe repairs," p. 10-11
(3) Laundering in establishments	Same, "Laundry services," p. 4-5
(4) Barbershops and beauty parlors	Same, "Beauty shop services," p. 13-14
(5) Toilet articles	Same, "Toilet goods," p. 13
(6) Cleaning and polishing preparations	Same, "Laundry soaps and detergents," p. 4-5

Personal Consumption Expenditures on Medical Care

This group of personal consumption expnediture items includes drug preparations and sundries, ophthalmic products and orthopedic appliances, physicians, dentists, and other professional services and privately controlled hospitals and sanitariums. Specific time series for each of these expenditure items were first developed from the sources cited above, deflated, and then summed to get the total personal consumption expenditures on medical care for all years from 1947 to 1960.

The deflators were derived from the Bureau of Labor Statistics, Consumer Price Index (1957-1959 = 100) Price Indexes for Selected Items and Groups (September 1962). In one case, we had to use the BLS, Wholesale Price Index (March 1962), Code 15-5. After the 1957-1959 = 100 base was shifted to 1954 = 100, by dividing each column through the particular 1954 index, they were each used to deflate the specific expenditure items. The price-indexes used in each case are listed below:

Expenditure Item	Data Source and Price Index Used
(1) Drug preparations	BLS Consumer Price Index, "Drugs and Prescriptions," p. 13
(2) Opthalmic products and orthopedic appliances	BLS Wholesale Price Index, "Other miscellaneous products," CODE 15-5
(3) Physicians	BLS Consumer Price Index, "General practitioners' fees," p. 10
(4) Dentists	Same "Dentists' fees," p. 10
(5) Other professional services	Same "Physicians' fees," p. 10
(6) Hospitals and sanitariums	Same, "Hospital rates," p. 10

personal care and cleaning and on medical care were thus expressed in constant 1954 dollars.

(3) Projections of personal consumption expenditures on personal care and cleaning, as well as on medical care, were made by finding the projected percent shares of the individual commodity expenditure items making up these two expenditure groups, adding them up for each decade, and then applying the result to the projected personal consumption expenditures total for the United States. The percent breakdown of total personal consumption expenditures in terms of 51 expenditure items had been made in connection with a different project undertaken by Arthur D. Little, Inc.

9. NEW ENGLAND VALUE ADDED PROJECTIONS:

Three sets of 2-digit value added projections were made for New England. The first two were obtained by relating New England's value added to U.S. value added through least squares regression, using 2-digit value added series in constant 1954 dollars derived for the period 1947-1962.* These two sets of projections were used as checks on the third set of 2-digit projections obtained by summing for each decade New England's estimated value added levels in each 3-digit industry.

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* 4-digit value added data were available for New England for only 1947, 1954, and 1958. The 1947 and 1954 data were adjusted for SIC changes by using the adjustment factors presented in Supplementary Table 9. The data for the intervening years were adjusted at the 2-digit level only. We found the adjusted 1947 and 1954 data at the 2-digit level as a percent of the unadjusted data, and interpolated to get adjustment factors at the 2-digit level for the intervening years. Meanwhile, the value added data for 1958 were in certain cases adjusted for coverage deficiencies.

Adjusted value added series were then deflated by using the appropriate price indexes presented in Supplementary Table 10. In deflating the 2-digit series, a derived 2-digit implicit price index was used.

The first two sets of 2-digit projections were derived from the following regression equations:

(1) New England = 40.5 + 0.02942 (U.S.)

(22.4) (0.002) $R^2 = .948$

(2) New England = -17.3 + 0.04146 (U.S.) - 7.84 (t)

(0.01312) (8.43) $R^2 = .948$

where:

New England = New England 2-digit value added series in millions of constant 1954 dollars

U.S. = U.S. 2-digit value added series in millions of constant 1954 dollars

t = time (1947=1,...,2020=74)

The third set of 2-digit value added projections were made by first projecting New England's percent shares of national value added levels via least squares regression (i.e., New England's percent share of U.S. value added in a 3-digit industry = a + b log t), and then applying them to the already projected U.S. 3-digit value added levels. New England's percent shares were projected through the following regression equations:

SIC 281: $Y = 1.75 - 0.20 \log^t$

SIC 282: $Y = 3.75 + 0.74 \log^t$

SIC 283: $Y = 3.37 - 0.63 \log^t$

SIC 284: $Y = 7.80 - 1.24 \log^t$

SIC 285: $Y = 3.86 - 0.18 \log^t$

SIC 286: 287: 289: $Y = 3.38 - 0.08 \log^t$

where:

Y = Value added in millions of 1954 dollars

t = time (1947 = 1,...,2020 = 74)

SUPPLEMENTARY TABLE 9

ADJUSTMENTS MADE IN PRE-1958 VALUE ADDED SERIES TO ACCOUNT FOR THE 1958 INDUSTRIAL CLASSIFICATION CHANGES

New SIC*		Composed of Old SIC**	% of Old in New
281	2812	2812	100
	2813	2896	100
	2814	2821	100
	2815	2822	100
	2816	2852	98.42
	2818	2829	98.63
	2819	2819	100
		2811	100
282	2821	2823	100
	2822	2824	100
	2823	2825	46.53
	2824	2825	52.50
283	2831	2831	100
	2833	2832-2833	100
	2834	2834	99.45
284	2841	2841	99.79
		2842	46.26
	2842	2842	50.26
		2899	16.84
	2843	2842	2.02
		2843	99.38
		2829	.99
	2844	2893	100
285	2851	2851	99.86
	2852	2853	95.99
		2842	1.27

* The 1957 Standard Industrial Classification Manual, as used in the 1958 Census of Manufactures.

** Based on the 1945 and 1949 SIC Manuals, as modified in the 1947 and 1954 Census of Manufactures.

(Supplementary Table 9 Continued)

New SIC*		Composed of Old SIC**	% of Old in New
286	2861	2861	100
		2862	100
		2863	100
		2865	100
		2611	5.44***
287	2871	2871	100
	2872	2872	100
	2873-2879	2897	92.66
		2899	7.37
289	2891	2894	100
		2899	4.93
	2892	2826	100
	2893	2891	100
	2894	2887	100
	2895	2895	98.13
	2899	2892	100
		2899	64.43
		3985	100
		2898	100

*** Corresponds to "tall oil." Adjustments were made by estimating the tall oil output for each year from 1947 to 1957 and by adding it to the SIC 286 value added figure.

SUPPLEMENTARY TABLE 10

PRICE INDEXES USED TO DEFLATE CHEMICALS AND ALLIED PRODUCTS (SIC 28) VALUE ADDED SERIES
(1954 = 100.0)

Years	SIC 28 Implicit Price Index	SIC 281	282	283	284	285	286	287	289
1947	91.7	84.1	94.8	112.2	93.7	87.3	94.8	84.0	93.7
1948	--	89.3	97.0	107.6	96.8	88.8	97.0	89.0	96.8
1949	88.0	81.8	88.6	99.7	88.4	89.7	88.6	92.5	88.4
1950	89.1	86.0	89.9	98.5	87.9	88.0	89.9	89.9	87.9
1951	101.4	102.6	102.9	101.9	100.8	96.6	102.9	94.1	100.8
1952	97.5	97.9	97.6	98.5	96.0	97.8	97.6	97.9	96.0
1953	98.7	100.0	98.8	99.0	96.0	98.5	98.8	99.9	96.0
1954	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1955	99.7	100.5	99.6	98.9	98.5	101.5	99.6	99.6	98.5
1956	100.3	103.3	100.2	98.1	96.0	106.3	100.2	95.9	96.0
1957	102.1	105.0	102.3	99.4	98.2	112.0	102.3	94.5	98.2
1958	102.7	105.0	103.2	100.1	99.3	113.7	103.2	95.5	99.3
1959	102.6	105.4	102.8	99.3	99.1	113.7	102.8	94.6	99.1
1960	102.9	105.7	103.0	99.8	99.2	113.9	103.0	97.0	99.2
1961*	101.7	103.7	102.0	97.9	98.1	117.2	102.0	99.0	98.1

NOTES: SIC 28: Derived by dividing the value added series in current dollars (adjusted for SIC changes) by the sum of the deflates 3-digit value added series.
SIC 281: U.S. Bureau of Labor Statistics, Wholesale Price Index Code 06-1 (March, 1962)
SIC 282: BLS Code 06 (April, 1962)
SIC 286: " " " " "
SIC 284: BLS Code 06-7 (March, 1962)
SIC 289: " " " " "
SIC 283: BLS Code 06-3 (March, 1962)
SIC 285: BLS Code 06-21 (March, 1962)
SIC 287: BLS Code 06-6 (March, 1962)

* Average of the first eleven months.

SUPPLEMENTARY TABLE 11

SIC 28 - CHEMICAL AND ALLIED PRODUCTS INDUSTRY DEFLATED U.S. VALUE ADDED SERIES
(Millions of 1954 dollars; SIC 28 as % of GNP and 3-digit components as % of SIC 28 total)

Years	28	281	282	283	284	285	286,287,289
1947 Value Added	5,641.8	1,934.5	781.9	663.1	928.2	549.0	785.2
%	2.00	34.29	13.86	11.75	16.45	9.73	13.92
1949	6,776.2	2,462.5	954.4	1,006.8	1,051.0	495.6	806.0
	2.32	36.34	14.08	14.86	15.51	7.32	11.89
1950	8,104.1	2,985.3	1,340.1	1,151.0	1,165.9	569.3	892.4
	2.59	36.84	16.54	14.20	14.39	7.02	11.01
1951	7,962.4	2,839.4	1,278.3	1,240.1	1,041.2	589.3	973.9
	2.33	35.66	16.05	15.57	13.08	7.40	12.23
1952	8,710.7	3,219.0	1,370.8	1,278.7	1,230.9	609.4	1,001.9
	2.46	36.95	15.74	14.68	14.13	7.00	11.50
1953	9,330.6	3,551.5	1,432.4	1,313.8	1,280.5	664.9	1,087.6
	2.52	38.06	15.35	14.08	13.73	7.13	11.65
1954	9,051.9	3,231.2	1,446.4	1,330.2	1,299.4	655.3	1,089.3
	2.51	35.70	15.98	14.70	14.35	7.24	12.03
1955	10,846.2	3,966.1	1,828.3	1,540.2	1,533.3	726.2	1,252.1
	2.75	36.56	16.86	14.20	14.14	6.69	11.55
1956	11,519.9	4,239.0	1,780.4	1,798.0	1,695.0	712.9	1,294.6
	2.87	36.80	15.45	15.61	14.71	6.19	11.24
1957	11,787.2	4,179.6	1,865.2	1,977.8	1,772.5	686.2	1,305.9
	2.89	35.46	15.82	16.78	15.04	5.82	11.08
1958	11,945.3	4,056.9	1,840.9	2,094.2	1,916.5	709.7	1,327.1
	2.98	33.96	15.41	17.53	16.05	5.94	11.11
1959	13,852.4	4,761.1	2,329.5	2,290.5	2,158.6	805.5	1,507.2
	3.24	34.37	16.82	16.54	15.58	5.81	10.88
1960	13,970.5	4,826.4	2,190.0	2,353.8	2,246.9	796.5	1,556.9
	3.18	34.55	15.68	16.85	16.08	5.70	11.14
1961	14,519.6	5,051.1	2,242.3	2,492.2	2,413.6	778.8	1,541.6
	3.24	34.79	15.44	17.16	16.62	5.36	10.63

SUPPLEMENTARY TABLE 12

CHEMICAL AND ALLIED PRODUCTS (SIC 28)
NEW ENGLAND VALUE ADDED SERIES (1947-1961)
(millions of 1954 dollars)

Years	New England SIC 28 Total	SIC 281	282	283	284	285	286,287,289
1947	228.7	33.6	28.6	22.0	70.8	21.1	27.6
1949	247.0	--	--	--	--	--	--
1950	290.5	--	--	--	--	--	--
1951	251.9	--	--	--	--	--	--
1952	264.3	--	--	--	--	--	--
1953	324.4	--	--	--	--	--	--
1954	319.2	54.7	72.1	41.0	95.1	24.9	28.4
1955	356.9	--	--	--	--	--	--
1956	362.5	--	--	--	--	--	--
1957	374.4	--	--	--	--	--	--
1958	375.9	56.6	75.2	50.8	127.6	24.8	44.2
1959	473.5	--	--	--	--	--	--
1960	475.0	75.2	100.7	62.6	147.7	29.7	59.1
1961	462.9	--	--	--	151.6	--	--

SUPPLEMENTARY TABLE 13

U.S. VALUE ADDED PROJECTIONS, CHEMICALS AND ALLIED PRODUCTS (SIC 28)
(millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
(1) SIC 28 (Y=-5427.00+174.71X)	13,970.5	23,050.7	37,027.5	56,595.1	85,596.9	125,430.8	183,958.6
(2) SIC 28 (Y=2523.000+39.230 X +502.706t)	13,970.5	20,982.3	29,147.7	38,568.5	50,107.6	64,079.1	82,248.1
(3) SUM of 3-digit projections)	13,970.5	23,773.6	37,645.2	56,381.1	83,414.4	120,686.1	175,290.9
SIC 281	4,826.4	8,050.4	12,847.6	19,563.5	29,517.5	43,189.3	63,277.3
SIC 282	2,190.0	3,665.8	5,951.9	9,061.4	13,479.4	19,499.8	28,512.2
SIC 283	2,353.8	5,230.1	8,604.1	12,605.8	19,196.8	27,331.0	39,388.5
SIC 284	2,246.9	3,375.4	5,114.9	7,842.8	10,847.4	16,026.3	23,458.7
SIC 285	796.5	1,028.1	1,310.9	1,641.8	2,054.0	2,570.2	3,251.6
SIC 286) 287) 289)	1,556.9	2,423.8	3,815.8	5,665.8	8,319.3	12,069.5	17,402.6

SUPPLEMENTARY TABLE 14

NEW ENGLAND VALUE ADDED PROJECTIONS, CHEMICALS AND ALLIED PRODUCTS (SIC 28)
(millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
(1) N.E.=40.5+0.02942 (U.S.)	470.8	739.9	1,148.0	1,699.2	2,494.6	3,591.1	5,197.6
(2) N.E.= -17.3+0.04146 (U.S.) -7.84 (t)	470.8	780.2	1,276.9	1,975.3	3,017.7	4,484.5	6,670.1
(3) SUM of New England 3-digit Projections	475.0	746.0	1,156.0	1,716.1	2,484.2	3,575.2	5,143.2
SIC 281	75.2	118.3	185.0	277.8	413.2	600.3	873.2
SIC 282	100.7	174.9	290.5	450.4	678.0	992.5	1,462.7
SIC 283	62.6	130.8	207.4	293.7	437.7	609.5	862.6
SIC 284	147.7	205.6	301.8	451.7	612.9	891.1	1,285.5
SIC 285	29.7	37.1	46.9	58.4	72.9	90.7	114.5
SIC 286 287 289	59.1	79.3	124.4	184.1	269.5	391.1	544.7

D. RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS (SIC 30)

10. SUMMARY OF METHODOLOGY AND PROJECTIONS

New England 2-digit value added projections were made by relating New England's 2-digit value added through least squares regression to national value added, using 2-digit value added series in constant 1954 dollars. National value added projections were obtained by summing for each decade the individual value added projections made for each 3-digit industry, using a variety of methods.

In general, projected growth in the New England and national rubber and miscellaneous plastics products industry will be somewhat faster than the rest of the economy. While the national value added total in constant 1954 dollars is anticipated to increase about eleven-fold between 1960 and 2020, New England's value added total is expected to grow nine-fold. New England's percent share of national value added is expected to gradually decline from 14.5 percent in 1960 to 11.5 percent in 2020 (refer to Table C-8).

11. NATIONAL VALUE ADDED PROJECTIONS

National value added projections were obtained by first deriving individual 3-digit industry value added projections and then summing them for each decade. The individual 3-digit value added projections were obtained by applying a variety of methods, to take fully into account the important factors underlying the growth of each 3-digit industry. These 3-digit projections are explained below in detail.

As in the case of other industries already explained, value added data at a 4-digit detail were obtained from the 1947, 1954, 1958 Census of Manufactures and the Annual Survey of Manufactures series for the period 1947-1962. These series were then adjusted for the standard industrial classification changes that occurred in 1958, and then aggregated into 3-digit series. Appropriate price indexes were subsequently used to deflate these series in order to express them in constant 1954 dollars. When summed for each year, these 3-digit series yielded national 2-digit value added series in constant 1954 dollars.

In order to deflate New England's 2-digit value added series, we found implicit price deflaters at the 2-digit level by dividing the national undeflated 2-digit value added series by the deflated 2-digit series.

12. *NEW ENGLAND VALUE ADDED PROJECTIONS:*

New England value added projections were made by relating New England's value added through least squares regression to U.S. value added, using 2-digit value added series in constant 1954 dollars derived for the period 1947-1962.* An equation which did not include "time" as an additional explanatory variable, as shown below, was found to give a better fit than one with the "time" variable.

$$\text{New England} = 147.6 + 0.112\ X$$
$$(33.9)\quad(0.0028) \qquad\qquad R^2 = .918$$

where:

New England = New England 2-digit value added series in millions of constant 1954 dollars

U. S. = U.S. 2-digit value added series in millions of constant 1954 dollars

t = time (1947 = 1,...,2020 = 74)

New England value added projections were made for the Rubber and Plastics Products Industry (SIC 30) by substituting into the equation projected U.S. value added totals as shown in Table C-8. New England projections are shown also in Table C-8. Historical and other relevant data are presented in the supplementary tables.

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* 4-digit value added data were available for New England for only 1947, 1954, and 1958. The 1947 and 1954 data were adjusted for SIC changes by using the adjustment factors presented in Supplementary Table 15. The data for the intervening years were adjusted at the 2-digit level only. We found the adjusted 1947 and 1954 data at the 2-digit level as a percent of the unadjusted data, and interpolated to get adjustment factors at the 2-digit level for the intervening years. Meanwhile, the value added data for 1958 were in certain cases adjusted for coverage deficiencies.

Adjusted value added series were then deflated by using the appropriate price indexes presented in Supplementary Table 16. In deflating the 2-digit series, a derived 2-digit implicit price index was used (Supplementary Table 17).

TABLE C-8

SUMMARY OF U.S. and NEW ENGLAND VALUE ADDED PROJECTIONS, RUBBER and MISCELLANEOUS PLASTICS PRODUCTS (SIC 30)*

(in millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
U.S. Value Added Projections (sum of 3-digit projections)	3,782.7	6,187.5	9,638.5	14,260.9	20,909.2	29,900.6	43,087.2
Index (1960=100)	100	164	255	377	553	790	1,139
New England Value Added Projections	547.5	840.6	1,227.1	1,738.8	2,489.4	3,496.5	4,973.4
Index (1960=100)	100	154	224	318	455	639	908
New England as percent of U.S.	14.5	13.6	12.7	12.2	11.9	11.7	11.5

* For all details, refer to accompanying text.

a. SIC 301 - Tires and Inner Tubes - Output in tires and inner tubes is most closely related to that in motor vehicles. Since projections of output in the motor vehicle industry were not available, we decided to project value added in SIC 301-Tires and Inner Tubes by using the median FRB index of industrial production projections for tires and inner tubes available from Landsberg, et.al., Resources for America's Future.* Since the index in this source was projected only up to year 2000, we extrapolated it to 2020 on the basis of the average decadal growth rates between 1950 and 2000. Value added projections were then derived by multiplying these projected indexes by the national value added total in 1960, expressed in constant 1954 dollars (refer to Supplementary Table 19).

b. SIC 302 - Rubber Footwear - Value added in SIC 302-Rubber Footwear was projected by relating it to growth in national population. Thus, we first projected per capita consumption of rubber footwear and multiplied the results by the U.S. population projections made available by the Economic Task Group of the Ad Hoc Water Resources Council Staff.

Projections of per capita consumption of rubber footwear were made through least squares regression, by relating the per capita consumption series to the log of time (i.e., $Y = a + b \log t$).** The considerable fluctuations in the series were smoothed out by taking a four-year moving average. A logarithmic function was used in our regression so as to dampen the decline in the series. Otherwise, projected per capita value added would have been too low.

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* Hans H. Landsberg, Leonard L. Fischman and Joseph L. Fisher, Resources in America's Future (Baltimore: The Johns Hopkins Press, for the Resources for the Future, Inc., 1963), P.579.

** The following equation was used:

$$Y = 0.8182 - 0.0971 \log t \qquad R^2 = .744$$
$$(0.0169) \quad (0.0133)$$

where

Y = Per capita consumption of rubber footwear in constant 1954 dollars

log t = logarithm of time, were time is coded so that the midpoint of 1949-1950 = 1, and the midpoint of 1960-1961 = 12

c. SIC 303 - Reclaimed Rubber and SIC 306 - Fabricated Rubber Products, n.e.c. - Value added in these two 3-digit industries was projected by relating their combined value added series in constant 1954 dollars to Federal Reserve Board index of industrial production, through least squares regression. An equation which did not include "time" as an additional variable, as shown below, was found to provide a better fit:

$$Y = 73.9 + 9.55\ X$$
$$(73.6)\ (0.794) \qquad R^2 = .911$$

where:

Y = Value added in SIC 303 and SIC 306 in millions of 1954 dollars

X = Federal Reserve Board index of industrial production (1957=100).

Value added projections were derived for each decade by substituting into the equation projected values of the FRB index, which are presented in Appendix B.

d. SIC 307 - Miscellaneous Plastics Products - Value added in this industry was projected by relating it through least squares regression to the "consumer durables" component of the gross national product (GNP). An equation which did not include "time" as an additional variable, as shown below, was found to give a better fit than the one with the "time" variable:

$$Y = -1{,}447.1 + 66.3\ X$$
$$(327.9)\ (9.2) \qquad R^2 = .785$$

where:

Y = Value added in SIC 307 in millions of 1954 dollars

X = "Consumer Durables" component of the gross national product (GNP) in billions of 1954 dollars.

Value added projections were derived for each decade by substituting into the equation projected values of "Consumer Durables", which are presented in Appendix B. The negative intercept in the equation indicates that plastics products are expected to account for an increasing share of consumer durables.

For a summary of U.S. 3-digit value added projections, refer to Supplementary Table 19.

SUPPLEMENTARY TABLE 15

ADJUSTMENTS MADE IN PRE-1958 VALUE ADDED SERIES TO ACCOUNT FOR THE 1958 STANDARD INDUSTRIAL CLASSIFICATION CHANGES

	New SIC	Composed of Old SIC	Percent of Old in New
301	3011	3011	100.00
		3099	2.41
302	3021	3021	100.00
303	3031	3031	100.00
306	3069	3099	97.19
307	3079	3971	100.00

Source: U.S. Bureau of the Census, 1958 Census of Manufactures, Appendix C.

SUPPLEMENTARY TABLE 16

PRICE INDEXES USED TO DEFLATE THE 3-DIGIT COMPONENTS OF SIC 30*
(1954 = 100.0)

Years	SIC 301	302	303	306	307
1947	76.2	79.6	77.9	76.1	79.9
1948	78.0	84.6	80.9	80.2	79.5
1949	75.6	84.1	83.8	80.5	80.6
1950	87.0	86.0	89.7	88.5	81.1
1951	102.5	99.4	100.0	106.9	101.2
1952	99.4	99.8	100.0	102.6	100.6
1953	97.4	97.4	100.0	100.6	100.8
1954	100.0	100.0	100.0	100.0	100.0
1955	111.1	103.2	101.2	106.2	95.4
1956	116.6	112.0	105.0	108.7	86.7
1957	115.5	116.0	110.0	110.2	86.8
1958	116.8	122.2	110.0	110.6	85.6
1959	109.8	128.1	110.0	111.1	81.9
1960	106.0	133.1	110.0	113.0	81.6
1961	105.4	133.5	110.0	112.3	78.0
1962	99.3	134.6	110.0	111.6	77.7

* Standard Industrial Classification

SIC 301	Tires and Inner Tubes
SIC 302	Rubber Footwear
SIC 303	Reclaimed Rubber
SIC 306	Fabricated Rubber Products, n.e.c.
SIC 307	Miscellaneous Rubber Products

U.S. Bureau of Labor Statistics Wholesale Commodity Price Index Used -- by Commodity Code

BLS Code 07-2:	Tires and Tubes
BLS Code 07-31:	Rubber Footwear
BLS Code 07-13:	Reclaimed Rubber
Average of:	
BLS Code 07-32:	Heels and Soles
BLS Code 07-33:	Rubber Belts and Belting
BLS Code 07-34:	Other Rubber Products
BLS Code 06-73:	Plastic Materials

SUPPLEMENTARY TABLE 17

DERIVED PRICE INDEX FOR NEW ENGLAND (SIC 30) BASED ON THE PRICE INDEXES FOR U.S. THREE-DIGIT INDUSTRIES WEIGHTED BY THE RELATIVE IMPORTANCE OF THREE-DIGIT INDUSTRIES IN NEW ENGLAND (SIC 30)

	New England Weighted Price Index for SIC 30 (1954=100)	Weights: Value Added in 3-Digit Industries As A % of Value Added in New England SIC 30		
		SIC: 301, 302, 303 (Applied to Average of BLS 07-13, 07-2, and 07-31)	306 (Applied to Average of BLS 07-32, 07-33 and 07-34)	307 (Applied to BLS 06-73)
1947	77.7	46.36	34.46	19.18
1949	80.8	44.13	36.15	19.73
1950	86.6	43.01	36.99	20.00
1951	103.1	41.89	37.84	20.28
1952	101.0	40.77	38.68	20.55
1953	99.7	39.65	39.52	20.82
1954	100.0	38.53	40.37	21.10
1955	103.4	37.35	39.94	22.71
1956	104.3	36.17	39.51	24.33
1957	105.4	34.98	39.08	25.94
1958	105.8	33.80	38.65	27.55
1959	104.7	32.37	40.18	27.46
1960	105.1	34.28	36.82	28.90
1961	103.1	33.94	35.38	30.68
1962	102.2	34.35	34.84	30.83

Note: 1949-1953 and 1955-1957 are interpolated from 1947, 1954 and 1958 based on the Census of Manufactures for those years, 1959-1962 are based on the Annual Survey of Manufactures.

SUPPLEMENTARY TABLE 18

RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS (SIC 30), U.S. AND NEW ENGLAND
VALUE ADDED SERIES
(millions of 1954 dollars)

	U.S. Value Added	New England Value Added	New England as Percent of U.S.
1947	2,020.4	356.9	17.6
1949	1,895.0	329.4	17.4
1950	2,428.4	390.9	16.1
1951	2,124.8	349.9	16.5
1952	2,236.3	385.3	17.2
1953	2,579.8	456.5	17.7
1954	2,552.8	462.4	18.1
1955	2,743.7	488.4	17.8
1956	3,003.8	515.1	17.1
1957	3,095.2	531.6	17.2
1958	3,138.6	491.5	15.7
1959	3,760.5	554.3	14.7
1960	3,782.7	547.5	14.5
1961	4,028.3	578.8	14.4
1962	4,548.2	652.1	14.3

SUPPLEMENTARY TABLE 19

SUMMARY OF U.S. 3-DIGIT VALUE ADDED PROJECTIONS, RUBBER AND MISCELLANEOUS PLASTICS PRODUCTS (SIC 30)
(millions of 1954 dollars)

SIC	Industry Title	Actual 1960	1970	1980	1990	2000	2010	2020
301	Tires and Inner Tubes	1,199.6	1,727.4	2,327.3	3,047.1	4,090.7	5,434.3	7,245.8
302	Rubber Footwear	121.8	145.8	170.9	200.2	233.6	273.6	320.3
303 & 306	Reclaimed Rubber and Fabricated Rubber Products, n.e.c.	1,054.6	1,630.9	2,395.0	3,464.9	5,050.5	7,228.3	10,428.3
307	Miscellaneous Plastics Prod.	1,406.6	2,683.4	4,745.3	7,548.8	11,534.4	16,964.4	25,092.8
		(Index: 1960=100)						
301	Tires and Inner Tubes	100	144	194	254	341	453	604
302	Rubber Footwear	100	120	140	164	192	225	263
303 & 306	Reclaimed Rubber and Fabricated Rubber Products, n.e.c.	100	155	227	329	479	685	989
307	Miscellaneous Plastics Prod.	100	191	337	537	820	1206	1784

E. FABRICATED METAL PRODUCTS (SIC 34)

13. SUMMARY OF METHODOLOGY AND PROJECTIONS

To take account of compositional differences between the regional and national fabricated metal products industry, the output of each 3-digit component was projected separately at the U.S. level. The sum of these 3-digit projections was then checked in each benchmark year against independent 2-digit output projections. Both the 3-digit and 2-digit national projections were derived from regression equations using components of the gross national product, Federal Reserve Board Index of industrial production or other economic series as independent variables. Subsequently, New England's output in each 3-digit component was projected, by first estimating the region's share of national 3-digit output levels through least squares regression, and then multiplying these projected shares by the U.S. 3-digit output levels. The sum of all 3-digit output levels thus derived for New England was checked in each benchmark year against two separate 2-digit New England output projections obtained by relating New England's 2-digit output series to the national 2-digit output series through least squares regression equations one of which included "time" as an additional explanatory variable. In almost all cases, national 2-digit output projections obtained by summing the separate 3-digit projections were accepted as our final output projections for the industry as a whole. Likewise, at the regional level, the sum of the separate 3-digit output projections comprised our final regional output projections for the industry.

In general, projected growth in the national and New England fabricated metals products industry will be steady but slower than the projected growth indicators for the rest of the economy. Whereas the nation's and New England's value added total is expected to grow under six-fold between 1960 and 2020, GNP is expected to grow by 8.75-fold and the FRB index of industrial production is expected to grow ten-fold (10.04).

New England's projected growth rates are slightly under national trends, as indicated in Table C-9. It is important to point out that the New England projections obtained by summing the separate 3-digit value added projections are remarkably close to 2-digit New England Projections obtained by relating the regional growth of the industry to national growth trends via least squares regression.

TABLE C-9

SUMMARY OF U.S. AND NEW ENGLAND VALUE ADDED PROJECTIONS, FABRICATED METAL PRODUCTS (SIC 34)*

(in millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
U.S. Value Added Projections (sum of 3-digit projections)	8,980.8	11,806.8	15,516.4	20,580.8	27,859.4	37,794.6	52,051.8
Index (1960=100)	100	131	173	229	310	421	580
New England Value Added Projections:							
(1) N.E. = 123.2+0.07168 (U.S.)	766.8	969.5	1,235.4	1,598.4	2,120.2	2,922.3	3,854.3
Index (1960=100)	100	126	161	208	276	381	503
(2) N.E. = -54.5+0.1141(U.S.)-19.70(t)	766.8	819.9	1,046.1	1,427.0	2,060.5	2,997.1	4,426.8
Index (1960=100)	100	107	136	186	269	391	577
(3) SUM of 3-digit projections	766.8	926.3	1,212.7	1,620.5	2,225.2	3,056.7	4,265.2
Index (1960=100)	100	121	158	211	290	399	556

*For all details, refer to accompanying text.

14. NATIONAL VALUE ADDED PROJECTIONS:

a. Regression Analysis - The regression equations used in making 3-digit and 2-digit industry value added projections for the United States are presented in Table C-10. Value added series for each industry were plotted against a number of explanatory variables to determine which of these is most closely correlated to the particular industry series. Each industry was then regressed on the finally selected explanatory or independent variable. Two types of equations were fitted: (1) a simple linear regression equation of the form $Y = a + bX$, and (2) a multiple regression equation of the form $Y = a + b_1X_1 + b_2X_2$, where X_2 usually represents "time" as an additional explanatory variable.

In some cases several explanatory variables were tried alternatively until an acceptable fit was achieved. In a few instances where the possibility of a nonlinear relationship appeared, semi- or double logarithmic function was tried. In general, however, the best marriage of statistical significance and economic plausibility was obtained from a simple linear relationship.

To derive projections for each decade, projected values of the explanatory variables were substituted into the equations. Thus, two sets of 2-digit value added projections were obtained from the first two equations in Table C-10. The other equations provided projections for the 3-digit industries, which, when summed, each decade, provided a third set of national 2-digit value added projections.

The derivation of the historical data used in the regression analyses, as well as the derivation of the projected values of the explanatory variables, are explained below in detail.

b. Value Added Data Selection and Adjustment

(1) Basic value added data at 4-digit industry detail were obtained from the 1947,1954,1958 Census of Manufactures and from the Annual Survey of Manufactures, for the period 1947-1961.*

*In some cases, data were available only up to 1960.

TABLE C-10

U.S. VALUE ADDED PROJECTIONS, FABRICATED METAL PRODUCTS (SIC 34)

REGRESSION EQUATIONS

SIC	Industry Title	Regression Equations*	R^2	Percent Level of Significance** (.01=1%)
34	Fabricated Metal Products Total	Y=3376.0+57.10X (1430.0) (9.43)	.870	.01
		Y=-752.0+127.44X-261.0(t) (23.6) (83.1)	.920	.01
	Where:			
		Y=Value Added, in millions of 1954 dollars		
		X=FRB industrial production index		
		t=Time (1947=1,...,2010=64)		
341	Metal Cans	Y=1399+829.6X+197.1 log t (347.0) (48.0)	.970	.01
	Where:			
		Y=Value Added in millions of 1954 dollars		
		X=Personal Consumption Expenditures on Nondurable Goods (GNP component) in billions of 1954 dollars		
		t=Time (1947=1,...,2020=74)		
342	Cutlery, Hand Tools Hardware	Y=285.6+6.6076X (1511.0) (1.907)	.680	.01
	Where:			
		Y=Value Added in millions of 1954 dollars		
		X=Personal Consumption Expenditures on Nondurable Goods (GNP component) in billions of 1954 dollars		

*Variations in the number of significant digits in the equations arise from the fact that, for purposes of convenience in presentation, value added is expressed in millions of dollars while GNP components are expressed in billions of dollars. In our regression analysis, however, these variables were expressed in different units (i.e., tens or hundreds of millions or billions) in order to minimize errors that might otherwise have been introduced by rounding. Estimated variance of the regression coefficients "a" and "b" is given underneath these coefficients in each equation.

**"Percent level of significance" states the probability that such a correlation would arise, by random sampling, from an uncorrelated population. In other words, a 1% level of significance for R (coefficient of correlation) may be interpreted as meaning that there is only one chance in a hundred of getting a value of R as high as that recorded when in fact the variables have zero correlation.

TABLE C-10 (continued)

			R^2	Percent Le of Significa
343	Heating & Plumbing Equipment	Y=% approximation (No significant correlation with independent variables could be found)***		
344	Structural Metal Products	Y=296.0+3524.0 log X (617.0) (369.0)	.730	.01
	Where:	Y=Value Added in millions of 1954 dollars X=Construction Expenditures (GNP component) in billions of 1954 dollars		
345	Screw Machine Products	Y=165.2+6.447X (173.0) (1.94)	.680	.01
	Where:	Y=Value Added in millions of 1954 dollars X=FRB index of industrial production		
346	Metal Stampings	Y=80.2+13.812X-37.43t (4.25) (15.0)	.740	.01
	Where:	Y=Value Added in millions of 1954 dollars X=FRB index of industrial production t=Time (1947=1,...,2020=74)		
347	Coating, Engraving, etc.	Y=-101.7+4.626X (48.0) (.54)	.930	.01
	Where:	Y=Value Added in millions of 1954 dollars X=FRB index of industrial production		
348	Fabricated Wire Products	Y=-98.147.772X-19.83t (1.61) (5.70)	.860	.01
	Where:	Y=Value Added in millions of 1954 dollars X=FRB index of industrial production t=Time (1947=1,...,2020=74)		
349	Miscellaneous Fabricated Products	Y=3022.8+2130.5 log X (124.0) (208.1)	.900	.01
	Where:	Y=Value Added in millions of 1954 dollars X=FRB index of industrial production		

***The ten-year equivalent of the 1947-1960 percent change in New England's percentage share of U.S. Value added in SIC 343 was extrapolated at a dampened rate.

(2) The 4-digit value added series were then adjusted for standard industrial classification changes that occurred in 1958, by using the adjustment factors given in Supplementary Table 20 (refer to end of this section). This adjustment table was derived from Appendix C of the 1958 Census of Manufactures and served as a "bridge" between the pre-1958 industrial classification system and the "new" classification system used since 1958. The objective of the adjustment of all pre-1958 value added series was to develop value added series for years before and after 1958 that would be homogeneous and consistent in terms of industrial classification.

(3) Value added series adjusted for SIC changes were then aggregated into 3-digit series, which in turn were deflated by using appropriate wholesale price indexes selectively developed from U.S. Bureau of Labor Statistics publication of wholesale price indexes (refer to Supplementary Table 21).

U.S, 2-digit value added series, measured in constant 1954 dollars, were then obtained by summing the 3-digit deflated value added series. Following this, a derived 2-digit price index was found by dividing the 2-digit U.S. value added series (adjusted for SIC changes) by the deflated 2-digit value added series.

c. Explanatory Variables: Data Selection and Adjustment - The 2-digit and 3-digit U.S. value added series measured in constant 1954 dollars constitute the dependent variables. In order to obtain a set of independent or explanatory variables to which the dependent variables could be related through least-squares regression, we experimented with as many independent variables as possible for each 3-digit value added series and for the 2-digit value added series, before making a final selection of a set of explanatory variables.

The explanatory variables were drawn from expenditure components of the gross national product (e.g., personal consumption expenditures on nondurable goods), the Federal Reserve Board Index of industrial production, and other variables. The GNP components and the FRB index are discussed in Appendix B.

15. NEW ENGLAND VALUE ADDED PROJECTIONS:

Three sets of 2-digit value added projections were made for New England. The first two were obtained by relating New England's value added to U.S. value added through least squares regression, using 2-digit value added series in constant 1954 dollars derived for the period 1947-1962.* These two sets of projections were used as checks on the third set of 2-digit projections obtained by summing for each decade New England's estimated value added levels in each 3-digit industry.

The first two sets of 2-digit projections were derived from the following regression equations:

(1) New England = 123.2+0.07168(U.S.)
(51.0) (0.0065) $R^2 = .910$

(2) New England = 54.5+0.1141(U.S.)-19.70(t)
(0.0249) (11.27) $R^2 = .930$

where:

New England = New England 2-digit value added series in millions of constant 1954 dollars

U.S. = U.S. 2-digit value added series in millions of constant 1954 dollars

t = time (1947=1,...,2020=74)

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* 4-digit value added data were available for New England for only 1947, 1954, and 1958. The 1947 and 1954 data were adjusted for SIC changes by using the adjustment factors presented in Supplementary Table 20. The data for the intervening years were adjusted at the 2-digit level only. We found the adjusted 1947 and 1954 data at the 2-digit level as a percent of the unadjusted data, and interpolated to get adjustment factors at the 2-digit level for the intervening years. Meanwhile, the value added data for 1958 were in certain cases adjusted for coverage deficiencies.

Adjusted value added series were then deflated by using the appropriate price indexes presented in Supplementary Table 21. In deflating the 2-digit series, a derived 2-digit implicit price index was used.

The third set of 2-digit value added projections were made by first projecting New England's percent shares of national value added levels via least squares regression (i.e., New England's percent share of U.S. value added in a 3-digit industry = a + b log t), and then applying them to the already projected U.S. 3-digit value added levels. New England's percent shares were projected through the following regression equations:

SIC 341	$y = 1.8737 - .3815 \log t$
SIC 343	$y = 6.3287 - 3.124 \log t$
SIC 344	$y = 4.5848 - .6974 \log t$
SIC 345	$y = 17.064 - 1.449 \log t$
SIC 346	$y = 6.4865 + .3047 \log t$
SIC 347	$y = 9.8309 - .0046 \log t$
SIC 348	$y = 9.6274 - 1.034 \log t$
SIC 349	$y = 6.8659 + 1.6342 \log t$

where:

y = Value added in millions of 1954 dollars

t = Time (1947 = 1,...,2020 = 74)

In the case of SIC 342, we assumed that the percentage decline in New England's share of national value added during the 1947-1960 period, converted into a ten-year equivalent, will prevail during the 1960-1970 period. Thereafter, New England's share will fall at a dampened rate, such that the percent change in the share will fall by one half each decade.

SUPPLEMENTARY TABLE 20

ADJUSTMENTS MADE IN PRE-1958 VALUE ADDED SERIES TO ACCOUNT FOR THE 1958 INDUSTRIAL CLASSIFICATION CHANGES

SIC	ADD	DEDUCT
341	-	-
342	-	-
343	3568	-
344	2561 3569	-
345*	3494 3495	
346		3465 3466 3467 3468
347	3465 3466 3467 3468	3471
348		3481
349	3591 3592	3494 3495

Source: U.S. Bureau of the Census, 1958 Census of Manufactures, Appendix C.

* SIC 345 not defined prior to 1957 SIC revision.

SUPPLEMENTARY TABLE 21

DERIVED PRICE INDEX FOR THE FABRICATED METALS INDUSTRY (SIC 34)

Year	A. FRB Index of Industrial Production: Fabricated Metals Component[1] (1954 = 100)	B. Dept. of Comm. Index of Sales: Fabricated Metals Component[2] (1954 = 100)	C. Derived Price Index[3] (B / A) (1954 = 100)
1947	84.3	67.3	79.8
1948	85.4	69.3	81.1
1949	77.5	62.2	80.3
1950	94.4	79.6	84.3
1951	101.1	92.8	91.8
1952	98.9	92.6	93.6
1953	111.2	103.3	92.9
1954	100.0	100.0	100.0
1955	109.0	110.6	101.5
1956	109.0	120.2	110.3
1957	112.4	125.4	111.6
1958	103.4	117.5	113.7
1959	116.9	136.8	117.0
1960	119.1	136.2	114.4

Notes:

[1] From U.S. Department of Commerce, Business Statistics 1961 Edition, p.14. Converted from 1957 = 100 to 1954 = 100.

[2] Ibid., p.21. Converted from 1957 = 100 to 1954 = 100; entry for 1947 estimated.

[3] The comparability of this derived price index for fabricated metals with the U.S. Department of Labor Commodity Wholesale Price Indexes is quite satisfactory:

(1954 = 100 in each case)	1947	1960
Derived Price Index (shown above)	79.8	114.4
Durable Goods	75.2	118.2
Metals and Metal Products	71.3	120.2
Heating Equipment	83.4	104.5
Plumbing Equipment	80.0	111.5

SUPPLEMENTARY TABLE 22

U. S. VALUE ADDED SERIES, FABRICATED METAL PRODUCTS (SIC 34)

(millions of 1954 dollars)

- 3-digit components as percent of total SIC 34 -

Years	SIC 34	341	342	343	344	345	346	347	348	349
1947 Value Added	6,698.2	290.1	913.8	1,021.3	1,687.9	539.1	866.2	219.7	334.5	825.6
% of Total	100.0	4.3	13.6	15.3	25.2	8.1	12.9	3.3	5.0	12.3
1949	6,502.3	342.9	898.8	783.2	1,828.5	460.9	818.2	212.4	341.2	816.1
	100.0	5.3	13.8	12.0	28.1	7.1	12.6	3.3	5.2	12.6
1950	7,916.0	405.9	1,090.6	1,063.8	2,085.8	642.7	1,039.1	219.8	441.4	908.3
	100.0	5.1	13.8	13.5	26.4	8.1	13.1	2.8	5.6	11.5
1951	8,452.5	427.1	1,072.0	953.9	2,229.4	857.3	1,078.3	273.7	453.5	1,107.2
	100.0	5.1	12.7	11.3	26.4	10.1	12.7	3.2	5.4	13.1
1952	8,339.0	453.9	1,007.7	895.6	2,367.5	823.0	1,045.5	249.6	428.9	1,067.4
	100.0	5.4	12.1	10.7	28.4	9.9	12.5	3.0	5.1	12.8
1953	9,381.6	505.7	1,153.3	930.7	2,538.5	897.8	1,349.1	356.5	484.7	1,165.2
	100.0	5.4	12.3	9.9	27.0	9.6	14.4	3.8	5.2	12.4
1954	8,231.3	500.4	1,040.7	836.9	2,445.7	665.1	958.1	284.8	413.3	1,086.4
	100.0	6.1	12.6	10.2	29.7	8.1	11.6	3.5	5.0	13.2
1955	9,226.3	562.1	1,260.8	937.6	2,423.5	823.1	1,087.8	319.5	476.9	1,230.0
	100.0	6.1	13.7	10.2	26.3	8.9	11.8	3.5	5.2	13.3
1956	9,111.8	572.1	1,148.6	796.9	2,694.7	767.3	1,000.6	315.8	458.5	1,288.8
	100.0	6.3	12.6	8.8	29.6	8.4	11.0	3.5	5.0	14.2
1957	9,323.8	580.5	1,119.8	711.8	3,001.4	790.0	974.8	385.2	451.3	1,309.0
	100.0	6.2	12.0	7.6	32.2	8.5	10.5	4.1	4.9	14.0
1958	8,278.1	588.0	1,057.4	591.0	2,605.9	663.8	922.9	318.5	386.9	1,143.8
	100.0	7.1	12.8	7.1	31.5	8.0	11.1	3.9	4.7	13.8
1959	8,826.6	571.2	1,201.7	665.6	2,509.1	801.1	1,064.4	395.9	457.5	1,251.4
	100.0	6.5	13.6	7.5	28.4	9.1	12.1	4.5	5.2	14.2
1960	8,980.8	577.0	1,231.7	666.8	2,560.4	799.6	1,070.5	424.3	453.6	1,196.9
	100.0	6.4	13.7	7.4	28.5	8.9	11.9	4.7	5.1	13.3

SUPPLEMENTARY TABLE 23

U.S. VALUE ADDED PROJECTIONS, FABRICATED METAL PRODUCTS (SIC 34)

(millions of 1954 dollars)

SIC Regression Equations*	1960 Actual	1970	1980	1990	2000	2010	2020
(1) SIC 34(Y=3376.0+57.10X)	8,980.8	12,683.	17,251.	23,647.	33,125.	46,144.	65,272.
(2) SIC 34(Y=752.0+127.44X-261.0t)	8,980.8	13,757.	21,342.	33,005.	51,550.	77,997.	118,079.
(3) SUM of 3-digit projections	8,980.8**	11,806.8	15,516.4	20,580.8	27,859.4	37,794.6	52,051.8
341	577.0	754.4	898.4	1,031.6	1,165.3	1,298.4	1,431.7
342	1,231.7	1,512.8	1,970.7	2,579.3	3,452.2	4,685.8	6,440.1
343	666.8	712.9	838.0	1,185.5	1,706.3	2,530.7	3,646.4
344	2,560.0	3,302.3	3,875.6	4,414.9	4,962.8	5,497.7	6,042.2
345	799.6	1,216.1	1,731.8	2,453.9	3,524.1	4,994.0	7,153.7
346	1,070.5	1,272.9	2,003.5	3,176.2	5,094.7	7,869.5	12,122.2
347	424.3	652.3	1,022.4	1,540.5	2,308.4	3,363.2	4,912.9
348	453.6	692.8	1,116.3	1,788.5	2,880.3	4,454.0	6,859.3
349	1,196.7	1,690.3	2,059.7	2,410.4	2,765.3	3,101.3	3,443.3

* For an explanation of the regression equations, refer to Table C-10.

** Parts may not add up to total due to rounding.

SUPPLEMENTARY TABLE 24

NEW ENGLAND VALUE ADDED PROJECTIONS, FABRICATED METAL PRODUCTS (SIC 34)*

SIC	1960 (actual)	1970	1980	1990	2000	2010	2020
341	8.7	10.2	11.6	12.9	14.1	15.3	16.6
342	248.7	236.0	272.4	336.1	437.1	584.8	797.9
343	17.9	14.4	12.9	14.1	15.7	17.5	17.9
344	101.5	119.5	136.4	151.9	167.7	183.1	198.2
345	129.9	183.1	257.0	360.2	512.8	721.6	1,027.3
346	74.5	88.0	139.2	222.0	357.1	554.0	855.8
347	40.5	64.1	100.4	151.3	226.7	330.3	482.4
348	33.0	56.8	89.8	141.8	225.8	345.6	527.5
349	112.0	154.2	193.0	230.2	268.2	304.5	341.6
Total SIC 34 in New England	766.8	926.3	1,212.7	1,620.5	2,225.2	3,056.7	4,265.2

* for all explanations, refer to accompanying text.

SUPPLEMENTARY TABLE 25

NEW ENGLAND 3-DIGIT VALUE ADDED SERIES, FABRICATED METAL PRODUCTS (SIC 34)

(millions of 1954 dollars)

Year	SIC 34	341	342	343	344	345	346	347	348	349
1947	674.1	5.5	258.3	63.9	81.7	92.1	58.7	21.3*	34.1	58.5
1954	661.2	7.1	243.3	32.5	65.3	105.5	52.9	29.3	44.8	80.5
1958	674.2	8.3	227.6	16.9	103.0	96.7	59.7	31.6	31.4	99.1
1959	770.6	8.8*	254.3	18.0*	109.0	126.1	76.2	39.9	33.4*	104.8
1960	766.8	8.7*	248.7	17.9*	101.5	129.9	74.5	40.5	33.0*	112.0

Sources: Census of Manufactures and Annual Survey of Manufactures. For explanations, refer to accompaning text.

*Derived - Usually the unreported 4-digit or 3-digit data were derived by distributing the unaccounted 3-digit or 2-digit excess in the same proportions as the nearest known year.

SUPPLEMENTARY TABLE 26

U. S. AND NEW ENGLAND VALUE ADDED SERIES, FABRICATED METAL PRODUCTS (SIC 34)

	U.S. SIC 34*	N.E. SIC 34*	N.E. as % of U.S.
	(millions of current dollars)		
1947	$4,921.5	506.2	10.28
1949	4,834.2	423.5	8.76
1950	6,210.8	561.2	9.04
1951	7,138.6	692.5	9.70
1952	7,168.3	660.3	9.21
1953	8,143.7	741.8	9.11
1954	7,596.3	624.4	8.22
1955	8,404.3	680.0	8.09
1956	8,243.8	747.9	9.07
1957	9,453.8	749.4	7.93
1958	9,422.9	766.5	8.13
1959	10,444.6	901.6	8.63
1960	10,284.7	877.2	8.53

* From Census of Manufactures and Annual Survey of Manufactures. Unrevised for SIC changes (since revision of N.E. data was not possible in all years).

F. MACHINERY, EXCEPT ELECTRICAL (SIC 35)

16. SUMMARY OF METHODOLOGY AND PROJECTIONS

To take account of compositional differences between the regional and national non-electrical machinery industry, the output of each 3-digit component was projected separately at the U.S. level. The sum of these 3-digit projections was then checked in each benchmark year against independent 2-digit output projections. Both the 3-digit and 2-digit national projections were derived from regression equations using components of the gross national product, Federal Reserve Board Index of industrial production or other economic series as independent variables. Subsequently, New England's output in each 3-digit component was projected, by first estimating the region's share of national 3-digit output levels through least squares regression, and then multiplying these projected shares by the U.S. 3-digit output levels. The sum of all 3-digit output levels thus derived for New England was checked in each benchmark year against two separate 2-digit New England output projections obtained by relating New England's 2-digit output series to the national 2-digit output series through least squares regression equations one of which included "time" as an additional explanatory variable. In almost all cases, national 2-digit output projections obtained by summing the separate 3-digit projections were accepted as our final output projections for the industry as a whole. Likewise, at the regional level, the sum of the separate 3-digit output projections comprised our final regional output projections for the industry.

In general, the projected growth in the nation's non-electrical machinery industry will be steady but slower than the rest of the economy. While national value added is expected to increase almost seven-fold between 1960 and 2020, gross national product (GNP) is expected to grow 8.75-fold and the FRB index of industrial production is projected to increase 10.04-fold.

New England's value added in the non-electrical machinery industry is expected to grow 4.24-fold, the lowest of the three projections. The other two, obtained by relating New England's 2-digit value added to national value added through least squares regression, indicate almost a seven-fold growth in value added (refer to Table C-11).

TABLE C-11

SUMMARY OF U.S. AND NEW ENGLAND VALUE ADDED PROJECTIONS, MACHINERY EXCEPT ELECTRICAL (SIC 35)*

(in millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
U. S. Value Added Projections							
(sum of 3-digit projections)	11,501.5	18,093.0	24,546.8	32,632.2	43,601.3	57,961.5	78,023.6
Index (1960=100)	100	157	213	284	379	504	678
New England Value Added Projections							
(1) N.E.=74.3+0.10562(U.S.)	1,214.5	1,985.3	2,667.0	3,520.9	4,679.4	6,196.2	8,315.2
Index (1960=100)	100	163	220	290	385	510	685
(2) N.E.=-93.10+0.13885(U.S.)-25.53(t)	1,214.5	1,806.4	2,447.3	3,314.6	4,582.3	6,321.0	8,851.3
Index (1960=100)	100	149	202	273	377	520	729
(3) SUM of 3-digit projections	1,214.5	1,752.0	2,205.8	2,734.2	3,385.3	4,159.0	5,150.5
Index (1960=100)	100	144	182	225	279	342	424

* For all details, refer to accompanying text.

17. NATIONAL VALUE ADDED PROJECTIONS:

a. Regression Analysis - The regression equations used in making 3-digit and 2-digit industry value added projections for the United States are presented in Table C-12. Value added series for each industry were plotted against a number of explanatory variables to determine which of these is most closely correlated to the particular industry series. Each industry was then regressed on the finally selected explanatory or independent variable. Two types of equations were fitted: (1) a simple linear regression equation of the form $Y=a+bX$, and (2) a multiple regression equation of the form $Y=a+b_1X_1+b_2X_2$, where X_2 usually represents "time" as an additional explanatory variable.

In some cases several explanatory variables were tried alternatively until an acceptable fit was achieved. In a few instances where the possibility of a non-linear relationship appeared, semi- or double logarithmic function was tried. In general, however, the best marriage of statistical significance and economic plausibility was obtained from a simple linear relationship.

To derive projections for each decade, projected values of the explanatory variables were substituted into the equations. Thus, two sets of 2-digit value added projections were obtained from the first two equations in Table C-12. The other equations provided projections for the 3-digit industries, which, when summed, each decade, provided a third set of national 2-digit value added projections.

The derivation of the historical data used in the regression analyses, as well as the derivation of the projected values of the explanatory variables, are explained below in detail.

b. Value Added Data Selection and Adjustment

(1) Basic value added data at 4-digit industry detail were obtained from the 1947,1954,1958 Census of Manufactures and from the Annual Survey of Manufactures, for the period 1947-1961.*

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* In some cases, data were available only up to 1960.

(2) The 4-digit value added series were then adjusted for standard industrial classification changes that occurred in 1958, by using the adjustment factors given in Supplementary Table 27 (refer to end of this section). This adjustment table was derived from Appendix C of the 1958 Census of Manufactures and served as a "bridge" between the pre-1958 industrial classification system and the "new" classification system used since 1958. The objective of the adjustment of all pre-1958 value added series was to develop value added series for years before and after 1958 that would be homogeneous and consistent in terms of industrial classification.

(3) Value added series adjusted for SIC changes were then aggregated into 3-digit series, which in turn were deflated by using appropriate price indexes shown in Supplementary Tables 28 and 29.

c. Explanatory Variables: Data Selection and Adjustment - The 2-digit and 3-digit U.S. value added series measured in constant 1954 dollars constitute the dependent variables. In order to obtain a set of independent or explanatory variables to which the dependent variables could be related through least-squares regression, we experimented with as many independent variables as possible for each 3-digit value added series and for the 2-digit value added series, before making a final selection of a set of explanatory variables.

The explanatory variables were drawn from expenditure components of the gross national product (e.g., personal consumption expenditures on nondurable goods), the Federal Reserve Board index of industrial production and other variables. The GNP components and the FRB index are discussed in Appendix B.

TABLE C-12

U.S. VALUE ADDED PROJECTIONS, MACHINERY EXCEPT ELECTRICAL (SIC 35)
REGRESSION EQUATIONS

SIC	Industry Title	Regression Equations*	R^2	Percent Level of Significance** (.01=1%)
35	Machinery, except Electrical	$Y_1 = 1960.00+226.54X$ (917.0) (22.27)	.946	Less than .01
		$Y_2 = 2647.00+171.06X+197.50t$ (21.99) (37.40)	.960	" " "
		where: Y = Value Added in millions of 1954 dollars; X = Total Durables less household durables in billions of 1954 dollars; t = time (1947=1,..., 2010 = 64)		
351	Engines & Turbines	$Y = -2298.7+1563.5 \log X$ (491.8) (252.9)	.870	" " "
		where: Y = Value Added in millions of 1954 dollars; X = FRB industrial production index		
353	Construction, Mining, etc., Machinery	$Y = 787.7+25.804X$ (151.3)(11.84)	488	" " "
		where: Y = Value Added in millions of 1954 dollars; X = GNP Construction Component in billions of 1954 dollars		

* Variations in the number of significant digits in the equations arise from the fact that for purposes of convenience in presentation, value added is expressed in millions of dollars while GNP components are expressed in billions of dollars. In our regression analysis, however, these variables were expressed in different units (i.e., tens or hundreds of millions or billions) in order to minimize errors that might otherwise have been introduced by rounding. Estimated variance of the regression coefficients "a" and "b" is given underneath these coefficients in each equation.

**"Percent level of significance" states the probability that such a correlation would arise, by random sampling, from an uncorrelated population. In other words, a 1% level of significance for R (coefficient of correlation) may be interpreted as meaning that there is only one chance in a hundred of getting a value of R as high as that recorded when in fact the variables have zero correlation.

TABLE C-12 (continued)

SIC	Industry Title	Regression Equations*	R^2	Percent Level of Significance
354	Metalworking Machinery	Y = -3.9269+6.5131 log X (1.8423)(1.9956) where: Y = Value added in billions of 1954 dollars X = Value added in SIC 34 (Fabricated Metal Products) in billions of 1954 dollars	.446	Less than .01
355	Special Industry Machinery	Y = -5.7506+3.0310 log X (1.8088)(0.7723) where: Y = Value added in billions of 1954 dollars X = Producers' Durable Equipment (GNP Component) in billions of 1954 dollars	.507	" " .02
356	General Industry Machinery	Y = 675.0+2.571 X (179.0)(0.465) where: Y = Value added in millions of 1954 dollars X = Gross National Product (GNP) in billions of 1954 dollars	.711	" " .01
357	Office, Computing Machinery	Y = -3.4849+2.0250 log X (0.6160)(0.2938) where: Y = Value added in billions of 1954 dollars X = GNP Services component in billions of 1954 dollars	.795	" " .01
358	Service Industry Machinery	Y = -252.0+59.652 X (534.5)(24.279) where: Y = Value Added in millions of 1954 dollars X = Producers' Durables - GNP Component in billions of 1954 dollars	.544	" " .01
359	Miscellaneous Machinery	Y = -672.1+15.210 X (116.0)(13.02) where: Y = Value Added in Millions of 1954 dollars X = FRB industrial production index	.958	" " .01

18. NEW ENGLAND VALUE ADDED PROJECTIONS:

Three sets of 2-digit value added projections were made for New England. The first two were obtained by relating New England's value added to U.S. value added through least squares regression, using 2-digit value added series in constant 1954 dollars derived for the period 1947-1962.* These two sets of projections were used as checks on the third set of 2-digit projections obtained by summing for each decade New England's estimated value added levels in each 3-digit industry.

The first two sets of 2-digit projections were derived from the following regression equations:

$$(1) \quad \text{New England} = \underset{(201.5)}{74.3} + \underset{(0.01789)}{0.10562} \text{ (U.S.)}$$

$$(2) \quad \text{New England} = -93.10 + \underset{(0.00995)}{0.13885} \text{ (U.S.)} - \underset{(4.00)}{25.53} \text{ (t)}$$

where:

New England = New England 2-digit value added series in millions of constant 1954 dollars

U. S. = U.S. 2-digit value added series in millions of constant 1954 dollars

t = time (1947=1,...,2020=74)

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* 4-digit value added data were available for New England for only 1947, 1954, and 1958. The 1947 and 1954 data were adjusted for SIC changes by using the adjustment factors presented in Supplementary Table 27. The data for the intervening years were adjusted at the 2-digit level only. We found the adjusted 1954 data at the 2-digit level as a percent of the unadjusted data, and used this proportionality factor (92.9 percent) in adjusting the data for the intervening years. Meanwhile, the value added data for 1958 were in certain cases adjusted for coverage deficiencies. After this, the 3-digit value added totals were updated to 1959 and 1960, since data for these years are lacking for certain 3-digit industries.

These value added series were then deflated by using the derived 2-digit industry price index presented in Supplementary Table 28.

The third set of 2-digit value added projections were made by first projecting New England's percent shares of national value added levels via least squares regression (i.e., New England's percent share of U.S. value added in a 3-digit industry = a + b log t), and then applying them to the already projected U.S. 3-digit value added levels. New England's percent shares were projected through the following regression equations:

SIC 351:	$Y = 1.0902 - 0.0074$	$\log t$
SIC 352:	$Y = 0.6758 - 0.3651$	$\log t$
SIC 353:	$Y = 1.3650 + 0.0577$	$\log t$
SIC 354:	$Y = 1.4441 - 0.1265$	$\log t$
SIC 356:	$Y = 1.4756 - 0.0519$	$\log t$
SIC 357:	$Y = 1.9782 - 0.5563$	$\log t$
SIC 358:	$Y = 1.0140 - 0.2614$	$\log t$
SIC 359:	$Y = 1.3108 - 0.5775$	$\log t$

where:

Y = New England's percent share of national value added in the same 3-digit industry

t = time (1947=1,...,2020=74)

In the case of SIC 355 we assumed that the percentage decline in New England's share of national value added during the 1947-1960 period, converted into a ten-year equivalent, will prevail during the 1960-1970 period. Thereafter, New England's share will fall at a dampened rate, such that the percent change in the share will fall by one-half each decade.

SUPPLEMENTARY TABLE 27

ADJUSTMENTS MADE IN PRE-1958 VALUE ADDED SERIES TO ACCOUNT FOR THE 1958 INDUSTRIAL CLASSIFICATION CHANGES (SIC 35)

SIC	Add	Deduct
351	-	
352	4.50% of 3563	52.39% of 3521
353	52.36% of 3521 88.57% of 3563 99.68% of 3565 100.00% of 3562	
354	3.17% of 3599 60.16% of 3594 15.61% of 3589	1.63% of 3544 2.79% of 3541
355	4.68% of 3567	2.08% of 3559
356	100.00% of 3593 39.58% of 3594	17.58% of 3566 100.00% of 3563 100.00% of 3562 100.00% of 3565 4.68% of 3567 1.88% of 3561 19.29% of 3569
357	-	100.00% of 3575 23.55% of 3579 2.14% of 3571 5.54% of 3576
358	15.32% of 3579 100.00% of 3997 4.12% of 3439 3.79% of 3621	56.21% of 3589 41.20% of 3585 95.24% of 3584
359	-	100.00% of 3591 100.00% of 3592 100.00% of 3593 6.41% of 3599 100.00% of 3594

NOTE: All 4-digit SIC's shown above refer to the "old" SIC's (i.e., pre-1958).

Source: U.S. Bureau of the Census, 1958 Census of Manufactures, Appendix C.

SUPPLEMENTARY TABLE 28

DERIVED PRICE INDEX FOR THE MACHINERY (EXCEPT ELECTRICAL) INDUSTRY (SIC 35)

Years	Derived Sales Index (1954 = 100)	Derived Production Index (1954 = 100)	SIC 35 Price Index (1954 = 100)	Price Index for Agricultural Machinery and Equipment (SIC 352) (1954 = 100)
(1)	(2)	(3)	(4)	(5)
1947	61	86	71	73.9
1948	70	86	81	83.0
1949	63	73	86	88.6
1950	73	83	88	90.6
1951	96	105	91	98.3
1952	104	114	91	99.5
1953	110	117	94	100.1
1954	100	100	100	100.0
1955	108	108	100	100.8
1956	127	120	106	104.4
1957	133	116	115	109.3
1958	118	97	122	113.8
1959	144	115	125	117.3
1960	149	119	125	119.6

NOTES:

Column 2: Monthly average sales of manufacturers in the non-electrical machinery industry converted into index form. Derived from United States Department of Commerce, Business Statistics-1961 Edition, p.21. The monthly series multiplied by 12, yield average annual sales. Dividing this series by the 1954 average yearly sales yields the sales index.

Column 3: Federal Reserve Board monthly production indexes can be obtained from the source cited for column 2, p. 14. The series were converted into a 1954 base (1954 = 100.0).

Column 4: Obtained by dividing column 2 by column 3.

Column 5: Ibid., p. 39. This series was used to deflate the SIC 352 (Agricultural Machinery and Equipment) value added data.

SUPPLEMENTARY TABLE 29

PRICE INDEXES USED TO DEFLATE SELECTED 3-DIGIT VALUE ADDED SERIES, MACHINERY EXCEPT ELECTRICAL (SIC 35)*

(1954 = 100.0)

Years	SIC 354	SIC 355	SIC 356	SIC 357
1947	70.3	71.6	72.4	87.2
1949	79.3	85.7	83.2	89.9
1950	84.1	88.7	86.2	91.0
1951	94.5	91.9	96.4	96.9
1952	96.4	91.4	95.6	96.6
1953	98.5	93.6	97.9	98.7
1954	100.0	100.0	100.0	100.0
1955	107.0	100.7	104.5	102.7
1956	117.4	105.9	115.2	106.3
1957	125.4	114.6	123.0	110.9
1958	127.8	123.6	124.9	112.7
1959	131.0	124.7	129.0	114.0
1960	135.1	125.7	130.2	114.7
1961	137.0	133.0	129.2	115.3
1962	140.0	129.1	129.8	115.5

* U.S. Bureau of Labor Statistics wholesale commodity price indexes were shifted from a base of 1957-1959=100.0 to 1954=100.0, and then used as shown above to deflate the 3-digit value added series for SIC 354,355,356, and 357. The BLS wholesale price indexes used in each case is given below:

SIC	BLS Wholesale Price Index Code	
354	11-3:	Metalworking Machinery and Equipment
355	11-5:	Miscellaneous Machinery
356	11-4:	General Purpose Machinery and Equipment
357	11-53:	Office and Store Machines and Equipment

SOURCES:

(1) For years 1947-1959: U.S. Bureau of Labor Statistics, Wholesale Price Index (March, 1962).

(2) For years 1960-1962: U.S. Bureau of Labor Statistics, 1962 Statistical Supplement - Monthly Labor Review, p.79.

SUPPLEMENTARY TABLE 30
U.S. VALUE ADDED SERIES, MACHINERY EXCEPT ELECTRICAL (SIC 35)*
(in millions of 1954 dollars)

Years	SIC 35	351	352	353	354	355	356	357	358	359
1947	9,743.2	542.2	825.9	1,538.4	1,695.0	1,465.4	1,511.2	535.2	1,100.2	382.0
1949	7,944.6	534.9	893.1	1,230.5	1,266.9	1,210.9	1,265.2	484.9	921.0	259.2
1950	8,587.2	536.7	902.7	1,299.1	1,494.9	1,233.5	1,313.5	554.8	1,063.7	323.8
1951	10,928.1	641.8	1,028.1	1,804.4	2,003.0	1,484.5	1,570.3	602.1	1,044.3	525.5
1952	12,589.9	814.2	1,078.8	2,066.1	2,644.6	1,471.4	1,720.4	640.7	1,182.4	666.2
1953	12,658.6	826.0	975.9	2,064.9	2,749.2	1,370.1	1,726.1	695.4	1,233.5	785.4
1954	10,918.7	690.1	792.7	1,650.7	2,445.4	1,618.7	1,659.8	718.7	1,105.6	685.4
1955	12,182.2	751.3	916.4	2,067.7	2,287.1	1,329.9	1,779.5	757.7	1,251.3	771.3
1956	13,452.7	787.1	897.9	2,389.1	2,623.6	1,514.9	1,811.7	866.9	1,266.1	854.7
1957	12,314.7	834.3	829.4	2,134.9	2,296.6	1,344.6	1,712.1	1,004.6	1,077.6	794.3
1958	10,156.7	875.4	891.7	1,684.3	1,610.4	1,083.8	1,549.4	861.2	752.6	786.1
1959	11,635.5	900.5	937.8	1,924.3	1,900.7	1,269.9	1,828.7	1,010.8	880.6	924.5
1960	11,501.5	799.7	752.8	1,730.0	1,989.3	1,402.1	1,755.7	1,128.9	874.4	920.7
1961					1,835.6	1,324.2	1,707.0	1,202.5		
1962					2,170.0	1,493.7	1,879.8	1,331.3		

* Sum of 3-digit value added totals for any one year may not add up to the 2-digit value added total, since different price indexes were used in deflating the 2-digit and 3-digit value added series.

SUPPLEMENTARY TABLE 31

U.S. VALUE ADDED SERIES, MACHINERY EXCEPT ELECTRICAL (SIC 35)*

(in millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
(1) SIC 35 (Y = 1960.00+226.54X)	11,501.5	19,857	29,032	41,423	58,391	82,586	117,926
(2) SIC 35 (Y = 2647.00+171.06X+197.50t)	11,501.5	20,901	29,804	41,136	55,923	76,167	104,828
(3) SUM of 3-digit projections	11,501.5*	18,093.0	24,546.8	32,632.2	43,601.3	57,961.5	78,023.6
SIC 351	799.7	1,160.1	1,431.2	1,688.5	1,949.0	2,195.6	2,446.5
SIC 352	752.8	1,681.1	2,413.4	3,377.2	4,743.2	6,580.9	9,218.2
SIC 353	1,730.0	2,627.5	3,463.6	4,596.4	6,232.3	8,510.8	11,811.2
SIC 354	2,150.1	3,057.1	3,829.6	4,628.1	5,484.5	6,346.9	7,252.2
SIC 355	1,409.9	2,089.4	2,579.2	3,045.4	3,516.1	3,975.9	4,443.9
SIC 356	1,828.1	2,327.0	3,076.0	4,094.0	5,563.0	7,606.0	10,570.0
SIC 357	1,035.8	1,293.1	1,641.4	1,966.9	2,306.6	2,625.5	2,944.5
SIC 358	874.4	2,050.6	3,088.5	4,508.2	6,554.3	9,399.7	13,521.6
SIC 359	920.7	1,807.1	3,023.9	4,727.5	7,252.3	10,720.2	15,815.5

* Parts may not add up to total due to rounding

SUPPLEMENTARY TABLE 32

NEW ENGLAND VALUE ADDED SERIES, MACHINERY EXCEPT ELECTRICAL (SIC 35)
(millions of 1954 dollars)

Years	Value Added	New England as Percent of U.S.
1947	1,199.2	12.3
1949	883.2	11.1
1950	1,022.7	11.9
1951	1,313.2	12.0
1952	1,551.7	12.3
1953	1,530.0	12.1
1954	1,200.8	11.0
1955	1,295.1	10.6
1956	1,454.2	10.8
1957	1,321.8	10.7
1958	1,005.6	9.9
1959	1,184.7	10.2
1960	1,214.5	10.6

G. ELECTRICAL MACHINERY (SIC 36)

19. SUMMARY OF METHODOLOGY AND PROJECTIONS

To take account of compositional differences between the regional and national electrical machinery industry, the output of each 3-digit component was projected separately at the U.S. level. The sum of these 3-digit projections was then checked in each benchmark year against independent 2-digit output projections. Both the 3-digit and 2-digit national projections were derived from regression equations using components of the gross national product, Federal Reserve Board Index of industrial production or other economic series as independent variables. Subsequently, New England's output in each 3-digit component was projected by first estimating the region's share of national 3-digit output levels through least squares regression, and then multiplying these projected shares by the U.S. 3-digit output levels. The sum of all 3-digit output levels thus derived for New England was checked in each benchmark year against two separate 2-digit New England output projections obtained by relating New England's 2-digit output series to the national 2-digit output series through least squares regression equations one of which included "time" as an additional explanatory variable. In almost all cases, national 2-digit output projections obtained by summing the separate 3-digit projections were accepted as out final output projections for the industry as a whole. Likewise, at the regional level, the sum of the separate 3-digit output projections comprised out final regional output projections for the industry.

The electrical machinery industry is expected to grow nationally and in New England at a rate faster than the rest of the economy. Nationally, the industry's output is expected to increase by 11.74-fold during the 1960-2020 projection horizon. In New England, the industry is expected to grow even slightly faster (refer to Table C-13).

TABLE C-13

SUMMARY OF U.S. AND NEW ENGLAND VALUE ADDED PROJECTIONS -- ELECTRICAL MACHINERY (SIC 36)

(millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
U.S. Value Added Projections (sum of 3-digit projections)	11,336.7	18,012.8	28,215.0	42,354.7	62,946.9	91,295.0	133,085.0
Index (1960=100)	100	159	249	374	555	805	1,174
New England Value Added Projections							
(1) N.E.=102.9+0.0979(U.S.)	1,177.3	1,865.5	2,863.7	4,247.3	6,262.3	9,036.1	13,125.3
Index (1960=100)	100	158	243	361	532	768	1,115
(2) N.E.=72.1 + 0.1139 (U.S) -12.16(t)	1,177.3	1,832.0	2,872.4	4,361.3	6,585.2	9,692.4	14,330.6
Index (1960=100)	100	156	244	370	559	823	1,217
(3) Sum of 3-digit projections	1,177.3	1,882.9	3,007.7	4,581.0	6,895.3	10,098.4	14,835.7
Index (1960=100)	100	160	255	389	586	858	1,260

20. NATIONAL VALUE ADDED PROJECTIONS

a. Regression Analysis. - The regression equations used in making 3-digit and 2-digit industry value added projections for the United States are presented in Table C-14. Value added series for each industry were plotted against a number of explanatory variables to determine which of these is most closely correlated to the particular industry series. Each industry was then regressed on the finally selected explanatory or independent variables. Two types of equations were fitted: (1) a simple linear regression equation of the form $Y = a + bX$, and (2) a multiple regression equation of the form $Y = a + b_1X_1 + b_2X_2$, where X_2 usually represents "time" as an additional explanatory variable.

In some cases several explanatory variables were tried alternatively until an acceptable fit was achieved. In a few instances where the possibility of a nonlinear relationship appeared, semi- or double logarithmic function was tried. In general, however, the best marriage of statistical significance and economic plausibility was obtained from a simple linear relationship.

To derive projections for each decade, projected values of the explanatory variables were substituted into the equations. Thus, two sets of 2-digit value added projections were obtained from the first two equations in Table C-14. The other equations provided projections for the 3-digit industries, which, when summed, each decade, provided a third set of national 2-digit value added projections.

The derivation of the historical data used in the regression analyses, as well as the derivation of the projected values of the explanatory variables, are explained below in detail.

TABLE C-14

U.S. VALUE ADDED PROJECTIONS, ELECTRICAL MACHINERY (SIC 36) REGRESSION EQUATIONS

SIC	INDUSTRY TITLE	REGRESSION EQUATIONS*	R^2	Percent level** of Significance(.01=1%)
36	Electrical Machinery	Y=-2468.0 + 124.36X (656.0) (7.42)	.98	.01
		Y=-1589.0 + 109.38X + 55.6t (24.51) (86.6)	.98	.01
		where: Y=Value Added in millions of 1954 dollars X=FRB index of industrial production t=Time (1947=1,..., 2010=64)		
361	Electric Distribution Products	Y=-237.6 + 14.847X (138.9) (1.555)	.88	.01
		where: Y=Value added in millions of 1954 dollars X=FRB index of industrial production		
362	Electric Industrial Apparatus	Y=142.7 + 15.589X (183.0) (2.437)	.78	.01
		where: Y=Value Added in millions of 1954 dollars X=Total Durable Goods (GNP Component) in billions of 1954 dollars		
363	Household Appliances	Y=-45.8 + 44.144 X (157.8) (4.605)	.88	.01
		where: Y=Value Added in millions of 1954 dollars X=Consumer Durables (GNP Component) in billions of 1954 dollars		
364	Lighting and Wiring Devices	Y= 9.4 + 12.725 X (122.5)(1.631)	.83	.01
		where: Y=Value added in millions of 1954 dollars X=Total Durable Goods (GNP Component) in billions of 1954 dollars		
365	Radio and TV Receiving Equipment	Y=-666.7 + 13.632X (125.3) (1.411)	.89	.01
		where: Y=Value Added in millions of 1954 dollars X=FRB index of industrial production		

TABLE C-14 (cont'd)

SIC	INDUSTRY TITLE	REGRESSION EQUATIONS*	R^2	Percent Level of Significance (.01=1%)**
366	Communications Equipment	Y =-851.9 + 26.804X (267.2) (2.997) where: Y=Value Added in millions of 1954 dollars X=FRB index of industrial production	.87	.01
367 369	Electrical Components Electrical Products, n.e.c.	Y =-955.0 +29.537X (310.0) (3.479) where: Y=Combined Value Added in millions of 1954 dollars X=FRB Index of industrial production	.86	.01

* Variations in the number of significant digits in the equations arise from the fact that for purposes of convenience in presentation, value added is expressed in millions of dollars while GNP components are expressed in billions of dollars. In our regression analysis, however, these variables were expressed in different units (i.e., tens or hundreds of millions or billions) in order to minimize errors that might otherwise have been introduced by rounding. Estimated variance of the regression coefficients "a" and "b" is given underneath these coefficients in each equation.

** "Percent Level of Significance" states the probability that such a correlation would arise, by random sampling, from an uncorrelated population. In other words, a 1% level of significance for R (coefficient of correlation) may be interpreted as meaning that there is only one chance in a hundred of getting a value of R as high as that recorded when in fact the variables have zero correlation.

b. Value Added Data Selection and Adjustment

(1) Basic value added data at 4-digit industry detail were obtained from the 1947, 1954, 1958 Census of Manufactures and from the Annual Survey of Manufactures, for the period 1947-1961.*

(2) The 4-digit value added series were then adjusted for standard industrial classification changes that occurred in 1958, by using the adjustment factors given in Supplementary Table 33 (refer to end of this section). This adjustment table was derived from Appendix C of the 1958 Census of Manufactures and serves as a "bridge" between the pre-1958 industrial classification system and the "new" classification system used since 1958. The objective of the adjustment of all pre-1958 value added series was to develop value added series for years before and after 1958 that would be homogeneous and consistent in terms of industrial classification.

(3) Value added series adjusted for SIC changes were then aggregated into 3-digit series, which in turn were deflated by using appropriate wholesale price indexes selectively developed from U.S. Bureau of Labor Statistics publication of wholesale price indexes (refer to Supplementary Table 34).

U.S. 2-digit value added series, measured in constant 1954 dollars, were then obtained by summing the 3-digit deflated value added series. Following this, a derived 2-digit price index was found by dividing the 2-digit U.S. value added series (adjusted for SIC changes) by the deflated 2-digit value added series.

c. Explanatory Variables: Data Selection and Adjustment - The 2-digit and 3-digit U.S. value added series measured in constant

* In some cases, data were available only up to 1960.

1954 dollars constitute the dependent variables. In order to obtain a set of independent or explanatory variables to which the dependent variables could be related through least-squares regression, we experimented with as many independent variables as possible for each 3-digit value added series and for the 2-digit value added series, before making a final selection of a set of explanatory variables.

The explanatory variables were drawn from expenditure components of the gross national product (e.g., personal consumption expenditures on nondurable goods), the Federal Reserve Board index of industrial production, and other variables. The GNP components and the FRB index are discussed in Appendix B.

21. NEW ENGLAND VALUE ADDED PROJECTIONS

Three sets of 2-digit value added projections were made for New England. The first two were obtained by relating New England's value added to U.S. value added through least squares regression, using 2-digit value added series in constant 1954 dollars derived for the period 1947-1962.* These two sets of projections were used as checks on the third set of 2-digit projections obtained by summing for each decade New England's estimated value added levels in each 3-digit industry.

The first two sets of 2-digit projections were derived from the following regression equations:

$$(1)\quad \text{New England} = \underset{(45.8)}{102.9} + \underset{(0.0055)}{0.0979}\,(\text{U.S.}) \qquad R^2 = .96$$

$$(2)\quad \text{New England} = 72.1 + \underset{(0.0257)}{0.1139}\,(\text{U.S.}) - \underset{(19.03)}{12.16}(t) \qquad R^2 = .96$$

where:

New England = New England 2-digit value added series in millions of constant 1954 dollars

U.S. = U.S. 2-digit value added series in millions of constant 1954 dollars.

t = time (1947 = 1, . . . , 2020 = 74)

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*4-digit value added data were available for New England for only 1947, 1954, and 1958. The 1947 and 1954 data were adjusted for SIC changes by using the adjustment factors presented in Supplementary Table 33. The data for the intervening years were adjusted at the 2-digit level only. We found the adjusted 1947 and 1954 data at the 2-digit level as a percent of the unadjusted data, and interpolated to get adjustment factors at the 2-digit level for the intervening years. Meanwhile, the value added data for 1958 were in certain cases adjusted for coverage deficiencies. Adjusted value added series were then deflated by using the appropriate price indexes presented in Supplementary Table 34. In deflating the 2-digit series, a derived 2-digit implicit price index was used.

The third set of 2-digit value added projections were made by first projecting New England's percent shares of national value added levels via least squares regression (i.e., New England's percent share of U.S. value added in a 3-digit industry = a + b log t), and then applying them to the already projected U.S. 3-digit value added levels. New England's percent shares were projected through the following regression equations:

SIC 361	$y = 18.455 - 3.396 \log t$
SIC 322	$y = -1.3303 + 4.359 \log t$
SIC 363	$y = 11.1217 - 3.673 \log t$
SIC 364	$y = 11.974 + 2.585 \log t$
SIC 365	$y = 7.8456 - 2.332 \log t$
SIC 366	$y = 6.4946 + 4.422 \log t$
SIC 367 & 369	$y = 9.1200 + 2.977 \log t$

where:

y = New England value added/U.S. value added, expressed as a percent

t = time (1947 = 1)

SUPPLEMENTARY TABLE 33

ELECTRICAL MACHINERY INDUSTRY (SIC 36) ADJUSTMENTS IN VALUE ADDED FOR SIC RECLASSIFICATION

	New SIC	Composed of Old SIC	% of New in Old
361	3611	3613	99.78
	3612	3615	99.76
	3613	3616	66.31
362	3621	3614	100.00
	3622	3616	33.68
	3623	3617	100.00
	3624	3612	100.00
	3629	3619	88.77
363	3631	3439	17.02
		3621	17.06
	3632	3585	41.20
	3633	3581	99.88
	3634	3621	71.92
	3635	3584	94.21
	3636	3583	100.00
	3639	3439	12.57
		3589	40.10
		3621	2.47
364	3641	3651	100.00
	3642	3471	99.66
	3643	3611	54.64
		3661	1.34
	3644	3611	45.24
365	3651	3661	22.91
	3652	3663	100.00
366	3661	3664	99.86
	3662	3661	46.28
		3669	97.56
367	3671	3662	38.58
	3672	3662	9.10
	3673	3662	22.38
	3679	3661	27.76
		3662	29.83
369	3691	3691	100.00
	3692	3692	100.00
	3693	3693	100.00
	3694	3641	99.95
	3699	3699	73.39
		3669	2.42

Source: U.S. Bureau of the Cenus, 1958 Census of Manufactures, Appendix C.

SUPPLEMENTARY TABLE 34

U.S. BUREAU OF LABOR STATISTICS WHOLESALE PRICE INDEXES USED TO DEFLATE ELECTRICAL MACHINERY INDUSTRY VALUE ADDED

	Electrical Machinery & Equipment BLS Code 11-7	Household Appliances 12-4	TV, Radio Receivers & Phonographs 12-5
1947	76.2	88.6	99.6
1948	79.8	92.9	103.6
1949	81.8	92.3	107.2
1950	84.4	93.0	100.2
1951	96.6	98.5	96.1
1952	95.3	98.0	96.0
1953	98.0	98.9	99.0
1954	100.0	100.0	100.0
1955	101.6	97.5	96.2
1956	109.6	96.2	96.3
1957	118.1	96.2	97.7
1958	120.6	95.6	97.6
1959	122.4	95.5	96.0
1960	121.9	92.9	94.5

This Index was used to deflate SIC's	This Index was used to deflate SIC 363	This Index was used to deflate SIC 365
36		
361		
362		
364		
366		
367		
369		

(2) The 4-digit value added series were then adjusted for standard industrial classification changes that occurred in 1958, by using the adjustment factors given in Supplementary Table 40 (refer to end of this section). This adjustment table was derived from Appendix C of the 1958 Census of Manufactures and serves as a "bridge" between the pre-1958 industrial classification system and the "new" classification system used since 1958. The objective of the adjustment of all pre-1958 value added series was to develop value added series for years before and after 1958 that would be homogeneous and consistent in terms of industrial classification.

(3) Value added series adjusted for SIC changes were then aggregated into 3-digit series, which in turn were deflated by using appropriate wholesale price indexes selectively developed from U.S. Bureau of Labor Statistics publication of wholesale price indexes (refer to Supplementary Table 41).

SUPPLEMENTARY TABLE 36

U.S. VALUE ADDED PROJECTIONS, ELECTRICAL MACHINERY (SIC 36)

(millions of 1954 dollars)

Regression Equations*	1960 Actual	1970	1980	1990	2000	2010	2020
(1) SIC 36 (Y=-2468.0+124.36X)	11,336.7	17,803	27,751	41,680	62,324	90,678	132,338
(2) SIC 36 (Y=-1589.0+109.38X +55.6t)	11,336.7	17,571	26,875	39,680	58,390	83,880	121,071
(3) SUM of 3-digit projections	11,336.7	18,012.8	28,215.0	42,354.7	62,946.9	91,295.0	133,085.0
SIC 361	1,296.2	2,182.5	3,370.2	5,033.1	7,497.7	10,882.8	15,856.5
SIC 362	1,437.9	2,385.2	3,519.1	5,057.4	7,198.4	10,191.0	14,609.3
SIC 363	1,799.2	2,704.4	4,077.2	5,944.5	8,597.6	12,213.0	17,625.0
SIC 364	1,176.1	1,808.7	2,718.6	3,952.9	5,670.8	8,072.0	11,617.1
SIC 365	840.2	1,555.3	2,645.9	4,172.7	6,435.6	9,543.7	14,110.4
SIC 366	2,308.3	3,517.2	5,661.5	8,663.5	13,113.0	19,224.3	28,203.6
SIC 367, 369	2,478.8	3,859.5	6,222.5	9,530.6	14,433.8	21,168.2	31,063.1

* For the explanation of these and other regression equations, refer to Table C-14.

SUPPLEMENTARY TABLE 37

NEW ENGLAND AND U.S. COMPARATIVE VALUE ADDED SERIES, ELECTRICAL MACHINERY (SIC 36)*

(millions of current dollars)

	U.S. SIC 36*	N.E. SIC 36*	N.E. as % of U.S.
1947	$3,860.2	451.3	11.69
1949	3,901.7	433.2	11.10
1950	4,815.4	519.7	10.79
1951	5,753.2	728.1	12.66
1952	6,873.2	831.3	12.09
1953	7,876.2	933.0	11.85
1954	7,403.1	885.5	11.96
1955	7,739.6	858.1	11.09
1956	9,112.0	1,023.5	11.23
1957	9,620.4	1,032.1	10.73
1958	10,395.4	1,005.9	9.68
1959	12,533.9	1,316.9	10.51
1960	13,068.7	1,392.7	10.66

* Unadjusted for SIC changes since New England value added series could not be adjusted for certain years.

SUPPLEMENTARY TABLE 38

NEW ENGLAND VALUE ADDED SERIES, ELECTRICAL MACHINERY, (SIC 36)

(millions of 1954 dollars)

Year	SIC 36	361	362	363	364	365	366	367 & 369
1947	614.4	128.4*	91.1	119.3*	96.7*	18.1*	69.6*	91.3*
1954	911.9	187.3*	108.9	139.3*	106.9	51.8	145.1	172.6*
1958	861.5	159.4	40.8	99.1	140.4	35.9	163.3	222.5
1959	1,106.3	174.3	52.3	105.6	178.4	33.4**	263.6	298.8
1960	1,177.3	188.9	47.5	113.2	187.5	35.6**	281.0	323.6

*partially derived

** derived

Usually the unreported 4-digit or 3-digit data were derived by distributing the unaccounted 3-digit or 2-digit excess in the same proportion as the nearest known year.

SUPPLEMENTARY TABLE 39

NEW ENGLAND VALUE ADDED PROJECTIONS, ELECTRICAL MACHINERY, (SIC 36)*

(millions of 1954 dollars)

SIC	1970	1980	1990	2000	2010	2020
361	300.5	446.6	647.8	942.5	1,340.8	1,920.2
362	111.9	188.3	294.8	447.7	666.5	996.4
363	163.6	224.2	302.6	409.2	548.4	750.8
364	281.1	433.1	641.2	932.8	1,343.2	1,952.8
365	72.0	113.0	167.3	245.2	346.4	492.5
366	443.2	751.3	1,192.1	1,856.8	2,783.7	4,162.9
367 + 369	510.6	851.2	1,335.2	2,061.1	3,069.4	4,560.1
Total 36 in New England	1,882.8	3,007.7	4,581.0	6,895.3	10,098.4	14,835.7

* for all details, see the accompanying text.

H. PRIMARY METALS INDUSTRIES (SIC 33)

22. SUMMARY OF METHODOLOGY AND PROJECTIONS

New England value added projections were made for the primary metals industries by summing for each decade the separate 3-digit value added projections, which were obtained by first projecting New England's percent shares of 3-digit national value added totals and then applying these share projections to the already projected national 3-digit value added levels. National value added projections, meanwhile, were derived by relating each 3-digit industry's value added series to components of the gross national product through least squares regression.

We decided to make value added projections only for those 3-digit industries which were regionally important and which, together, comprised over 85 percent of the industry's total regional value added. Thus, we refrained from projecting New England's total value added in the primary metals industry by relating it to national 2-digit value added, since this procedure would have completely ignored the compositional differences between the regional and the national industry. By the same token, we are equally justified in focusing our attention on only the four major regional 3-digit industries, since the others are either declining or are individually negligible. This leads us to believe that during the projection period, their combined share of the region's total value added in the primary metals industries will continue to diminish.

In general, the primary metals industry will nationally grow at a much slower pace than the rest of the economy, increasing its value added by only 2.5-fold between 1960 and 2020. This, we believe, is primarily due to anticipated continual relative decline in the steel input requirements of the durable goods industries.

New England is projected to continue its relative decline, dropping its share of national value added in the primary metals industries (SIC 331, 332, 335, and 339) from 4.9 percent in 1960 to 3.9 percent in 2020. This will mean a doubling in the region's value added total between 1960 and 2020 (refer to Table C-15).

TABLE C-15

SUMMARY OF UNITED STATES AND NEW ENGLAND VALUE ADDED PROJECTIONS, PRIMARY METALS INDUSTRIES (SIC 33)

(in millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
U.S. Value Added Projections (Sum of projections for SIC 331, 332, 335 and 339)	9,303.2*	12,492.6	14,867.3	17,057.4	19,168.5	21,232.2	23,358.4
Index (1960 = 100)	100	134	160	183	206	228	251
New England Value Added Projections (Sum of Projections for SIC 331, 332, 335 and 339)	453.6**	548.9	613.6	681.6	753.6	828.2	907.9
Index (1960 = 100)	100	121	135	150	166	183	200
New England as Percent of U.S. (SIC 331, 332, 335 and 339)	4.88	4.39	4.13	4.00	3.93	3.90	3.89

* This is equal to 86.07 percent of the 2-digit value added total in 1960, after adjustments for price changes.

** This is equal to 91.87 percent of the 2-digit value added total, before adjustments for price changes.

23. NATIONAL VALUE ADDED PROJECTIONS

National value added for the primary metals industries was projected at the 3-digit level as follows:

(1) The ferrous components (SIC 331 and 332) were combined and regressed against the total durable goods component of the gross national product, using a logarithmic equation to reflect the declining portion of steel inputs in the production of durable goods;

(2) Nonferrous Rolling and Drawing (SIC 335) was regressed against total durable goods plus private construction components of the gross national product, using a logarithmic form of equation; and

(3) Primary metals, n.e.c. (SIC 339) was also related to total durable goods, using a logarithmic form of equation (refer to Table C-16 for these regression equations).

Before arriving at these equation forms or deciding on the independent or explanatory variables, each value added series case was plotted against a number of explanatory variables to determine which of these is most closely correlated to the particular industry series. Simple linear regression equation of the form $Y = a + b X$ and multiple regression equation of the form $Y = a + b_1 X_1 + b_2 X_2$ were tried in each case. Logarithmic equations were accepted not only because they provided the best fit to historical data, but also they yielded projections for the future that would be economically plausible.

Value added projections were derived in each case by substituting into the regression equation the projected values of the independent variable. These already projected independent or explanatory variables are presented in Appendix B. The value added series necessary in the regression analysis were derived as outlined below.

(1) Basic value added data at 4-digit industry detail were obtained from the 1947, 1954, 1958 Census of Manufactures and from the Annual Survey of Manufactures, for the period 1947-62.

(2) The 4-digit value added series were then adjusted for standard industrial classification changes that occurred in 1958, by using the adjustment factors given in Supplementary Table 40 (refer to end of this section). This adjustment table was derived from Appendix C of the 1958 Census of Manufactures and serves as a "bridge" between the pre-1958 industrial classification system and the "new" classification system used since 1958. The objective of the adjustment of all pre-1958 value added series was to develop value added series for years before and after 1958 that would be homogeneous and consistent in terms of industrial classification.

(3) Value added series adjusted for SIC changes were then aggregated into 3-digit series, which in turn were deflated by using appropriate wholesale price indexes selectively developed from U.S. Bureau of Labor Statistics publication of wholesale price indexes (refer to Supplementary Table 41).

TABLE C-16

REGRESSION EQUATIONS, PRIMARY METALS INDUSTRIES (SIC 33)

SIC	INDUSTRY TITLE	REGRESSION EQUATION*	R^2	Percent Level of Significance (.01 = 1%)**
331	Steel Rolling and Finishing	Y=-11,763.0 + 9,925.0 log X (1,045.0) (1,767.0) where: Y=Value added in millions of 1954 dollars X=Total Durable Goods component of GNP in billions of 1954 dollars	.718	.01
332	Iron and Steel Foundries (Combined)			
335	Nonferrous Rolling and Drawing	Y=-4492.3 + 2980.2 log X (789.3) (390.6) where: Y=Value added in millions of 1954 dollars X=Total Durable Goods plus Private Construction components of GNP in billions of 1954 dollars	.803	.01
339	Primary Metal Industries n.e.c.	Y=-746.478 + 625.032 log X (134.17) (71.86) where: Y = Value Added in millions of 1954 dollars X = Total Durable Goods component of GNP in billions of 1954 dollars	.882	.01

* Variations in the number of significant digits in the equations arise from the fact that for purposes of convenience in presentation, value added is expressed in millions of dollars, while GNP components are expressed in billions of dollars. In our regression analysis, however, these variables were expressed in different units (i.e., tens or hundreds of millions or billions) in order to minimize errors that might otherwise have been introduced by rounding. Estimated variance of the regression coefficients "a" and "b" is given underneath these coefficients in each equation.

** "Percent level of significance" states the probability that such a correlation would arise, by random sampling from an uncorrelated population. In other words, a 1% level of significance for R (coefficient of correlation) may be interpreted as meaning that there is only one chance in a hundred of getting a value of R as high as that recorded when in fact the variables have zero correlation.

24. NEW ENGLAND VALUE ADDED PROJECTIONS

After having derived deflated 3-digit value added series for New England,* regional 3-digit projections were obtained as outlined below:

(1) For SIC 331 and 332 (combined), and for SIC 339, New England's percent shares of national value added were projected as a function of the logarithm of time, reflecting a dampened rate of decline in the region's share of national value added (refer to Supplementary Table 45).

(2) For SIC 335, New England's percent share of national value added was projected by assuming, first, that New England's share will fall during the 1960-1970 period at the same rate as that experienced during the 1947-(1958-1962 ave.) period. Secondly, we assumed that the percent change in New England's share after 1970 will fall by one-half, again reflecting a dampened rate of decline in the region's relative position vis-a-vis the nation.

(3) These projected shares were then multiplied by the already projected national value added levels to obtain New England value added projections for each decade.

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* 4-digit value added data were available for New England for only 1947, 1954 and 1958. The 1947 and 1954 data were adjusted for SIC changes by using the adjustment factors presented in Supplementary Table 40. The value added data for 1958 were in certain cases adjusted for coverage deficiencies.

Adjusted value added series were then aggregated into 3-digit series and deflated by using the appropriate price indexes presented in Supplementary Table 41.

SUPPLEMENTARY TABLE 40

ADJUSTMENTS MADE IN PRE-1958 VALUE ADDED SERIES TO ACCOUNT FOR THE 1958 STANDARD INDUSTRIAL CLASSIFICATION CHANGES (SIC 33)

New SIC	Composed of Old SIC	% of Old In New	
335			
3351	3351	96.3	
	3392	.7	
3352	3352	100.0	
	3497	63.7	
3356	3359	100.0	
3357	3631	100.0	
	3392	70.0	
	3351	3.7	
336			
3361	3361	47.0	New SIC 336 is 98.0% of old SIC 336.
3362	3361	22.9	
3369	3361	28.2	
339			
3391	3391	100.0	New SIC 339 is 31.1% of Old SIC 339.
3392	3399	14.4	
3399	3399	32.0	
331			
3312	3312	99.6	
3313	3313	100.0	
3315	3392	29.2	
	3481	97.9	
3316	3399	48.9	
3317	3312	.4	
	3393	100.0	
332			
3321	3321	100.0	New SIC 332 is 100% of Old SIC 332.
3322	3322	100.0	
3323	3323	100.0	

Supplementary Table 40 (Cont'd)

New SIC	Composed of Old SIC	% of Old in New	
333			
3331	3331	100.0	New SIC 333 is 100% of Old SIC 333.
332	3332	100.0	
3333	3333	100.0	
3334	3334	100.0	
3339	3339	100.0	
334			
3341	3341	100.0	New SIC 334 is 100% of Old SIC 334.

Source: U.S. Bureau of the Census, 1958 Census of Manufactures, Appendix C.

SUPPLEMENTARY TABLE 41

PRICE INDEXES USED TO DEFLATE THE VALUE ADDED SERIES, PRIMARY METALS INDUSTRIES

(SIC 33)

(1954=100)

Year	(1) SIC 331	(2) 332	(3) 333	(4) 334	(5) 335	(6) 336	(7) 339	(8) SIC 33
1947	67.5	69.1	83.5	81.5	74.8	70.0	71.4	70.2
1949	79.7	83.1	89.5	87.7	75.8	75.7	81.9	80.1
1950	85.0	84.5	92.0	93.9	79.8	80.4	86.2	84.4
1951	92.6	92.4	114.7	122.0	92.7	90.1	96.0	94.2
1952	93.8	92.8	109.6	109.4	95.7	92.8	96.1	95.0
1953	98.7	97.8	99.1	101.3	101.9	99.2	99.2	99.1
1954	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1955	105.7	102.5	113.9	122.3	111.6	110.2	106.8	107.0
1956	116.4	113.0	123.5	130.3	124.3	120.5	116.0	117.8
1957	125.0	121.8	106.8	109.0	112.7	112.0	118.3	120.6
1958	126.9	125.4	97.0	98.1	106.5	108.0	117.6	119.5
1959	129.3	127.9	102.5	106.7	112.7	113.0	120.0	123.1
1960	127.8	128.9	105.8	109.4	114.9	117.5	120.2	123.2
1961	127.9	129.3	103.1	104.4	110.4	112.2	119.5	121.7
1962[9]	126.2	129.5	102.9	101.4	109.3	110.4	118.6	120.4

1. U.S. Bureau of Labor Statistics, Wholesale Price Index, "Iron and Steel," Code 10-1 (March 1962).

2. BLS, Wholesale Price Index, "Foundry and Forge Shop Products," Code 10-15 (March 1962).

3. BLS, Wholesale Price Index, "Primary (Nonferrous) Metal Refinery Shapes," Code 10-22 (March 1962).

4. BLS, Wholesale Price Index, "Secondary (Nonferrous) Metal and Alloy Basic Shapes," Code 10-24 (March 1962).

5. Implicit price index, derived by using BLS Wholesale Price Indexes Code 10-26 and 10-25. SIC 3357 deflated by Code 10-26 and the rest of SIC 335 deflated by Code 10-25. The respective deflated sums are added; and then the adjusted value added total (SIC 335) is divided by the deflated total.

6. BLS Wholesale Price Index, Code 10-25 (March 1962).

7. BLS Wholesale Price Index, Code 10------"Metal and Metal Products" (March 1962).

8. Derived (implicit) price index, obtained by dividing the U.S. 2-digit value added series (adjusted for SIC changes) by the sum of separately deflated 3-digit component industries.

9. 1962 Indexes from U.S. Bureau of Labor Statistics, 1962 Statistical Supplement to Monthly Labor Review, page 78.

SUPPLEMENTARY TABLE 42

U.S. VALUE ADDED SERIES, PRIMARY METALS INDUSTRIES (SIC 33)

(millions of 1954 dollars)

(2-digit totals as percent of GNP; 3-digit totals as percent of the 2-digit total)

Year		SIC 33	331	332	333	334	335	336	339
1947	Value Added	7,913.4	3,845.8	1,623.0	390.0	146.8	1,127.4	414.2	366.2
	%	2.80	48.60	20.51	4.93	1.85	14.25	5.23	4.63
1949		6,809.7	3,575.3	1,117.2	306.0	113.3	1,016.9	363.4	317.6
		2.32	52.50	16.41	4.49	1.67	14.93	5.34	4.66
1950		8,933.4	4,639.9	1,385.5	441.2	146.6	1,468.9	453.0	398.3
		2.80	51.94	15.51	4.94	1.64	16.44	5.07	4.46
1951		9,903.8	5,160.9	1,671.0	434.9	126.8	1,496.9	476.0	537.4
		2.90	52.11	16.87	4.39	1.28	15.11	4.81	5.43
1952		9,742.3	5,003.1	1,584.5	460.2	137.2	1,491.8	503.2	562.3
		2.74	51.36	16.26	4.72	1.41	15.31	5.17	5.77
1953		11,355.4	6,192.4	1,662.7	604.6	106.3	1,619.0	577.0	593.4
		3.09	54.53	14.64	5.32	.94	14.26	5.08	5.23
1954		9,521.3	5,216.5	1,339.3	614.2	142.3	1,339.6	467.4	401.9
		2.62	54.79	14.07	6.45	1.49	14.07	4.91	4.22
1955		12,297.2	7,153.7	1,633.2	763.2	166.5	1,595.9	520.1	464.5
		3.13	58.17	13.28	6.21	1.35	12.98	4.23	3.78
1956		11,976.9	6,895.2	1,607.5	774.2	152.9	1,575.6	494.6	476.9
		2.99	57.57	13.42	6.46	1.28	13.16	4.13	3.98
1957		11,241.9	6,449.4	1,382.7	805.6	129.6	1,514.0	505.1	455.7
		2.74	57.37	12.30	7.17	1.15	13.47	4.49	4.05
1958		9,766.9	5,408.1	1,054.4	722.1	150.1	1,620.7	435.9	375.7
		2.44	55.37	10.80	7.39	1.54	16.59	4.46	3.85
1959		11,080.2	6,032.4	1,314.5	773.1	156.2	1,839.8	509.0	455.1
		2.59	54.44	11.86	6.98	1.41	16.61	4.59	4.11

SUPPLEMENTARY TABLE 42 (cont'd)

Year		SIC 33	331	332	333	334	335	336	339
1960	Value Added	10,807.9	6,013.8	1,224.1	876.1	144.7	1,617.1	484.0	448.2
	%	2.46	55.64	11.32	8.11	1.34	14.96	4.48	4.15
1961		10,567.5	5,710.1	1,161.4	840.4	173.2	1,728.9	498.2	455.3
		2.37	54.03	10.99	7.95	1.64	16.36	4.72	4.31
1962		11,502.3	6,010.3	1,351.2	923.6	186.2	1,853.7	605.4	571.9
		2.42	52.25	11.75	8.03	1.62	16.12	5.26	4.97

SUPPLEMENTARY TABLE 43

SIC 33 -- PRIMARY METAL INDUSTRIES U.S. VALUE ADDED PROJECTIONS

(in millions of 1954 dollars)

SIC	Industry	Regression Equations**		1960 Actual	1970	1980	1990	2000	2010	2020
331	Steel Rolling and Finishing	Y = -11,763.0 + 9,925.0 log X		7,237.9	9,581.0	11,344.0	12,962.0	14,521.0	16,045.0	17,616.0
			Growth Index:	100	130	154	176	198	218	240
332	Iron and Steel Foundries									
335	Nonferrous Rolling and Drawing	Y = -4492.3 + 2980.2 log X		1,617.1	2,313.9	2,814.6	3,284.8	3,738.7	4,182.5	4,638.7
			Growth Index:	100	137	167	194	221	248	275
339	Primary Metal Industries n.e.c.	Y = -746.478 + 625.032 log X		448.2	597.7	708.7	810.6	908.8	1,004.7	1,103.7
			Growth Index:	100	131	155	177	199	220	242
	SUM (SIC 331, 332, 335, 339)			9,303.2*	12,492.6	14,867.3	17,057.4	19,168.5	21,232.2	23,358.4
			Growth Index:	100	134	160	183	206	228	251

* Equal to 86.08 percent of total SIC 33 value added.

** Refer to Table C-16.

SUPPLEMENTARY TABLE 44

SIC 33-- PRIMARY METAL INDUSTRIES

NEW ENGLAND DEFLATED VALUE ADDED SERIES*
(thousands 1954 dollars)

Year	331	332	333	334	335	336	339
1947	73,196	73,573		7,086	247,214	32,543	24,882
1949							
1950							
1951							
1952							
1953							
1954	78,488	47,246	663	6,354	242,136	23,537	41,296
1955							
1956							
1957							
1958	81,410	34,856	321	8,303	279,137	22,592	38,693
1959	99,342	42,127			324,048		40,418
1960	96,620	40,225			275,681		41,143
1961	90,406	38,797			286,785		37,491
1962	95,516	40,270			288,947		44,995

*Because of strong compositional differences between the New England and the United States primary metals industries, the national 2-digit price index has not been used to deflate 2-digit value added series.

SUPPLEMENTARY TABLE 45

SIC 33 -- PRIMARY METAL INDUSTRIES, NEW ENGLAND VALUE ADDED PROJECTIONS

(in millions of 1954 dollars)

SIC	Regression Equations*	Actual 1960	1970	1980	1990	2000	2010	2020
331 & 332	Y = 1.9091 - .0519X	136.8	176.8	208.2	236.9	264.6	291.7	319.6
	Growth Index:	100	129	152	173	193	213	234
335	(See Text)	275.7	324.4	351.9	385.8	425.0	467.5	514.1
	Growth Index:	100	118	128	140	154	170	186
339	Y = 10.0580 - 2.1130X	41.1	47.7	53.5	58.9	64.0	69.0	74.2
	Growth Index:	100	116	130	143	156	168	181
SUM of SIC 331, 332, 335, 339		453.6	548.9	613.6	681.6	753.6	828.2	907.9
	Growth Index:	100	121	135	150	166	183	200

NOTES:

* Where X = log of time
Y = New England as percent of U.S. value added. Applying these percent shares to U.S. value added projections yields the New England value added projections given in this table.

SUPPLEMENTARY TABLE 46

SIC 33 -- PRIMARY METAL INDUSTRIES

NEW ENGLAND INDUSTRIAL COMPOSITION

	New England value added as percent of U.S. total		Comparative percent breakdown of employment: 1958[3]		Comparative percent breakdown of employment: 1962[4]	
	1958[1]	1962[1]	New England	U.S.	New England	U.S.
33	4.50[2]	4.38[2]	100.00	100.00	100.00	100.00
331	1.51	1.59	18.97	52.74	17.74	50.26
332	3.31	2.98	11.94	16.60	11.31	17.02
333	.04	--	---	4.29	---	4.26
334	5.53	--	.07	1.32	---	1.39
335	17.22	15.59	52.30	14.62	52.29	15.36
336	5.18	--	5.36	5.67	---	6.35
339	10.30	7.87	9.39	4.76	9.69	5.36

NOTES:

1. Computed after both the U.S. and the New England totals were adjusted for price changes by using Supplementary Table 41. For data sources, see footnotes #3 and #4.
2. Computed before adjusting for price changes.
3. U.S. Bureau of the Census, 1958 Census of Manufactures, Vol. 3, p. 63 and general summary.
4. U.S. Bureau of the Census, 1962 Annual Survey of Manufactures, M 62 (AS)-1 and part 1 on New England - M 62 (AS) - 4.1.

-- Data not available.

I. TRANSPORTATION EQUIPMENT (SIC 37)

We projected value added in New England's transportation equipment industry by relating it to New England prime military contract awards, since over 90 percent of total value added in this industry in New England comprising SIC 372 (Aircraft and Parts) and SIC 373 (Ship and Boat Building) depends to a large extent on military contracts.

A detailed explanation of our projections of prime military contract awards in New England is presented in Appendix H. In this section we summarize the value added projections based on these prime military contract awards projections.

In summary form, the methodology consisted of the following steps:

(1) Given projections of prime military contract awards in New England expressed in constant 1960 dollars, we applied to them a constant percentage factor to obtain New England's value added total in the transportation equipment industry for each decade. This constant factor is the 1958-1962 average ratio of value added to prime military contract awards in New England.

(2) The value added projections expressed in 1960 dollars were then converted into constant 1954 dollars by dividing them through by the implicit price deflator for durable goods in 1960 (119.1) with 1954 = 100.0, as given in U.S. Department of Commerce, Survey of Current Business (September 1963), p. 10). These projections are given in Table C-17.

The value added projections for New England's transportation equipment industry (SIC 37), obtained by applying these two steps, are predicated on our basic assumptions about the size of defense expenditures in the future and the geographical distribution of defense contracts. These assumptions are spelled out in Appendix H.

We used value added series and military contract awards in current dollars since appropriate price deflators could not be found for either

series.* We assumed that price changes in both series will not differ significantly.

* When we applied an index based to a large extent on wages in the aircrat industry to both the value added and military contract award series, the correlation between the two series was reduced. This was due to the fact that the index rose quite rapidly, and that changes in value added were much less volatile than those in prime military contract awards. Thus, a slight increase in value added became a slight decline after deflation, while the increases in prime military contract awards in current dollars were maintained in the deflated series. Deflating the two series, therefore, resulted in movement in opposite directions, which reduced the correlation between the two series.

TABLE C-17

NEW ENGLAND VALUE ADDED PROJECTIONS, TRANSPORTATION EQUIPMENT (SIC 37)
(in millions of 1954 dollars)

	1960 Actual	1970	1980	1990	2000	2010	2020
New England Prime Military Contract Awards	1,728.0	2,119	2,605	3,134	3,438	3,528	3,483
Index (1960 = 100)	100	123	151	181	199	204	202
New England Value Added Projections	844.7	968	1,191	1,432	1,571	1,612	1,592
Index (1960 = 100)	100	115	141	170	186	191	189
Value Added as Percent of Prime Military Contract Awards	48.9	45.7	45.7	45.7	45.7	45.7	45.7

SUPPLEMENTARY TABLE 47

NEW ENGLAND VALUE ADDED SERIES, TRANSPORTATION EQUIPMENT (SIC 37) AND

PRIME MILITARY CONTRACT AWARDS

(in millions of current dollars)

Year[1]	Prime Military Contract Awards[2]	Value Added (SIC 37)[3]
1958	1,795	858.0
1959	2,270	978.6
1960	2,048	1,005.5
1961	2,334	1,099.6
1962	2,736	1,130.3

1. Prime military contract awards are given for fiscal years, while value added totals are given for calendar years.

2. Office of the Secretary of Defense, Five Year Trends in Defense Procurement, 1958-1962, June 1963, Appendix III, pp. 52-54.

3. U.S. Bureau of the Census, 1958 Census of Manufactures and Annual Survey of Manufactures, 1961 and 1962.

J. LOCATION QUOTIENT ANALYSIS

25. INTRODUCTION

To make a preliminary identification of a region's export and non-export industries, location quotients are frequently used. Expressed either as a ratio or as a pure number, the location quotient is computed as follows:

R_i: number of employees in industry i in the region,

R : number of employees in all industries in the region (i.e.total regional employment)

N_i: number of employees in industry i in the nation,

N : number of employees in all industries in the nation (i.e., total national employment)

$$\frac{R_i/N_i}{R/N} \quad \text{or} \quad \frac{R_i/R}{N_i/N}$$

Other units of measurement, such as value added, income originating, etc., may be used, depending on the purpose of the study. In this study we used employment data. Whatever the unit of measurement, the industries for which the location quotient exceeds unity (i.e., 1.0000) are recognized as the region's export industries.

The use of location quotients for anything but an initial identification of export industries should be avoided, however, because of the technique's many limitations. Some of these shortcomings are cited by Isard,* and many others can be added to the list.**

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* Walter Isard, et. al., Methods of Regional Analysis: An Introduction to Regional Science (New York: The Technology Press of M.I.T. and John Wiley and Sons, Inc., 1960), p. 108.

** The method contains implicit assumptions concerning a real or regional uniformity of the earnings of the factors of production, production functions, economies of scale, and patterns of consumption. In addition, it assumes that no products are exported by an industry until local needs are met, and that goods produced by a given industry are homogeneous. See, Otis D. Duncan et al., Metropolis and Region (Baltimore: The Johns Hopkins Press, 1960), p. 209.

In our location quotient analysis presented here in Tables C-18, C-19, C-20, and C-21, we limited detailed treatment to 2-digit industries employing at least one percent of New England's total employment. Each of the industries was studied over time, usually over the last two decades. Four different data sources were used, as cited at the top of each of the four tables listed above. The tables present for each industry:

(1) employment;
(2) location quotient;
(3) percent share of New England's total employment (totals differ from source to source);
(4) percent of U.S. employment in the industry (i.e., New England manufacturing employment as percent of U.S. manufacturing employment; New England employment in a given industry as percent of national employment in the same industry).

Among New England's major SIC groups, (i.e. the 1-digit level), manufacturing is the only export sector. At the 2-digit level, there are twelve export industries. Location quotients vary for the same industry among the four data sources used, each of which has a different coverage. For example, in the Census of Population, which includes all industrial sectors, an export industry was defined as one with a location quotient of at least 1.3. On the other hand, in the Census of Manufactures, which covers only the manufacturing industries, the criterion was a location quotient of 1.0 or more. The cut-off points were thus varied for each data source to account for differentials in coverage and for differences in the total employment base used.

26. ANALYSIS OF GROWTH PATTERNS

Each export industry, as a result of the location quotient analysis, was classified as either growing, stable, or declining. An industry was classified as growing if its employment has been increasing. Generally, an increase in an industry's employment is accompanied by an increase in

its percent share of New England's total employment, although its location quotient and share of national employment in the same industry might be declining. In such a case, the industry is growing at a slower rate in New England than in the nation as a whole.

At the other extreme, an industry's employment might be declining in New England and in the U.S. while its location quotient and percent share of the same industry in the nation have been increasing. This would only indicate that the industry is declining less rapidly in New England than in the nation as a whole. An example is the leather and leather products industry (SIC 31), which we classified as declining.

Stable industries were defined as those which do not exhibit any clear trend either upward or downward. Such industries may show considerable fluctuations in employment, yet no clearcut trend in either direction. Employment in the ordnance and accessories industry (SIC 19) is an example.

a. Growing Industries. -

SIC 30, rubber and plastics products employment has been increasing according to Tables C-19, 20 and 21. The relative importance, as measured by the location quotient, has been fairly stable at about 2.4, with no trend in either direction. With roughly 65,000 employees, the industry has approximately 2% of New England employment on its payrolls. Nearly one fifth of U.S. employees in the industry work in New England.

SIC 36, electrical machinery has experienced a 50% increase in employment since 1950, according to Tables 18, 20 and 21. The steadiness or slight decline of the location quotient indicates a similar rapid growth of the industry throughout the nation. The industry's share of New England employment has been increasing and stood at over 4.0% by 1960. That year the regional industry employed 11% of all workers in the national industry.

SIC 38, professional, scientific and controlling instruments; photographical and optical goods; watches and clocks, employed about 50,000

persons in 1962. This employment was roughly 1.5% of total New England employment and 14% of total U.S. employment in the industry. The relative concentration measured by the location quotient is fairly constant at somewhat over 2.0 (measured on a total employment base).

SIC 63, insurance carriers (Table C-19) had a 23% increase in employment from 1953 to 1962, when employment reached more than 80,000. The New England industry's relative employment concentration has remained steady with a location quotient of 1.4, indicating a comparable growth of the national industry. The percent of New England employment in this industry is rising and was 2.6% in 1962. The New England industry's employment is about 10% of that in the national industry.

SIC 82, educational services, has had an average yearly increase in employment of 2.0% over the past twenty years (Table C-18). Educational employment in the rest of the nation has been growing more rapidly, so the industry's location quotient has declined. Educational services' share of New England employment rose from 1.4% in 1940 to 1.8% in 1960. The regional industry's per cent of national industry employment has declined during this time and is now about 9.0%.

b. Stable Industries. -

Manufacturing employment has no trend in either direction which is consistent among the four sources. The relative concentration is either constant or slightly declining, according to location quotients in the four tables. As percent of both total New England employment and of U.S. manufacturing employment, New England manufacturing employment is declining.

SIC 19, ordnance and accessories, is represented adequately only in Table C-20 (BLS). Employment in 1961 was almost double that in 1947. The relative importance of the New England industry has declined because of even more rapid growth in the rest of the nation. The location quotient dropped from 4.0 in 1947 to 2.0 in 1961, with a low point of 1.2

in 1953. The industry's percent of New England employment has increased since 1947, but was still under 1% by 1961. New England employment in the industry as a per cent of national employment in SIC 19 has declined from 55% in 1947 to 15% in 1961.

SIC 26, paper and allied products, reached a peak employment in 1956 and declined somewhat between that year and 1962. The location quotient has remained steady at 1.8 (on a total employment basis). The industry's share of New England employment has remained fairly steady at about 2.3%, while its share of employment in the national industry has declined from about 15% in 1947 to 12% in 1961.

SIC 34, fabricated metals, barely holds its own as an export industry with a minimum location quotient in most instances. Its share of New England employment is roughly 3%, growing or declining, depending upon which source is consulted. The New England industry's share of national industry employment is declining and has been roughly 9.0% in recent years.

SIC 35, machinery except electrical, has an employment of over 160,000. The location quotient has been fairly stable at 1.7 since the early 1950's. The industry's share of New England employment is about 4.0% and has been declining over the past decade. The New England industry's share of employment in the national industry is roughly 10% and has been declining gradually since 1947.

c. Declining Industries. -

SIC 22, textiles, has shown a substantial decline according to all four tables. Employment is roughly one half of what it was twenty years ago. Most of the decline occurred after 1950. Since 1958, the downward trend has been much more gradual than it was in the early 1950's. The location quotient has declined but is still quite high at 2.0. The industry's share of New England employment is now 3% and its share of the national industry is 13%.

SIC 31, leather and leather products, as noted earlier, is a declining industry which is becoming relatively more concentrated in New England, since the regional industry is not losing employment as quickly as the national industry. The decline is considerably smaller than that in the textile industry. In 1962, there were approximately 110,000 workers employed by the leather industry - roughly 3.0% of total New England employment. The regional industry employs nearly one third of all workers in the national industry and has a location quotient of about 4.7 on a total employment basis.

SIC 39, miscellaneous, includes jewelry and silverware and costume jewelry and notions. Employment in the industry division has declined steadily since 1947 (refer to Table C-21). Table C-19 shows a slight increase between 1959 and 1962. The industry employs about 2.0% of all New England workers and 16% of all those in the national industry.

SOURCES

1. U.S. Bureau of the Census, County Business Patterns, First Quarter, 1962, Part 1, U.S. Summary and Part 2, New England States, (Washington, D.C.: U.S. Government Printing Office, 1963); also, the same publications for 1953, 1956, and 1959.

2. _____, U.S. Census of Manufactures: 1958, Vol. III, Area Statistics, (Washington, D.C.: U.S. Government Printing Office, 1961); also, the same publication for 1947 and 1954.

3. _____, U.S. Census of Population: 1960, General Social and Economic Characteristics, Final Reports for U.S., Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont, (Washington, D.C.: U.S. Government Printing Office, 1962), Table 62.

4. U.S. Department of Labor, Bureau of Labor Statistics, Bulletin No. 1312, Employment and Earnings Statistics for the United States, 1909-60, 1961.

5. _____, Bulletin No. 1370, Employment and Earnings Statistics for States and Areas, 1939-62, 1963.

6. _____, New England Regional Office, Employment in New England, 1947-1961, 1962.

7. _____, unpublished replacement series on employment by industry for each of the New England states, revised on the basis of the 1957 SIC code, 1947-1961.

TABLE C-18

NEW ENGLAND EXPORT INDUSTRIES

(Census of Population*)

Industry	SIC	Series	1940	1950	1960
Manufacturing		(1) Employment	1,176,558	1,398,299	1,479,168
		(2) Location Quotient	1.6	1.5	1.4
		(3) % of N.E. Employment	38.6	38.7	36.7
		(4) % of U.S. Industry Employment	11.0	9.5	8.4
Textiles	22	(1)	266,905	257,533	125,406
		(2)	3.4	3.3	2.1
		(3)	8.8	7.1	3.1
		(4)	22.9	21.0	13.1
Fabricated Metals	34	(1)	n.a.	96,445	116,185
		(2)	n.a.	1.8	1.4
		(3)	n.a.	2.7	2.9
		(4)	n.a.	11.4	9.0
Machinery	35	(1)	97,348	136,226	162,136
		(2)	2.1	1.7	1.7
		(3)	3.2	3.8	4.0
		(4)	14.1	10.9	10.3
Electrical Machinery	36	(1)	42,775	109,647	167,440
		(2)	1.5	2.0	1.8
		(3)	1.4	3.0	4.2
		(4)	10.2	12.7	11.3
Educational Services	82	(1)	42,985	59,597	72,748
		(2)	1.9	1.7	1.4
		(3)	1.4	1.6	1.8
		(4)	12.6	11.2	8.5

*Location quotient of at least 1.3; per cent of New England total employment at least 1.0%.

TABLE C-19

NEW ENGLAND EXPORT INDUSTRIES

(County Business Patterns)[1]

Industry	SIC	Series	1953	1956	1959	1962
Manufacturing		(1) Employment	1,590,213	1,495,908	1,414,290	1,454,267
		(2) Location Quotient	1.3	1.2	1.2	1.2
		(3) % of N.E. Private Non-Farm Employment	54.6	51.7	47.8	46.4
		(4) % of U.S. Industry Employment	9.2	11.3	8.7	8.9
Ordnance	19	(1)	32,101[2]	20,779[2]	21,530[2]	35,660[2]
		(2)	1.3[2]	1.6[2]	1.4[2]	2.0[2]
		(3)	1.1[2]	0.7[2]	0.7[2]	1.1[2]
		(4)	9.9[2]	11.1[2]	9.5[2]	15.2[2]
Textiles	22	(1)	221,075	171,594	125,501	110,381
		(2)	2.5	2.3	2.0	1.8
		(3)	7.6	5.9	4.2	3.5
		(4)	18.7	16.2	14.1	12.6
Paper	26	(1)	70,204	74,022	71,371	72,186
		(2)	1.8	1.9	1.8	1.6
		(3)	2.4	2.6	2.4	2.3
		(4)	13.5	13.2	12.7	12.3
Rubber and Plastic	30	(1)	50,665	49,098	60,316	66,034
		(2)	2.5	2.7	2.2	2.4
		(3)	1.7	1.7	2.0	2.1
		(4)	18.7	19.0	16.8	17.0
Leather	31	(1)	118,187	116,882	111,809	110,143
		(2)	4.2	4.3	4.8	4.3
		(3)	4.1	4.0	3.8	3.5
		(4)	30.2	30.5	31.9	31.2
Fabricated Metal	34	(1)	102,544	98,118	98,121	96,379
		(2)	1.3	1.3	1.3	1.3
		(3)	3.5	3.4	3.3	3.1
		(4)	9.2	9.0	9.0	9.2

TABLE C-19 (Continued)

Industry	SIC	Series	1953	1956	1959	1962
Machinery	35	(1)	203,419	190,335	152,668	160,888
		(2)	1.6	1.6	1.6	1.5
		(3)	7.0	6.6	5.2	5.1
		(4)	11.6	11.2	10.9	11.1
Electrical Machinery	36	(1)	146,527[2]	136,007	132,223	156,412
		(2)	1.8[2]	1.8	1.6	1.6
		(3)	5.0[2]	4.7	4.5	5.0
		(4)	13.2[2]	12.8	11.2	11.1
Instruments	38	(1)	38,100	40,346[2]	41,595[2]	47,654[2]
		(2)	1.8	1.9[2]	2.0[2]	1.9[2]
		(3)	1.3	1.4[2]	1.4[2]	1.5[2]
		(4)	12.8	13.6[2]	14.1[2]	13.9[2]
Miscellaneous[3]	39	(1)	101,217	96,667	63,082	64,002
		(2)	2.9	2.8	2.3	2.4
		(3)	3.5	3.3	2.1	2.0
		(4)	20.6	19.6	17.1	17.3
Insurance Carriers	63	(1)	65,305	69,322	74,657	80,637
		(2)	1.4	1.3	1.4	1.4
		(3)	2.2	2.4	2.5	2.6
		(4)	10.0	9.5	9.9	9.9
Educational Services	82	(1)	4,348[4]	3,774[4]	56,717	71,692
		(2)	1.0[4]	0.9[4]	2.1	2.1
		(3)	0.2[4]	0.1[4]	1.9	2.3
		(4)	7.4[4]	6.3[4]	15.2	14.9

[1] Location quotient of at least 1.3; per cent of New England private non-farm employment at least 1.0%.

[2] These data are minimum estimates for New England because not all states reported.

[3] The most important industries in the Miscellaneous group are Jewelry and Silverware (SIC 391) and Costume Jewelry and Notions (SIC 396).

[4] Not comparable to later data because of coverage changes.

TABLE C-20

NEW ENGLAND EXPORT INDUSTRIES

(Bureau of Labor Statistics)[1]

Industry	SIC	Series	1940	1947	1950	1953	1954	1956	1958	1959	1960	1961
Manufacturing		(1)[2] Employment	1,229.6	1,543.2	1,468.7	1,600.0	1,471.5	1,522.3	1,382.4	1,450.0	1,451.8	1,428.2
		(2) Location Quotient	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3	1.3
		(3) % of N.E. Non-Agricultural Employment	45.1	46.3	43.9	44.6	42.1	41.8	39.2	39.7	39.2	38.3
		(4) % of U.S. Industry Employment	11.2	9.9	9.6	9.1	9.0	8.8	8.7	8.7	8.7	8.8
Ordnance	19	(1)[2]	n.a.	14.9	12.5	21.2	18.5	16.2	21.2	23.7	27.1	29.6
		(2)	n.a.	4.0	4.0	1.2	1.7	1.3	2.0	2.0	2.3	2.0
		(3)	n.a.	0.4	0.4	0.6	0.5	0.4	0.6	0.6	0.7	0.8
		(4)	n.a.	55.2	41.7	9.1	11.3	11.7	14.6	13.7	14.5	14.7
Textiles	22	(1)[2]	n.a.	279.7	264.2	207.4	170.2	161.6	124.2	127.1	119.5	112.9
		(2)	n.a.	2.8	2.8	2.5	2.3	2.2	1.9	1.9	1.9	1.9
		(3)	n.a.	8.4	7.9	5.8	4.9	4.4	3.5	3.5	3.2	3.0
		(4)	n.a.	21.5	21.0	18.0	16.3	15.7	13.5	13.5	13.1	12.8
Paper	26	(1)[2]	n.a.	71.6	67.7	72.6	73.4	76.0	71.7	73.5	74.0	72.6
		(2)	n.a.	2.0	1.8	1.8	1.9	1.9	1.8	1.8	1.8	1.7
		(3)	n.a.	2.2	2.0	2.0	2.1	2.1	2.0	2.0	2.0	1.9
		(4)	n.a.	15.4	14.0	13.7	13.8	13.4	12.7	12.6	12.5	12.3
Rubber and Plastics	30	(1)[2]	n.a.	58.8	54.6	62.6	56.8	63.2	59.5	64.0	64.6	64.4
		(2)	n.a.	2.6	2.3	2.4	2.3	2.4	2.4	2.6	2.4	2.4
		(3)	n.a.	1.8	1.6	1.7	1.6	1.7	1.7	1.8	1.7	1.7
		(4)	n.a.	18.2	17.6	17.3	17.3	17.1	17.3	17.3	17.3	17.6

TABLE C-20 (continued)

Industry	SIC	Series	1940	1947	1950	1953	1954	1956	1958	1959	1960	1961
Leather	31	(1)[2]	n.a.	114.4	117.2	115.8	112.3	113.8	107.7	113.4	109.1	106.9
		(2)	n.a.	3.8	3.9	4.0	4.0	4.4	4.4	4.4	4.1	4.1
		(3)	n.a.	3.4	3.5	3.2	3.2	3.1	3.1	3.1	2.9	2.9
		(4)	n.a.	27.8	29.7	29.8	30.1	29.7	30.0	30.2	29.8	29.6
Fabricated Metals	34	(1)[2]	n.a.	110.6	101.7	112.8	103.4	106.9	97.3	100.9	100.3	98.5
		(2)	n.a.	1.5	1.4	1.4	1.4	1.3	1.3	1.3	1.3	1.3
		(3)	n.a.	3.3	3.0	3.1	3.0	2.9	2.8	2.8	2.7	2.6
		(4)	n.a.	11.2	10.4	9.8	9.7	9.4	9.0	9.0	8.9	9.2
Machinery	35	(1)[2]	n.a.	189.7	151.3	186.7	165.0	176.6	144.6	152.8	158.6	155.0
		(2)	n.a.	1.8	1.7	1.7	1.6	1.6	1.5	1.6	1.6	1.6
		(3)	n.a.	5.7	4.5	5.2	4.7	4.8	4.1	4.2	4.3	4.2
		(4)	n.a.	13.8	12.5	12.0	11.6	11.2	10.6	10.5	10.8	11.1
Electrical Machinery	36	(1)[2]	n.a.	112.3	112.4	149.6	132.9	141.3	130.2	150.3	158.1	157.5
		(2)	n.a.	1.4	1.6	1.6	1.6	1.6	1.5	1.6	1.6	1.6
		(3)	n.a.	3.4	3.4	4.2	3.8	3.9	3.7	4.1	4.3	4.2
		(4)	n.a.	10.9	11.3	11.2	11.2	10.7	10.4	10.8	10.9	11.0
Instruments	38	(1)[2]	n.a.	41.0	34.5	47.8	44.8	48.5	42.8	46.0	46.1	45.5
		(2)	n.a.	2.0	1.7	1.9	1.9	2.2	2.0	2.2	1.7	2.0
		(3)	n.a.	1.2	1.0	1.3	1.3	1.3	1.2	1.3	1.2	1.2
		(4)	n.a.	15.4	13.8	14.2	13.9	14.3	13.2	13.3	13.0	13.2

[1]Location quotient of at least 1.3; per cent of New England non-agricultural employment at least 1.0%.

[2]Series (1) in thousands.

TABLE C-21

NEW ENGLAND EXPORT INDUSTRIES

(Census of Manufactures and Annual Survey of Manufactures)[1]

Industry	SIC	Series	1939[2]	1947	1954	1958	1959[3]	1960[3]
Manufacturing		(1) Employment	947,412	1,475,162	1,431,300	1,359,919	1,429,600	1,429,900
		(2) Location Quotient	1.0	1.0	1.0	1.0	1.0	1.0
		(3) % Of N.E. Manufacturing Employment	100.0	100.0	100.0	100.0	100.0	100.0
		(4) % of U.S. Industry Employment	12.1	10.3	9.1	8.8	8.9	8.9
Ordnance	19	(1)	n.a.	n.a.	24,326	18,625	n.a.	n.a.
		(2)	n.a.	n.a.	n.a.	1.1	n.a.	n.a.
		(3)	n.a.	n.a.	1.7	1.4	n.a.	n.a.
		(4)	n.a.	n.a.	n.a.	9.1	n.a.	n.a.
Textiles	22	(1)	260,557	281,939	167,129	124,037	125,400	119,100
		(2)	2.0	2.2	1.8	1.5	1.5	1.5
		(3)	27.5	19.1	11.7	9.1	8.8	8.3
		(4)	24.1	22.9	16.3	13.8	13.5	13.2
Paper	26	(1)	46,062	69,345	70,377	71,212	71,800	73,400
		(2)	1.4	1.5	1.4	1.4	1.4	1.4
		(3)	4.9	4.7	4.9	5.2	5.0	5.1
		(4)	17.1	15.3	13.3	12.8	12.5	12.7
Rubber and Plastic	30	(1)	26,661	45,249	60,959	61,388	65,100	64,900
		(2)	1.8	1.7	2.0	2.0	1.9	2.0
		(3)	2.8	3.1	4.3	4.5	4.6	4.5
		(4)	22.0	17.5	18.0	17.6	17.2	17.2

TABLE C-21 (Continued)

Industry	SIC	Series	1939[2]	1947	1954	1958	1959[3]	1960[3]
Leather	31	(1)	106,992	109,177	110,090	108,625	114,700	112,800
		(2)	2.7	2.7	3.3	3.5	3.5	3.6
		(3)	11.3	7.4	7.7	8.0	8.0	7.9
		(4)	32.7	28.5	30.8	31.1	31.6	31.5
Fabricated Metals	34	(1)	57,477	109,005	98,160	96,038	101,300	98,800
		(2)	1.1	1.1	1.0	1.0	1.0	1.0
		(3)	6.1	7.4	6.9	7.1	7.1	6.9
		(4)	12.7	11.2	9.3	9.1	9.3	9.1
Machinery	35	(1)	82,766	201,583	179,324[4]	150,126	158,800	158,200
		(2)	1.3	1.3	1.3[4]	1.3	1.3	1.3
		(3)	8.7	13.7	12.5[4]	11.0	11.1	11.1
		(4)	15.4	13.0	11.6[4]	11.1	11.3	11.1
Electrical Machinery	36	(1)	35,486	96,048	120,847[4]	118,489	140,200	151,200
		(2)	1.2	1.2	1.4[4]	1.2	1.3	1.3
		(3)	3.7	6.5	8.4[4]	8.7	9.8	10.6
		(4)	14.3	12.1	12.6[4]	10.6	11.2	11.3
Instruments	38	(1)	19,123	37,212	36,599	42,983	44,600	45,100
		(2)	1.8	1.5	1.5	1.7	1.6	1.5
		(3)	2.0	2.5	2.6	3.2	3.1	3.2
		(4)	22.5	15.2	13.4	14.5	13.9	13.5
Miscellaneous[5]	39	(1)	57,989	107,000	103,688	87,896	94,900	93,200
		(2)	2.0	2.3	1.8	1.8	1.8	1.8
		(3)	6.1	7.3	7.2	6.5	6.6	6.5
		(4)	24.0	23.1	16.9	15.4	15.9	15.6

Data by source: 1959 and 1960 from U.S. Bureau of the Census, Annual Survey of Manufactures, 1959 and 1960; 1954 and 1958 from Census of Manufactures, 1958; 1947 from Census of Manufactures, 1954; 1939 from Census of Manufactures, 1947

1 Location quotient of at least 1.0; per cent of New England manufacturing employment at least 2.0%.

2 1939 data are for production workers only.

3 Rounded to nearest 100.

4 Data from Census of Manufactures, 1954.

5 The most important industries in the Misc. group are: Jewelry and Silverware (SIC 391) Costume Jewelry and Notions (SIC 396).

APPENDIX D

PRODUCTIVITY PROJECTIONS FOR NEW ENGLAND'S "BASE" MANUFACTURING INDUSTRIES

PRODUCTIVITY PROJECTIONS FOR NEW ENGLAND'S "BASE" MANUFACTURING INDUSTRIES

Productivity projections for each "base" manufacturing industry were made in order to translate the "base" industry value added projections into employment projections. The methodology followed in this process involved the following steps. First, we derived productivity index(i.e., value added per employee, 1960 = 100.0) projections for each "base" industry, as explained below in greater detail. Second, we converted our projections of New England value added for each "base" industry, as explained in Appendix C, into index form (1960 = 100.0). Third, we derived employment growth indexes for all "base" industries by dividing the productivity index projections for each benchmark year by the respective value added index projections. Applying these employment growth indexes to the respective New England "base" industry employment levels in 1960 (Annual Survey of Manufactures), yielded the employment projections, which were subsequently converted into Bureau of Labor Statistics establishment payroll employment terms and then into Census of Population equivalents.

Derivation of productivity index projections for New England required three different approaches. In the first case, the projections were made through least squares regression, by fitting an exponential equation of the form $Y = a\ (1 + r)^t$* to New England value added per employee data for the period 1947-1961, expressed in index

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* Where "Y" is the index of value added per employee, "t" is time (1947 = 1), "a" is the value added per employee index at time t = 0, and "R is the average annual rate of increase in value added per employee. Fitting such an equation to historical data and substituting into the equation the future values of "t" provides productivity index projections which assumes a constant annual average rate of increase in value added per employee. This constant rate may be thought of as a "best" estimate of the average historical rate reflected in the value added per employee series.

In order to fit the productivity relationship by linear regression methods, a transformation of the equation from exponential to linear form is required. This was done by taking logarithms of both sides of the equation, yielding the transformation, $\log Y = a' + b'\ (t)$, where "a'" is now the log of "a" and "b'" is the log of (1 + r).

form (1960 = 100.0). In the second case, projections were made through least-squares regression, by fitting an equation of the form Y = a + bt** to New England value added per employee data for the period 1947-1961 expressed in index form (1960 = 100.0), based on the assumption of a dampening rate of growth in productivity. In the third and final case, productivity index projections were made on the basis of an average annual rate of increase in productivity as computed for the period 1947-1961 for selected years.

These three cases are explained below in sequence (A, B, and C), including descriptions of the regression equations finally used in making productivity index projections. The tables accompanying this text present the historical data used in deriving value added per employee series for New England for the period 1947-1961 and the projected productivity indexes for the benchmark years. The historical data is compiled primarily from the 1958 Census of Manufactures and the subsequent Annual Survey of Manufactures series.

** Where "Y is the index of value added per employee, "a" is the value of the productivity index at time t = 0, "b" is the average annual rate of increase in productivity, and "t" is time (1947 = 0).

TABLE D-1

DERIVED PRICE INDEXES USED TO DEFLATE BASE INDUSTRY VALUE ADDED SERIES*

(1954=100.0)

Major Industries by SIC Codes

Years	22	28	30	31	33	34	35	36	37
1947	105.1	91.7	77.7	105.4	70.2	79.8	71.0	79.5	75.2
1949	102.0	88.0	80.5	101.8	80.1	80.3	86.0	84.8	85.9
1950	107.4	89.1	80.8	107.8	84.4	84.3	88.0	86.9	87.9
1951	120.0	101.4	103.1	122.4	94.2	91.8	91.0	96.9	93.9
1952	106.9	97.5	99.0	103.6	95.0	93.6	91.0	95.8	96.2
1953	103.4	98.7	99.7	104.0	99.1	92.9	94.0	98.2	98.3
1954	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1955	99.9	99.7	103.4	100.3	107.0	101.5	100.0	100.6	102.1
1956	99.2	100.3	104.3	105.8	117.8	110.3	106.0	106.3	108.0
1957	99.0	102.1	103.7	105.5	120.6	111.6	115.0	113.0	113.8
1958	96.4	102.7	105.9	106.8	119.5	113.7	122.0	114.4	116.3
1959	98.4	102.6	104.7	121.0	123.1	117.0	125.0	115.8	118.3
1960	99.2	102.9	105.1	117.3	123.2	114.4	125.0	115.3	119.1
1961	98.3	101.7	103.1	118.6	121.7	**	**	**	119.4

* A 2-digit price index for each "base" industry was developed generally by deflating the 3-digit components of each industry by using appropriate wholesale price indexes, and then deriving an implicit price index for the industry as a whole. Detailed explanations of the derivation of price indexes are given in connection with the "base" industry value added projections presented in Appendix C.

** Not available at the time this study was made.

TABLE D-2

NEW ENGLAND VALUE ADDED BY "BASE" INDUSTRIES, 1947-1961* (in thousands of constant 1954 dollars)

"Base" Industries by SIC Codes

Years	22	28	30	31	33	34	35	36	37
1947	1,165,105	237,227	288,988	430,597	412,231	634,380	1,310,641	567,594	275,231
1949	1,013,098	242,384	256,314	414,103	300,370	527,345	950,729	510,274	347,120
1950	1,140,670	291,086	318,080	403,442	486,392	665,744	1,100,849	598,047	348,968
1951	1,003,302	254,934	260,131	370,030	555,631	754,352	1,413,589	751,355	410,490
1952	1,079,453	265,578	286,476	478,010	532,655	705,455	1,670,266	867,784	606,857
1953	1,047,006	328,371	327,703	480,648	487,108	798,449	1,646,957	950,141	751,299
1954	834,185	332,811	421,718	477,162	469,616	659,287	1,312,335	885,454	686,722
1955	891,945	361,147	335,896	517,675	454,502	669,917	1,331,197	807,225	727,365
1956	908,760	377,172	364,811	503,777	480,434	678,092	1,565,299	941,274	809,021
1957	750,909	388,364	359,963	505,358	403,143	671,508	1,422,873	913,335	861,119
1958	730,539	375,936	490,996	536,665	439,121	674,180	1,038,409	879,263	737,801
1959	863,480	473,513	554,318	519,755	521,301	770,578	1,184,759	1,137,225	827,224
1960	819,013	470,796	547,492	526,627	471,066	766,775	1,214,542	1,207,861	844,214
1961	811,351	462,850	580,566	514,531	471,344	**	**	**	845,527

* Unadjusted for changes in Standard Industrial Classification.

** Not available at the time this study was made.

TABLE D-3

NEW ENGLAND EMPLOYMENT IN "BASE" INDUSTRIES,

1947-61*

"Base" Industries by SIC Codes

Years	22	28	30	31	33	34	35	36	37
1947	281,939	28,518	45,249	109,177	62,029	109,005	201,583	96,048	51,580
1949	244,228	26,269	39,725	112,526	48,748	87,104	154,795	77,458	49,780
1950	268,315	28,428	43,392	111,629	57,027	97,882	163,762	95,216	47,870
1951	249,336	29,617	46,500	106,121	65,530	105,699	200,801	113,781	65,365
1952	222,142	28,755	46,167	113,222	64,118	102,490	208,054	121,737	85,269
1953	220,627	31,814	50,808	119,546	55,843	103,957	207,034	141,512	92,583
1954	167,129	27,586	60,959	110,090	61,476	98,160	179,324	120,847	92,301
1955	166,401	28,356	47,300	114,731	57,034	94,167	179,848	124,919	90,871
1956	161,987	29,186	47,934	113,284	59,265	96,357	192,127	131,716	99,504
1957	138,176	30,804	44,853	110,823	57,338	94,800	189,267	130,807	113,423
1958	124,037	27,039	61,388	108,625	59,241	96,038	150,126	118,489	99,793
1959	125,429	29,852	65,088	114,696	62,881	101,267	158,785	140,159	99,534
1960	119,061	30,903	64,892	112,836	61,657	98,815	158,193	151,214	98,198
1961	110,488	30,755	65,014	111,754	58,420	94,025	155,417	155,625	104,982

* Unadjusted for changes in Standard Industrial Classification.

TABLE D-4

PRODUCTIVITY INDEX PROJECTIONS FOR NEW ENGLAND, 1960-2020

(1960 = 100.0)

"Base" Industries by SIC Codes

Years	22	28	30	31	33	34	35	36	37
1947*	59.8	56.2	75.6	84.9	90.5	76.9	89.1	78.3	67.0
1949*	60.1	62.4	76.4	79.2	83.9	80.0	84.1	87.3	87.6
1950*	61.6	69.2	86.8	77.8	116.1	89.8	92.1	83.3	91.6
1951*	58.3	58.2	66.2	75.1	115.4	94.3	96.5	87.5	78.9
1952*	70.4	62.4	73.5	90.9	113.1	90.9	110.0	94.5	89.4
1953*	68.7	69.8	76.4	86.6	118.7	101.5	109.0	89.0	101.9
1954*	72.6	79.2	82.0	92.9	100.0	86.6	100.3	97.1	93.5
1955*	78.1	86.1	84.1	97.2	109.4	94.2	101.4	85.7	100.5
1956	81.6	84.8	90.2	95.3	106.1	90.7	106.1	89.5	94.6
1957	79.0	82.8	90.5	97.7	92.0	91.3	97.9	87.4	88.3
1958	85.6	91.3	94.8	105.9	97.0	90.5	90.1	92.9	86.0
1959	100.1	104.1	100.9	97.1	108.5	98.1	97.2	101.6	96.7
1960	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1961	106.8	98.8	105.8	98.7	105.6	**	**	**	93.7
Projections									
1970	157.1	167.6	130.1	126.2	106.5	112.7	108.8	112.3	111.7
1980	251.2	273.7	171.6	155.9	108.5	129.0	116.4	129.0	128.6
1990	401.7	447.0	226.4	192.5	110.5	147.6	124.5	148.1	148.1
2000	642.4	729.9	298.7	237.9	112.6	168.8	133.2	170.0	170.4
2010	1027.4	1192.0	394.0	293.8	114.6	193.2	142.5	195.2	196.2
2020	1643.1	1946.6	519.7	363.0	116.8	221.0	152.5	224.1	225.8

* The productivity index series for all years prior to 1956 were adjusted so as to make them conform to the post-1956 indexes in terms of measurement of "value added." This was done by first deriving a pair of productivity indexes for 1956 for each industry, one based on "value added" not including "value added in merchandizing and net change in work-in process and finished products inventories" and the other including them. Then, their ratio, slightly exceeding unity, was multiplied by the indexes prior to 1956 in order to make them conform to the post-1956 indexes.

** Not available at the time this study was made.

1. "BASE" INDUSTRY PRODUCTIVITY PROJECTIONS: COMPUTATIONAL STEPS

Case A:

Projections made by fitting an exponential form of equation, assuming constant annual average rates of productivity increase, are given below; "Y" represents a deflated value added per employee index (1960 = 100.0) and "t" indicates "time" (1947 = 1).

SIC 30 - Rubber and Miscellaneous Plastics:

$$\log Y = \underset{(.014)}{1.9941} + \underset{(.002)}{.0120}\, t \qquad R^2 = .703$$

SIC 31 - Leather and Leather Products:

$$\log Y = \underset{(.012)}{2.0092} + \underset{(.0016)}{.0092}\, t \qquad R^2 = .688$$

SIC 34 - Fabricated Metals Products:

$$\log Y = \underset{(.024)}{1.9935} + \underset{(.002)}{.0058}\, t \qquad R^2 = .382$$

SIC 37 - Transportation Equipment

$$\log Y = \underset{(.019)}{1.9871} + \underset{(.0028)}{.0061}\, t \qquad R^2 = .216$$

Case B:

Projections made by fitting equations which imply a dampening rate of productivity increase:

SIC 22 - Textiles:

$$Y_1 = \underset{(7.908)}{47.4910} + \underset{(.334)}{3.5409}\, t \qquad R^2 = .896$$

$$Y_2 = 58.9147 - \underset{(.950)}{.1859}\, t + \underset{(.057)}{.2264}t^2 \qquad R^2 = .954$$

(Final projections represent the average of the projections obtained from Y_1 and Y_2 in each year.)

SIC 28 - Chemicals and Allied Products:

$$Y = 52.8252 + \underset{(1.534)}{2.3171t} + \underset{(.091)}{.0747t^2} \qquad R^2 = .882$$

Case C:

Projections based on historical productivity increases between selected years:

SIC 33 - Primary Metals:

Projected productivity increase of 1.53 percent per year was derived on the basis of the annual rate of increase between an average of 1947-49 and an average of 1959-61

SIC 35 - Nonelectrical Machinery:

Projected productivity increase of 1.15 percent per year was derived as the annual rate of increase between an average of 1947-49 and an average of 1959-60.

SIC 36 - Electrical Machinery

Projected productivity increase of 1.90 percent per year was derived from the 1947 to 1960 annual average rate of increase.

APPENDIX E

PROJECTIONS OF EMPLOYMENT IN NEW ENGLAND'S FISHERIES & MINING

PROJECTIONS OF EMPLOYMENT IN NEW ENGLAND'S FISHERIES AND MINING

We have projected employment in New England's fisheries to remain at the 1960 level of about 6800 -- the number of full-time (or full-time equivalent) workers enumerated in the Census of Population.

It is important, at the outset, to point to the serious discrepancies in the statistical sources reporting on employment in fisheries. According to the Bureau of Commercial Fisheries, employment in New England has been maintained at a level of 22,000-24,000 since 1951, despite a gradual decline in the quantity and value of the annual catch. (Table E-1). The above employment figures include not only individuals who are engaged in fisheries on a full-time basis but also "casual fishermen in boats or on shore," who do not come within the Census Bureau's definition of employment in the industry. Since the number of "casuals" has been rising in recent years as a proportion of the number reported by the Bureau of Commercial Fisheries, we decided to abide by the Census of Population definition, which was used as the base for the projection.

The United States currently ranks fifth in fish production among the nations of the world, accounting for about 7 percent of the world's total catch. About half of the national catch is used for human food, while the other half is converted into meal for livestock, fish oil for industrial use, and canned food for pets. In 1962, New England accounted for approximately 16 percent of the nation's catch, with inshore fisheries accounting for the bulk of the volume caught.

The catch from the high seas off foreign coasts is continuing to decline as the U.S. fishing industry remains at a competitive disadvantage with the fleets of other nations. In 1949, imports of fishery products accounted for only 20 percent of the U.S. supply, whereas in 1962 almost half of the nation's needs of both edible and industrial fishery products were met by imports.

The U.S. demand for fishery products has been increasing by about 5 percent per annum during the postwar period. Since per capita consumption of commercially caught fish has been declining (though only gradually), it is the demand for industrial fish products, primarily for animal feed, which has been the principal stimulant of national consumption.

For the purpose of this study, we are assuming that New England will continue to provide employment for about 6800 full-time fishermen. This assumption is based primarily on current uncertainties about the timing and the effect of government programs aimed at restoring the competitiveness of the U.S. fishing industry. While the application of new technology and the infusion of new capital may enable the industry to recapture a larger share of the fishery products consumed in the United States , little information is available about the effect of a program of modernization upon levels of productivity and hence upon future employment in the industry.

The following discussion of factors that are likely to affect employment levels in the New England fishing industry provides a qualitative background for our projection.

1. FACTORS FAVORING AN INCREASE IN FISHERIES EMPLOYMENT IN NEW ENGLAND

1. The projected doubling of U.S. population between 1960 and 2000, and continued rapid increase in per capita income, with a concurrent shift to higher protein diets.

2. The probability that the U.S. Government will take some action to prevent the further deterioration of this industry's competitive position. (Such action would be in the interest of regional economic development as well as of national defense preparedness).

3. Stimulation of demand for New England fish products domestically and abroad, and research and development of new uses (e.g. in the chemical and pharmaceutical industries).

TABLE E-1

FISH CATCH AND NUMBER OF FISHERMEN IN NEW ENGLAND, 1951-1961

YEAR	QUANTITY (thousand pounds)	VALUE (thousand dollars)	NUMBER OF FISHERMEN
1951	1,500,000	$114,245	23,639
1952	1,545,734	101,645	23,497
1953	1,374,040	97,958	26,392
1954	966,441	57,062	23,348
1955	955,418	57,243	25,566
1956	1,015,246	59,273	21,376
1957	1,030,833	60,810	22,288
1958	997,749	65,480	21,789
1959	933,206	66,236	21,051
1960	851,964	61,474	22,200
1961	780,000	61,000	21,737

Source: Market News Service, Bureau of Commercial Fisheries, United States Department of the Interior.

4. The application of modern technology to New England fisheries, e.g. midwater trawling gear, mechanized net handling equipment, stern trawlers, improved electronic fishery finding equipment and landing, holding and unloading equipment.

5. The proximity of New England to some of the world's best fishing grounds. (Since a shore-based operation is more economical than a factory ship operation, the New England fishing industry could capitalize on its geographical advantage if the fishing fleet were modernized.)

6. Rapidly rising wage rates in the countries that are currently competing with the U.S., causing the disparity in labor costs to shrink in future years.

2. FACTORS FAVORING A DECREASE IN FISHERIES PRODUCTION AND EMPLOYMENT IN NEW ENGLAND

1. Earnings are too low to attract young men to the industry. Working conditions on most vessels are hazardous; and the industry lacks the social status of other types of employment.

2. Competition will continue from foreign fishing fleets which, since the end of World War II, have captured an increasing share of the United States market. Many governments have offered liberal subsidies for such items as equipment, salt, bait, and bait storage.

3. U.S. fish processing firms have been stimulating imports in order to obtain their raw materials at the lowest possible cost.

4. Edible fishery products are facing competition within the U.S. from such low-cost, mass-produced protein foods as soybeans and chickens.

5. Ocean fisheries are subject to extreme fluctuations in fish supplies. In some of the older fisheries, increased fishing or the extension of the fishing area will not lead to increased yields and in some instances may endanger reproduction, unless adequate controls

are applied. For example, the ocean perch fishery near the New England shores requires increasing effort and cost because recent harvests have exceeded the rate at which this slow growing species is reproducing itself.

3. CONCLUSION

Our forecast for the maintenance of employment levels in New England's fishing industry is predicated on the following developments:

1. That the government will take action to prevent the further deterioration of this industry by increasing subsidies on fishing craft built in American shipyards. Without such support, commercial fishing in New England is likely to disappear over the next ten years.

2. New England fisheries will adopt improved methods of finding, catching, handling, preserving and transporting the catch. It is expected that, by means of the new technology, it will be possible to double the catch and thus reduce the industry's long-term dependence on government assistance.

3. Fishing craft will be larger and more highly mechanized but their number will remain about the same, as will the number of fishermen needed to operate them. It is expected that the working conditions and pay of the fishermen will be improved and that increased effort will be made to train young fishermen.

4. Fisheries will be used and managed on a sustained-yield basis.

5. Unilateral and bilateral international agreements will be reached, where needed, to protect the traditional fishing rights of New England fishermen in offshore fisheries.

6. Through research and development, many new and economic uses will be found for fisheries products and fuller utilization will be made of existing marine resources.

4. MINING EMPLOYMENT

Mining employment in New England is small and declining. Over the last three decades the region's total employment in this sector has been under 5000 persons. Between 1950 and 1960 employment in mining declined by 800 persons to a level of 4,000.

Mining activity in New England, as reported in the Census of Population, is of three types: (1) dimension stone quarrying; (2) sand, gravel and clay extraction; and (3) petroleum, metal and coal mining (composed almost entirely of executives and other personnel employed in central or branch offices, often working in New York but living in Connecticut).

We projected New England's mining employment by assuming that the decline between 1940 and 1960 would continue, but at a dampening rate. This assumption rests on the following expectations: (1) that employment in dimension stone quarrying will continue to decline; (2) that the sand and gravel component may rise slightly or decline slightly depending on the interplay between growth of construction demand paralleling population increase and growth in labor productivity; and (3) that the number of persons in the third component who reside in New England will remain about the same. Table E-2 presents the historical levelsof mining employment in New England, and the data underlying the projection. The rate of decline in future mining employment was dampened by computing the 1940-60 percentage decline and dividing by two in order to obtain a decadal rate of decline; this historical rate of decline was then halved in each succeeding decade to determine the projected rate of change in employment; lastly, the percentage changes were applied to the actual 1960 Census of Population figure for mining employment in New England to obtain the projections.

TABLE E-2

HISTORICAL AND PROJECTED MINING EMPLOYMENT IN NEW ENGLAND

Year	(A) Total Mining Employment[1]	(B) Each Decade's Employment as % of Previous Decade's Employment[2]	(C) Projected Mining Employment[3]
1940	4,633	1940-60 change equals	
1950	4,814	-13.56%, or =6.78% per	
1960	4,005	decade. 100.00	
1970		96.61	3,869
1980		98.31	3,804
1990		99.16	3,772
2000		99.58	3,756
2010		99.79	3,748
2020		99.90	3,744

1. Census of Population, 1940, 1950, and 1960.
2. Assumes that the historical percentage rate of change per decade (-6.78%) will diminish by one-half in each succeeding decade.
3. The percentages shown in column B multiplied by the previous decade's employment level, beginning with actual employment in 1960.

APPENDIX F

PROJECTIONS OF NEW ENGLAND'S AGRICULTURAL EMPLOYMENT,

(Extract from a report submitted by Economic Research Service,

U.S. Department of Agriculture)

PROJECTIONS OF NEW ENGLAND'S AGRICULTURAL EMPLOYMENT
(Extract from a Report submitted by Economic Research Service, U.S. Department of Agriculture)*

What agriculture will be in the future is difficult, if not impossible, to predict. There are many difficulties and hazards present in making detailed projections of agriculture even for a five-year period. Consequently, any projections of agriculture -- either national or regional -- which attempt to look to the end of the present century and beyond must at best be viewed as rough approximations of long-run expansions. Despite these shortcomings, the trends and directions set forth by these projections can be useful to policy-makers, planners and administrators in those agencies making long-term commitments involving resource development and conservation projects.

1. REGIONAL AGRICULTURE -- AN OVERVIEW

A process of continuous adjustment to changing conditions -- to market demand, to interregional competition, to new techniques of production and transportation, and to the opportunities and attractions that nearby cities offer to farm people -- has characterized New England agriculture since the beginning of the period of commercial farming.

There have been many changes. Wheat, wool, and beef were produced extensively until about 1830. The production of these commodities shifted westward in the latter part of the 19th century as new agricultural lands opened up. At the same time, the New England States expanded their production of more intensively grown crops, such as potatoes, cranberries, tobacco and apples. This shift has continued

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* *This Appendix consists of excerpts from the work undertaken by the* U.S. Department of Agriculture as an input for the projective economic study of New England. For the detailed text, see U.S.D.A. Economic Research Service, Resource Development Economics Division, An Analysis of Agriculture in the Economic Base of the New England Region with Projections (January 1964), mimeographed.

to the present. The poultry business, which makes a minimum demand on land resources, has also attained a place of prominence in parts of the region in recent decades. Dairying has long been important in New England agriculture. It is likely to remain so.

The maximum extension of New England agriculture occurred about 1880, when some 207,000 farms occupied 22 million acres, 5 million of which were in crops. By 1959, the number of farms had dropped below 60,000 and the acres in farms to 9.3 million acres, of which about 3.2 million acres was cropland.

Agriculturally, important differences exist between northern and southern New England. About 24 percent of the land area of southern New England was in farms in 1959. Generally, farming is much more intensive in the southern part.

2. FARM POPULATION AND EMPLOYMENT

With the exception of the years 1930 to 1940 when there was an increase of 48,000, the farm population of New England has been declining since about 1880.

In the absence of migration the regional population would grow, for the number of births to farm people exceeds the number of deaths. But, in most years since 1940, the net number of persons moving from farms has been much larger than the excess of births over deaths, thus producing population declines.

In 1940 farm population was about 623,000, or 7.4 percent of the total regional population. During the following decade farm population declined by 220,000 -- about 35 percent -- to a total of 403,000 in 1950. The farm population in 1950 was about 4.3 percent of the total regional population.

In the decade after 1950 there was a further population decline of about 171,000 -- or 42 percent -- to a total farm population of 232,000 in 1960 (Table F-1). The 1960 farm population estimate was about 2.2 percent of the total regional population.

TABLE F-1

FARM POPULATION AND ANNUAL AVERAGE NUMBER OF HIRED WORKERS, FAMILY WORKERS, AND TOTAL WORKERS ON NEW ENGLAND FARMS, 1950-'60

Year	Farm Population*	Farm Workers		Total Farm Workers
		Hired	Family	
	1,000	1,000	1,000	1,000
1950	403	71	148	219
1951	372	75	141	216
1952	368	71	136	207
1953	322	72	135	207
1954	301	71	131	202
1955	303	69	119	188
1956	294	65	114	179
1957	270	66	107	173
1958	258	66	106	172
1959	246	48	97	145
1960	232	46	91	137

* Civilian population living on farms, regardless of occupation.

An estimated 137,000 persons -- a decline of 93,000, or 37 percent from 1950 -- were employed on New England farms in 1960, according to data compiled by the Statistical Reporting Service (Table F-1). The estimates, which are designated "annual averages" of family, hired, and total farm-workers for each specified year, are the averages of estimates for 12 designated survey weeks throughout the year. Because of differences in method, employment concepts, and time of month for which the data are collected, SRS employment estimates are higher than those made by the Department of Labor.

The 46,000 hired farm workers in 1960 accounted for about one-third of the total work done on New England farms. Actually, hired labor has consistently held to this proportion of total farm employment in New England since 1950, as far back as reliable State farm employment estimates are available.

For the same period, farm employment in the region has held to about 60 percent of total farm population.

3. REGIONAL REQUIREMENTS

New England agriculture, like much of American agriculture, has been going through a period of adjustment during the recent 10-15 years. This is expected to continue. During this period its proportion of national farm output has been in constant decline. This trend is expected to continue throughout the present century.

The important fact regarding New England agriculture, however, is not its relationship to national agriculture, but rather its orientation toward its regional market.

New England is a deficit area for all but a few types of agricultural products. Most of its farm products are consumed within the region. The most important influence on the future of its agriculture will be the expanding prosperity of the region's industry and trade. As New England population and industry continues to grow, the fewer, larger, and more efficient farms that are expected to evolve

in response to economic influences will be favored with markets that demand and pay premium prices for the types of farm products which New England farms can most advantageously produce.

Table F-2 sets forth a series of projections of agricultural production in the New England region through 2020.

The dominant -- and increasing -- agricultural enterprise will continue to be dairy production for expanding metropolitan markets. New England's milk production will be increased as dairymen respond to the demand of regional markets. This will be accomplished largely through higher production per cow, by eventually expanding the number of cows, and by the importation of concentrate feeds. Dairy production is projected to increase about 43 percent by 1980, largely in response to the growing regional market.

TABLE F-2

PRIMARY AGRICULTURAL PRODUCTION OF NEW ENGLAND REGION, 1959, AND PROJECTIONS FOR 1980, 2000, AND 2020

Product	Unit	Actual 1959	Projected 1980	2000	2020
Meat[1]	Mil.lbs.	236	220	240	260
Poultry[2]	Mil.lbs.	494	220	240	240
Dairy products	Bil.lbs.	4.6	5.5	6.5	8.1
Eggs	Billion	2.8	3.8	4.9	5.9
Potatoes	Bil.lbs.	3.9	3.1	4.7	5.1
Vegetables, fresh market	Mil.lbs.	293	411	526	677
Vegetables, processed	Mil.lbs.	76	65	40	40
Apples	Mil.bu.	9.1	8.2	10.3	11.5
Cranberries	Thous.bbl.	533	711	1,002	1,405
Tobacco[3]	Mil.lbs.	18.4	7.0	--	--

1 Mainly beef and veal as a joint product of dairy production in projected years.

2 Mainly hens culled from laying flocks in projected years.

3 Tobacco projected to go out of production between 1980 and 2000.

The prospects of population growth will provide opportunities for expanded

production of poultry products, though the commercial broiler industry will have drastically declined. Primary emphasis will be given to egg production, with some increase in turkeys. These enterprises will have little impact on land use.

Population growth will provide an increased market for locally produced truck crops in season, but the availability of suitable land may be a limiting factor.

Fruit production, primarily apples and cranberries, will be expanded. Cranberry production will be geared to the national market, projected at a constant 40 percent.

Potato production will continue to be an important New England product geared to the demands of the national market. However, its proportion of the national market -- which has been greater than 20 percent in the past -- is projected to decline to about 10 percent of the national production in 2020. Competition from Idaho and the Red River of the North will contribute to the proportional decline in Maine potatoes.

To maintain and eventually expand farm output, the remaining agricultural land will be used more intensively and farm production techniques will improve steadily.

Table F-3 contains estimates of required farm employment in the New England region through 2020.

TABLE F-3

FARM EMPLOYMENT[1], NEW ENGLAND REGION, 1950, 1955, 1960 AND PROJECTIONS THROUGH 2020[2]

	Past			Projected		
Year	1950	1955	1960	1980	2000	2020
Thousands of workers[1]	101	91	68	65	62	59

[1]Full time equivalent of total farm employment.

[2]Employment equivalents are based on variable work year estimates of the Bureau of Labor Statistics. Estimated man-hours per work-year are as follows: 1950, 2,574 hours; 1955, 2397 hours; 1960, 2,254 hours; 1980, 1,880 hours; 2000, 1635 hours; and 2020, 1,500 hours.

These estimates were related to the anticipated level of agricultural production, the continued substitution of capital for labor and land through emphasis in farm mechanization and adoption of new technology, and the future structure of a regional agriculture with increasing farm size enabling more efficient use of both capital and labor.

The estimated employment requirements for the years 1980, 2000, and 2020 were built up to regional totals on the basis of projected man-hours per unit or acre efficiencies related to the amount of labor which would be required to produce the projected output by separate products as listed in Table F-2. These estimates include consideration of supporting activities not listed in the table, such as production of hay in connection with dairying.

APPENDIX G

PROJECTIONS OF NEW ENGLAND EMPLOYMENT IN FORESTRY, LUMBER AND WOOD PRODUCTS, AND PAPER AND ALLIED PRODUCTS, (Extract from a report submitted by Forest Service, United States Dept. of Agriculture).

PROJECTIONS OF NEW ENGLAND EMPLOYMENT IN FORESTRY, LUMBER AND WOOD PRODUCTS, AND PAPER AND ALLIED PRODUCTS, (Extract from a report submitted by Forest Service, United States Dept. of Agriculture).*

1. NEW ENGLAND'S FOREST RESOURCES: AN OVERVIEW

Forests, which occupy 79 percent of New England's land area, are a dominant feature of the landscape. At the present time, these forests support a large and growing woodpulp, paper, and board industry and a smaller and gradually declining lumber industry. The relative importance of the two industries is reversed from what it was several decades ago.

The forest land area of New England has also changed substantially in past years. In 1600, forests covered about 95 percent of the land area. As agriculture expanded, the forest area decreased rather gradually until 1800 and then more rapidly until 1870, when forests covered only 58 percent of the six-state area. Since that time the forest land area has increased and the present forested area is almost the same as in 1800.

The change in forest land area differs among regions within New England. The forested area of Connecticut is only slightly greater now than in 1870, while the area of forest land in Massachusetts has more than doubled over the same period.

Forest Land Area as a Percent of Total Land Area

State	1870	1962
Connecticut	60%	64%
Maine	76	88
Massachusetts	30	65
New Hampshire	51	87
Rhode Island	40	64
Vermont	41	63
Total	58%	79%

*This Appendix is based on the Forest Service Contribution to the projective economic study of New England. For detailed treatment, see U.S.D.A. Forest Service, Northeastern Forest Experiment Station, New England Economic Survey-Projected Employment and Production in Forest Industries in New England (November 1963). ADL has made several slight changes in the organization of the Forest Service Report and has omitted some parts and a number of tables.

Much of the forest land of New England, particularly outside of Maine, was farmed within the past century. As a result, these lands support relatively young timber growth. This, together with the knowledge that much of the forest land in southern New England is in small woodlands, has been considered in projecting development of the forest industries.

Although this report is concerned only with the industrial use of forest lands, it should be remembered that these lands also contribute to the social and economic welfare of New England through multiple use. They play an important role in outdoor recreation, in the protection of watersheds, and as habitat for wildlife.

The feasibility of increasing the production of lumber and woodpulp in New England depends in large measure on the status of the timber resource of the area. If the projected production of particular kinds of lumber and woodpulp or the projected total production of these products indicates that strong pressures will be placed on the available forest resource, either projections of production in these industries must be modified or increased employment and expenditures in forest management must be anticipated.

Information collected and compiled by the Forest Service concerning the present forest resource of New England and likely timber growth under various levels of timber inventory was analyzed. A comparison of this information with projected timber drain based on projected levels of production in both major industries indicated the following:

1. Overall timber growth in New England at the present time exceeds the current level of cutting.

2. Overall levels of projected timber growth for five major forest types for target years exceed projected levels of cutting for New England as a whole.

Thus, projected production of lumber and woodpulp for target years appears to be within the quantities of timber likely to be

available for these industries under the assumptions that were made. It is possible, however, that future timber quality and changes in forest land use may modify the projected availability of timber. It is further possible that analysis of regional differences in the production of timber products and the growth of timber may indicate specific areas in New England where the available timber supply may restrict increases in the production of timber products.

The projections of employment and production in New England that are presented in this report are derived from preliminary national projections of production in the basic wood-using industries. These projections were prepared by the Division of Forest Economics Research, U.S. Forest Service, Washington, D.C., by relating consumption of forest products to important economic variables such as population, income, construction starts, and other prime determinants of lumber, plywood and paper use. The Forest Service national projections had been prepared for 1970, 1980, 1990, and 2000. Extrapolations of these trends were made to the year 2020 for use in economic base surveys for comprehensive river basin development plans. The procedure used for making projections of lumber, woodpulp, and paper and board production for New England involved explicit projections of production in all other major regions of the United States. These projections are consistent with Forest Service projections of national production.

Projections of employment were made by relating projected labor productivity to projections of the levels of physical production. The 1960 Census of Population was used to provide estimates of the employment base.

2. LUMBER AND WOOD PRODUCTS, EXCEPT FURNITURE (SIC 24)

The Lumber and Wood Products Industry includes both primary manufacturing plants, which utilize timber as a raw material, and secondary manufacturing plants, which utilize lumber as their basic raw material. The primary segment of this industry is defined here as

including logging camps and logging contractors (SIC 241) and sawmills and planing mills (SIC 242). All other SIC three-digit codes included under SIC major group No. 24 (SIC's 243, 244, 249) are considered here to be secondary wood-using industries.

The primary wood-using industries are spatially tied closely to the timber resource; this is not necessarily true of the secondary wood-using industries. The Forest Service provides projections of lumber production through the year 2000; that is, the Forest Service provides projections of production for the primary lumber manufacturing group only. These projections of national lumber production were successively broken down for the Northeastern United States and for the New England area for both softwood and hardwood lumber using projections of historical trends.

Trend lines for softwood lumber were fitted using least squares regression analysis applied to Bureau of Census data for the period 1946 to 1962.* Production in major regions of the country as a percent of total national production was related to time using equations of the general form,

$$Y = a + b \log X, \qquad (1)$$

where Y is the percent of total national softwood lumber production and X is the year. This form of trend line gives what might be termed a dampened trend; that is, for regions in which lumber production as a percent of total national production is increasing, the equation form that is used projects a continuing increase in percentage but at a decreasing rate, while for regions for which the percent of total national production is decreasing, this form projects a continuing decrease but at a decreasing rate.

Three major regions, the West, the South, and the North, were used for these projections. Coefficients of determination for the equations that were used ranged from .89 to .94, indicating that the trend

* U.S. Bureau of the Census, Current Industrial Reports, Lumber Production and Mill Stocks (Annual, 1946-1961).

line accounts for a very substantial part of the variation in annual production as a percent of total national production. The resulting projections were modified somewhat to allow for expected shifts in regional production after 1970 as production levels in the West approach probable allowable timber cut levels.

Projections of hardwood lumber production were allocated to the two major hardwood producing areas, the South and North. Average production in the North over the post-World War II period has averaged 42.5 percent of all hardwood lumber production. Because there have been no discernible trends in postwar hardwood lumber production, this average was used as a basis for allocating projected hardwood lumber production for target years.

A further breakdown of softwood and hardwood lumber production in New England from lumber production in all of the North was made using Bureau of the Census lumber statistics. However, gaps in the data for several postwar years made the fitting of trend lines using regression analysis impractical and as a result, trend lines were fitted graphically. Projections of total lumber production in New England for target years are shown in Table G-1.

Projections of employment in the lumber industry (SIC 24) were made separately for the primary and secondary parts of the major group. The 1960 Census of Population provided estimates of 1950 and 1960 employment in logging and sawmills and planing mills, which make up the primary part of the major group.* A comparison of the 1960 New England employment figure with New England lumber output for that year indicated an average output per employee of 35,800 board feet of lumber. Output per employee was estimated to increase 600 board feet per year. Projections of future employment levels were made by dividing projected output for target years by projected levels of output per employee (Table G-1).

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* U.S. Bureau of the Census, 1960 Census of Population, State Reports: Detailed Characteristics.

TABLE G-1

NEW ENGLAND PRODUCTION AND EMPLOYMENT IN THE LUMBER AND WOOD PRODUCTS INDUSTRY (SIC 24)

Years	Lumber Production (mil. of board ft.)	Employment (Thousands)*		
		Primary (SIC 241,242)	Secondary (SIC 243,244,249)	Total
1947	1,140	--	---	--
1950	--	29.8	14.5	44.3
1954	990	--	---	--
1958	680	--	---	--
1959	780	--	---	--
1960	720	20.1	13.5	33.4
1961	680	--	---	--
1962	670	--	---	--
1970	680	16.2	12.5	28.7
1980	680	14.2	11.5	25.7
1990	740	13.7	10.5	24.2
2000	740	12.3	9.5	21.8
2010	(740)	(11.2)	(8.5)	(19.7)
2020	740	10.3	7.5	17.8

* Derived from 1950 and 1960 Census of Population. All projections are in Census of Population employment terms.

-- Not available.

(...) Interpolated by Arthur D. Little, Inc. for the purposes of this study on the basis of the explanations given in the Forest Service text. It was assumed, for example, that employment in the "secondary" group would decline by 1,000 employees per decade, and that production per employee would increase by 600 board feet per year (approximately 66,000 board ft./employee in 2010).

TABLE D-4

RED MEATS:1/ PRODUCTION AND PERCENTAGE DISTRIBUTION BY STATE FOR THE NEW ENGLAND REGION, 1960 AND PROJECTIONS FOR TEN YEAR INTERVALS TO 2020

Year	Red meat production							Percentage of New England region's production						
	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	New England Region	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	Index Number
	Millions of pounds							Percent						
1960....	45.7	17.5	70.1	57.1	6.2	35.6	232.2	19.7	7.5	30.2	24.6	2.7	15.3	100
1970....	35.9	19.3	86.1	50.1	6.5	32.1	230.0	15.6	8.4	37.4	21.8	2.8	14.0	99
1980....	34.4	18.8	89.9	42.1	4.6	30.2	220.0	15.6	8.5	40.9	19.1	2.1	13.8	95
1990....	36.1	19.4	101.1	38.4	4.3	30.7	230.0	15.7	8.4	44.0	16.7	1.9	13.3	99
2000....	37.7	20.3	110.5	36.7	3.6	31.2	240.0	15.7	8.5	46.0	15.3	1.5	13.0	103
2010....	40.0	21.1	118.6	35.8	2.9	31.6	250.0	16.0	8.4	47.5	14.3	1.2	12.6	108
2020....	41.0	22.0	124.5	36.6	2.8	33.1	260.0	15.8	8.5	47.9	14.1	1.0	12.7	112

1/ Includes the sum of cattle and calves, hogs, and sheep and lambs.

trends. These allocations were made separately for woodpulp and for paper and board. In both cases, production statistics for the 1947-1961 period were used.* Regression analysis was used to relate production in each of four major regions of the country to national production. The major regions used are the Northeast, the North Central, South, and West. In case of woodpulp, coefficients of determination ranged from .65 to .95; coefficients of determination for the paper and board production equations ranged from .91 to .99.

The resulting woodpulp production projections were modified substantially. For the Northeast, a comparison of projections of woodpulp and paper and board production indicated a widening gap between woodpulp and paper and board production. This divergence of trend lines resulted from post-World War II improvements and increases in capacity in old paper and board plants in the Northeast; continuation of these trend lines into the future would neglect the present practice of integrating woodpulp and paper and board production in new plants. Therefore, the woodpulp projections made using recent trends were modified upward to bring them more in line with current practice in constructing new plants.

Projections of wood pulp and paper and board production for the Northeast were further broken down to provide projections of production in New England using available data for the period 1945-1961* (data for four of the included years were not available). For these breakdowns, allowance was made for increasing production in the predominantly hardwood areas of the Northeast, some of which have no woodpulp mills at the present time but are expected to have them in the future (Table G-2).

Analysis of operating statistics for pulp mills and paper and board mills for 1961 indicate that of the total employment engaged

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* U.S. Bureau of the Census, Current Industrial Reports, Pulp, Paper, and Board (Annual, 1947-1961).

TABLE G-2

NEW ENGLAND PRODUCTION AND EMPLOYMENT IN THE PAPER AND ALLIED PRODUCTS INDUSTRY (SIC 26)

	Production (thousands of tons)		Employment (thousands of persons)*		
Years	Woodpulp	Paper & Board	Primary (SIC 261, 262, 263, 266)	Secondary (SIC 264, 265)	Total
1946	1,422	2,536	-	-	-
1947	-	-	-	-	-
1948	-	2,657	-	-	-
1949	-	2,429	-	-	-
1950	1,458	2,771	40.8	27.7	68.5
1951	1,676	2,966	-	-	-
1952	1,617	2,729	-	-	-
1953	1,556	2,819	-	-	-
1954	-	-	-	-	-
1955	-	-	-	-	-
1956	2,060	3,423	-	-	-
1957	-	-	-	-	-
1958	1,775	3,163	-	-	-
1959	1,899	3,369	-	-	-
1960	1,839	3,552	42.5	30.2	72.7
1961	1,952	3,507	-	-	-
1962	1,968	3,525	-	-	-
1970	2,300	4,200	42.5	33.6	76.1
1980	2,900	5,100	43.0	37.4	80.4
1990	3,600	6,200	45.6	41.7	87.3
2000	4,500	7,200	49.1	46.4	95.5
2020	5,200	10,000	52.0	57.4	109.4

- Not available

* All employment figures in Census of Population employment terms. Historical data obtained from the 1950 and 1960 Census of Population.

in the production of primary products in the Paper and Allied Products Industry group, 25 percent is attributable to woodpulp production and 75 percent is attributable to paper and board production.* Employment figures for 1960 for pulp, paper, and board mills were broken down into two groups on this basis and projected to target dates using the projections of production and assuming an increase in productivity in terms of outper per employee of 3.1 tons per year of woodpulp and of 2.1 tons per year of board and paper. These estimates of increases in output per employee were derived from production and employment figures for 1950 and 1960 (Table G-2).

Employment in the secondary part of Major SIC Group 26 was projected assuming a productivity increase of 2.1 percent in terms of output per employee. Major types of paper and board used in secondary production are coarse papers, container board, and bending board. Production of these paper types is expected to increase at an average annual weighted rate of 3.2 percent,** and employment projections in paper remanufacturing were made assuming a growth in output of 3.2 percent per year.

4. FORESTRY (SIC 08)

This major group includes establishments primarily engaged in the operation of timber tracts, forest nurseries, and related activities such as reforestation, forestry services and the gathering of gum, barks, balsam needles, maple sap, Spanish moss and other forest products. It does not include forestry employment accounted for elsewhere, such as the employment of foresters by government agencies and by manufacturing industries. Major group 08 is a relatively minor employment group in New England.

Data adequate for analyzing trends in employment in major

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* American Paper and Pulp Association, Labor and Operating Statistics, 1961.

** U.S. Forest Service. Preliminary estimates, Division of Forest Economics Research, 1963.

group 08 in New England are not available. Estimates for 1960 indicate that 1.8 thousand persons are employed in major group 08, as compared with 2.1 thousand persons in 1950.*

It appears likely that some increase in employment in forest nurseries (SIC group 082) and in forestry services (SIC group 085) will occur over the period for which these projections are made. On the other hand, it appears likely that some decreases in employment of the gathering of gums and barks (SIC group 084) and gathering of forest products not elsewhere classified (SIC group 086) is likely.

Overall, some minor decreases in employment during the next decade are likely, particularly for SIC groups 084 and 086. After 1970, increases in forestry services provided for increasing numbers of absentee owners should offset further decreases in 084 and 086 (Table G-3).

TABLE G-3

NEW ENGLAND EMPLOYMENT IN FORESTRY (SIC 08)

Years	Employment* (thousands)
1950	2.1
1960	1.8
1970	1.5
1980	1.5
1990	1.5
2000	1.5
2020	1.5

* In Census of Population employment terms.

* U.S. Bureau of the Census, 1960 Census of Population, State Reports: Detailed Characteristics.

APPENDIX H

PRIME MILITARY CONTRACT AWARDS IN NEW ENGLAND: TRENDS AND PROJECTIONS

PRIME MILITARY CONTRACT AWARDS IN NEW ENGLAND: TRENDS AND PROJECTIONS

1. INTRODUCTION

Projections of the value of prime military contract awards in New England are made for the purpose of deriving value-added projections for the region's transportation equipment industry (SIC 37). Unlike the other value-added projections, for which we used gross national product components and other national aggregates as explanatory variables in a framework encompassing a sequence of regression analyses, we decided to make value added projections for the region's transportation equipment industry via projections of prime military contracts because the industry is heavily defense-oriented. In 1960, for example, about 57 percent of total prime military contract awards made to New England were received by the transportation equipment industry. These contracts awarded to that industry were absorbed largely by SIC 372, aircraft and parts, and SIC 373, ship and boat building, which together account for over 90 percent of the industry's total value added in the region. The sensitiveness of the region's transportation equipment industry to prime military contract awards can thus be readily acknowledged.

The regression analysis framework through which value added projections for the region's "base" industries were made is presented elsewhere. The purpose of this appendix is to explain the assumptions and methods used in projecting prime military contract awards in New England. In summary form, the projection methodology consisted of two basic and inter-related steps. First, we projected federal government defense expenditures for the nation as a whole, and estimated from them future levels of prime military contract awards, always relying on the general assumptions explicitly stipulated for this study, i.e., that there will be no general war and that the postwar state of defense preparedness will continue for the foreseeable future. (Accordingly, we assumed that defense expenditures and military contract awards would increase in absolute terms,but would

decline gradually as a percent of gross national product (GNP) and of total government expenditures.)

Second, we projected New England's share of national prime military contract awards by assuming that the current disparity between New England's population share and its share of prime military contracts will disappear in the future and that the two shares will be equal by the end of the projection period. Implicit in this assumption is a more general assumption about the geographical distribution of prime military contract awards in the future, namely that the distribution of prime military contract awards will approach the distribution of population.

Crude as they may be in the face of national and international uncertainties, our estimates of national defense expenditures and prime military contract awards in New England take on significant dimensions, since the transportation industry, one of the prime movers of the regional economy, is so heavily defense-oriented.

2. PROJECTIONS OF DEFENSE EXPENDITURES AND PRIME MILITARY CONTRACTS IN THE UNITED STATES

On the basis of the general assumptions spelled out above and using appraisals of Defense Department programming policies made by Arthur D. Little, Inc. industry specialists, we projected U.S. national defense expenditures to decline to a level of approximately 8.0 percent by 1970, 7.5 percent by 1980, 5.0 percent by 2010, and 4.0 percent by 2020. Translating these percent shares into absolute figures, we find that defense expenditures are projected to grow by 75 percent between 1960 and 1980, about 3½-fold between 1960 and 2010, and about 4-fold between 1960 and 2020* Should past trends continue, we believe that this rise in defense expenditures will form a decreasing percentage of total government expenditures.

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* This assumes that GNP will increase at an average rate of 3.8 percent per annum between 1959-1961 and 1980, and 3.6 percent per annum between 1980 and 2020. See Appendix B on GNP component projections.

During the 1958-1962 period, prime military contracts comprised, on the average, 46.23 percent oftotal defense expenditures. Assuming that this average relationship would prevail during the projection period, we made projections of prime military contract awards in the nation as a whole. (See Table H-2)

3. PRIME MILITARY CONTRACT AWARDS IN NEW ENGLAND

It is important to emphasize that prime military contract awards represent only a very crude approximation of the region's contribution to national defense production. There is a well recognized geographic disparity between the location of prime military contracts, which simply indicates the place where the project stipulated by a contract will be finally assembled, and industry value added in defense production which includes all defense subcontracts. Because of the prevailing methods of defense subcontracting and difficulties of measuring these subcontract awards, we are impeded in studying the regional impact of defense expenditures. Further complications add to the problem. For example, there is a time disparity between the awarding of military contracts and the actual flow of money to the contracting and subcontracting industries. Data on prime military contracts are available for fiscal years only, whereas industry output measures such as "value added" are given for calendar years. Finally, prime contracts represent a gross measure, whereas "value added" is a net measure. For all these reasons, prime military contract awards should be taken only as a gross indication of a region's share of national defense expenditures, and their use should be appropriately qualified.

a. Past Trends - New England has fared well as a recipient of prime defense contract awards. In the three periods for which we have data - World War II (fiscal years 1941-45), the Korean War (fiscal years, 1951-53), and the immediate past (fiscal years 1958-63) - its share of prime defense contracts has been higher than its share

of the nation's population and income. During World War II, New England's share of contract awards averaged 8.9% of the total allocable among the states. The share declined to 8.1% during the Korean War, but during the six years, 1958-63, averaged 9.9%. Together, Connecticut and Massachusetts received the major portion of contract awards: 7.3% of total U.S. in World War II, 7.0% in the Korean War, and an average of 9.0% in 1958-63, with the recent growth for the region coming in the Massachusetts share, which went from 3.5% in World War II to 2.8% in the Korean War to an average 4.7% in 1958-63 (Refer to Table H-3).

Nationally, there has been a shift in emphasis over time in the procurement programs for military hard goods.*

	Deliveries		Contracts
	Fiscal Years		
	1942-44	1953	1961
Missiles	0	0.5	33.6
Aircraft	27.3	31.5	28.2
Electronics	6.6	11.2	18.0
Tank-Auto. Weapons Ammo. Prod. Equip. & Misc.	39.9	50.0	12.4
Ships	26.2	6.8	7.8
Total Military Hard Goods	100.0	100.0	100.0

In many states this shift in military emphasis from weapons to missiles has meant a definite change in the percentage share of defense procurement contracts received. For example, it resulted in a considerable decline in the shares of the states in the Ohio River Basin. Even though ship and aircraft contracts are so crucially important to New England, the region also has been fortunate in getting a foothold in the missiles and electronics fields. Military contracts in these two

* Office of the Secretary of Defense, The Changing Patterns of Defense Procurement (June 1962).

latter fields, we believe, have been largely responsible for the recent growth in New England's share of defense procurement contracts. With only the ship and aircraft contracts, New England's share would probably have remained stable.

Prime military contract awards to the transportation equipment industry in New England (SIC 37) accounted for 57% of total prime defense contract awards in the region in fiscal 1960* and for 50% of total awards in New England in fiscal 1962.** However, the transportation equipment awards were of quite different relative importance to the two important states of the region. In Connecticut, they accounted for 80%* of total awards in 1960 and 87%** in 1962. In Massachusetts, they accounted for 46%* in 1960 and 19%** in 1962 (Refer to Table H-4). Likewise, EDT and R contracts, which accounted for an average of 19% of total prime contract awards in New England in 1958-62, were of quite different relative importance in Connecticut and Massachusetts. In Connecticut, they averaged 9% of total prime contract awards, and in Massachusetts, 31% during the 1958-1962 period.

In the long run, it seems unlikely that New England can maintain as large a share of defense contract awards as it had during the post-war period. Already, other areas of the country are becoming aware of regional inequalities and are making attempts to correct them. Thus, despite its current nucleus of electronics firms, we believe that New England's share of prime military contract awards will gradually decline in the future.

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* Isard and Ganchow, Awards of Prime Military Contracts by County, State and Metropolitan Area of the United States, Fiscal Year 1960.

** Office of the Secretary of Defense, Five Year Trends in Defense Procurement, 1958-1962. The data for these two years are not strictly comparable because of slight differences in the classification of industries. Nevertheless, they do point out the widely different relative magnitude of transportation equipment awards in the two states.

b. Projections of Prime Military Contract Awards in New England - In projecting prime military contract awards in New England, we assumed that over time the geographical distribution of military contracts will converge with the distribution of population. Even now the percentage distribution of prime military contracts by states does not appear to be far apart. Accordingly, we assumed that the two shares would be equal by 2020. We then interpolated between New England's 1960 share of prime contract awards (10.1%) and its projected share of U.S. population in 2020 (5.1%),* to estimate the prime contract shares for the intervening years. We then obtained the future levels of prime military contract awards in New England by multiplying its estimated shares by the projected prime contract values in the nation as a whole expressed in millions of 1960 dollars (refer to Table H-6). These estimates indicate that the value of prime military contract awards in New England will increase by about 51 percent between 1960 and 1980, and that it will double by 2020.

* This is the share developed by our preliminary population projection. The final "equilibrium" projection yielded a New England share of 5.0 percent. The difference is of no material importance for the projection of prime military contract awards.

TABLE H-1

NATIONAL DEFENSE EXPENDITURES AS A PERCENT OF GROSS NATIONAL PRODUCT AND GOVERNMENT PURCHASES OF GOODS AND SERVICES, 1939-1963

Year	Gross National Product (millions of 1960 dollars)	Federal, State, and Local Gov't Purchases of Goods and Services (millions of current dollars)	National Defense Expenditures* (millions of current dollars)	National Defense Expenditures as a Percent of GNP %	National Defense Expenditures as a Percent of Gov't Purchases of Goods and Services %
1939	91,095	13,320	1,258	1.4	9.4
1940	100,618	14,073	2,223	2.2	15.8
1941	125,822	24,751	13,794	11.0	55.7
1942	159,133	59,717	49,567	31.1	83.0
1943	192,513	88,617	80,384	41.8	90.7
1944	211,393	96,529	88,615	41.9	91.8
1945	213,558	82,867	75,923	35.6	91.6
1946	210,663	30,498	18,791	8.9	61.6
1947	234,289	28,382	11,360	4.8	40.0
1948	259,426	34,536	11,578	4.5	33.5
1949	258,054	40,159	13,570	5.3	33.8
1950	284,599	39,029	14,257	5.0	36.5
1951	328,975	60,460	33,864	10.3	56.0
1952	346,999	76,044	46,408	13.4	61.0
1953	365,385	82,830	49,289	13.5	59.5
1954	363,112	75,254	41,189	11.3	54.7
1955	397,469	75,592	39,081	9.8	51.7
1956	419,180	78,967	40,355	9.6	51.1
1957	442,769	86,536	44,406	10.0	51.3
1958	444,546	93,458	44,837	10.1	47.9
1959	482,704	97,199	46,244	9.6	47.5
1960	502,601	99,616	45,687	9.1	45.9
1961	518,173	107,909	49,003	9.5	45.4
1962	554,894	116,977	53,298	9.6	45.6
1963	585,100(Prelim)	125,100	56,700	9.7	45.3

*For the purpose of maintaining comparability over time, national defense expenditure figures include only federal government defense expenditures and not those of state and local governments. In 1962 defense expenditures by state and local governments equaled $344 millions, or less than 1% of federal defense expenditures. The latter also exclude national defense transfer payments, grants-in-aid to states and local governments, and subsidies less surplus of government enterprises, all of which amounted to approximately 3% of all national defense expenditures in 1962.

SOURCE: U.S. Dept. of Commerce, Survey of Current Business, 7/62, '63 and 2/64 and The Conference Board the Economic Almanac, 1964, p. 117.

TABLE H-2

U.S. PRIME MILITARY CONTRACT AWARDS

(Based on Projections of Gross National Product and National Defense Expenditures)

Years	a Gross National Product (billions of 1960 dollars)	b Estimated National Defense Expenditures as a share of GNP (Percent)	c = a x b National Defense Expenditures (millions of 1960 dollars)	d Prime Military Contract Awards as Percent of Tot. Nat'l Defense Expenditures (1958-'62 average)	e = c x d Prime Military Contract Awards (millions of 1960 dollars)
1960	502.6*	9.09	45,687*	44.67	20,407**
1970	733.8	8.00	58,704	46.23	27,139
1980	1,065.5	7.50	79,913	46.23	36,944
1990	1,517.9	7.00	106,253	46.23	49,121
2000	2,171.2	6.00	130,272	46.23	60,225
2010	3,080.9	5.00	154,045	46.23	71,215
2020	4,397.8	4.00	175,912	46.23	81,324

* See the preceding table.

** *Office of the Secretary of Defense*, *Five Year Trends in Defense Procurement, 1958-1962* (June 1963), p. 52.

TABLE H-3

PRIME MILITARY CONTRACT AWARDS

	WWII[1]	Korea[1]	1958[2]	1959[2]	1960[2]	1961[2]	1962[2]	1963[3]
Net Value (Millions of Dollars)								
Maine	1,304	345	87	117	32	97	80	58
New Hampshire	422	174	34	41	72	105	59	51
Vermont	221	105	18	14	19	16	16	12
Massachusetts	7,246	2,613	735	1,151	1,070	1,072	1,310	1,060
Rhode Island	1,468	457	24	27	26	25	58	46
Connecticut	7,846	4,025	897	920	839	1,019	1,213	1,048
Total	18,507	7,719	1,795	2,270	2,058	2,334	2,736	2,276
Percentage Share of Total U.S. Contracts								
Maine	0.6	0.4	0.4	0.5	0.2	0.4	0.3	0.2
New Hampshire	0.2	0.2	0.2	0.2	0.4	0.5	0.2	0.2
Vermont	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Massachusetts	3.5	2.8	3.5	5.2	5.2	4.8	5.2	4.2
Rhode Island	0.7	0.5	0.1	0.1	0.1	0.1	0.2	0.2
Connecticut	3.8	4.2	4.2	4.2	4.1	4.6	4.8	4.2
Total	8.9	8.1	8.5	10.3	10.1	10.5	10.8	9.1

1. Office of the Secretary of Defense, The Changing Patterns of Defense Procurement, June 1962, Table III, pp. 15-17.
2. Office of the Secretary of Defense, Five Year Trends in Defense Procurement, 1958-1962, June 1963, Appendix III, pp. 52-54.
3. Department of Defense, Prime Contract Awards by State, June 1963.

TABLE H-4

MILITARY PRIME CONTRACT AWARDS FOR EXPERIMENTAL, DEVELOPMENTAL, TEST AND RESEARCH WORK

	1958	1959	1960	1961	1962
Net Value (Thousands of Dollars)[1]					
Maine	117	152	670	128	496
New Hampshire	2,635	7,109	8,842	10,664	8,204
Vermont	2,905	1,800	3,030	1,386	1,899
Massachusetts	232,318	304,945	397,517	348,452	361,973
Rhode Island	1,824	2,045	1,512	5,601	6,312
Connecticut	56,120	105,105	91,979	123,295	65,005
Total	295,649	421,156	503,550	489,526	443,889
Percentage Share of Total U.S. Contracts					
Maine	*	*	*	*	0.01
New Hampshire	0.10	0.10	0.20	0.18	0.13
Vermont	0.10	*	0.10	0.02	0.03
Massachusetts	5.70	5.90	7.20	5.78	5.92
Rhode Island	*	0.10	*	0.09	0.10
Connecticut	1.40	2.00	1.70	2.05	1.06
Total	7.30	8.10	9.20	8.12	7.25

1. Office of the Secretary of Defense, Five Year Trends in Defense Procurement, 1958-1962, June 1963, Appendix IV, pp. 56-58.

* Less than 0.005%.

TABLE H-5

AWARDS OF PRIME MILITARY CONTRACTS FOR SELECTED SIC'S IN NEW ENGLAND

1960

SIC	Industry Title	Thousands of Dollars	Percent Dist. %
22	Textile Mill Products	7,867	.384
28	Chemicals & Allied	7,575	.370
30	Rubber and Plastic Products	2,170	.106
31	Leather and Leather Products	10,595	.517
33	Primary Metal Industries	2,436	.119
34	Fabricated Metal Products	10,031	.489
35	Machinery, except Electrical	60,180	2.938
36	Electrical Machinery	180,580	8.815
37	Transportation Equipment	1,171,983	57.209
	Sum of Above	1,453,416	70.947
(7399 + 8921)	"Research"	294,005	14.352
	Total Prime Military Contract Awards	2,048,555*	100.000

* Due to certain prime contracts not being assigned to industry sectors, this total is slightly below the New England prime contracts total ($2,048,611,000) reported in the source cited here.

SOURCE: Walter Isard and James Ganschow, Awards of Prime Military Contracts by County, State and Metropolitan Area of the United States, Fiscal Year 1960.

TABLE H-6

PRIME MILITARY CONTRACT AWARDS IN NEW ENGLAND, 1960-2020

Years	U.S. Prime Contracts (millions of 1960 dollars)	X	Estimated New England Share of U.S. (percent)	=	Prime Military Contract Awards in New England (millions of 1960 dollars)	(millions of 1954 dollars**)
1960	20,407*		10.1		2,058*	1,728
1970	27,139		9.3		2,524	2,119
1980	36,944		8.4		3,103	2,605
1990	49,121		7.6		3,733	3,134
2000	60,225		6.8		4,095	3,438
2010	71,215		5.9		4,202	3,528
2020	81,324		5.1		4,148	3,483

*From Office of the Secretary of Defense, Five Year Trends in Defense Procurement, 1958-1962 (June 1963).

** Projections in millions of 1960 dollars are converted into a 1954 base by dividing them by the implicit price deflator for durable goods in 1960 (119.1) with 1954 = 100.0, given in U.S. Department of Commerce, Survey of Current Business (September 1963), p.10.

APPENDIX I

PROJECTIONS OF EMPLOYMENT IN NEW ENGLAND'S NONMANUFACTURING AND NONPRIMARY INDUSTRY SECTORS BY LEAST SQUARES REGRESSION

PROJECTIONS OF EMPLOYMENT IN NEW ENGLAND'S NONMANUFACTURING AND NONPRIMARY INDUSTRY SECTORS BY LEAST SQUARES REGRESSION

1. INTRODUCTION

The derivation of "equilibrium" employment projections for each of the major nonmanufacturing sectors (i.e., construction, transportation, communications, utilities, wholesale and retail trade, finance, insurance and real estate, services, and government) was explained in Section 16, Chapter IV. This appendix supplements the explanation given there by presenting the least squares regression equations (TABLE I-1) used in making the first round employment projections for each of the six major nonmanufacturing sectors (i.e., employment projections in Bureau of Labor Statistics establishment payroll employment terms), and by presenting a table which quantitatively illustrates the various steps outlined there (TABLE I-2). Table I-2 also contains a detailed step-by-step description of the process involved in deriving individual employment projections.

TABLE I-1

REGRESSION EQUATIONS USED IN PROJECTING EMPLOYMENT LEVELS IN EACH OF THE SIX MAJOR NONMANUFACTURING SECTORS

(where "Y" is employment in each sector, and "X" is total employment in all six sectors. Future values for "X" are derived as explained in Chapter IV of the report.)

1. Construction: $Y = 19.36 + 0.06531X$
   (23.13) (0.01114) $R^2 = .676$

2. Transportation, Communications, Utilities:
   $Y = 739.64 - 227.77 \log X$
   (32.86) (39.85) $R^2 = .664$

3. Wholesale and Retail Trade:
   $Y = 202.88 + 0.22491X$
   (12.13) (0.0058) $R^2 = .989$

4. Finance, Insurance, Real Estate:
   $Y = -72.55 + 0.1130X$
   (12.45) (0.0060) $R^2 = .957$

5. Services and Miscellaneous:*
   $Y = -337.63 + 0.38107X$
   (41.10) (0.0198) $R^2 = .959$

6. Government: $Y = -124.49 + 0.2639X$
   (20.84) (0.0101) $R^2 = .977$

* Includes employment in forestry, fisheries, mining, and the non-classifiable sector.

TABLE I-2

NEW ENGLAND "EQUILIBRIUM" EMPLOYMENT PROJECTIONS FOR EACH OF THE SIX MAJOR NONMANUFACTURING SECTORS

(Refer to the six-step computational process presented as a footnote to this table)

	1960	1970	1980	1990	2000	2010	2020
			(thousands of persons)				
STEP I:							
Construction	164.1	200.5	243.0	290.5	345.3	416.4	501.5
Trans.,Comm., Utilities	200.2	183.2	162.4	143.3	125.1	105.6	86.4
Wholesale and Retail Trade	708.5	826.7	972.9	1136.5	1325.2	1570.0	1863.2
Finance, Ins.,& Real Estate	185.2	240.9	314.4	396.6	491.4	614.5	761.8
Services & Miscel.	527.9	719.3	967.3	1244.3	1564.0	1978.8	2475.4
Government	469.9	607.5	779.0	971.1	1192.5	1479.7	1823.7
STEP II:			(1960 = 100)				
Construction	100.0	122.2	148.1	177.0	210.4	253.7	305.6
Trans.,Comm.,& Utilities	100.0	91.5	81.1	71.6	62.5	52.7	43.1
Wholesale & Retail Trade	100.0	116.7	137.3	160.4	187.0	221.6	263.0
Finance, Ins.,& Real Estate	100.0	130.1	169.8	214.2	265.4	331.8	411.3
Services & Misc.	100.0	136.3	183.2	235.7	296.3	374.8	468.9
Government	100.0	129.2	165.8	206.7	253.8	314.9	388.1
STEP III:			(thousands of persons)				
Construction	214.9	262.6	318.2	380.3	452.1	545.1	656.7
Transp.,Comm.,& Utilities	217.7	199.2	176.6	155.9	136.1	114.7	93.8
Wholesale & Retail Trade	673.1	785.5	924.2	1079.7	1258.7	1491.6	1770.3
Finance, Ins.,& Real Estate	183.8	239.1	312.1	393.7	487.9	609.9	756.0
Services	680.4	927.4	1246.5	1603.7	2016.0	2550.1	3190.4
Government	309.5	399.9	513.2	639.8	785.5	974.7	1201.2
TOTAL	2279.4	2813.7	3490.8	4253.1	5136.3	6286.2	7668.4

TABLE I-2 (Cont'd)

	1960	1970	1980	1990	2000	2010	2020
STEP IV:			(Percent Breakdown)				
	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Construction	9.43	9.33	9.12	8.94	8.80	8.67	8.56
Transp., Comm., & Utilities	9.55	7.08	50.6	3.67	2.65	1.83	1.22
Wholesale & Retail Trade	29.53	27.92	26.47	25.38	24.51	23.73	23.09
Finance, Ins.,& Real Estate	8.06	8.50	8.94	9.26	9.50	9.7o	9.86
Services	29.85	32.96	35.71	37.71	39.25	40.57	41.60
Government	13.58	14.21	14.70	15.04	15.29	15.50	15.67
STEP V:			(thousands of persons)				
"EQUILIBRIUM" TOTAL	2279.4	2819.4	3407.6	4101.3	4995.9	6113.9	7374.3
Construction	214.9	263.1	310.8	366.7	439.6	530.1	631.2
Transp., Comm., & Utilities	217.7	199.6	172.4	150.5	132.4	111.9	90.0
Wholesale & Retail Trade	673.1	787.2	902.0	1040.9	1224.5	1450.8	1702.7
Finance, Ins., & Real Estate	183.8	239.6	304.6	379.8	474.6	593.0	727.1
Services	680.4	929.3	1216.9	1546.6	1960.9	2480.4	3067.7
Government	309.5	400.6	500.9	616.8	763.9	947.7	1155.6
STEP VI:			(thousands of persons)				
ADJUSTED "EQUILIBRIUM" TOTAL	2279.4	2819.4	3407.6	4101.3	4995.9	6113.9	7374.3
Construction	214.9	263.9	310.8	365.4	437.1	525.8	625.3
Transp., Comm. & Utilities	217.7	192.0	173.8	164.5	162.4	160.8	157.8
Wholesale & Retail Trade	673.1	789.4	902.0	1037.2	1216.5	1438.0	1686.5
Finance, Ins. & Real Estate	183.8	240.2	304.6	378.5	471.6	588.8	720.5
Services	680.4	932.1	1215.5	1540.9	1948.9	2460.2	3039.7
Government	309.5	401.8	500.9	614.8	759.4	940.3	1144.5

NOTES:

STEP I: Employment projections in Bureau of Labor Statistics establishment payroll terms are made for each of the six major nonmanufacturing sectors, through the regression equations listed in this appendix. Future values of "X", substituted into each equation to obtain the employment projection for each sector, are determined as explained in Chapter IV of the report.

STEP II: Employment projections in BLS establishment payroll employment terms are expressed in index form (1960 = 100.0).

STEP III: The indexes of employment growth for each sector are applied to New England's 1960 employment levels in the major sectors, given in Census of Population terms, in order to express the individual sector employment projections in Census of Population equivalents.

STEP IV: Employment projections for each benchmark year are then expressed in percentage terms. Employment level in each sector is expressed as percent of total employment in all six sectors.

STEP V: "Equilibrium" employment total for all six sectors as a whole, given in Census of Population terms and found as explained in Chapter IV of the report, is distributed among the six sectors in each benchmark year on the basis of the percentage breakdown in Step IV. The resulting employment levels in each sector represent the "equilibrium" employment projections for the six sectors.

STEP VI: "Equilibrium" employment projections for each of the six sectors are adjusted judgmentally to reflect altered assumptions about future productivity rates.

APPENDIX J

SPECIAL POPULATION STUDIES

SPECIAL POPULATION STUDIES

1. PROJECTION OF NEW ENGLAND URBAN POPULATION

As one of the earliest settled areas of the United States, New England has for many years enjoyed a level of urbanization far above the national average. As can be seen on the accompanying table, "urban" population (as defined by the Census Bureau) has accounted for over 70% of New England's total population since 1910. In the country as a whole, on the other hand, the "urban" population reached 70% of the total population for the first time in 1960. During the fifty years prior to 1960, the level of urbanization did not change significantly in New England while in the U.S. it grew from 46% to 70% of the total population.

Because New England has been highly urbanized for so many years, it is somewhat more difficult to project future levels of urbanization here than in other parts of the country. In Massachusetts and Rhode Island, two of the heavily industrialized states of the region, over 80% of the people have been living in urban areas since 1900, while in Connecticut, the fastest growing state of the region, nearly 80% of the people lived in urban areas in 1960. In contrast, the urban populations of three less industrialized northern states accounted for only 38% to 58% of the total population in 1960.

Our projection of the future size of the urban population of New England is based on an examination of past trends in urbanization and population density in the six New England states. Estimates of future trends in these factors were made for the individual states, and the implications of these estimates for the future level of urbanization in New England was then examined in the light of past trends in New England as a whole.

TABLE J-1

GROWTH OF THE URBAN POPULATION IN NEW ENGLAND, 1900-2020

	Population (millions of persons)			Urban Population as Percent of Total	
	Total	Urban (Old Definition	Urban (New Definition)	(Old Definition)	(New Definition)
Actual:[1]					
1900	5.59	3.84		68.6	
1910	6.55	4.81		73.3	
1920	7.40	5.62		75.9	
1930	8.17	6.31		77.3	
1940	8.44	6.42		76.1	
1950	9.31	6.97	7.10	74.8	76.2
1960	10.51	7.89	8.03	75.1	76.4
Projected:[2]					
1970	11.84		9.30		78.5
1980	13.84		11.18		80.8
1990	16.17		13.35		82.6
2000	18.74		15.76		84.1
2010	21.72		18.52		85.3
2020	25.17		21.77		86.5

1 U.S. Bureau of the Census

2 Arthur D. Little, Inc. estimates, based on "equilibrium" projection of total population.

2. HOUSEHOLDS IN NEW ENGLAND

The number of households in New England is projected to rise over the next half century at a somewhat higher rate than the population. This results from projecting a slight decline in the average number of persons living in a household after 1980.* The following tabulation compares historical and projected declines in the average size of households in the nation as a whole and in New England:

Number of Persons Per Household

	Actual			Projected			
	1940	1950	1960	1980	2000	2010	2020
United States	3.78	3.52	3.38	3.41	3.33	3.34	n.a.
New England	3.82	3.65	3.37	3.41	3.40	3.36	3.33

a. Projection Method. - *The Bureau of Census publishes national* household projections to 1980. The Bureau's method is to apply age-sex-specific household status rates to the projected population classified according to sex and age. We applied the Bureau's Series B household status rates** to our New England projections to 1980 of number of persons aged 15 and over, with the following results:

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* By Census definition, a household includes all persons who occupy a housing unit, i.e., a house, an apartment or other group of rooms, or a room that constitutes separate living quarters. The occupants of a housing unit may vary from a family of two or more persons to a single individual.

** See Current Population Reports, Series P-20, No. 90, December 29, 1958, and slight revisions in Series P-20, No. 123, April 11, 1963.

Average number of persons, age 15 and over, per New England household

1960	1970	1980
2.38	2.37	2.35

We assumed that the 1980 figure would remain constant to the year 2020, implying that the average number of persons of working age per household would have become stabilized by 1980. Then, by using total projected New England population, we found that the average number of persons of all ages per household would decline from 3.37 in 1960 to 3.33 in 2020. Thus, the average size of households in New England can be expected to be somewhat larger than in the nation as a whole during the latter part of the projection period. The major cause of this disparity is our use of 1960 New England age-specific birth rates.

Having projected household size, we computed the total number of New England households for 1970-2020 by dividing the projected number of persons per household into the projected population of New England.

TABLE J-2

NUMBER OF HOUSEHOLDS IN NEW ENGLAND, 1930-2020

Actual[1]	Number of Households (millions)
1930	1.98
1940	2.21
1950	2.55
1960	3.12
Projected[2]	
1970	3.50
1980	4.06
1990	4.68
2000	5.52
2010	6.46
2020	7.56

1 U.S. Bureau of the Census

2 Arthur D. Little, Inc., estimate

APPENDIX K

CONVERSION FACTORS FOR MAJOR SERIES OF EMPLOYMENT DATA

CONVERSION FACTORS FOR MAJOR SERIES OF EMPLOYMENT DATA

1. INTRODUCTION

In order to utilize the available data sources to the best advantage in all phases of this study, we had to draw upon a number of basic data sources depending on the immediate purposes at hand. The more important of these sources were: (1) U.S. Department of Labor, Bureau of Labor Statistics household survey and establishment payroll employment series; (2) U.S. Department of Commerce, Bureau of the Census, Census (Annual Survey) of Manufactures value added and employment series; and (3) U.S. Department of Commerce, Bureau of the Census, Census of Population employment data. Utilization of different data sources for different purposes within the larger context of our study present problems of cross-comparability that could not be ignored. Hence we compiled a set of conversion factors to facilitate comparability among the various data sources used and the projection results achieved at different junctures in our study. The major conversions that have been made and the methodology used to arrive at them are presented in this appendix, as follows.

a. Conversion of projected U.S. nonagricultural employment (as supplied by the Economic Task Group of the Ad Hoc Water Resources Council Staff) from BLS household survey terms to BLS establishment payroll equivalents.*

   Basis of conversion: The 1960 ratio of the BLS establishment to the BLS household series (.8527). (This ratio is nearly the same as the average ratio of these two series for the 1955-61 period: .8525).

b. Conversion of the assumed U.S. and New England unemployment rate of 4.50 percent in BLS terms to 4.15 percent in Census of Population terms.

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* "BLS" is used throughout this appendix to denote Bureau of Labor Statistics (Department of Labor).

Basis of Conversion: The 1960 ratio of the Census of Population unemployment rate to the BLS unemployment rate (.9228).

c. Conversion of projected agricultural employment (as supplied by the Department of Agriculture) from BLS to Census of Population terms. (Note: missing years of 1970, 1980 and 2010 found by interpolation before conversion).

Basis of conversion: The 1960 ratio of Census of Population agricultural employment to BLS agricultural employment (1.2393).

d. Conversion of projected New England nonagricultural employment from BLS establishment payroll terms to Census of Population equivalents.

Basis of conversion: The average of the 1950 and 1960 ratios of the Census of Population series to the BLS establishment payroll series (1.0534).

e. Conversion of projected total industry employment from "equilibrium" BLS terms to "equilibrium" Census of Population terms.

Basis of Conversion: The 1960 ratio of Census of Population manufacturing employment to BLS manufacturing employment (1.0189).

APPENDIX L

HISTORICAL EMPLOYMENT (BLS SERIES) AND PERSONAL INCOME DATA FOR NEW ENGLAND

TABLE L-1

NEW ENGLAND EMPLOYMENT BY MAJOR INDUSTRIES, 1947-1961

(thousands of persons)

Industry Title	SIC	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
MANUFACTURING - BASE INDUSTRIES																
Textile Mill Products	22	279.7	282.8	243.2	264.2	249.0	214.8	207.4	170.2	167.4	161.6	139.5	124.2	127.1	119.5	112.1
Paper and Allied Products	26	71.6	70.4	65.2	67.7	71.1	70.5	72.6	73.4	75.2	76.0	74.8	71.7	73.5	74.0	72.4
Chemicals and Allied Products	28	28.1	28.3	26.4	27.3	29.3	29.7	29.8	29.5	30.6	31.7	31.9	31.9	34.1	35.3	35.0
Rubber and Misc. Plastic Products	30	58.8	57.6	53.1	54.6	59.9	59.7	62.6	56.8	61.0	63.2	63.3	59.5	64.0	64.6	64.6
Leather and Leather Products	31	114.4	115.6	115.6	117.2	110.7	114.9	115.8	112.3	116.2	113.8	111.3	107.7	113.4	109.1	106.5
Primary Metal Industries	33	73.4	72.6	62.5	65.9	71.3	68.3	71.8	63.6	65.3	68.5	67.8	61.5	63.6	62.3	58.7
Fabricated Metal Prods.	34	110.6	109.7	94.8	101.7	111.8	108.7	112.8	103.4	105.6	106.9	105.4	97.3	100.9	100.3	97.5
Machinery, except Electrical	35	189.7	176.9	143.2	151.3	188.0	189.5	186.7	165.0	164.8	176.6	174.3	144.6	152.8	158.6	154.9
Electrical Machinery	36	112.3	105.2	94.6	112.4	130.1	136.9	149.6	132.9	134.3	141.3	139.4	130.2	150.3	158.1	157.7
Transportation Equipment	37	55.0	57.4	54.6	53.6	70.2	90.5	103.7	97.4	94.6	106.3	117.9	107.7	107.2	103.6	109.9
Sub-Total-A		1093.6	1076.5	953.2	1015.9	1091.4	1083.5	1112.8	1004.5	1015.0	1045.9	1025.6	936.3	986.9	985.4	969.3
MANUFACTURING - NONBASE INDUSTRIES																
Ordnance & Accessories	19	14.9	15.9	13.6	12.5	15.7	19.6	21.2	18.5	15.3	16.2	18.1	21.2	23.7	27.1	29.6
Food and Kindred Prods.	20	85.8	85.3	84.9	84.2	85.5	85.8	86.8	86.4	85.2	86.0	85.4	83.9	83.5	83.4	81.4
Apparel and Other Finished Products	23	86.5	87.4	89.7	93.5	93.3	93.0	95.1	90.7	93.0	93.1	90.0	87.8	91.0	89.7	87.0
Lumber and Wood Products, except Furniture	24	47.8	44.1	39.0	41.6	47.1	44.9	43.0	38.3	40.6	41.2	36.9	33.7	35.1	35.3	32.6
Furniture and Fixtures	25	17.6	17.8	18.3	20.8	21.1	20.9	21.3	19.8	20.4	21.4	21.2	20.1	21.4	21.6	20.4
Printing, Publishing and Allied Industries	27	55.2	57.0	57.0	57.7	59.1	58.5	59.7	60.4	61.7	63.0	63.5	63.3	64.6	66.5	67.4
Stone, Clay and Glass Products	32	20.6	21.2	20.4	21.6	24.3	21.8	22.7	21.9	22.8	23.9	24.3	23.1	25.3	24.8	23.5
Instruments	38	41.0	41.3	33.5	34.5	39.7	42.8	47.8	44.8	45.9	48.5	47.7	42.8	46.0	46.1	45.7
Miscellaneous Manufacturing	39	80.2	83.5	81.0	86.4	86.5	82.6	89.6	86.2	84.1	83.1	75.4	70.2	72.5	71.9	67.8
Sub-Total-B		449.6	453.5	437.4	452.8	472.3	469.9	487.2	467.0	469.0	476.4	462.5	446.1	463.1	466.4	455.4
Total Manufacturing A + B		1543.2	1530.0	1390.6	1468.7	1563.7	1553.4	1600.0	1471.5	1484.0	1522.3	1488.1	1382.4	1450.0	1451.8	1424.7

TABLE L-1 (Cont'd)

Industry Title	SIC	1947	1948	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
B/A		.41	.42	.46	.45	.43	.43	.44	.47	.46	.46	.45	.48	.47	.47	.47
A/A+B		.71	.70	.69	.69	.70	.70	.70	.68	.68	.69	.69	.68	.68	.68	.68
B/A+B		.29	.30	.31	.31	.30	.30	.30	.32	.32	.31	.31	.32	.32	.32	.32
NONMANUFACTURING INDUSTRIES																
Contract Construction	(15-17)	127.4	136.0	129.8	141.9	153.9	149.0	145.9	151.6	163.2	172.7	175.5	162.0	164.3	164.1	162.3
Transportation, Communications, and Utilities	(40-49)	227.6	224.6	214.8	214.5	218.9	217.9	219.2	217.2	218.4	223.2	218.5	206.1	202.6	200.2	196.7
Wholesale & Retail Trade	(50-59)	598.9	616.5	615.0	623.2	643.3	643.9	652.4	661.2	669.7	689.1	693.1	680.3	691.7	708.5	715.6
Finance, Insurance, and Real Estate	(60-67)	128.5	133.2	134.9	138.8	144.0	148.3	152.0	158.0	162.6	167.5	173.4	175.9	179.8	185.2	190.7
Services	(70-89)	368.3	375.5	377.4	380.1	393.3	397.9	408.4	419.9	435.0	448.3	464.8	476.0	507.4	527.9	545.3
Government		336.9	356.2	370.2	376.6	387.8	402.2	407.3	410.8	414.5	423.0	433.4	445.1	455.6	469.9	485.8
Sub-Total-C		1787.6	1842.0	1842.1	1875.1	1941.2	1959.2	1985.2	2018.7	2063.4	2123.7	2158.7	2145.4	2201.4	2255.8	2296.4
Grand Total A + B + C		3330.8	3372.0	3232.7	3343.8	3504.9	3512.6	3585.2	3490.2	3547.4	3646.0	3646.8	3527.8	3651.4	3707.6	3721.1
A/A+B+C		.33	.32	.30	.30	.31	.31	.31	.29	.29	.29	.28	.27	.27	.27	.26
A+B/A+B-C		.46	.45	.43	.44	.45	.44	.45	.42	.42	.42	.41	.39	.40	.39	.38
C/A+B+C		.54	.55	.57	.56	.55	.56	.55	.58	.58	.58	.59	.61	.60	.61	.62

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, New England Regional Office, Employment in New England, 1947-1961 (November 1962).

TABLE L-2

UNITED STATES AND NEW ENGLAND PERSONAL INCOME
(billions of current dollars)

Year	U.S.	New England
1929	85.7	7.1
1930	76.8	6.6
1931	65.6	5.9
1932	50.0	4.7
1933	47.1	4.4
1934	53.5	4.8
1935	60.1	5.2
1936	68.4	5.8
1937	73.8	6.0
1938	68.4	5.5
1939	72.8	5.9
1940	78.5	6.4
1941	96.0	7.8
1942	122.4	9.5
1943	148.4	10.9
1944	160.1	11.3
1945	164.5	11.4
1946	175.7	12.3
1947	189.1	13.0
1948	207.4	13.9
1949	205.5	13.8
1950	225.5	15.2
1951	253.0	16.8
1952	269.1	17.7
1953	283.1	18.7
1954	284.7	18.9
1955	303.4	20.1
1956	330.4	21.6
1957	348.7	22.8
1958	357.5	23.3
1959	381.3	24.7
1960	397.0	25.9
1961	412.8	27.0
1962	437.4	28.5

Note: The above two series, as used in the regression calculations, are in billions of current dollars while the projection results given in the text are in billions of 1954 dollars. Current dollars were used in determining the regression relationship since to deflate both series by the same deflator would have had a neutral impact except for a very slight change in the estimate of the intercept.

PROJECTIVE ECONOMIC STUDY OF NEW ENGLAND

APPENDICES TO PART II

THE STATES

APPENDIX A

STATE DATA - HISTORICAL AND PROJECTIONS BY DECADES 1940-2020

TABLE A-1

EMPLOYMENT, POPULATION, HOUSEHOLDS, MASSACHUSETTS, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940	1950	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	611.091	727.335	736.628	793.8	852.2	933.6	1060.0	1187.7	1333.3
A,B	Primary Resource Industries	43.439	40.140	27.360	26.4	25.6	24.8	24.2	23.6	22.9
A.(01-09)	Agriculture, Forestry and Fisheries	41.924	38.694	26.147	25.2	24.5	23.7	23.1	22.5	21.8
(01-07)	Agriculture 1/	36.225	32.586	22.118	21.5	20.9	20.1	19.5	18.9	18.2
08	Forestry 2/	1.055	.453	.532	.5	.5	.5	.5	.5	.5
09	Fisheries	4.644	5.655	3.497	3.2	3.1	3.1	3.1	3.1	3.1
B.(10-14)	Mining	1.515	1.446	1.213	1.2	1.1	1.1	1.1	1.1	1.1
D.(19-39)	Manufacturing	567.652	678.195	709.268	767.4	826.6	908.8	1035.8	1164.1	1310.4
22	Textile Mill Products	126.544	116.576	52.336	35.4	25.3	19.3	16.5	14.1	12.2
24	Lumber and Wood Products, except Furniture 2/	6.687	7.435	5.915	4.1	3.4	2.9	2.3	2.0	1.8
26	Paper and Allied Products 2/	28.950	32.535	34.055	35.3	33.8	34.5	35.4	37.4	39.5
28	Chemicals and Allied Products	12.624	17.257	18.293	18.8	19.5	20.7	22.7	26.5	28.7
30	Rubber and Miscellaneous Plastics Products	14.918	26.010	34.028	38.1	40.8	43.2	47.1	49.9	53.2
31	Leather and Leather Products	70.058	70.154	56.488	48.8	45.2	41.2	40.6	37.7	35.0
33	Primary Metal Industries	45.852	20.803	21.366	19.9	18.3	17.2	16.5	15.6	14.6
34	Fabricated Metal Products		34.544	50.426	53.1	60.3	69.9	85.4	103.5	125.4
35	Machinery, except Electrical	41.553	57.479	66.030	79.7	87.1	95.6	107.1	117.6	129.5
36	Electrical Machinery	29.806	72.284	110.288	141.4	174.1	214.6	267.6	322.3	386.6
37	Transportation Equipment 3/	22.402	27.305	32.553	35.6	36.2	35.5	35.1	34.4	32.8
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	167.258	204.813	227.490	257.2	282.6	314.2	359.5	403.1	451.1
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	919.396	1099.243	1263.684	1515.4	1810.7	2166.7	2641.3	3246.5	3930.5
	TOTAL EMPLOYMENT	1530.487	1826.578	2000.312	2309.2	2662.9	3100.3	3701.3	4434.2	5263.8
	TOTAL POPULATION	4316.721	4690.514	5148.578	5812.3	6771.9	7929.8	9270.7	10875.2	12743.6
	Urban	3859.476	3959.239	4302.530	4951.3	5893.0	7009.9	8324.4	9863.7	11701.4
	Rural	457.245	731.275	846.048	861.0	878.9	919.9	946.3	1011.5	1042.2
	HOUSEHOLDS	1123.448	1286.490	1534.732	1719.8	1996.1	2300.6	2733.7	3237.4	3832.2

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

TABLE A-2

EMPLOYMENT, POPULATION, HOUSEHOLDS, CONNECTICUT, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940	1950	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	325.847	378.973	426.063	459.6	491.6	529.4	580.9	624.9	675.1
A,B	Primary Resource Industries	28.072	25.416	19.278	18.4	17.8	17.3	16.8	16.2	15.6
A.(01-09)	Agriculture, Forestry and Fisheries	27.478	24.879	18.143	17.6	17.0	16.5	16.0	15.5	14.9
(01-07)	Agriculture[1]	26.603	24.072	17.770	17.2	16.6	16.1	15.6	15.1	14.5
08	Forestry[2]	.337	.201	.183	.2	.3	.3	.3	.3	.3
09	Fisheries	.538	.606	.190	.2	.1	.1	.1	.1	.1
B.(10-14)	Mining	.594	.537	1.135	.8	.8	.8	.8	.7	.7
D.(19-39)	Manufacturing	297.775	353.557	406.785	441.2	473.8	512.1	564.1	608.7	659.5
22	Textile Mill Products	39.919	35.353	16.461	11.6	8.5	6.6	5.6	4.9	4.3
24	Lumber and Wood Products, except Furniture[2]	2.017	2.379	1.838	1.3	1.2	.9	.8	.7	.7
26	Paper and Allied Products[2]	5.418	6.767	8.188	7.8	7.4	7.4	7.7	7.8	9.2
28	Chemicals and Allied Products	5.638	9.353	12.070	12.1	12.9	14.0	15.9	18.9	20.8
30	Rubber and Miscellaneous Plastics Products	9.484	15.261	16.152	18.9	20.4	21.8	23.7	25.2	26.8
31	Leather and Leather Products	3.207	3.172	2.538	2.4	2.2	2.1	2.2	2.1	2.0
33	Primary Metal Industries	84.693	31.593	24.620	26.2	23.3	21.6	20.6	19.4	18.0
34	Fabricated Metal Products		53.009	52.001	53.5	59.4	67.8	81.8	97.9	117.6
35	Machinery, except Electrical	34.579	53.613	64.563	81.0	88.9	96.9	107.7	117.6	128.9
36	Electrical Machinery	12.325	28.109	36.890	43.7	55.2	64.2	75.9	87.3	100.1
37	Transportation Equipment[3]	16.271	23.394	69.833	69.6	72.5	75.7	72.2	60.9	47.4
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	84.224	91.554	101.631	113.1	121.9	133.1	150.0	166.0	183.7
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES[4]	353.143	448.637	584.376	729.0	905.5	1106.7	1351.7	1651.5	1989.7
	TOTAL EMPLOYMENT	678.990	827.610	1010.439	1188.6	1397.1	1636.1	1932.6	2276.4	2664.8
	TOTAL POPULATION	1709.242	2007.280	2535.234	2943.4	3527.8	4171.9	4838.7	5586.4	6451.1
	Urban	1158.162	1558.642	1985.567	2383.5	2943.7	3555.1	4190.6	4881.9	5699.4
	Rural	551.080	448.638	549.667	559.9	584.1	616.8	648.1	704.5	751.7
	HOUSEHOLDS	449.952	552.545	752.736	871.8	1031.7	1200.6	1425.6	1664.0	1945.2

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

TABLE A-3

EMPLOYMENT, POPULATION, HOUSEHOLDS, MAINE, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940	1950	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	132.395	142.583	130.570	132.8	136.6	141.0	150.1	155.8	162.1
A,B	Primary Resource Industries	40.394	35.301	20.664	20.6	20.5	20.4	20.1	20.0	19.7
A.(01-09)	Agriculture, Forestry and Fisheries	39.832	34.685	20.378	20.2	20.1	20.0	19.7	19.6	19.3
(01-07)	Agriculture[1]	36.552	28.998	17.444	17.2	16.9	16.8	16.5	16.4	16.1
08	Forestry[2]	.232	.698	.471	.3	.2	.2	.2	.2	.2
09	Fisheries	3.048	4.989	2.463	2.7	3.0	3.0	3.0	3.0	3.0
B.(10-14)	Mining	.562	.616	.286	.4	.4	.4	.4	.4	.4
D.(19-39)	Manufacturing	92.001	107.282	109.906	112.2	116.1	120.6	130.0	135.8	142.4
22	Textile Mill Products	23.337	25.512	14.923	10.4	7.7	6.0	5.3	4.6	4.0
24	Lumber and Wood Products except Furniture[2]	13.997	18.705	14.673	14.6	13.3	12.7	11.7	10.5	9.4
26	Paper and Allied Products[2]	13.978	16.401	18.552	20.3	22.6	25.4	28.7	30.1	31.7
28	Chemicals and Allied Products	.407	.723	1.072	1.1	1.1	1.1	1.2	1.4	1.6
30	Rubber and Miscellaneous Plastics Products	.118	.401	1.127	1.5	1.9	2.2	2.5	2.9	3.2
31	Leather and Leather Products	17.520	18.063	22.530	21.3	20.7	20.1	20.7	20.1	19.4
33	Primary Metal Industries	1.865	.653	.401	.5	.6	.6	.6	.5	.5
34	Fabricated Metal Products		.950	1.812	1.8	2.1	2.5	2.9	3.4	4.0
35	Machinery, except Electrical	3.330	4.843	2.834	3.7	4.0	4.4	4.9	5.4	5.9
36	Electrical Machinery	.085	.453	2.370	4.4	6.0	6.8	8.2	10.0	12.0
37	Transportation Equipment[3]	4.828	3.704	8.165	7.0	7.7	7.1	7.0	6.1	4.9
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	12.536	16.874	21.447	25.6	28.4	31.7	36.3	40.8	45.8
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES[4]	144.391	169.730	200.014	230.6	269.1	309.1	360.3	418.4	477.4
	TOTAL EMPLOYMENT	276.786	312.313	330.584	363.4	405.7	450.1	510.4	574.2	639.5
	TOTAL POPULATION	847.226	913.774	969.265	1019.4	1126.6	1233.8	1338.0	1440.0	1547.9
	Urban	343.057	472.000	497.114	544.1	637.2	733.6	824.3	914.9	1010.1
	Rural	504.169	441.774	472.151	475.3	489.3	500.2	513.7	525.1	537.8
	HOUSEHOLDS	220.272	246.615	280.355	293.6	322.8	353.0	387.0	420.6	457.8

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

TABLE A-4

EMPLOYMENT, POPULATION, HOUSEHOLDS, RHODE ISLAND, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940	1950	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	127.720	139.663	128.853	132.1	136.3	144.6	160.7	176.3	194.
A,B	Primary Resource Industries	5.859	5.398	4.214	3.9	3.6	3.3	3.1	2.6	2.
A.(01-09)	Agriculture, Forestry and Fisheries	5.670	5.223	4.081	3.8	3.5	3.2	3.0	2.5	2.
(01-07)	Agriculture[1/]	5.064	4.436	3.406	3.1	2.9	2.6	2.4	1.9	1.
08	Forestry[2/]	.089	.057	.094	.1	.1	.1	.1	.1	.
09	Fisheries	.517	.730	.581	.6	.5	.5	.5	.5	.
B.(10-14)	Mining	.189	.175	.133	.1	.1	.1	.1	.1	.
D.(19-39)	Manufacturing	121.861	134.265	124.639	128.2	132.7	141.3	157.6	173.7	191.
22	Textile Mill Products	57.175	56.872	28.022	19.6	14.1	10.8	9.4	8.0	7.
24	Lumber and Wood Products except Furniture[2/]	.696	.754	.448	.3	.2	.2	.2	.2	.
26	Paper and Allied Products[2/]	1.332	1.613	2.104	2.1	2.1	2.3	3.0	3.4	3.
28	Chemicals and Allied Products	1.390	1.731	2.203	2.3	2.5	2.7	3.0	3.6	4.
30	Rubber and Miscellaneous Plastics Products	4.335	8.880	7.333	8.2	8.8	9.3	10.1	10.7	11.
31	Leather and Leather Products	.675	.502	1.387	1.2	1.3	1.2	1.4	1.4	1.
33	Primary Metal Industries	15.316	4.604	6.778	6.3	5.8	5.4	5.1	4.9	4.
34	Fabricated Metal Products		5.896	7.281	7.4	8.4	10.0	12.3	15.1	18.
35	Machinery, except Electrical	10.800	10.813	11.884	14.5	15.9	17.1	18.6	20.1	21
36	Electrical Machinery	.173	5.024	6.801	9.0	11.0	13.0	15.9	18.7	21
37	Transportation Equipment[3/]	.509	1.208	3.738	3.6	3.6	3.5	3.4	3.1	3
19,20,21,23,25, 27,29,32,38,29	Other Manufacturing	29.460	36.368	46.660	53.7	59.0	65.8	75.2	84.5	94
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES[4/]	133.403	164.824	188.419	220.6	260.8	309.6	380.2	469.2	572
	TOTAL EMPLOYMENT	261.123	304.487	317.272	352.7	397.1	454.2	540.9	645.5	767
	TOTAL POPULATION	713.346	791.896	859.488	929.5	1051.9	1201.4	1386.7	1602.9	1857
	Urban	653.383	667.212	742.897	809.6	925.7	1082.7	1268.7	1485.3	1743
	Rural	59.963	124.684	116.591	119.9	126.2	118.7	118.0	117.6	113
	HOUSEHOLDS	188.028	216.795	257.335	280.6	314.9	356.6	416.0	484.0	567

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services Government; Nonclassified.

TABLE A-5

EMPLOYMENT, POPULATION, HOUSEHOLDS, NEW HAMPSHIRE, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940	1950	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	86.238	95.945	100.672	108.1	117.4	131.8	148.2	164.0	180.8
A,B	Primary Resource Industries	16.483	13.797	7.487	7.3	7.3	7.2	7.0	6.9	6.7
A.(01-09)	Agriculture, Forestry and Fisheries	16.165	13.609	7.283	7.1	7.1	7.0	6.8	6.7	6.5
(01-07)	Agriculture[1/]	15.502	13.220	6.949	6.8	6.8	6.7	6.5	6.4	6.2
08	Forestry[2/]	.519	.251	.247	.2	.2	.2	.2	.2	.2
09	Fisheries	.144	.138	.087	.1	.1	.1	.1	.1	.1
B.(10-14)	Mining	.318	.188	.204	.2	.2	.2	.2	.2	.2
D.(19-39)	Manufacturing	69.755	82.148	93.185	100.8	110.1	124.6	141.2	157.1	174.1
22	Textile Mill Products	15.865	18.742	12.430	8.7	6.4	5.0	4.4	3.8	3.4
24	Lumber and Wood Products, except Furniture[2/]	7.897	8.585	5.729	4.6	4.1	4.0	3.6	3.3	3.0
26	Paper and Allied Products[2/]	6.450	7.393	7.521	7.6	10.0	11.9	13.7	15.4	16.3
28	Chemicals and Allied Products	.243	.400	.501	.5	.6	.6	.7	.8	1.0
30	Rubber and Miscellaneous Plastics Products	.209	.760	2.111	2.6	3.1	3.6	4.3	4.9	5.5
31	Leather and Leather Products	21.724	22.285	20.937	18.8	18.1	17.1	17.2	16.4	15.4
33	Primary Metal Industries	1.587	.901	1.416	1.5	1.4	1.4	1.4	1.4	1.3
34	Fabricated Metal Products		1.268	2.498	2.6	2.9	3.4	4.3	5.5	6.7
35	Machinery, except Electrical	3.340	5.128	10.576	13.2	14.9	17.1	19.8	22.4	25.1
36	Electrical Machinery	.329	2.858	9.369	14.4	19.7	26.0	34.0	42.5	52.6
37	Transportation Equipment[3/]	2.435	2.212	4.510	4.0	5.3	8.0	7.9	7.6	7.2
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	9.676	11.616	15.587	22.3	23.6	26.5	29.9	33.1	36.6
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES[4/]	89.611	106.723	133.772	166.8	212.0	271.6	341.9	430.6	533.3
	TOTAL EMPLOYMENT	175.849	202.668	234.444	274.9	329.4	403.4	490.1	594.6	714.1
	TOTAL POPULATION	491.524	533.242	606.921	700.9	852.5	1047.8	1242.5	1468.3	1729.2
	Urban	283.225	306.806	353.766	431.1	544.5	679.0	808.9	976.0	1156.0
	Rural	208.299	226.436	253.155	269.8	308.0	368.8	433.6	492.3	573.2
	HOUSEHOLDS	133.714	149.475	180.020	205.4	246.6	306.3	363.7	439.3	517.9

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in U.S. Government Shipyards.
4/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

TABLE A-6

EMPLOYMENT, POPULATION, HOUSEHOLDS, VERMONT, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940	1950	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	59.944	61.203	53.276	57.8	62.2	67.5	74.7	80.9	88.0
A,B	Primary Resource Industries	32.430	27.351	17.891	18.0	17.9	17.8	17.8	17.7	17.7
A.(01-09)	Agriculture, Forestry and Fisheries	30.975	25.499	16.857	16.8	16.7	16.6	16.6	16.5	16.5
(01-07)	Agriculture[1/]	30.676	25.002	16.586	16.6	16.5	16.4	16.4	16.3	16.3
08	Forestry[2/]	.261	.467	.246	.2	.2	.2	.2	.2	.2
09	Fisheries	.038	.030	.025	.0	.0	.0	.0	.0	.0
B.(10-14)	Mining	1.455	1.852	1.034	1.2	1.2	1.2	1.2	1.2	1.2
D.(19-39)	Manufacturing	27.514	33.852	35.385	39.8	44.3	49.7	56.9	63.2	70.3
22	Textile Mill Products	4.065	4.478	1.234	.9	.6	.4	.4	.2	.2
24	Lumber and Wood Products except Furniture[2/]	5.240	6.336	4.774	3.8	3.5	3.5	3.2	3.0	2.8
26	Paper and Allied Products[2/]	1.424	1.817	2.283	3.0	4.5	5.8	7.0	7.9	8.9
28	Chemicals and Allied Products	.172	.334	.451	.5	.5	.5	.7	.8	.7
30	Rubber and Miscellaneous Plastics Products	.397	.715	.829	1.0	1.1	1.2	1.3	1.4	1.4
31	Leather and Leather Products	.654	.478	.630	.6	.6	.7	.6	.6	.6
33	Primary Metal Industries	.992	.476	.556	.5	.6	.5	.5	.5	.4
34	Fabricated Metal Products		.778	2.167	3.2	3.2	3.7	4.7	5.7	6.8
35	Machinery, except Electrical	3.746	4.350	6.249	7.2	8.5	9.4	10.7	11.8	13.2
36	Electrical Machinery	.057	.919	1.722	2.6	3.0	4.0	5.2	6.4	8.0
37	Transportation Equipment	.037	.555	.424	.5	.6	.8	.8	.7	.5
19,20,21,23,25, 27,29,32,38,39	Other Manufacturing	10.730	12.616	14.066	16.0	17.6	19.2	21.8	24.2	26.8
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES[3/]	63.748	76.061	88.320	106.0	129.5	154.1	184.1	220.1	259.3
	TOTAL EMPLOYMENT	123.692	137.264	141.596	163.8	191.7	221.6	258.8	301.0	347.3
	TOTAL POPULATION	359.231	377.747	389.881	434.5	509.3	585.3	663.4	747.2	840.7
	Urban	123.239	137.612	149.921	180.4	235.9	289.7	343.1	398.2	459.3
	Rural	235.992	240.135	239.960	254.1	273.4	295.6	320.3	349.0	381.4
	HOUSEHOLDS	92.937	100.160	110.732	124.8	144.7	166.5	189.8	214.8	241.3

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Based on projections furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; Nonclassified.

APPENDIX B

SPECIAL ALLOCATION FACTORS

APPENDIX B - SPECIAL ALLOCATION FACTORS

1. MARKET ACCESSIBILITY POTENTIAL

The market accessibility factor which we used in allocating economic activities in manufacturing among the New England states is a generalized measure of the potential of each New England state to attract economic activity by virtue of having major highway systems in proximity to major national market centers.

Historical evidence indicates that manufacturing activities have, as a rule, been attracted toward areas of high market potential, as represented by major metropolitan trading centers. In particular, economic activities of the manufacturing type show a strong tendency to fall off as the distance from metropolitan centers increases, despite the dispersal effect recently created by technological developments in the transportation industry and by specialized amenity factors. While the long-range impact of technological developments in the localization of economic activities is difficult to foresee, we believe that the "pull" of metropolitan market areas -- as opposed to the "pull" of resource areas -- will continue to play the dominant role in the future localization of manufacturing activities.

The market accessibility factor for each New England state was determined for any given year by means of the following two-step process:

1. We determined each state's present and future percent share of total limited access highway mileage in the six-state New England region on the basis of existing data and maps.

2. We divided this percent share by the state's average distance to major national market centers; which, for our purposes, were designated as New York and Boston. The sum of the quotients thus obtained for all six states was then constrained to add up to 100 percent, and these constrained percent shares were then used as measures of the potential market accessibility of each of the six New England states. A more detailed explanation of the computational procedure is given below.

a. Limited Access Highway Mileage Computation and Projections. - The concept of limited access highways as used in this study comprises all existing and planned federally aided interstate highway systems including toll roads and other limited access highways of the type similar to Route 128 and Route 3 in Massachusetts. Existing and planned limited access highway mileage for each New England state was obtained for the years 1960, 1970, and 1980 from the existing highway maps and official state and federal publications on existing and projected highway systems

and extensions. For each year, the limited access highway capacity for each state was then expressed as a percent of the New England total. These percent shares were then used, as described above, to compute the market accessibility factor for each state.

b. Measurement of Proximity to Major Market Centers. - Using the 1960 Census of Population data and existing highway maps, a measure of proximity to major national market centers was computed for each state. Our approach in deriving such a measure consisted, initially, of defining New York and Boston as major market centers to which New England production centers are oriented. Subsequently, we measured the distance (i.e., highway mileage) between New York and all cities of the size class 25,000 or greater[1/] in each state; we then measured the distance between Boston and these same cities in each state. Each state's average aggregate distance to Boston-New York was then computed using the following equation:

$$\text{Measure of Proximity to Market Centers for a Given State} = \frac{\dfrac{\left[\sum_{i=1}^{n}\left(\text{Dist. of city}_i \text{ to New York}\right)\left(\text{1960 Population}\right)\right]}{\sum_{i=1}^{n}\left(\text{1960 Population}_i\right)} + \dfrac{\left[\sum_{i=1}^{n}\left(\text{Dist. of city}_i \text{ to Boston}\right)\left(\text{1960 Population}\right)\right]}{\sum_{i=1}^{n}\left(\text{1960 Population}_i\right)}}{2}$$

Where: $i = (1, \ldots, n)$ = Number of cities with a population of 25,000 or more in 1960.

Units used: Miles, number of persons.

c. Calculation of the Market Accessibility Factor. - Table B-1 summarizes the computations used to obtain the market accessibility factor for the years 1957, 1970, and 1980. Column A shows the percent distribution of limited access highway mileage (actual plus proposed, where appropriate) among the states in the respective years; Column B presents the measure of average market proximity (in miles) derived for each state. Column A was divided by Column B, and the quotients representing the market accessibility factor for each state were expressed in percentage terms as shown in Column C. Mileage was divided by average distance since, other things being equal, large distance would be considered an adverse factor when considering new industry locations.

The market accessibility factor shown in Column C was one of the factors used for projecting the distribution of employment in the commodity industries for 1970 and 1980.

1/ On the basis of the 1960 Census of Population

TABLE B-1

DERIVATION OF MARKET ACCESSIBILITY FACTOR

For 1960 Simulation	A. Percent Distribution 1957 Highway Mileage	B. Proximity to Major Markets (in miles)	C. Market Accessibility Factor[1]
Connecticut	27.30%	114.9	29.63%
Maine	13.02	251.8	6.45
Massachusetts	48.73	113.3	53.63
New Hampshire	8.76	144.3	7.57
Rhode Island	2.19	99.6	2.74
Vermont	.00	258.0	.00
	100.00%		100.00%

For 1970 Projections	Percent Distribution 1970 Highway Mileage	Proximity to Major Markets	Market Accessibility Factor
Connecticut	25.58%	114.9	28.98%
Maine	13.72	251.8	7.10
Massachusetts	37.12	113.3	42.66
New Hampshire	13.28	144.3	11.98
Rhode Island	5.09	99.6	6.65
Vermont	5.21	258.0	2.63
	100.00%		100.00%

For 1980 Projections	Percent Distribution 1980 Highway Mileage	Proximity to Major Markets	Market Accessibility Factor
Connecticut	20.93%	114.9	25.34%
Maine	16.65	251.8	9.19
Massachusetts	31.86	113.3	39.11
New Hampshire	12.75	144.3	12.30
Rhode Island	5.21	99.6	7.27
Vermont	12.60	258.0	6.79
	100.00%		100.00%

1/ Column C, showing percent distribution, was derived by dividing Column A by Column B and was then constrained to add to 100%.

2. WAGES

As explained in Chapter III, wage-rate differentials among the six New England states constituted one of the factors used in determining the location theory method for projecting employment in the commodity industries. These differentials were derived from Bureau of Labor Statistics hourly earnings data, augmented in a few instances by estimates from other sources when the Bureau's series were incomplete. As previously noted, our historical analysis revealed that the wage-rate differentials among the six states in each of the industries to be projected had remained virtually constant during the post-war period. Thus, we assumed that the state wage-rate differentials in 1970 and 1980 for each industry would equal the 1959-1963 average differentials.

In order to use state wage differentials as a location factor it was necessary to express the differentials in percent distribution form. This was done by using the differentials as weights to adjust the distribution of a given industry in the previous decade. The required calculations involved a two-step process. First, the wage differentials for a given industry were computed by dividing the median wage for the six states (based on the 1959-63 averages) by the average wage in each state. Second, the differential thus obtained for each state was multiplied by that state's share of the industry in the previous decade. The resulting adjusted shares were constrained to add to 100 percent.

The amount to be allocated on the basis of the wage differential factor varied from industry to industry, depending in general on the importance of labor costs in each industry. For example, if the wage differential factor for an industry were given a weight of 20 percent, then 20 percent of the 1970 (or 1980) projected New England employment in that industry would be allocated among the states on the basis of the wage differential factor in its percent distribution form. The remaining 80 percent of the New England total would be allocated on the basis of the other location influencing factors.

APPENDIX C

PROJECTIONS OF EMPLOYMENT IN FISHERIES AND MINING IN THE NEW ENGLAND STATES

APPENDIX C - PROJECTIONS OF EMPLOYMENT [1/] IN FISHERIES AND MINING IN THE NEW ENGLAND STATES

1. EMPLOYMENT IN FISHERIES

In our analysis of future trends of employment for the New England region as a whole, we projected that the number of full-time fishermen would remain at approximately 6,800; that is, the 1960 employment level.

While this projection foreshadows a halt in the decline in levels of employment experienced during the 1950-1960 decade (when the number of full-time employed fishermen fell from 12,100 to 6,800), it also precludes a return to conditions which existed during the 1940-1950 decade, when New England's full-time employment in fisheries rose from 8,900 to 12,100 or by nearly 40 percent.

Within the context of the data provided in our first study, projections for individual states and the method of derivation of these projections are given below:

a. State Projection Results. - Table C-1 presents projections of employment in the fishery industry of individual New England states. The projections show very gradual declines in employment over the next two decades in all states except Maine, where a slight gain is forecast. For the period after 1980, this study assumes that individual states will maintain their 1980 percent share of the total fisheries employment projected for the New England region. Expectations of increased employment in Maine are based principally on growth prospects for the sardine and lobster industries and on a forecast of limited growth in Maine's non-fishery employment opportunities. The limitation of opportunities in jobs other than fishing is expected to act as a brake on the movement of fishermen out of the fishing industry into other employment areas.

b. The Derivation of Projections. - The projected employment in fisheries for individual states in New England was derived in part from projections made for New England as a whole and in part from judgments formed as a result of discussions held with representatives of the Bureau of Commercial Fisheries and appropriate state agencies charged with the collection and analysis of fisheries statistics.

1/ All figures and projections are based on Census of Population data unless otherwise noted (see Projective Economic Study of New England, Appendix E.)

TABLE C-1

PROJECTED EMPLOYMENT IN THE FISHING INDUSTRY OF THE NEW ENGLAND STATES[1/]

(Thousands of employees in Census of Population terms)

	1950	1960	1970 [2/]	1980	1990	2000	2010	2020
Massachusetts	5.655	3.497	3.250	3.100		Same as 1980		
Maine	4.989	2.463	2.750	3.00		"		
Rhode Island	.730	.581	.540	.500		"		
Connecticut	.606	.190	.170	.150		"		
New Hampshire	.138	.087	.060	.050		"		
Vermont	.030	.025	.020	-----		"		
New England Total	12.148	6.843	6.800	6.800	6.800	6.800	6.800	6.800

1/ For derivation of projections for total New England (see Projective Economic Study of New England, - Appendix E)

2/ Components do not necessarily add up to the total because of rounding.

----Negligible

While it is readily conceded that the future growth of employment opportunities in the fishing industry hinges heavily on a complex of factors that affect the future demand and supply of fishery products -- such as changes in the existing levels and structure of tariffs, foreign competition, changes in the availability both at home and abroad of alternative land-based employment opportunities for fishermen, the rate of depletion of fishery resources, and the vagaries of shifting consumer preferences -- no attempt was made here to appraise future developments in each of these areas of influence in a systematic manner.

The primary reasons for not considering this complex of factors in making our projections were:

1. The difficulty of assessing the long-run changes in these factors;

2. The fact that fishery employment represents a relatively small portion of total employment in individual states -- for example, in Maine, one of the states most heavily involved in the fishing industry, fisheries accounted for only about .75 percent of full-time total employment in 1960, and in Massachusetts fisheries accounted for only .15 percent of total 1960 employment; and

3. The ambiguities of historical statistics dealing with fishery employment.

An example of ambiguous statistics is provided in Table C-2, which compares employment statistics for the fishing industry of three major states. Column A shows figures provided by the Bureau of Commerical Fisheries which portray relatively little change in the level of fisheries employment in Massachusetts and Maine during the last decade; Column B, on the other hand, lists figures obtained from the Census of Population which reveal a considerable drop in the number of employed over the same period.

There is no fully satisfactory explanation for the seemingly divergent employment trends revealed by the two sets of numbers, other than that the Bureau of the Census and the Bureau of Commercial Fisheries employ different methods and definitions in assembling their data. Thus, the Census Bureau, for example, in its Census of Population, enumerates fishery employees on the basis of full-time employees only, whereas the Bureau of Commerical Fisheries includes virtually all part-time fishery employees in compiling its statistics. These part-time employees are generally included in the "regular" and "casual" fisherman category. Regular fishermen are defined as those who receive more than half their annual income from fishing; casual fishermen are those who receive less than one-half of their annual income from fishing.

Data discrepancies also arise because the two agencies compile their employment figures at different times during the year and by means of

TABLE C-2

COMPARATIVE STATISTICS ON TOTAL EMPLOYMENT

IN THE FISHING INDUSTRY

	Massachusetts		Maine		Connecticut	
State	A	B	A	B	A	B
1940	10,342	4,644	5,996	3,048	940	538
1950	10,380	5,655	9,725	4,989	1,229	606
1951	10,604		8,823		1,908	
1952	10,754		8,619		2,064	
1953	11,195		9,331		2,620	
1954	9,467		9,483		1,198	
1955	9,060		9,010		1,235	
1956	8,302		9,721		1,223	
1957	9,258		9,704		1,145	
1958	9,162		9,586		1,381	
1959	8,965		9,875		931	
1960	10,174	3,497	9,802	2,463	810	190
1961	9,888		9,345		877	
1962	10,252		9,017		707	

Sources:

A) U.S. Bureau of Commercial Fisheries, *Fisheries Statistics of the United States 1940-1962.*

B) U.S. Bureau of Census, Census of Population 1940, 1950, and 1960.

different procedures. The average number of yearly full-time employees in the industry probably lies somewhere between the two figures provided by these two principal data sources.

2. EMPLOYMENT IN MINING

As was pointed out in our first report, Projective Economic Study of New England, Appendix E, employment in New England's mining industry accounts for a very small portion of New England's total employment, less than one percent in 1960. Moreover, this portion is expected to diminish further, although at a somewhat less rapid rate than in the past.

a. State Projection Results. - Table C-3 presents projection results for mining employment in the six New England states for the period 1970-2020. While the direction of change in the level of employment is expected to differ somewhat from state to state, the magnitude of these changes will be quite small.

The level of mining employment in Maine, for example, is expected to rise somewhat as a result of the continued development and exploitation of newly discovered mineral resources and in response to increased demands for gravel and sand to meet the needs of future highway construction projects.

b. Derivation of State Projections. - Because of the scarcity of reliable data on mining employment at the state level, employment projections for this industry were derived by applying each state's 1950-1960 average share of New England mining employment to projections of mining employment for New England as a whole (see Table C-3).

These shares, which we computed on the basis of Census of Population employment data, actually differ little from similar shares derived from County Business Patterns and the 1958 Census of Mineral Industries (see Table C-4). However, none of the major data sources provided information for a period sufficiently long or adequate in terms of comparability of data to allow us to form accurate judgments about past employment trends.

TABLE C-3

PROJECTED MINING EMPLOYMENT IN

THE NEW ENGLAND STATES

(Thousands of employees in Census of Population terms)

	1960 1/	1970	1980	1990	2000	2010	2020
Connecticut	1.135	.8	.8	.8	.8	.7	.7
Maine	.286	.4	.4	.4	.4	.4	.4
Massachusetts	1.213	1.2	1.1	1.1	1.1	1.1	1.1
New Hampshire	.204	.2	.2	.2	.2	.2	.2
Rhode Island	1.33	.1	.1	.1	.1	.1	.1
Vermont	1.034	1.2	1.2	1.2	1.2	1.2	1.2
New England	4.005	3.9	3.8	3.8	3.8	3.7	3.7

1/ Actual

TABLE C-4

PERCENTAGE DISTRIBUTION OF MINING

EMPLOYMENT IN NEW ENGLAND

	Census of Population Shares		County Business Patterns Shares		Census of Mineral Industries Shares
	1960	Average[2/] 1950-1960	1962	Average[3/] 1953-1962	1958
Massachusetts	30.3	30.1	43.8	41.2	35.5
Connecticut	28.3	19.8	19.9	21.0	23.8
Maine	7.2	10.0	9.8	6.0	8.3
Vermont	25.8	32.1	22.0	22.6	21.5
New Hampshire	5.1	4.5	5.1	5.0	6.5
Rhode Island	3.3	3.5	4.5	4.3	4.1
New England[1/]	100.0	100.0	100.0	100.0	100.0

1/ Components may not add up to total because of rounding
2/ Average of data from the 1950 and 1960 Census of Population
3/ Average computed on the basis of shares derived for 1953, 1956, 1959, and 1962 from County Business Patterns.

APPENDIX D

PROJECTIONS OF AGRICULTURAL EMPLOYMENT FOR THE NEW ENGLAND STATES

(Summary of a report submitted by Economic Research Service, U.S. Department of Agriculture.)

APPENDIX D - PROJECTIONS OF AGRICULTURAL EMPLOYMENT FOR THE NEW ENGLAND STATES

(Summary of a report submitted by Economic Research Service, U.S. Department of Agriculture.)[1/]

1. STUDY OBJECTIVES

The projective study of the agricultural sector of the New England States, prepared by the Economic Research Service, United States Department of Agriculture, was aimed at achieving a threefold objective:

(1) To provide a description of the present structure of the agricultural sector of the New England States;

(2) To provide projections of production by commodity groups for six target dates, 1970, 1980, 1990, 2000, 2010, and 2020; and,

(3) To provide projections of labor requirements for the same six target dates.

This report,[1/] which summarizes the results derived for individual New England states, is the second in a series of three studies. The first considered the New England region as a whole; the third will deal with substate areas.

2. METHODOLOGY

Following is a step-by-step review of the methodology used in this study:

(1) Project National Population - The projections of the Ad Hoc Water Resources Council (at the medium level of projection) were adopted for this study to assure a set of assumptions regarding national population growth which are consistent with other phases of the Connecticut River Basin Study and with other studies currently underway. These projections provide an annual rate of population growth of approximately 1.7 percent.

(2) Project Domestic Per Capita Utilization by Commodity Classes - These per capita utilization rates are intended to reflect the

1/ For the detailed study see U.S.D.A., Economic Research Service, Agricultural Trends and Projections by States for the New England Region (July, 1964).

influence of the income elasticities of the commodity classes. They are the expected path of equilibrium between production and domestic utilization of each commodity class.

(3) Project National Requirements - National requirements were obtained by combining (a) the index of population, (b) the index of per capita domestic utilization, (c) a factor for other uses such as export, seed, industrial use, etc., and (d) present production in these commodity classes.

(4) Project Proportion of National Production Expected to be Produced in New England - Historically, New England's share in national production of almost all agricultural commodities has been declining. This trend is expected to continue throughout the projection period.

(5) Project New England Production - The product of the national requirements by commodity class and the proportion of production expected in New England gave the expected New England production by commodity class.

(6) Determine Historical Shifts in Production within the New England Region - Historical shifts in production were determined from data from the Statistical Reporting Service, U.S.D.A., and from the United States Census of Agriculture for the years 1939 through 1962.

(7) Find Preliminary Distribution of Production between the Six New England States

(8) Check and Revise Preliminary Distribution of Production - At this step the production figures were reviewed by production specialists and agricultural economists at the six New England Land Grant Colleges. Their counsel on the extent and influence of factors such as urban pressure, area distribution of production, and trends in land use was heeded in revising preliminary projections for distribution of production. A further check for consistency of trend was made for each commodity class.

(9) Finalize Production Projections by State

(10) Determine Historical Trend of New England Labor Requirements in Man Years

(11) Determine Labor Productivity Weights for Production of Each Commodity in Each State - This step involved a judgment of the future course of labor requirements per unit of product to reflect continued substitution of capital for labor. These weights are intended to reflect the man hours required

to produce a unit of each commodity. These weights times the production in each appropriate commodity class added together equal the man-hour requirement for each state.

(12) Find the Deviations of the Man-hour Requirements by State from the New England Trend of Man-hour Requirements

(13) Determine Labor Requirements in Man Years for Each State by Applying these Deviations to the New England Trend of Labor Requirements

(14) Determine Implicit Number of Man Hours per Man Year for Each State

These fourteen steps briefly outline the procedure used to obtain the projections of production and labor requirements. These projections reflect the continued pressure of urban expansion on agricultural land and labor supplies, particularly in Southern New England.

3. LIVESTOCK PRODUCTION

a. Dairy Products. - Maine and New Hampshire are projected to maintain their share of New England dairy production. Vermont is projected to increase its share of the New England total, while the three Southern New England states, whose share in dairy production has declined are expected to continue this trend. Rhode Island is the only state that is projected to experience an absolute decline as well as a relative decline in the production of dairy products.

The dairy products category is the whole milk equivalent of the milk marketed by farmers and milk used on farms where produced. Production per cow is expected to increase substantially as the number of dairy farms decline, and the marginal producers leave the industry, permitting the more efficient dairy operators to take over a larger share of total output. Improved methods of raising and harvesting forage are expected to contribute toward increased dairy production from fewer acres and thereby prevent an even larger reduction in Southern New England's share in total dairy output for the region. Total dairy production in absolute quantities for New England is projected to increase to more than twice the 1960 level by 2020.

b. Eggs. - New England egg production has been projected to rise continuously to more than double the 1960 output by 2020. Maine leads the way in meeting this projected expansion with a substantial increase in its share of the New England total. Connecticut follows with some increase in its percentage of New England's total egg output. The remaining four states are projected to show relative declines in egg production, with Massachusetts, Rhode Island, and Vermont registering absolute decreases in production.

Since egg production as carried out in New England does not require much land, urban expansion is less likely to affect the location of operations through pressure on land; urban expansion will, however, have a less direct effect, in that it will reduce the labor force available and/or will result in the imposition of zoning ordinances. Institutional factors, such as the structures of freight rates for hauling feed to New England, could play a major role in the pattern of egg production, since nearly all of the feed for poultry of all kinds comes from outside the region.

c. Poultry. - New England poultry production is difficult to project because of the fast-moving nature of the industry. The cost of feed in New England relative to other producing areas is a major factor. The output of farm chickens is largely geared to the population of layers within a state and consists mainly of birds culled from flocks kept for egg production. The pattern of farm chicken production is, therefore, closely associated with the projected egg output.

The production of commercial broilers is projected to decline substantially through a continuation of the trend of recent years. Output is projected to stabilize after this adjustment takes place due to the demand for locally grown birds from the region's markets. Some of the processing plants have supply areas that will enable them to continue to operate and contract for broilers even after the current production levels have been greatly reduced. Turkey production in the future is expected to stabilize at a level geared to a speciality market for locally grown birds.

Maine is projected to gain relative to the other New England states in the production of poultry. This results from its position with respect to eggs and broilers. Connecticut's stable position arises from the projections of egg production and related farm chicken output.

d. Red Meats. - The production of meat in New England is mostly confined to cattle and calves which, in turn, reflects the trend in the dairy industry. The cattle and calves sold for meat are mainly animals culled from dairy herds. Vermont, the leading dairy state, is projected to increase its share of total meat output while Southern New England's share is projected to decline.

Other meat animals are projected to become even less important in their already minor contributions to total New England production. Hogs are mainly garbage-fed, which explains why their production is concentrated near metropolitan areas such as Boston, Massachusetts. There are a few specialty meat product plants in New England which utilize the hogs which are raised in the region.

Sheep and lamb production is a more extensive kind of operation and it is concentrated in areas away from urban centers where pasture is

relatively cheap. Maine is the chief source of supply at present and it is projected to become relatively more important in the future.

4. CROP PRODUCTION

a. Potatoes. - Projected production of potatoes shows an even heavier concentration in Maine than has been true in recent years. Much of the land currently devoted to potatoes in Connecticut and Rhode Island is subject to urban expansion. In the recent past, potato production has moved to land formerly used for growing binder-type tobacco, but urban encroachment will probably be the important factor in the future. Maine's potato output will undoubtedly be affected by the award of a sugar beet allotment for 1966, but the impact of this action is difficult to foresee at present.

b. Vegetables. - Most of the projected increase in the production of fresh market vegetables is expected to occur in Maine. Pressure from metropolitan areas has been reducing the acreage used to produce vegetables in the Southern New England states. Massachusetts is projected to retain its dominant position while losing ground relative to Maine and New Hampshire. The decline in tobacco area has released land in certain places for utilization by vegetable crops. However, this source of land is nearly exhausted unless shade grown tobacco follows binder tobacco in decline. The volume of fresh market vegetables grown in Southern New England would be expected to decline even further if it were not for local demand, particularly for fresh produce from roadside stands.

Processed vegetables are projected to decrease in importance as the regional market for fresh vegetables expands. Land formerly used for vegetables for processing may in some cases be expected to be shifted to growing fresh market vegetables. The location of processing plants and their contracts could easily upset these projections.

c. Tobacco. - Although production of tobacco in New England is expected to come to an end some time after 1980, this projection will depend on institutional and technological factors in the industry. The land which is released from tobacco is likely to go into vegetable production or urban development.

5. BERRY AND FRUIT PRODUCTION

a. Cranberries. - Massachusetts is the only New England State that produces cranberries commercially; its production is projected to increase to meet the increased demand for cranberries. The 1960 crop was unusually large due to the high yields which were obtained.

b. Apples. - New England apple production varies widely from year to year and, although 1960 was used as the base year, it should be pointed out that the 1960 commercial crop was smaller than that of recent years. As Southern New England becomes more urbanized, the location of production is projected to shift in a pattern which is already in evidence. Maine, New Hampshire, and Vermont are projected to increase their shares of total New England production, while production in the three Southern states is expected to decline on an absolute as well as a relative basis. Much of New England contains sites well suited to apple production. Demand for McIntosh apples, a New England specialty, will influence future trends in the industry.

6. AGRICULTURAL LABOR

Agricultural labor requirements were projected to continue a gradual decline in all six states. Maine, New Hampshire, and Vermont show very gradual declines while Massachusetts, Rhode Island, and Connecticut show substantial declines. Allowances were made for shorter working hours in all states in the future. The average work year is projected to be shorter in the Southern New England states than in the Northern New England states. The projected shorter work year reflects the pressure of off-farm employment alternatives and the increase of enterprises not included in the commodity classes, such as nurseries, greenhouses, and small fruit enterprises.

The shortening of the work year also reflects the fact that agricultural products will be marketed by farmers further along the marketing chain. In Southern New England an upsurge of direct marketing is expected in the form of gallon-jug dairies, producer-distributors, and roadside sales outlets for almost all agricultural products.

TABLE D-1

DAIRY PRODUCTS: PRODUCTION AND PERCENTAGE DISTRIBUTION BY STATE FOR THE NEW ENGLAND REGION, 1960 AND PROJECTIONS FOR TEN YEAR INTERVALS TO 2020

Year	Dairy production							Percentage of New England region's production						
	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	New England Region	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	Index Number
	Millions of pounds							Percent						
1960...	703	377	1914	752	123	748	4617	15.2	8.2	41.4	16.3	2.7	16.2	100
1970...	790	433	2219	765	128	765	5100	15.5	8.5	43.5	15.0	2.5	15.0	110
1980...	852	467	2541	743	99	798	5500	15.5	8.5	46.2	13.5	1.8	14.5	119
1990...	930	510	2906	730	84	840	6000	15.5	8.5	48.5	12.1	1.4	14.0	130
2000...	1007	553	3260	730	72	878	6500	15.5	8.5	50.2	11.2	1.1	13.5	141
2010...	1131	621	3796	730	58	964	7300	15.5	8.5	52.0	10.0	0.8	13.2	158
2020...	1255	688	4310	730	57	1060	8100	15.5	8.5	53.2	9.0	0.7	13.1	175

TABLE D-2

EGGS: PRODUCTION AND PERCENTAGE DISTRIBUTION BY STATE FOR THE NEW ENGLAND REGION, 1960 AND PROJECTIONS FOR TEN YEAR INTERVALS TO 2020

Year	Egg production							Percentage of New England region's production						
	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	New England Region	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	Index Number
	Millions of Eggs							Percent						
1960....	753	326	163	660	75	675	2652	28.4	12.3	6.1	24.9	2.8	25.5	100
1970....	1144	350	160	580	70	896	3200	35.8	10.9	5.0	18.1	2.2	28.0	121
1980....	1520	350	155	570	65	1140	3800	40.0	9.2	4.1	15.0	1.7	30.0	143
1990....	1925	350	150	560	60	1305	4350	44.3	8.0	3.4	12.9	1.4	30.0	164
2000....	2297	375	145	560	53	1470	4900	46.9	7.7	3.0	11.4	1.1	30.0	185
2010....	2634	400	140	560	46	1620	5400	48.8	7.4	2.6	10.4	0.9	30.0	204
2020....	2965	425	140	560	40	1770	5900	50.2	7.2	2.4	9.5	0.7	30.0	222

TABLE D-3

POULTRY:[1/] PRODUCTION AND PERCENTAGE DISTRIBUTION BY STATE FOR THE NEW ENGLAND REGION, 1960 AND PROJECTIONS FOR TEN YEAR INTERVALS TO 2020

Year	Poultry production							Percentage of New England region's production						
	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	New England Region	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	Index Number
	Millions of pounds							Percent						
1960....	240.5	35.5	6.6	59.9	8.1	98.5	449.1	53.6	7.9	1.5	13.3	1.8	21.9	100
1970....	213.6	24.5	6.2	36.5	4.8	64.4	350.0	61.0	7.0	1.8	10.4	1.4	18.4	78
1980....	128.3	13.9	5.2	25.7	3.0	43.9	220.0	58.2	6.3	2.4	11.7	1.4	20.0	49
1990....	140.4	12.9	4.8	23.9	2.7	45.3	230.0	61.0	5.6	2.1	10.4	1.2	19.7	51
2000....	149.6	13.0	4.5	23.0	2.5	47.4	240.0	62.3	5.4	1.9	9.6	1.0	19.8	53
2010....	148.9	13.0	4.3	22.3	2.3	49.2	240.0	62.0	5.4	1.8	9.3	1.0	20.5	53
2020....	148.7	13.0	4.2	21.3	2.1	50.7	240.0	61.9	5.4	1.8	8.9	0.9	21.1	53

1/ Includes the sum of farm chickens, commercial broilers, and turkeys.

TABLE D-4

RED MEATS:1/ PRODUCTION AND PERCENTAGE DISTRIBUTION BY STATE FOR THE NEW ENGLAND REGION, 1960 AND PROJECTIONS FOR TEN YEAR INTERVALS TO 2020

Year	Red meat production							Percentage of New England region's production						
	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	New England Region	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	Index Number
	Millions of pounds							Percent						
1960....	45.7	17.5	70.1	57.1	6.2	35.6	232.2	19.7	7.5	30.2	24.6	2.7	15.3	100
1970....	35.9	19.3	86.1	50.1	6.5	32.1	230.0	15.6	8.4	37.4	21.8	2.8	14.0	99
1980....	34.4	18.8	89.9	42.1	4.6	30.2	220.0	15.6	8.5	40.9	19.1	2.1	13.8	95
1990....	36.1	19.4	101.1	38.4	4.3	30.7	230.0	15.7	8.4	44.0	16.7	1.9	13.3	99
2000....	37.7	20.3	110.5	36.7	3.6	31.2	240.0	15.7	8.5	46.0	15.3	1.5	13.0	103
2010....	40.0	21.1	118.6	35.8	2.9	31.6	250.0	16.0	8.4	47.5	14.3	1.2	12.6	108
2020....	41.0	22.0	124.5	36.6	2.8	33.1	260.0	15.8	8.5	47.9	14.1	1.0	12.7	112

1/ Includes the sum of cattle and calves, hogs, and sheep and lambs.

TABLE D-5

POTATOES: PRODUCTION AND PERCENTAGE DISTRIBUTION BY STATE FOR THE NEW ENGLAND REGION, 1960 AND PROJECTIONS FOR TEN YEAR INTERVALS TO 2020

Year	Potato production							Percentage of New England region's production						
	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	New England Region	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	Index Number
	Millions of pounds							Percent						
1960....	3366	31	42	167	141	158	3905	86.2	0.8	1.1	4.3	3.6	4.0	100
1970....	2700	20	24	116	110	130	3100	87.2	0.6	0.8	3.7	3.5	4.2	79
1980....	2800	13	17	80	90	100	3100	90.4	0.4	0.5	2.6	2.9	3.2	79
1990....	3643	10	12	75	75	85	3900	93.4	0.3	0.3	1.9	1.9	2.2	100
2000....	4477	8	10	70	60	75	4700	95.2	0.2	0.2	1.5	1.3	1.6	120
2010....	4700	7	9	64	50	70	4900	96.0	0.1	0.2	1.3	1.0	1.4	125
2020....	4915	7	8	60	45	65	5100	96.4	0.1	0.1	1.2	0.9	1.3	131

TABLE D-6

VEGETABLES, FRESH MARKET: PRODUCTION AND PERCENTAGE DISTRIBUTION BY STATE FOR THE NEW ENGLAND REGION, 1960 AND PROJECTIONS FOR TEN YEAR INTERVALS TO 2020

Year	Vegetable production							Percentage of New England region's production						
	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	New England Region	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	Index Number
	Millions of pounds							Percent						
1960	6	16	0	173	13	107	315	2.0	5.0	0	55.0	4.2	33.8	100
1970	39	20	1	200	10	90	360	10.8	5.6	0.3	55.5	2.8	25.0	114
1980	64	27	1	220	9	90	411	15.6	6.6	0.2	53.5	2.2	21.9	130
1990	92	34	1	240	8	90	465	19.8	7.3	0.2	51.6	1.7	19.4	148
2000	128	40	1	260	7	90	526	24.3	7.6	0.2	49.5	1.3	17.1	167
2010	177	46	1	280	6	90	600	29.5	7.7	0.2	46.6	1.0	15.0	190
2020	230	50	1	300	6	90	677	34.0	7.4	0.1	44.3	0.9	13.3	215

TABLE D-7

VEGETABLES, PROCESSED: PRODUCTION AND PERCENTAGE DISTRIBUTION BY STATE FOR THE NEW ENGLAND REGION, 1960 AND PROJECTIONS FOR TEN YEAR INTERVALS TO 2020

Year	Vegetable production							Percentage of New England region's production						
	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	New England Region	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	Index Number
	Millions of pounds							Percent						
1960....	58	5	0.8	12	0	0.2	76	76.4	7.0	0.8	15.9	0	0.4	100
1970....	54	6	0	12	0	0	72	75.0	8.3	0	16.7	0	0	95
1980....	48	6	0	11	0	0	65	73.9	9.2	0	16.9	0	0	86
1990....	36	6	0	10	0	0	52	69.3	11.5	0	19.2	0	0	68
2000....	26	6	0	8	0	0	40	65.0	15.0	0	20.0	0	0	53
2010....	26	6	0	8	0	0	40	65.0	15.0	0	20.0	0	0	53
2020....	26	6	0	8	0	0	40	65.0	15.0	0	20.0	0	0	53

TABLE D-8

APPLES, COMMERCIAL CROP:[1/] PRODUCTION AND PERCENTAGE DISTRIBUTION BY STATE FOR THE NEW ENGLAND REGION, 1960 AND PROJECTIONS FOR TEN YEAR INTERVALS TO 2020

Year	Apple production							Percentage of New England region's production						
	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	New England Region	Maine	New Hampshire	Vermont	Massachusetts	Rhode Island	Connecticut	Index Number
	Thousands of bushels							Percent						
1960[1/]	1420	1050	1030	2250	120	1050	6920	20.5	15.2	14.9	32.5	1.7	15.2	100
1970	1900	1500	1000	2475	125	1200	8200	23.2	18.3	12.2	30.2	1.5	14.6	118
1980	2200	1650	1100	2150	100	1000	8200	26.9	20.1	13.4	26.2	1.2	12.2	118
1990	3000	2000	1365	2150	85	900	9500	31.5	21.1	14.4	22.6	0.9	9.5	137
2000	3500	2300	1475	2100	75	850	10300	34.0	22.3	14.3	20.4	0.7	8.3	149
2010	3800	2500	1710	2000	65	825	10900	34.9	22.9	15.7	18.3	0.6	7.6	158
2020	4000	2600	2100	1945	55	800	11500	34.7	22.6	18.3	16.9	0.5	7.0	166

1/ 1960 crop smaller than recent years.

TABLE D-9

ESTIMATED AGRICULTURAL LABOR IN MAN YEAR EQUIVALENTS[1/], AND INDEX NUMBERS, NEW ENGLAND REGION, 1960 WITH DECENNIAL PROJECTIONS TO 2020

State	1960	1970	1980	1990	2000	2010	2020
Maine	16,049	15,727	15,487	15,284	15,084	14,374	14,658
Index No.	100	98.0	96.5	95.2	94.0	92.7	91.3
New Hampshire	5,530	5,474	5,401	5,301	5,199	5,092	4,983
Index No.	100	99.0	97.7	95.8	94.0	92.1	90.1
Vermont	14,941	14,911	14,817	14,714	14,610	14,520	14,440
Index No.	100	99.8	99.2	98.5	97.8	97.2	96.6
Massachusetts	15,494	15,041	14,553	14,054	13,548	13,043	12,539
Index No.	100	97.1	93.9	90.7	87.4	84.2	80.9
Rhode Island	1,596	1,480	1,350	1,217	1,097	939	797
Index No.	100	92.7	84.6	76.3	68.7	58.8	49.9
Connecticut	14,390	13,867	13,392	12,930	12,480	12,032	11,583
Index No.	100	96.4	93.1	89.8	86.7	83.6	80.5
New England	68,000	66,500	65,000	63,500	62,000	60,500	59,000
Index No.	100	97.8	95.6	93.4	91.2	89.0	86.8

1/ Based on variable work year estimates of Bureau of Labor Statistics.

	1960	1970	1980	1990	2000	2010	2020
N.E. average man year (man hours) =	2254	2060	1880	1758	1635	1567	1500

APPENDIX E

PROJECTIONS OF EMPLOYMENT IN FORESTRY, LUMBER AND WOOD PRODUCTS, AND PAPER AND ALLIED PRODUCTS FOR THE NEW ENGLAND STATES,

(Summary of a report submitted by the Forest Service, Northeastern Forest Experiment Station, U.S. Department of Agriculture.)

APPENDIX E - PROJECTIONS OF EMPLOYMENT IN FORESTRY, LUMBER AND WOOD PRODUCTS, AND PAPER AND ALLIED PRODUCTS FOR THE NEW ENGLAND STATES,

(Summary of a report submitted by the Forest Service, Northeastern Forest Experiment Station, U.S. Department of Agriculture.)[1/]

1. INTRODUCTION

The future development of the forest-based industries in each of the New England states depends to a substantial degree on the forest resources of the state and on the pressure put on these forests to supply outdoor recreation services, watershed protection, and wildlife habitat. All of these uses are important in New England, although the relative importance varies somewhat from state to state. The kind of forest and the suitability of the forest as a resource base for wood manufacturing also varies within New England.

Softwoods, particularly white pine, spruce and fir, provide much of the timber base in Northern New England, and especially in Maine and New Hampshire. Hardwood species, including oak, maple, birch, and beech, take on greater relative importance in Southern New England and in Vermont. This to some extent determines the kind of industry to be found in the various states.

The impact of the urban population in the coastal cities of New England has also substantially affected the use of the forest in surrounding areas. Recreation pressure on forest land varies a good deal with the kind of land and its proximity to cities, lakes, and mountains. In general, the pressure from this use is greatest in areas that are aesthetically pleasing. The pressure on forest land for its watershed protection capabilities is greatest in Southern New England and close to the major cities. As a result of these considerations, the use of the forest as a source of raw materials for wood-using industries is being more and more limited to Northern New England, in spite of the presence of substantial volumes of timber in Southern New England. Although this is the general pattern, there are still some forest-based industries in the southern half of New England, in addition to the secondary forest products industries in this area.

In a prior report by the U.S. Forest Service, projections of production and employment were made for all of New England. In that report, it was assumed that the broad patterns of regional industrial development within the United States could be identified and projected

1/ For the detailed study see U.S.D.A., Forest Service, Northeastern Forest Experiment Station, New England Economic Survey, State Projections (July, 1964).

through trend analysis of historical data series. This was basically the method used in allocating projected national production of forest products to the various regions of the country, including New England.

In this phase of the New England Economic Survey, projections of production and employment were broken down into state components. This breakdown required an analysis of production and employment trends in forest products industries in each of the states in New England, the projection of production and employment based on historical trends, current expansion plans, and projected shifts in relative levels of production, and the comparison of projected levels of production with potential timber availability by states. The impact of changes in forest land use and timber availability was important in this analysis.

2. LUMBER AND WOOD PRODUCTS, EXCEPT FURNITURE (SIC-24)

Projections of employment were made separately for two segments of the lumber industry. The primary production segment is closely tied to the timber resource that supplies its raw material, while the secondary segment is more closely tied to markets for the final products. The following distinction between the two segments of the lumber industry is made:

(1) Primary Production - Logging camps and logging contractors (SIC-241), and sawmills and planing mills (SIC-242).

(2) Secondary Production - Millwork, veneer, plywood, and prefabricated structural wood products (SIC-243), and wooden containers (SIC-244).

Lumber production for New England as a whole is expected to increase only slightly between 1962 and 2020 (Table E-1). The small projected increase is expected to be in softwood lumber, while production of hardwood lumber is expected to remain constant. The three Northern states are expected to increase their share of total production, while a concurrent decrease in the share of production is projected for the three Southern states. These projected shifts are based primarily on expected changes in forest land use.

Employment in the primary segment of the lumber industry was projected for target years by applying projected increases in productivity by state to projected lumber production by state. Employment in SIC-241 attributable to pulpwood production was projected to decrease over the projection period. The net shift in employment in the primary segment of the lumber industry is toward the three Northern New England states, in spite of a relative decrease in productivity projected for Massachusetts and Connecticut.

In the secondary segment of the lumber industry, the relative shifts in employment are also likely to favor Northern New England (Table

TABLE E-1

PRODUCTION AND PROJECTED PRODUCTION OF LUMBER IN NEW ENGLAND BY STATES FOR SELECTED YEARS[1/]

Year	Me.	N.H.	Vt.	Mass.	Conn.	R.I.	Total
			State				
			Million bd. ft.				
1947	459	323	204	132	20	3	1141
48	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-
1950	-	-	-	-	-	-	-
51	-	-	-	-	-	-	-
52	-	-	-	-	-	-	-
53	-	-	-	-	-	-	-
54	395	271	-*	-*	-*	-*	991
1955	415	240	-*	-*	-*	-*	1035
56	395	239	-*	-*	-*	-*	1074
57	351	287	-	-*	-*	-*	-
58	286	154	120**	90**	26**	3**	679
59	304	207	-	-	-	3**	776
1960	303	206	129**	91	27	3**	759
61	297	159	121**	79	28	3**	687
62	310	160	90**	79	30	3**	672
1970	310	160	120	70	20	-	680
1980	320	160	120	60	20	-	680
1990	360	170	140	60	10	-	740
2000	370	170	140	50	10	-	740
2020	380	170	140	40	10	-	740

1/ Production estimates from U.S. Bureau of the Census Current Industrial Report Series, Lumber Production and Mill Stocks.

* No figures given in Bureau of the Census reports because of a disclosure problem.

** Estimates.

E-2). Between 1950 and 1960 the share of employment in the secondary segment increased slightly in the three Northern New England states. Only Maine showed an increase in the absolute level of employment during this period. New Hampshire and Massachusetts had the greatest relative decreases, primarily because of the decline of the wooden box industry.

Total employment in the primary and secondary segments of the lumber industry is projected to decrease by 2020 to 53 percent of the 1960 level. Maine's share is projected to increase over this period from 44 percent to 53 percent of the total, while Massachusetts' share is projected to decrease from 18 percent to 10 percent. Shares of the other states are projected to remain relatively constant.

3. PAPER AND ALLIED PRODUCTS (SIC-26)

The paper industry was also broken down into primary and secondary segments identified as follows:

(1) Primary Production Segment. Pulp mills (SIC-261), paper mills except building paper mills (SIC-262), paper board mills (SIC-263), and building paper and building board mills (SIC-266).

(2) Secondary Production Segment. Converted paper and paper board products, except containers and boxes (SIC-264) and paper board containers and boxes (SIC-265).

Overall employment in the paper industry in New England is projected to increase by some 50 percent between 1960 and 2020. Employment in the primary segment of the industry is expected to increase by about 22 percent between 1960 and 2020, while employment in the secondary segment (SIC-264 and 265) is expected to increase by about 90 percent.

Employment figures for the primary segment of the paper industry are related to the level of production of woodpulp, paper, and board. Woodpulp production in New England is projected to increase by more than 180 percent between 1960 and 2020. Present production is concentrated in Maine and New Hampshire, which together produced 95.4 percent of the region's total woodpulp in 1962 (Table E-3). Paper and board production in New England is projected to nearly triple its present level by 2020. Maine presently produces the greatest amount of paper and board; Massachusetts' production is second to Maine's.

Projections of employment by states in the primary segment of the paper industry were made by relating increases in output per employee for each state to projected increases in production of woodpulp and paper and board for each state (Table E-4). The projections indicate a shift in relative employment in the primary segment of the paper industry away from Massachusetts to Northern New England (Table E-5). Massachusetts is the only state in which an absolute decline in employment in the

TABLE E-2

EMPLOYMENT AND PROJECTED EMPLOYMENT FOR THE LUMBER AND WOOD PRODUCTS INDUSTRY (SIC-24) IN NEW ENGLAND BY STATES FOR SELECTED YEARS 1/

	State																				
	Maine			N.H.			Vermont			Mass.			Conn.			R. I.			Total		
Year	241 242	243 244 249	Total	241 242	243 244 249	Total	241 242	243 244 249	Total	241 242	243 244 249	Total	241 242	243 244 249	Total	241 242	243 244 249	Total	241 242	243 244 249	Total
	Thousands																				
1950	14.1	4.6	18.7	5.8	2.8	8.6	4.9	1.4	6.3	3.3	4.1	7.4	1.3	1.1	2.4	0.3	0.4	0.7	29.8	14.5	44.3
1960	9.3	5.4	14.7	3.8	2.0	5.8	3.5	1.3	4.8	2.3	3.6	5.9	0.9	0.9	1.8	0.2	0.3	0.5	19.9	13.5	33.4
1970	8.5	6.1	14.6	3.0	1.6	4.6	2.5	1.3	3.8	1.6	2.5	4.1	0.6	0.7	1.3	-	0.3	0.3	16.2	12.5	28.7
1980	7.5	5.8	13.3	2.7	1.4	4.1	2.2	1.3	3.5	1.3	2.1	3.4	0.5	0.7	1.2	-	0.2	0.2	14.2	11.5	25.7
1990	7.3	5.4	12.7	2.7	1.3	4.0	2.2	1.3	3.5	1.2	1.7	2.9	0.3	0.6	0.9	-	0.2	0.2	13.7	10.5	24.2
2000	6.7	5.0	11.7	2.5	1.1	3.6	2.0	1.2	3.2	0.9	1.4	2.3	0.2	0.6	0.8	-	0.2	0.2	12.3	9.5	21.8
2020	5.6	3.8	9.4	2.1	0.9	3.0	1.7	1.1	2.8	0.7	1.1	1.8	0.2	0.5	0.7	-	0.1	0.1	10.3	7.5	17.8

1/ Employment data and projections based on Census of Population figures.

TABLE E-3

PRODUCTION AND PROJECTED PRODUCTION OF WOODPULP IN NEW ENGLAND BY STATES FOR SELECTED YEARS[1/]

Year	State						
	Maine	N.H.	Vt.	Mass.	Conn.	R.I.	Total
	Thousand Tons						
1946	1,185	177	*	*	*	*	1,422
47	-	-	-	-	-	-	-
48	-	-	-	-	-	-	-
49	-	-	-	-	-	-	-
1950	1,183	*	*	*	*	*	1,458
51	1,350	236	*	*	*	*	1,676
52	1,304	*	*	*	*	*	1,617
53	1,226	*	*	*	*	*	1,556
54	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-
56	1,690	262	*	*	*	*	2,060
57	-	-	-	-	-	-	-
58	1,410	*	*	*	*	*	1,775
59	1,520	*	*	*	*	*	1,900
1960	1,666	*	*	*	*	*	1,839
61	1,595	262	24	-	-	-	1,952
62	1,626	249	25**	*	*	*	1,968
1970	1,960	250	25	45	5	15	2,300
1980	2,280	400	120	60	20	20	2,900
1990	2,680	540	220	100	40	20	3,600
2000	3,180	700	390	150	60	20	4,500
2020	3,580	800	520	200	80	20	5,200

1/ Production estimates from U.S. Bureau of the Census Current Industrial Report Series, Pulp, Paper and Board.

* No figures given in Bureau of the Census reports because of disclosure problem.

** Estimates.

TABLE E-4

PRODUCTION AND PROJECTED PRODUCTION OF PAPER AND BOARD IN NEW ENGLAND BY STATES FOR SELECTED YEARS[1/]

Year	State						
	Maine	N.H.	Vt.	Mass.	Conn.	R.I.	Total
	Thousand Tons						
1946	1,195	216	99	691	334(R.I. incl.)		2,535
47	-	-	-	-	-	-	-
48	1,260	221	*	694	305	*	2,657
49	1,184	218	*	610	264	*	2,429
1950	1,328	263	*	718	316	*	2,771
51	1,416	283	*	773	327	*	2,966
52	1,372	244	*	679	287	*	2,729
53	1,370	272	*	711	309	*	2,819
54	-	-	-	-	-	-	-
1955	-	-	-	-	-	-	-
56	1,817	317	*	804	298	*	3,423
57	-	-	-	-	-	-	-
58	1,609	299	*	760	309	*	3,163
59	1,691	343	*	773	361	*	3,369
1960	1,806	344	*	870	336	*	3,552
61	1,832	348	*	804	334	*	3,507
62	1,831	362	170**	803	339	20**	3,525
1970	2,250	410	260	900	360	20	4,200
1980	2,680	580	360	1,050	400	30	5,100
1990	3,150	750	500	1,250	500	50	6,200
2000	3,570	910	660	1,400	580	80	7,200
2020	4,700	1,400	1,060	1,800	840	200	10,000

1/ Production estimates from U.S . Bureau of the Census Current Industrial Report Series, Pulp and Paper Board.

* No figures given in Bureau of the Census reports because of disclosure problem.

** Estimates.

TABLE E-5

EMPLOYMENT AND PROJECTED EMPLOYMENT FOR THE PAPER AND ALLIED PRODUCTS INDUSTRY (SIC-26) IN NEW ENGLAND BY STATES FOR SELECTED YEARS[1]

	State																				
	Maine			N. H.			Vermont			Mass.			Conn.			R. I.			Total		
Year	261 262 263 266	264 265	Total	261 262 263 266	264 265	Total	261 262 263 266	264 265	Total	261 262 263 266	264 265	Total	261 262 263 266	264 265	Total	261 262 263 266	264 265	Total	261 262 263 266	264 265	Total
	Thousands																				
1950	15.9	0.5	16.4	6.0	1.4	7.4	1.4	0.4	1.8	13.2	19.3	32.5	1.9	4.9	6.8	0.4	1.2	1.6	38.8	27.7	66.5
1960	17.6	1.0	18.6	5.6	2.0	7.6	1.1	1.2	2.3	14.8	19.2	34.0	3.0	5.2	8.2	0.5	1.6	2.1	42.5	30.2	72.7
1970	18.2	2.1	20.3	4.8	2.8	7.6	1.3	1.7	3.0	15.1	20.2	35.3	2.6	5.2	7.8	0.5	1.6	2.1	42.5	33.6	76.1
1980	18.9	3.7	22.6	5.5	4.5	10.0	1.9	2.6	4.5	13.6	20.2	33.8	2.6	4.8	7.4	0.5	1.6	2.1	43.0	37.4	80.4
1990	19.6	5.8	25.4	6.1	5.8	11.9	2.5	3.3	5.8	14.0	20.5	34.5	2.8	4.6	7.4	0.6	1.7	2.3	45.6	41.7	87.3
2000	20.7	8.0	28.7	6.7	7.0	13.7	3.3	3.7	7.0	14.6	20.8	35.4	3.1	4.6	7.7	0.7	2.3	3.0	49.1	46.4	95.5
2020	21.9	9.8	31.7	7.7	8.6	16.3	4.3	4.6	8.9	13.7	25.8	39.5	3.5	5.7	9.2	0.9	2.9	3.8	52.0	57.4	109.4

1/ Employment data and projections based on Census of Population figures.

primary segment is expected between 1960 and 2020. New Hampshire and Vermont are projected to have the largest increases in their relative shares of employment in the primary segment, although Maine is projected to have the largest increase in total employment.

The employment projections for the secondary segment of the paper industry are made by extrapolation of recent trends in employment by states and by consideration of important factors affecting future plant location. This segment of the paper industry is spatially oriented toward its markets; therefore, the forces shaping the future distribution of employment in New England in the secondary segment are different from those shaping employment patterns for the primary segment. On the other hand, paper producing companies are tending to integrate with converters and this leads to economies in location of secondary plants in conjunction with primary plants.

The trend in employment between 1950 and 1960 was upward in the secondary segment of the paper industry in New England as a whole. The shares of employment shifted away from Massachusetts somewhat and toward the southern portions of the Northern New England states. The absolute level of employment in Massachusetts remained almost constant between 1950 and 1960, while modest increases were recorded in each of the other five states. These trends are expected to continue in the future (Table E-5).

4. FORESTRY (SIC-08)

Employment in forestry (SIC-08) in New England is minor. It includes employment in the management of forest tracts and nurseries not included elsewhere under manufacturing industries or government and employment in collecting and gathering very minor forest products. It declined from about 2,100 in 1950 to about 1,800 in 1960 and is projected to decline to 1,500 in 1970 and then remain at that level (Table E-6).

It is probable that shifts are taking place in the type of employment in the major group away from gathering forest products toward the management of forest tracts and nurseries. The latter type of employment in Southern New England is probably increasing slowly as owners of small tracts of forest land become interested in the management of their lands.

Projections of the shares by state of New England employment in forestry have been made to reflect a relative shift away from Northern New England toward Southern New England (Table 6). The importance of this shift to overall employment levels is minor.

TABLE E-6

EMPLOYMENT AND PROJECTED EMPLOYMENT IN FORESTRY (SIC-08)

IN NEW ENGLAND BY STATES FOR SELECTED YEARS

Year	State						Total
	Maine	N.H.	Vt.	Mass.	Conn.	R.I.	
	Thousands						
1950	0.7	0.2	0.5	0.4	0.2	0.1	2.1
1960	0.4	0.3	0.3	0.5	0.2	0.1	1.8
1970	0.3	0.2	0.2	0.5	0.2	0.1	1.5
1980	0.2	0.2	0.2	0.5	0.3	0.1	1.5
1990	0.2	0.2	0.2	0.5	0.3	0.1	1.5
2000	0.2	0.2	0.2	0.5	0.3	0.1	1.5
2020	0.2	0.2	0.2	0.5	0.3	0.1	1.5

APPENDIX F

SPECIAL POPULATION STUDIES

APPENDIX F - SPECIAL POPULATION STUDIES

1. INTRODUCTION

In Chapter III we described the methods used to derive the population forecasts for the New England states presented in Chapter II of this report. In addition, we discussed the reasoning that dictated the selection of our methods of population projection in preference to others

For purposes of comparison, however, and also as a rough measure of the possible range of forecasts that can be obtained by employing different projection methods and assumptions, this Appendix presents population projections derived by an independent projection method also known as the "demographic" or component or cohort-survival method. In addition, we have also compared these projections with state population forecasts produced by other research agencies and organizations.

Finally, this Appendix presents detailed forecasts of urban population and number of households for each of the New England states.

2. "DEMOGRAPHIC" (COMPONENT OR COHORT-SURVIVAL) POPULATION PROJECTIONS

a. Assumptions and Derivation. - The "demographic" population projections which we derived for each of the six New England states incorporate both assumptions made in our original "demographic" projection for the New England region as a whole and those thought to be implied in our final or "adjusted" New England population projection (see Projective Economic Study of New England, Chapters II and III).

(1) Review of Major Assumptions used in making the Population Projection for New England region as a whole. - In our original "demographic" projection of total New England population, the 1960 New England age-specific birth rates were used throughout and the resulting number of births was adjusted to represent various given levels in the gross reproduction rate. The projections of national age-sex survival ratios made by the U.S. Department of Health, Education, and Welfare were used, and it was assumed that no net in- or out-migration would occur in the future.

However, the assumption which seemed to be implied in the "adjusted" or final total New England population projection (derived from our "adjusted" labor force projections for total New England) was that a net in-migration of 200,000 people to the region would take place during the 1970-1980 decade.

(2) Assumptions of "Demographic" Projections at the State Level. - In making population projections for each of the six New England

states, each state's 1960 age-specific birth rates were used and the resulting births were adjusted to follow trends in the gross reproduction rate similar to those used in the original projection for total New England. Survival ratios by age and sex were applied to the population of each state in 1950 to estimate how many persons in each age-sex class would be living in the state in 1960, if no in- or out-migration had occurred during the decade. By comparing these estimates with the actual 1960 population distribution, it was possible to estimate migration rates by age-sex group during the decade. Total net in- or out-migration for each state was then projected to 1970 at the average of the rates prevailing in the 1940-1950 and 1950-1960 decades. After 1980, net in- or out-migration from each state was projected at the same average rate except that in each pentad the rate was gradually diminished by assuming it to be 90% of that during the previous pentad. This meant that the rates of net in- or out-migration were projected to decline gradually to about 43% of their original levels by 2020. In addition, migration rates in each decade were adjusted proportionately to be consistent with those projected for New England as a whole. The same national survival ratio projections were used in each state as in the New England study.

When the population projections for the six states for each decade were totaled, it was found they added up to somewhat less (e.g., 99.1% in 1970 and 97.4% in 2020) than the final "adjusted" New England total.

An additional correction was made to bring the figures into agreement.

b. Projection Comparisons. - Table F-1 provides comparisons of the state population projections derived by means of the "demographic" method described above (row ADL-2) with those obtained from the commodity industry employment projections (row ADL-1) shown in Chapter II of this report. It is clear that the difference between these two projections can vary significantly in relative as well as in absolute terms, particularly as the projection period lengthens. For most states and projection years, however, the projections produced in this report by either method fall well within the range provided by population forecasts derived from other studies.

3. PROJECTIONS OF URBAN POPULATION

a. Concepts and Definitions. - In the past, demographers have nearly always distinguished between the urban and rural residents of the population, since the characteristics and living habits of these two groups differed significantly. In recent years, however, the advancing homogenization of the population of the United States, accompanied by radical growth of surburbanization, has begun to erase many of the essential characteristics, such as differences in consumption habits, that formerly served to distinguish the residents of rural sections of the United States from those dwelling in urban areas.

TABLE F-1

COMPARISON OF POPULATION PROJECTIONS FOR THE SIX NEW ENGLAND STATES, 1970-2020

(Thousands of Persons)

	Conn.	Maine	Mass.	N.H.	R.I.	Vt.	New England 1/
1970 2/							
ADL-1	2,943	1,019	5,812	701	930	435	11,840
ADL-2	3,056	1,032	5,711	692	947	401	11,840
A	2,766	1,018	5,595	655	943	404	11,380
B II-1	3,285	1,092	5,954	715	955	433	12,434
B II-2	3,235	1,046	5,799	698	944	406	12,129
B III-1	3,205	1,063	5,807	699	933	423	12,130
B III-2	3,157	1,018	5,655	682	923	396	11,831
C	3,067	1,056	5,767	692	955	417	11,954
D		1,010	5,690	679	938	401	
E				665			
F						404	
G					944		
H-1					986		
H-2					967		
H-3					939		
I-1	3,068						
I-2	2,847						
J-1	3,196						
J-2	2,898						
K				700	986		
1980 2/							
ADL-1	3,528	1,127	6,772	852	1,052	509	13,840
ADL-2	3,895	1,136	6,500	811	1,069	429	13,840
D		1,084	6,384	769	1,041	426	
E				736			
F						422	
G					1,057		
H-1					1,179		
H-2					1,093		
H-3					1,047		
I-1	3,710						
I-2	3,145						
J-1	4,160						
J-2	3,526						
K					1,178		

1/ Components do not necessarily add up due to rounding.
2/ Characters in this column refer to sources listed at the end of this table.

TABLE F-1 - Continued

	Conn.	Maine	Mass.	N.H.	R.I.	Vt.	New England
1990[2/]							
ADL-1	4,172	1,234	7,930	1,048	1,201	585	16,170
ADL-2	4,827	1,250	7,468	953	1,213	459	16,170
E				815			
F						442	
I-1	4,558						
I-2	3,992						
2000[2/]							
ADL-1	4,839	1,338	9,271	1,243	1,387	663	18,739
ADL-2	5,829	1,382	8,544	1,118	1,369	497	18,739
E				903			
I-1	5,624						
I-2	4,707						
L II-1	5,322	1,633	8,481	1,117	1,652	557	18,762
L II-2	5,145	1,854	9,312	1,125	1,661	712	19,809
L IV-1	4,106	1,230	6,435	856	1,270	412	14,309
L IV-2	3,958	1,411	7,110	861	1,276	540	15,156
L *	4,869	1,494	7,759	1,022	1,511	510	17,165
2010[2/]							
ADL-1	5,586	1,440	10,875	1,468	1,603	747	21,720
ADL-2	6,979	1,539	9,798	1,306	1,551	548	21,720
2020[2/]							
ADL-1	6,451	1,548	12,744	1,729	1,858	841	25,170
ADL-2	8,270	1,733	11,264	1,526	1,762	615	25,170

TABLE F-1. - Sources

ADL-1 Arthur D. Little, Inc. - derived from commodity industry employment projections.

ADL-2 Arthur D. Little, Inc. - derived from "demographic" or cohort-survival or component method projections.

A. Everett J. Burtt, Jr., and Frank L. Sweetser, New England Population and Labor Force Projections, Research Report, Federal Reserve Bank of Boston 1970 Projections No. 5, January, 1959, pp. 9-15. These projections incorporate 1949-51 and 1959-61 white survival ratios for the fifty and sixty decades. Fertility is assumed to continue to 1970 at the 1950-55 levels; net migration is expected to continue at the 1940-55 rate.

B. Individual State Population Projections made by U.S. Bureau of the Census for Population Projections, 1960-1970, Research Division, National Education Association, June, 1961. There are four projections which represent combinations of two assumptions concerning fertility and two concerning migration. The two concerning fertility reflect use of Census Series II and Series III fertility assumptions. The two concerning migration reflect (1) the amount of net migration in each five-year projection period being equal to the amount which occurred in 1955-60, and (2) the amount being equal to one-half the amount which occurred in 1955-60.

C. These are based on percentage increases given in Nation's Business, 49:82-3, December, 1961.

D. Forecast by private utility company, September, 1964.

E. J.R. Bowring, Population of New Hampshire, Concord, New Hampshire: State Planning Project, Report No. 3, 1964, page 13. It appears that this was based on projection of dependency ratios and was assumed to remain at the 1950-1960 rate.

F. H.H. Squire and K.A. Scheele, A Projection of the Vermont Population, Montpelier, Vermont, Central Planning Office, 1964.

G. Rhode Island Development Council, Planning Division, Projections of Population, Labor Force, and Employment by State, County, City and Town, to 1965-1970-1975-1980-1985, page 11. The fertility ratio implied by the 1960 Census was considered constant throughout the projection period; survival rates computed from the 1949-51 Rhode Island Life Tables also were held constant; and out-migration at the 1950-60 rates was assumed to decline during the sixties and be zero after 1970.

TABLE F-1. - Sources (Continued)

H. Sidney Goldstein and Kurt B. Mayer, Population Projections, Rhode Island Cities and Towns, 1970 and 1980, Planning Division, Rhode Island Development Council, State Planning section, Publication No. 5. There are three population projections, all of which assume a continuation of 1950-60 birth and death rates. The state was divided into four subareas and migration assumptions were made concerning each subarea. Projection (1) results in net in-migration to the state of 19,200 in 1960-70 and 64,600 in 1970-80; (2) in no net in- or out-migration; and (3) in net out-migration of 27,400 in 1960-70 and 14,900 in 1970-80.

I. Connecticut Development Commission, Population, A Demographic Analysis of Connecticut, 1790-2000, Connecticut Interregional Planning Program Technical Report 131, November, 1962. There are two population projections in both of which the future number of males and females aged 10 years and over have been determined by extrapolation of the linear trends in the survival and migration of their respective five-year age groups since 1880. In projection (1), the straight line method, it was assumed that the general ratio of the male and female five-year age groups under 10 years old to the balance of the population in 1960 will remain constant to 2000. In Projection (2), the cyclical method, fertility ratios have been related to economic factors of young males entering the labor force and general employment opportunities.

J. Edward G. Stockwell and Dorothy G. Ingalls, The Population of Connecticut, Illustrative Projections by Age and Sex, 1960-1980, Bulletin 375, January, 1963. University of Connecticut Agricultural Experimentation Station, Storrs, Connecticut. There are two population projections, both of which assume a continuation of 1959-60 survival ratios. Projection (1) assumes a continuation of the 1959-60 level of fertility and a continuation of the 1950-60 age-specific migration rates. Projection (2) assumes a linear decline in fertility reaching by 1980 a level 25 percent below that prevailing during the 1959-60 period and a rate of migration half that of the 1950-60 decade.

K. The Labor Market Role of the State Employment Services, Committee on Labor and Public Welfare, U. S. Senate, 88th Congress, 2nd Session, January 24, 1964. The New Hampshire estimate is from a statement by Benjamin C. Adams, Commissioner, New Hampshire Department of Employment Security, on page 515. The Rhode Island estimate is from a statement by Frank A. Carter, Jr., Director of the Rhode Island Department of Employment Security, on page 708, in which he quotes source H-1 above.

TABLE F-1. - Sources (Continued)

L. Projections to the Years 1976 and 2000: Economic Growth, Population, Labor Force and Leisure, and Transportation, ORRRC Study Report 23, Washington, D.C., 1962. There are five projections given in this volume. The first four represent combinations of U. S. Census Series II and IV fertility assumptions with two migration assumptions: (1) the high which assumes the annual migration of 1950-58 prevailing to 1970 and then a return to the annual average migration of 1940-58 to 1980, and (2) the low, which assumes that between 1958 and 1980, migration will be half that of 1940-58. From 1980 to 2000, changes in the population share of each state in the total U. S. population correspond to changes for these proportions between 1970 and 1980. The resulting figures are essentially the same as those prepared by the Census Bureau for the Senate Select Committee for National Water Resources. The fifth projection, L, is the ORRRC "judgment" projection which is consistent with its U. S. "judgment" population projection. This embodies fertility assumptions similar to Census Series III and the high migration assumption described above. These appear on pages 13-16 of the source cited.

The lines of distinction have been further blurred by the changes in concepts and definitions used by the U. S. Bureau of the Census in enumerating the urban population group. Without detailing the history of such changes, it should be made clear that the projections of urban population derived in this report are based on definitions adopted by the Census Bureau for its 1960 Census. This definition in its briefest form, defines the urban population as comprising: ". . . . all persons living in urbanized areas and places of 2,500 inhabitants or more outside urbanized areas."1/

b. Results. - As shown in Table F-2, future levels of urbanization in individual New England states are projected to move closer to those forecast for the New England region as a whole. In the case of Vermont, for example, where urban residents represented only approximately 38% of total population in 1960 (about half the percentage shown for New England as a whole), urban population as a percent of total population is forecast to rise significantly to almost two/thirds of the New England level by 2020. In other states such as Connecticut, Massachusetts, and Rhode Island, however, where levels of urbanization are already dramatically high, future increases in the rate of urbanization are likely to be modest.

c. Method of Derivation. - Historically, the levels of urbanization of geographic areas have borne a statistical relationship to population densities. Thus, in deriving our urban population projections, we used estimates of future population densities of individual states (based on population forecasts given in Chapter II) as guides in determining future levels of urban population. Basically, the procedure used was as follows:

1. Graphs showing plots of the historical relationship between urbanization and population density were drawn for individual states.

2. Forecasts of population density (number of persons per square mile) were derived by dividing state population projections by state areas (number of square miles).

3. Urban population as a percent of total population was obtained for each state in each decade by extrapolating the curvilinear relationships established between levels of urbanization and population density.

4. The projected percentages of urban population for each state were then multiplied by the projection of the state's total population to obtain an estimate of urban population.

1/ For a definition of an urban area as used by the Census Bureau in its 1960 Census, and a more precise definition of the urban and rural classification, see U.S. Department of Commerce, Bureau of the Census United States Census of Population: 1960.

TABLE F-2

GROWTH OF THE URBAN POPULATION IN THE NEW ENGLAND STATES, 1950-2020

	Actual				Projected			
	1950	1960	1970	1980	1990	2000	2010	2020
Connecticut								
Total population (thousands of persons)	2007.3	2535.2	2943.4	3527.8	4171.9	4838.7	5586.4	6451.1
Urban population (thousands of persons)	1558.6	1985.6	2383.5	2943.7	3555.1	4190.6	4881.9	5699.4
Urban percent of total	77.6	78.3	81.0	83.4	85.2	86.6	87.4	88.3
Population density (persons per sq. mi.)	409.7	517.5	600.8	720.1	851.6	987.7	1140.3	1316.8
Maine								
Total population (thousands of persons)	913.8	969.3	1019.4	1126.6	1233.8	1338.0	1440.0	1547.9
Urban population (thousands of persons)	472.0	497.1	544.1	637.2	733.6	824.3	914.9	1010.1
Urban percent of total	51.7	51.3	53.4	56.6	59.5	61.6	63.5	65.3
Population density (persons per sq. mi.)	29.5	31.3	32.9	36.3	39.8	43.1	46.4	49.9
Massachusetts								
Total population (thousands of persons)	4690.5	5148.6	5812.3	6771.9	7929.8	9270.7	10875.2	12743.6
Urban population (thousands of persons)	3959.2	4302.5	4951.3	5893.0	7009.9	8324.4	9863.7	11701.4
Urban percent of total	84.4	83.6	85.1	87.0	88.4	89.8	90.7	91.8
Population density (persons per sq. mi.)	596.2	654.5	738.8	860.8	1008.0	1178.4	1382.4	1619.9
New Hampshire								
Total population (thousands of persons)	533.2	606.9	700.9	852.5	1047.8	1242.5	1468.3	1729.2
Urban population (thousands of persons)	306.8	353.8	431.1	544.5	679.0	808.9	976.0	1156.0
Urban percent of total	57.5	58.3	61.5	63.9	64.8	65.1	66.5	66.9
Population density (persons per sq. mi.)	59.2	67.3	77.8	94.6	116.2	137.8	162.9	191.8
Rhode Island								
Total population (thousands of persons)	791.9	859.5	929.5	1051.9	1201.4	1386.7	1602.9	1857.5
Urban population (thousands of persons)	667.2	742.9	809.6	925.7	1082.7	1268.7	1485.3	1743.8
Urban percent of total	84.3	86.4	87.1	88.0	90.1	91.5	92.7	93.9
Population density (persons per sq. mi.)	748.5	812.4	878.5	994.2	1135.5	1310.7	1515.0	1755.7
Vermont								
Total population (thousands of persons)	377.7	389.9	434.5	509.3	585.3	663.4	747.2	840.7
Urban population (thousands of persons)	137.6	149.9	180.4	235.9	289.7	343.1	398.2	459.3
Urban percent of total	36.4	38.5	41.5	46.3	49.5	51.7	53.3	54.6
Population density (persons per sq. mi.)	40.7	42.0	46.8	54.9	63.1	71.5	80.6	90.6
New England								
Total population (thousands of persons)	9314.4	10509.4	11840.0	13840.0	16170.0	18740.0	21720.0	25170.0
Urban population (thousands of persons)	7101.4	8031.8	9300.0	11180.0	13350.0	15760.0	18520.0	21770.0
Urban percent of total	76.2	76.4	78.5	80.8	82.6	84.1	85.3	86.5
Population density (persons per sq. mi.)	147.6	166.5	187.6	219.2	256.2	296.9	344.1	398.7

Source: Same as Table F-3

5. Finally, minor adjustments were made in the urban population projections so that the sum of the urban population estimates for the six states equalled the New England control total.

4. HOUSEHOLDS IN THE NEW ENGLAND STATES

a. Projection Results. - The numbers of households in individual New England states are generally projected to rise at somewhat slower rates than population during the next three decades and thereafter at somewhat faster rates than population (see Table F-3). This is consistent, of course, with the projected trends in the household formation/population relationships for New England as a whole (see Projective Economic Study of New England, Appendix J) and reflect for the most part shifts in the future size of households.

b. Projection Method. - The numbers of households in individual New England states were projected after first forecasting future trends in the sizes of households in each state. Estimates of the future sizes of households were in turn derived as follows: First, the percentages of population aged 15 and over for each state in each decade, 1970-2020, were calculated from our population projections.2/

Second, the future numbers of persons age 15 and over per household in each state were projected to follow the trend projected for New England as a whole (see Projective Economic Study of New England, Appendix J).

Third, the numbers of households were then computed for each state by dividing projected population aged 15 and over by the number of persons aged 15 and over per household as determined above.

Finally, slight adjustments were made in the individual state household projections so that their sum equalled the projected New England total for each decade. The projected sizes of households were computed by dividing the projected total populations by the projected numbers of households.

2/ The percentages calculated in this case were derived from our "demographic" population projections, with the assumptions that they would be applicable also to the "economic" population growth projection derived in this report and shown in Chapter II.

TABLE F-3

NUMBER OF HOUSEHOLDS IN THE NEW ENGLAND STATES, 1950-2020

	Actual*		Projected					
	1950	1960	1970	1980	1990	2000	2010	2020
Connecticut								
Number of households	552.5	752.7	871.8	1031.7	1200.6	1425.6	1664.0	1945.2
Number of persons per household	3.63	3.37	3.38	3.42	3.47	3.39	3.36	3.32
Maine								
Number of households	246.6	280.4	293.6	322.8	353.0	387.0	420.6	457.8
Number of persons per household	3.71	3.46	3.47	3.49	3.50	3.46	3.42	3.38
Massachusetts								
Number of households	1286.5	1534.7	1719.8	1996.1	2300.6	2733.7	3237.4	3832.2
Number of persons per household	3.65	3.35	3.38	3.39	3.45	3.39	3.36	3.33
New Hampshire								
Number of households	149.5	180.0	205.4	246.6	306.3	363.7	439.3	517.9
Number of persons per household	3.57	3.37	3.41	3.46	3.42	3.42	3.38	3.34
Rhode Island								
Number of households	216.8	257.3	280.6	314.9	356.6	416.0	484.0	567.6
Number of persons per household	3.65	3.34	3.31	3.34	3.37	3.33	3.31	3.27
Vermont								
Number of households	100.2	110.7	124.8	144.7	166.5	189.8	214.8	241.3
Number of persons per household	3.77	3.52	3.48	3.52	3.52	3.50	3.48	3.48
New England								
Number of households	2552.1	3115.8	3496.0	4056.8	4683.6	5515.8	6460.1	7562.0
Number of persons per household	3.65	3.37	3.39	3.41	3.45	3.40	3.36	3.33

*Source: U.S. Department of Commerce, Bureau of the Census, United States Census of Population, 1950 and 1960, Detailed Characteristics, PC (1) Series, (Washington: U.S. Government Printing Office).

APPENDIX G

PERSONAL INCOME PROJECTIONS FOR THE NEW ENGLAND STATES

APPENDIX G

PERSONAL INCOME PROJECTIONS FOR THE NEW ENGLAND STATES

1. INTRODUCTION

The basic methods used to derive personal income projections for the six New England states have already been briefly discussed in Chapter III of this report. This appendix presents a more detailed explanation of the methods of derivation and presents the projection results. In addition, this appendix includes historical data which strongly support the basic rationale that underlies our method. It contains a comparison between our projections and those obtained by means of a regression analysis approach. Finally, it contains the state per capita personal income levels which indirectly serve as a check on the reasonableness of the projection results.

2. DESCRIPTION OF PROJECTION METHOD

The basic method used for projecting personal income in our study consists of a two-part procedure. In the first part, involving income projections for 1970 and 1980, each state's percent share of projected New England employment in the non-primary resource industries (i.e., total state employment minus employment in the agricultural, forestry, fisheries, and mining sectors) was used as an "indicator" in determining the state's percent share of New England's projected total personal income. The "indicator" for each state, so defined, was subsequently modified in two basic ways in order to determine more accurately the state's percent share of New England's projected personal income total.

First, the "indicator" was weighted by the 1959-1963 average hourly manufacturing wage-rate in that state in order to account for the wage rate differentials between the six states.

Secondly, it was adjusted for a minor discrepancy between each state's percent share of total New England personal income in 1960, and the state's percent share of total New England non-resource employment in 1960 (again weighted by each state's 1959-1963 average hourly wage-rate in manufacturing) to account for wage-rate differentials among states.

Finally, the sum of the projected personal income shares for all six states was constrained to add to 100%, since the projected percent shares of the six states must exhaust the total personal income for the New England region as a whole.

The method described above is best summarized by means of the following expression:

$$\text{State's projected \% share of total N.E. personal income (1970, 1980)} = \text{State's projected \% share of N.E. non-resource employment (1970,1980), weighted by wage-rate differentials} \times \frac{\text{State's \% share of N.E. personal income in 1960}}{\text{State's \% share of N.E. non-resource employment in 1960, weighted by wage-rate differentials}}$$

The second part of our forecasting method, which is used to derive projections for 1990, 2000, 2010, and 2020, is obtained directly from the first part in that it incorporates the projections determined for 1980. The assumptions, however, as well as the basic strategy are somewhat altered. In the first place, we dropped the explicit assumption that the wage-rate differentials will be maintained, because of the difficulty in postulating the continuation of these historical and current wage-rate differentials beyond 1980. Secondly, and as a result of the first modification, we also dropped the use of each state's percent share of projected New England non-resource employment as a means of approximating the state's projected share of New England personal income. Instead, we assumed that after 1980, each state's projected percent share of New England's total population (corrected for the 1980 relationship between each state's share of total regional personal income and its share of total regional population) will be the determinant of the state's percent share of total regional personal income. Again, keeping in mind that the projected personal income percent shares for the six states must in each decade be constrained to add up to 100%, we can summarize this part of our method by the equation shown below:

$$\text{State's projected \% share of N.E. personal income} = \frac{\text{State's \% share of N.E. personal income in 1980}}{\text{State's \% share of N.E. population in 1980}} \times \text{State's projected \% share of N.E. population (1990, 2000, 2010, 2020)}$$

Personal income projections were thus obtained for each state by multiplying its projected percent share of New England's total personal income <u>by</u> the projected New England personal income total. The income forecasts for each decade from 1970 through 2020 and the implied state per capita income projections are shown in Tables G-1 and G-2.

3. SUPPORT DATA

The historical parallelism between the percent distribution of New England's non-resource employment among the six states and the percent distribution of New England's total personal income (in current dollars) is presented in Table G-3, for the years 1940, 1950, and 1960.

TABLE G-1

TOTAL PERSONAL INCOME IN THE NEW ENGLAND STATES, 1960-2020

(billions of 1954 dollars)

	1960	1970	1980	1990	2000	2010	2020
Connecticut	6.4	9.2	13.3	18.9	26.7	37.5	53.0
Maine	1.6	2.2	3.0	3.9	5.2	6.8	8.9
Massachusetts	11.3	16.1	22.8	32.1	45.7	65.1	93.4
New Hampshire	1.1	1.6	2.4	3.5	5.1	7.2	10.5
Rhode Island	1.6	2.3	3.1	4.2	6.0	8.4	11.9
Vermont	0.6	0.9	1.4	1.9	2.6	3.5	4.9
New England	22.6	32.3	46.0	64.5	91.3	128.5	182.6

TABLE G-2

PER CAPITA PERSONAL INCOME IN THE NEW ENGLAND STATES, 1960-2020

(in 1954 dollars)

	1960	1970	1980	1990	2000	2010	2020
Connecticut	2,502	3,126	3,770	4,530	5,518	6,713	8,216
Maine	1,641	2,158	2,663	3,161	3,886	4,722	5,750
Massachusetts	2,199	2,770	3,367	4,048	4,930	5,986	7,329
New Hampshire	1,824	2,283	2,815	3,340	4,105	4,904	6,072
Rhode Island	1,907	2,474	2,947	3,496	4,327	5,241	6,406
Vermont	1,647	2,071	2,749	3,246	3,919	4,684	5,828
New England	2,150	2,728	3,324	3,989	4,872	5,916	7,255

TABLE G-3

PERCENT DISTRIBUTION BY STATES OF NEW ENGLAND NON-RESOURCE EMPLOYMENT AND PERSONAL INCOME: 1940, 1950, 1960

States (1)	% Distribution of N.E. Non-Resource Empl. (Unweighted) (2)	Weighted % Distribution of N.E. Non-Resource Empl. (See note below) (3)	Weighted % Distribution of N.E. Non-Resource Empl. (See note below) (4)	% Distribution of N.E. Personal Income (Undeflated) (5)
1940				
Connecticut	22.60	24.62		24.48
Massachusetts	51.63	52.89		52.91
Rhode Island	8.86	8.19	Not	8.35
New Hampshire	5.53	4.72	Available	4.45
Maine	8.21	6.69		6.94
Vermont	3.17	2.90		2.87
Total	100.00	100.00		100.00
1950				
Connecticut	23.16	24.46	24.75	25.43
Massachusetts	51.58	52.57	52.28	51.38
Rhode Island	8.64	8.17	8.23	8.48
New Hampshire	5.45	4.87	4.89	4.60
Maine	8.00	7.15	7.01	7.16
Vermont	3.17	2.78	2.84	2.95
Total	100.00	100.00	100.00	100.00
1960				
Connecticut	25.17	28.04	28.03	28.01
Massachusetts	50.10	50.29	50.43	50.00
Rhode Island	7.95	7.18	7.19	7.24
New Hampshire	5.77	5.13	4.89	4.89
Maine	7.87	6.69	6.68	7.03
Vermont	3.14	2.67	2.78	2.83
Total	100.00	100.00	100.00	100.00

NOTES:
Column (2): U.S. Department of Commerce, Bureau of the Census, 1960 Census of Population. Non-resource employment here is defined as total employment minus agricultural, forestry, fisheries, and mining employment.
Column (3): Column (2) weighted by average hourly wages in each state in 1950 and 1960. For 1940, we used as weights the 1939 average wages and salaries per employee in each state, obtained from the U.S. Department of Commerce Census of Manufactures: 1947, Vol III (Statistics by States).
Column (4): Column (2) weighted by average hourly wages during 1950-1952 for 1950, and during 1959-1963 for 1960.
Column (5): Percent distribution of New England personal income in current dollars. 1940 and 1950 data obtained from U.S. Department of Commerce, Personal Income by States since 1929 (1956), p.140; 1960 data from the Survey of Current Business (August, 1964), p. 16

TABLE G-4

COMPARISONS OF PROJECTED PERSONAL INCOME SHARES,

NEW ENGLAND STATES, 1980-2020

States	1980			2000			2020		
	A	B	C	A	B	C	A	B	C
Connecticut	28.98	28.87	28.80	29.29	29.02	29.32	29.01	29.24	29.64
Maine	6.48	6.95	6.60	5.67	6.95	6.20	4.88	6.93	5.88
Massachusetts	49.67	49.22	49.92	50.09	49.11	50.20	51.17	48.97	50.53
New Hampshire	5.16	4.82	4.89	5.55	4.87	4.99	5.74	4.89	5.06
Rhode Island	6.76	7.35	6.98	6.57	7.25	6.48	6.53	7.18	6.09
Vermont	2.95	2.79	2.81	2.83	2.80	2.81	2.67	2.79	2.80
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

(A) Results based on projections used in this report.

(B) Results derived from a regression equation of the form $Y_i = a + b_1 X_1$*

(C) Results derived from a regression equation of the form $Y_i = a + b_1X_1 + b_2X_2$*

* Where: Y_i = Total Personal Income of state i

X_1 = Total Personal Income of New England

X_2 = Time (1929 = 1)

The personal income projections for each of the six states were first expressed as percent of the projected N.E. total, and then constrained to have them add up to 100.00 percent.

As shown by that table, a weighting of the percent distribution of the region's non-resource employment by wage-rate differentials brings each state's share of non-resource employment closer to its share of personal income. In many cases, the two shares actually approach identity. This historical correspondence covering the last three decades, offers strong evidence in support of a continued close relationship between the percent distribution of New England's non-resource employment and the percent distribution of projected personal income, particularly when adjusted for wage differentials and minor base-period discrepancies.1/

1/ The discovery of the close association between a region's level of personal income and its industrial structure is by no means original to this report. It has been pointed out by other authors. Thus Harvey S. Perloff in a survey study of area development in the U.S. economy states:

> "The level of income within an area is closely associated with its industrial structure - whether, that is, low-wage or high-wage industries predominate. Thus, average per capita income tends to vary inversely with the relative importance of agriculture within a state and also with the relative importance of resource-processing industries (those for which the products of agriculture and mining are important), since both these sectors are on the low-income-paying side. Incomes are positively associated with the relative importance of employment in the fabricating industries (whose material inputs are largely intermediate products), and these industries are important in the Manufacturing Belt states and in the Far West areas with the highest incomes.
>
> Of course, there are substantial variations in income payments among the various industries within these broad categories, and variations tend to be reflected in the income levels of the states where they predominate. It is also worth noting that the level of state per capital income tends to be higher where there is a relatively large employment in the business services (industries at least one-third of whose output is purchased by other than final consumers); but there is no significant association between income and employment in consumer services."

From Harvey S. Perloff with Vera W. Dodds, How a Region Grows, Supplementary Paper No. 17, Committee for Economic Development, March 1963, P. 125.

APPENDIX H

PROJECTIONS OF OUTPUT (VALUE ADDED) FOR MAJOR WATER USING INDUSTRIES

PROJECTIONS OF OUTPUT (VALUE ADDED) FOR MAJOR WATER-USING INDUSTRIES

1. INTRODUCTION

The derivation of output (value added) projections for five of the major water-using industries of the New England states [i.e., Chemicals and Allied Products (SIC 28), Primary Metals (SIC 33, Machinery, except Electrical (SIC 35), Electrical Machinery (SIC 36), and Transportation Equipment (SIC 37)] involved two main steps:

First, the projected percent distribution of an industry's output (value added) among states was determined by its projected employment distribution and then adjusted for productivity differentials. Second, these percent-share projections for each state were multiplied by projected value added in a given industry for New England as a whole. This gave value-added projections for each of the five industries for the six states expressed in constant (1954) dollars. The individual state projections of output (value added) for the major water-using industries are shown in Table H-1.

Because of its crucial role in determining the value-added projections for states, the allocation method comprising the first step is explained below in greater detail.

2. ALLOCATION METHOD

The simple allocation method described above was chosen primarily because of the difficulties encountered in making long-range productivity projections by two-digit SIC industry categories at the state level. The principal problems involved stem from data gaps which arise largely because of government regulations that prohibit the disclosure of information pertaining to an industry's operation, if the industry in a region is composed of less than three firms.

The allocation method is based essentially on the projected distribution of the individual industry's employment shares among the six states, modified in several respects in order to approximate more realistically the future share distribution of New England's value-added total among the six states. The following steps were involved in arriving at these value-added percent-share distribution projections for each industry.

1. As will be recalled from Chapter III, state employment projections for each industry were first obtained in Bureau of Labor Statistics (BLS) terms, and then converted into Census of Population equivalents. While employment defined in Census of Population equivalents measures employment on the basis of where employees reside,

both the Bureau of Labor Statistics and the Census of Manufactures definitions cover employment on the basis of where the employees work. Even the latter two sources enumerate employment in somewhat different ways, although the differences are slight.

In deriving state output (value added) projections, which require the definition of employment by place of work (i.e., in Census of Manufactures terms), we thus needed only to adjust the percent distribution of our projected state employment levels for each industry given in BLS terms, by the BLS-Census of Manufactures coverage differential, to arrive at percent distributions of state employment projections for each industry in Census of Manufactures terms. We used as adjustment factors the average 1954-1962 relationship between the Census (and/or Annual Survey) of Manufactures and the Bureau of Labor Statistics employment for the particular industry and state.

2. The percent distribution of projected employment levels, corrected for definitional differences as described above, was then further adjusted for productivity differentials in the same industry between the six states. For each state and industry, this adjustment factor was obtained by dividing the 1954 and 1958 average of value added by the average employment for the same two years to obtain output per employee. These two benchmark years were selected because both value added and employment data for most of the five industries and the six states were not available on a consistent basis for other years after 1950. The selection of 1954 and 1958 thus provided a uniform base for measuring average productivity differentials among the six states in a given industry.

3. Finally, the projected industry output shares of the six states were constrained to 100.00 percent. This rather minor adjustment was required to exhaust the total value added projected for New England as a whole in each decade.

In summary form, the allocation method (excluding the constraint adjustment) can be expressed by the following equation:

$$\text{State's \% share of projected N.E. value-added total} = \text{State's \% share of projected N.E. empl. (in BLS terms)} \times \frac{\text{Census (Annual Survey) of Manufactures empl. (1954-1962 average)}}{\text{Bureau of Labor Statistics (BLS) employment (1954-1962 average)}} \times \frac{\text{Value Added (1954, 1958 average)}}{\text{Census of Manufactures empl. (1954, 1958 average)}}$$

TABLE H-1

PROJECTIONS OF OUTPUT (VALUE ADDED) FOR MAJOR WATER USING INDUSTRIES, NEW ENGLAND STATES, 1958-2020
(in millions of 1954 dollars)

	1958*	1970	1980	1990	2000	2010	2020
C 28 Chemicals and Allied Products							
New England	375.9	746	1156	1716	2484	3575	5143
Connecticut	126.5	236	369	560	824	1203	1752
Maine	5.4	11	16	24	35	49	70
Massachusetts	219.8	448	689	1011	1448	2068	2952
New Hampshire	3.0	6	10	15	22	31	45
Rhode Island	17.7	36	58	86	125	181	262
Vermont	3.5	9	14	20	30	43	62
C 33 Primary Metal Industries							
New England	465.3	549	614	682	754	828	908
Connecticut	216.7	271	297	328	361	395	432
Maine	1.6	2	2	2	3	3	3
Massachusetts	163.2	183	209	233	258	284	312
New Hampshire	14.0	12	14	17	19	21	24
Rhode Island	66.4	77	87	96	106	117	128
Vermont	3.4	4	5	6	7	8	9
C 35 Machinery, Except Electrical							
New England	1005.6	1752	2206	2734	3385	4159	5151
Connecticut	404.1	724	911	1118	1387	1712	2112
Maine	11.1	9	12	14	18	18	33
Massachusetts	457.6	764	960	1188	1468	1801	2230
New Hampshire	49.0	96	125	161	205	258	326
Rhode Island	50.0	94	118	142	172	207	250
Vermont	33.8	65	80	101	126	156	195
C 36 Electrical Machinery							
New England	1005.9	1866	2864	4247	6262	9036	13125
Connecticut	302.9	468	727	1081	1513	2081	2905
Maine	5.5	34	57	75	108	152	224
Massachusetts	607.9	1148	1734	2604	3875	5638	8247
New Hampshire	55.5	136	228	367	573	867	1306
Rhode Island	25.0	61	91	133	192	272	390
Vermont	9.1	19	27	44	68	103	156
C 37 Transportation Equipment							
New England	858.0	968	1191	1433	1571	1612	1592
Connecticut	586.5	640	798	975	1059	1039	953
Maine	42.9	43	56	61	67	70	68
Massachusetts	214.7	262	308	358	403	459	523
New Hampshire	.7	1	2	3	3	4	4
Rhode Island	6.3**	14	15	19	21	22	26
Vermont	6.9**	8	12	15	17	17	17

For Footnotes, see following page and footnote 1/ to Table 14.

* 1958 New England value-added total for each industry, expressed in millions of 1954 dollars was derived by deflating the respective industry value-added totals by appropriate price indexes, as explained in detail in Projective Economic Study of New England, Appendix C.

1958 state value-added totals for each industry, expressed in millions of 1954 dollars were obtained by allocating the deflated New England total to each state, on the basis of each state's percent share of the New England value-added total in current dollars. This method was used because of the lack of reliable price indexes for individual industries at the state level.

** Since value-added data were not available for Rhode Island and Vermont due to disclosure regulations, a special method was adopted in approximating their 1958 value-added totals for this industry, expressed in millions of 1954 dollars. The two states together comprised 1.54 percent of New England's total value added in 1958 in this industry, amounting to $13.3 million.

We apportioned this amount among the two states on the basis of their respective shares of the Bureau of Labor Statistics employment data reported in 1958. Then, we expressed the resulting value-added estimates of the 1958 New England total. Finally, we applied these percent shares (Rhode Island: 0.73%, Vermont: 0.81%) to the New England 1958 value-added total (in millions of 1954 dollars), in order to obtain the respective value-added totals for 1958 in constant 1954 dollars (i.e., Rhode Island $6.3 million, Vermont $6.9 million).

APPENDIX I

CONVERSION AND LINKAGE STEPS FOR DATA SERIES

TABLE I-1

STATE SHARES OF COMMODITY EMPLOYMENT, NONCOMMODITY EMPLOYMENT AND POPULATION, 1930-1960[1/]

		Percent of New England			
		1930	1940	1950	1960
Connecticut	Commodity Employment	20.5	24.3	24.5	27.0
	Noncommodity Employment	19.1	20.7	21.7	23.8
	Population	19.7	20.3	21.5	24.1
Maine	Commodity Employment	9.3	9.9	9.2	8.3
	Noncommodity Employment	8.7	8.5	8.2	8.1
	Population	9.8	10.0	9.8	9.2
Massachusetts	Commodity Employment	49.4	45.4	47.1	46.7
	Noncommodity Employment	56.0	54.0	53.2	51.4
	Population	52.0	51.2	50.4	49.0
New Hampshire	Commodity Employment	6.5	6.4	6.2	6.4
	Noncommodity Employment	4.9	5.3	5.2	5.4
	Population	5.7	5.8	5.7	5.8
Rhode Island	Commodity Employment	9.7	9.5	9.0	8.2
	Noncommodity Employment	7.7	7.8	8.0	7.7
	Population	8.4	8.4	8.5	8.2
Vermont	Commodity Employment	4.6	4.5	4.0	3.4
	Noncommodity Employment	3.6	3.7	3.7	3.6
	Population	4.4	4.3	4.1	3.7

1/ The shares are based on Census of Population data. For a compositional breakdown of the commodity and noncommodity industry sectors, see Chapter III, Table 16.

CONVERSION AND LINKAGE STEPS FOR DATA SERIES

1. INTRODUCTION

In Chapter III of this report we referred to a sequence of steps by which we bridged gaps in data comparability and established causal linkages between one data series and another; e.g., data series for population and employment in commodity industries.

This Appendix lists the most important of the adjustment and linkage procedures involved and, where appropriate, quantifies the factors used in particular conversion steps.

2. ADJUSTMENT PROCEDURES AND FACTORS

(1) Conversion of projected New England employment in manufacturing from Bureau of Labor Statistics establishment payroll data to Census of Population terms.

Basis of Conversion: The 1960 relationship between Census of Population employment and Bureau of Labor Statistics employment in each industry group.

(2) Conversion of projected agricultural employment (as supplied by the Department of Agriculture) from man-year equivalents to Census of Population terms.

Basis of Conversion: The 1960 ratio of each state's percent share of New England employment in Census of Population terms to each state's percent share of New England employment in man-year equivalents supplied by the Department of Agriculture.

(3) Linkage of projected New England population to projected commodity industry employment.

Basis of Conversion: See factors for each year in Table I-2. These factors represent the ratio of a state's population share to its commodity employment share interpolated from 1960 to equal 1.000 by 2020. To place these projections in historical perspective, the state shares of population, commodity employment, and noncommodity employment are provided in Table I-1.

(4) Linkage of projected noncommodity industry employment (service industry employment in Census of Population terms) to population projections.

Basis of Conversion: See factors for each year in Table I-3. These factors represent the ratio of a state's noncommodity employment share to its population share, again interpolated from 1960 to equal 1.000 by 2020. The historical changes in these shares are presented in Table I-1.

TABLE I-2

LINKAGE FACTORS BETWEEN POPULATION AND STATE EMPLOYMENT IN COMMODITY INDUSTRIES, IN THE NEW ENGLAND STATES, 1960-2020[1/]

	1960	1970	1980	1990	2000	2010	2020
Connecticut	.892	.910	.930	.948	.966	.983	1.000
Maine	1.111	1.090	1.070	1.052	1.034	1.017	1.000
Massachusetts	1.048	1.040	1.030	1.022	1.014	1.007	1.000
New Hampshire	.908	.920	.940	.955	.970	.985	1.000
Rhode Island	1.002	1.000	1.000	1.000	1.000	1.000	1.000
Vermont	1.095	1.070	1.060	1.045	1.030	1.015	1.000

TABLE I-3

LINKAGE FACTORS BETWEEN STATE NONCOMMODITY INDUSTRY EMPLOYMENT AND POPULATION IN THE NEW ENGLAND STATES, 1960-2020[2/]

	1960	1970	1980	1990	2000	2010	2020
Connecticut	.985	.988	.991	.994	.996	.998	1.000
Maine	.883	.902	.921	.940	.960	.980	1.000
Massachusetts	1.049	1.040	1.032	1.024	1.016	1.008	1.000
New Hampshire	.941	.950	.960	.970	.980	.990	1.000
Rhode Island	.936	.946	.956	.967	.978	.989	1.000
Vermont	.968	.974	.980	.985	.990	.995	1.000

1/ Interpolated for decades between 1960 and 2020.
2/ Interpolated for decades between 1960 and 2020.

PROJECTIVE ECONOMIC STUDY OF NEW ENGLAND

APPENDICES TO PART III

SUB-STATE AREAS

APPENDIX A

SUBAREA EMPLOYMENT AND POPULATION:

HISTORICAL AND PROJECTED, BY DECADES, 1940-2020

TABLE A-1

EMPLOYMENT AND POPULATION IN MASSACHUSETTS SUBAREA M-1, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 5/	1950 5/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	73.5	92.9	89.0	94.5	98.8	105.0	116.1	127.4	139.8
A,B	Primary Resource Industries	7.7	7.1	4.8	4.4	3.9	3.6	3.6	3.5	3.4
A.(01-09)	Agriculture, Forestry and Fisheries	7.5	7.0	4.6	4.3	3.8	3.5	3.5	3.4	3.3
(01-07)	Agriculture 1/	7.3	6.9	4.5	4.2	3.7	3.4	3.3	3.2	3.1
08	Forestry 2/	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2
09	Fisheries	--	--	--	--	--	--	--	--	--
B.(10-14)	Mining	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1
D.(19-39)	Manufacturing	65.8	85.8	84.2	90.1	94.9	101.4	112.5	123.9	136.4
24	Lumber and Wood Products, except Furniture 2/	0.8	1.9	1.2	0.3	0.3	0.4	0.4	0.5	0.6
26	Paper and Allied Products 2/	9.3	9.7	11.0	12.3	12.1	12.9	13.9	14.9	16.0
28	Chemicals	1.6	3.8	4.9	5.5	6.3	6.6	7.3	8.5	9.2
35 & 36	Machinery and Electrical Machinery	12.0	20.0	16.9	21.1	23.1	25.5	28.7	31.9	35.7
37	Transportation Equipment	2.7	2.4	4.6	4.7	4.8	4.6	4.6	4.4	4.1
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	39.5	48.0	45.6	46.2	48.4	51.4	57.6	63.7	70.8
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	92.3	110.5	130.0	157.6	190.7	230.6	283.7	351.5	428.1
	TOTAL EMPLOYMENT	165.8	203.4	219.0	252.1	289.5	335.5	399.8	479.0	567.9
	TOTAL POPULATION	454.0	508.3	587.4	656.7	756.7	875.8	1014.7	1183.2	1374.7
	Urban	388.8	398.8	465.2	531.5	625.6	735.5	865.5	1019.4	1199.2
	Rural	65.2	109.5	122.2	125.2	131.1	140.3	149.2	163.8	175.5

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-2

EMPLOYMENT AND POPULATION IN MASSACHUSETTS SUBAREA M-2, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 5/	1950 5/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	96.8	112.7	109.5	118.7	126.7	136.9	153.5	170.1	189.3
A,B	Primary Resource Industries	5.9	5.1	3.3	3.4	3.3	3.1	3.1	3.0	2.9
A.(01-09)	Agriculture, Forestry and Fisheries	5.8	5.0	3.2	3.3	3.2	3.1	3.0	2.9	2.8
(01-07)	Agriculture 1/	5.4	4.9	3.2	3.2	3.1	3.0	2.9	2.8	2.7
08	Forestry 2/	0.4	0.1	--	0.1	0.1	0.1	0.1	0.1	0.1
09	Fisheries	--	--	--	--	--	--	--	--	--
B.(10-14)	Mining	0.1	0.1	0.1	0.1	--	--	--	--	--
D.(19-39)	Manufacturing	90.9	107.6	106.2	115.4	123.5	133.8	150.4	167.2	186.4
24	Lumber and Wood Products, except Furniture 2/	0.6	0.9	0.9	0.8	0.8	0.7	0.5	0.4	0.3
26	Paper and Allied Products 2/	3.9	4.7	5.6	6.2	5.8	5.9	5.8	6.0	6.1
28	Chemicals	0.6	0.7	1.4	1.7	2.1	2.3	2.5	2.9	3.2
35 & 36	Machinery and Electrical Machinery	13.1	21.7	22.7	28.0	31.6	36.1	42.0	48.0	55.0
37	Transportation Equipment	0.9	1.7	1.1	1.3	1.3	1.3	1.2	1.2	1.2
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	71.8	78.0	74.5	77.4	81.8	87.5	98.4	108.7	120.7
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	84.2	100.9	118.6	144.0	174.3	210.8	259.4	321.5	391.6
	TOTAL EMPLOYMENT	181.1	213.7	228.1	262.8	301.0	347.7	412.9	491.6	580.9
	TOTAL POPULATION	504.5	546.4	583.2	657.6	762.1	886.3	1032.1	1204.4	1406.2
	Urban	402.8	408.6	421.6	487.8	581.3	691.4	823.2	976.8	1162.1
	Rural	101.7	137.8	161.6	169.8	180.8	194.9	208.9	227.6	244.1

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-3

EMPLOYMENT AND POPULATION IN MASSACHUSETTS SUBAREA M-3, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 6/	1950 6/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	410.8	486.8	510.5	547.3	589.1	650.5	743.6	837.8	945.5
A,B	Primary Resource Industries	25.1	24.0	16.7	16.0	15.7	15.5	14.9	14.6	14.2
A.(01-09)	Agriculture, Forestry and Fisheries	24.1	22.9	15.7	15.1	14.9	14.6	14.1	13.8	13.4
(01-07)	Agriculture 1/	19.8	17.8	12.3	12.1	12.0	11.7	11.3	11.0	10.6
08	Forestry 2/	4.3	5.1	0.4	0.3	0.3	0.3	0.2	0.2	0.2
09	Fisheries			3.0	2.7	2.6	2.6	2.6	2.6	2.6
B.(10-14)	Mining	1.0	1.1	1.0	0.9	0.8	0.8	0.8	0.8	0.8
D.(19-39)	Manufacturing	385.7	462.8	493.8	531.4	573.4	635.0	728.7	823.2	931.3
24	Lumber and Wood Products, except Furniture 2/	1.5	4.2	3.7	2.6	1.9	1.4	1.0	0.8	0.6
26	Paper and Allied Products 2/	13.0	15.7	14.6	14.2	13.4	13.5	13.5	14.6	15.7
28	Chemicals	12.2	13.3	11.7	11.1	10.5	11.2	12.2	14.3	15.5
35 & 36	Machinery and Electrical Machinery	38.5	73.7	124.6	156.4	188.6	227.9	279.7	332.0	393.2
37	Transportation Equipment 3/	18.8	23.0	26.5	29.3	29.8	29.2	28.9	28.4	27.2
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	*Other Manufacturing 4/*	301.7	332.9	312.7	317.8	329.2	351.8	393.4	433.1	479.1
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 5/	717.6	850.9	963.8	1149.7	1366.0	1626.7	1974.3	2417.6	2918.5
	TOTAL EMPLOYMENT	1128.4	1337.7	1474.3	1697.0	1955.1	2277.2	2718.0	3255.3	3864.1
	TOTAL POPULATION	3189.6	3446.9	3756.1	4233.4	4934.7	5790.3	6778.2	7960.9	9342.9
	Urban	2953.8	3035.6	3295.5	3783.9	4501.7	5358.1	6362.4	7537.2	8941.8
	Rural	235.8	411.3	460.6	449.5	433.0	432.2	415.8	423.7	401.1

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.
6/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-4

EMPLOYMENT AND POPULATION IN MASSACHUSETTS SUBAREA M-R, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940[5]	1950[5]	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	26.2	30.8	27.6	33.3	37.6	41.2	46.8	52.4	58.7
A,B	Primary Resource Industries	4.5	4.1	2.6	2.7	2.7	2.6	2.6	2.5	2.4
A.(01-09)	Agriculture, Forestry and Fisheries	4.3	4.0	2.6	2.6	2.6	2.5	2.5	2.4	2.3
(01-07)	Agriculture[1]	3.4	3.1	2.1	2.1	2.1	2.0	2.0	1.9	1.8
08	Forestry[2]			--	--	--	--	--	--	--
09	Fisheries	0.9	0.9	0.5	0.5	0.5	0.5	0.5	0.5	0.5
B.(10-14)	Mining	0.2	0.1	--	0.1	0.1	0.1	0.1	0.1	0.1
D.(19-39)	Manufacturing	21.7	26.7	25.0	30.6	34.9	38.6	44.2	49.8	56.4
24	Lumber and Wood Products, except Furniture[2]	0.1	0.3	0.3	0.4	0.3	0.3	0.4	0.3	0.3
26	Paper and Allied Products[2]	2.7	2.4	2.8	2.6	2.5	2.2	2.2	1.9	1.7
28	Chemicals	0.1	0.2	0.3	0.5	0.6	0.6	0.7	0.8	0.9
35 & 36	Machinery and Electrical Machinery	6.3	12.4	12.1	15.7	18.0	20.7	24.3	28.0	32.2
37	Transportation Equipment	0.1	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.4
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing[3]	12.3	11.1	9.1	11.0	13.1	14.4	16.2	18.5	20.9
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES[4]	33.3	41.1	51.2	64.1	79.8	98.6	123.8	156.0	192.3
	TOTAL EMPLOYMENT	59.5	71.9	78.9	97.3	117.3	139.9	170.6	208.3	251.0
	TOTAL POPULATION	168.6	188.9	221.8	264.6	318.4	377.4	445.7	526.7	619.8
	Urban	114.2	116.2	120.2	148.1	184.4	224.9	273.3	330.3	398.3
	Rural	54.4	72.7	101.6	116.5	134.0	152.5	172.4	196.4	221.5

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-5

EMPLOYMENT AND POPULATION IN CONNECTICUT SUBAREA C-1, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 6/	1950 6/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	190.2	218.9	240.4	260.3	278.6	299.9	330.4	358.2	389.9
A,B	Primary Resource Industries	12.0	10.5	7.8	7.1	6.9	6.7	6.5	6.3	6.0
A.(01-09)	Agriculture, Forestry and Fisheries	11.7	10.2	7.0	6.6	6.4	6.2	6.0	5.9	5.6
(01-07)	Agriculture 1/	11.3	9.8	6.8	6.5	6.3	6.1	5.9	5.8	5.5
08	Forestry 2/	0.4	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1
09	Fisheries			--	--	--	--	--	--	--
B.(10-14)	Mining	0.3	0.3	0.8	0.5	0.5	0.5	0.5	0.4	0.4
D.(19-39)	Manufacturing	178.2	208.4	232.6	253.2	271.7	293.2	323.9	351.9	383.9
24	Lumber and Wood Products, except Furniture 2/	0.6	1.3	0.9	0.6	0.5	0.4	0.4	0.3	0.3
26	Paper and Allied Products 2/	2.7	2.6	3.2	3.0	2.9	3.0	3.3	3.5	4.3
28	Chemicals	5.2	7.7	7.5	8.0	8.3	8.9	9.8	11.2	12.1
35 & 36	Machinery and Electrical Machinery	26.0	42.9	55.9	68.8	79.9	89.7	102.6	114.8	128.6
37	Transportation Equipment 3/	4.6	4.9	20.8	21.6	23.5	24.9	23.8	20.0	15.6
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 4/	139.1	149.0	144.3	151.2	156.6	166.3	184.0	202.1	223.0
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 5/	207.0	254.8	334.1	414.2	513.3	626.2	763.7	931.9	1121.8
	TOTAL EMPLOYMENT	397.1	473.7	574.6	674.5	791.9	926.1	1094.1	1290.1	1511.7
	TOTAL POPULATION	989.7	1149.0	1433.8	1663.8	1993.7	2354.7	2733.9	3162.8	3659.4
	Urban	711.2	965.0	1210.5	1454.3	1792.2	2161.0	2544.3	2961.2	3454.3
	Rural	278.5	184.0	223.3	209.5	201.5	193.7	189.6	201.6	205.1

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.
6/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-6

EMPLOYMENT AND POPULATION IN CONNECTICUT SUBAREA C-2, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 6/	1950 6/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	93.9	113.6	132.2	145.1	156.6	167.9	179.6	187.4	196.4
A,B	Primary Resource Industries	8.4	8.0	6.5	6.3	5.9	5.6	5.2	4.9	4.6
A.(01-09)	Agriculture, Forestry and Fisheries	8.2	7.8	6.3	6.1	5.7	5.4	5.0	4.7	4.4
(01-07)	Agriculture 1/	8.1	7.7	6.2	6.0	5.6	5.3	4.9	4.6	4.2
08	Forestry 2/	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
09	Fisheries			--	--	--	--	--	--	--
B.(10-14)	Mining	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
D.(19-39)	Manufacturing	85.5	105.6	125.7	138.8	150.7	162.3	174.4	182.5	191.8
24	Lumber and Wood Products, except Furniture 2/	0.3	0.9	0.7	0.5	0.5	0.3	0.3	0.3	0.3
26	Paper and Allied Products 2/	1.5	2.0	2.2	2.1	2.0	2.3	2.3	2.2	2.6
28	Chemicals	1.7	1.5	2.3	2.2	2.3	2.5	2.7	3.1	3.4
35 & 36	Machinery and Electrical Machinery	22.1	35.1	41.0	49.8	56.8	63.0	71.2	78.9	87.7
37	Transportation Equipment 3/	8.5	15.0	33.9	36.0	39.0	41.0	39.1	33.0	25.7
19,20,21,22,23, 25,27,29,30,31, 32.33,34,38,39	Other Manufacturing 4/	51.4	51.2	45.6	48.2	50.1	53.2	58.8	65.0	72.1
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 5/	110.5	146.4	187.5	237.4	296.7	364.4	446.8	547.6	661.4
	TOTAL EMPLOYMENT	204.4	260.1	319.8	382.5	453.3	532.3	626.4	735.0	857.8
	TOTAL POPULATION	506.2	607.0	778.4	922.7	1119.5	1331.9	1543.1	1778.8	2052.5
	Urban	349.1	470.9	618.4	745.2	927.7	1126.8	1333.8	1558.9	1825.2
	Rural	157.1	136.1	160.0	177.5	191.8	205.1	209.3	219.9	227.3

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.
6/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-7

EMPLOYMENT AND POPULATION IN CONNECTICUT SUBAREA C-R, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 6/	1950 6/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	39.5	45.5	53.4	54.2	56.2	61.6	70.8	79.3	88.8
A,B	Primary Resource Industries	7.5	7.0	5.0	5.0	4.9	4.9	4.9	4.9	4.9
A.(01-09)	Agriculture, Forestry and Fisheries	7.4	6.9	4.9	4.9	4.8	4.8	4.8	4.8	4.8
(01-07)	Agriculture 1/	7.1	6.6	4.7	4.7	4.7	4.7	4.7	4.7	4.7
08	Forestry 2/	0.3	0.3	--	--	--	--	--	--	--
09	Fisheries			0.1	0.1	0.1	0.1	0.1	0.1	0.1
B.(10-14)	Mining	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
D.(19-39)	Manufacturing	32.0	38.5	48.4	49.2	51.3	56.7	65.9	74.4	83.9
24	Lumber and Wood Products, except Furniture 2/	0.5	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1
26	Paper and Allied Products 2/	1.2	2.2	2.8	2.7	2.5	2.1	2.1	2.1	2.3
28	Chemicals	0.1	0.6	2.2	1.9	2.3	2.7	3.4	4.6	5.3
35 & 36	Machinery and Electrical Machinery	1.3	3.2	4.6	6.1	7.3	8.4	9.9	11.2	12.8
37	Transportation Equipment 3/	3.2	3.6	15.1	12.0	10.0	9.8	9.3	7.9	6.1
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 4/	25.7	28.7	23.6	26.3	29.0	33.5	41.1	48.5	57.3
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 5/	39.4	48.6	62.7	77.4	95.5	116.1	141.2	171.9	206.6
	TOTAL EMPLOYMENT	79.0	94.1	116.1	131.6	151.7	177.7	212.0	251.2	295.4
	TOTAL POPULATION	213.2	251.3	323.1	356.9	414.6	485.3	561.7	644.8	739.2
	Urban	97.9	122.7	156.7	184.0	223.8	267.3	312.5	361.8	419.9
	Rural	115.3	128.6	166.4	172.9	190.8	218.0	249.2	283.0	319.3

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.
6/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-8

EMPLOYMENT AND POPULATION IN MAINE SUBAREA Me-1, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 5/	1950 5/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	23.7	24.6	23.3	25.7	27.3	28.9	29.5	31.2	33.1
A,B	Primary Resource Industries	13.0	11.3	6.8	6.4	6.0	6.0	5.8	5.6	5.4
A.(01-09)	Agriculture, Forestry and Fisheries	13.0	11.3	6.8	6.4	6.0	6.0	5.8	5.6	5.4
(01-07)	Agriculture 1/	12.9	11.2	6.6	6.3	5.9	5.9	5.8	5.6	5.4
08	Forestry 2/	0.1	0.1	0.1	0.1	0.1	0.1	--	--	--
09	Fisheries			--	--	--	--	--	--	--
B.(10-14)	Mining	--	--	--	--	--	--	--	--	--
D.(19-39)	Manufacturing	10.7	13.3	16.5	19.3	21.2	22.9	23.6	25.5	27.7
24	Lumber and Wood Products, except Furniture 2/	2.7	3.5	2.7	3.3	3.6	3.7	3.7	3.4	3.1
26	Paper and Allied Products 2/	3.7	3.5	5.9	6.9	7.7	8.6	8.1	9.3	10.6
28	Chemicals	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
35 & 36	Machinery and Electrical Machinery	0.2	0.4	0.8	1.2	1.5	1.7	2.0	2.3	2.7
37	Transportation Equipment	0.2	0.1	0.4	0.5	0.6	0.6	0.6	0.6	0.6
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	3.9	5.7	6.6	7.3	7.8	8.3	9.2	9.8	10.6
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	29.9	36.8	45.0	53.8	64.8	74.4	86.7	100.7	114.9
	TOTAL EMPLOYMENT	53.6	61.4	68.3	79.5	92.0	103.3	116.2	131.9	148.0
	TOTAL POPULATION	191.5	204.2	232.4	239.8	272.2	299.7	320.2	345.7	372.7
	Urban	52.2	94.1	118.8	128.0	154.0	178.2	197.3	219.6	243.2
	Rural	139.3	110.1	113.6	111.8	118.2	121.5	122.9	126.1	129.5

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service

2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay, and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-11

EMPLOYMENT AND POPULATION IN NEW HAMPSHIRE SUBAREA NH-1, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 6/	1950 6/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	55.5	64.7	69.2	74.0	80.3	90.9	101.6	112.1	123.6
A,B	Primary Resource Industries	8.4	7.7	4.1	3.9	3.9	3.8	3.7	3.6	3.5
A.(01-09)	Agriculture, Forestry and Fisheries	8.2	7.6	3.9	3.8	3.8	3.7	3.6	3.5	3.4
(01-07)	Agriculture 1/	7.9	7.4	3.8	3.7	3.7	3.6	3.5	3.4	3.3
08	Forestry 2/	--	--	--	--	--	--	--	--	--
09	Fisheries	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
B.(10-14)	Mining	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
D.(19-39)	Manufacturing	47.2	57.0	65.1	70.1	76.4	87.0	97.8	108.5	120.1
24	Lumber and Wood Products, except Furniture 2/	1.8	3.8	2.5	1.9	1.4	1.3	1.2	1.1	1.1
26	Paper and Allied Products 2/	1.5	1.5	2.1	2.7	4.3	5.5	5.8	6.2	6.1
28	Chemicals	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.6	0.7
35 & 36	Machinery and Electrical Machinery	1.2	4.8	13.5	19.3	24.6	30.9	38.9	47.3	56.9
37	Transportation Equipment 3/	2.4	2.1	4.4	3.9	5.2	7.9	7.8	7.5	7.1
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 4/	40.2	44.5	42.3	41.9	40.5	41.0	43.6	45.9	48.3
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 5/	56.6	69.7	88.5	112.7	145.5	186.5	234.7	295.6	366.1
	TOTAL EMPLOYMENT	112.2	134.4	157.7	186.7	225.8	277.3	336.3	407.7	489.7
	TOTAL POPULATION	307.3	341.6	404.8	470.9	579.2	714.7	846.6	1000.8	1179.8
	Urban	207.2	230.5	278.0	325.1	410.3	508.9	600.8	718.8	845.0
	Rural	100.1	111.1	136.8	145.8	168.9	205.8	245.8	282.0	334.8

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes employment in government-owned facilities.
4/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
5/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.
6/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-12

EMPLOYMENT AND POPULATION IN NEW HAMPSHIRE SUBAREA NH-2, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 5/	1950 5/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	12.3	12.9	13.3	14.0	15.2	16.4	18.4	20.5	22.7
A,B	Primary Resource Industries	2.5	2.0	1.2	1.1	1.1	1.1	1.1	1.1	1.1
A.(01-09)	Agriculture, Forestry and Fisheries	2.4	1.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1
(01-07)	Agriculture 1/	2.3	1.8	1.1	1.1	1.1	1.1	1.1	1.1	1.1
08	Forestry 2/	0.1	--	--	--	--	--	--	--	--
09	Fisheries			--	--	--	--	--	--	--
B.(10-14)	Mining	0.1	0.1	--	--	--	--	--	--	--
D.(19-39)	Manufacturing	9.8	10.9	12.1	12.9	14.1	15.3	17.3	19.3	21.6
24	Lumber and Wood Products, except Furniture 2/	1.1	1.4	1.0	0.8	0.7	0.7	0.7	0.6	0.5
26	Paper and Allied Products 2/	0.6	1.3	1.2	0.9	1.2	1.1	1.2	1.4	1.6
28	Chemicals	--	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2
35 & 36	Machinery and Electrical Machinery	1.4	2.1	3.8	4.9	6.0	7.2	8.8	10.4	12.2
37	Transportation Equipment	--	--	--	--	--	--	--	--	--
19,20,21,22,23, 25,27,29,30, 31 32,33,34,38,39	Other Manufacturing 3/	6.7	6.1	6.0	6.1	6.1	6.2	6.5	6.8	7.1
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	10.3	11.5	15.3	19.0	24.3	31.1	39.1	49.3	61.0
	TOTAL EMPLOYMENT	22.6	24.4	28.6	33.0	39.4	47.5	57.5	67.7	83.7
	TOTAL POPULATION	60.4	65.3	71.4	83.2	101.1	122.4	144.9	171.1	201.7
	Urban	31.3	3.15	34.3	42.4	53.8	66.4	79.3	96.2	114.6
	Rural	29.1	33.8	37.1	40.8	47.3	56.0	65.6	74.9	87.1

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.
5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding

-- Fewer than 50 persons.

TABLE A-13

EMPLOYMENT AND POPULATION IN NEW HAMPSHIRE SUBAREA NH-3, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 5/	1950 5/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	12.8	12.6	12.2	13.3	14.5	15.9	18.4	20.7	22.4
A,B	Primary Resource Industries	3.9	2.9	1.6	1.6	1.6	1.5	1.5	1.5	1.5
A.(01-09)	Agriculture, Forestry and Fisheries	3.9	2.9	1.6	1.6	1.6	1.5	1.5	1.5	1.5
(01-07)	Agriculture 1/	3.7	2.8	1.5	1.5	1.5	1.5	1.5	1.5	1.5
08	Forestry 2/	0.2	0.1	0.1	0.1	0.1	--	--	--	--
09	Fisheries			--	--	--	--	--	--	--
B.(10-14)	Mining	--	--	--	--	--	--	--	--	--
D.(19-39)	Manufacturing	9.0	9.7	10.6	11.8	12.9	14.4	16.7	19.2	20.9
24	Lumber and Wood Products, except Furniture 2/	2.0	2.1	1.5	1.4	1.5	1.4	1.2	1.1	0.9
26	Paper and Allied Products 2/	4.4	4.6	4.3	4.0	4.5	5.1	6.4	7.5	8.2
28	Chemicals	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1
35 & 36	Machinery and Electrical Machinery	0.1	0.2	0.7	1.0	1.3	1.6	2.0	2.4	2.9
37	Transportation Equipment	--	--	--	--	--	--	--	--	--
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	2.5	2.7	4.1	5.3	5.6	6.2	7.3	8.1	8.8
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	15.4	16.4	19.0	21.6	25.4	32.5	40.9	51.5	63.8
	TOTAL EMPLOYMENT	28.2	29.0	31.1	34.9	39.9	48.4	59.4	72.2	86.2
	TOTAL POPULATION	83.9	83.9	86.0	94.6	109.1	132.1	157.3	185.3	216.1
	Urban	31.2	30.0	36.1	44.6	56.6	73.6	92.8	117.4	144.4
	Rural	52.7	53.9	49.9	50.0	52.5	58.5	64.5	67.9	71.7

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-14

EMPLOYMENT AND POPULATION IN NEW HAMPSHIRE SUBAREA NH-R, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 5/	1950 5/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	5.3	5.5	6.0	6.7	7.4	8.5	9.7	10.7	12.0
A,B	Primary Resource Industries	1.7	1.3	0.7	0.6	0.6	0.6	0.6	0.6	0.5
A.(01-09)	Agriculture, Forestry and Fisheries	1.6	1.3	0.7	0.6	0.6	0.6	0.6	0.5	0.5
(01-07)	Agriculture 1/	1.6	1.2	0.6	0.5	0.5	0.5	0.5	0.4	0.4
08	Forestry 2/	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
09	Fisheries			--	--	--	--	--	--	--
B.(10-14)	Mining	0.1	--	--	--	--	--	--	--	--
D.(19-39)	Manufacturing	3.6	4.2	5.4	6.1	6.7	7.9	9.1	10.2	11.5
24	Lumber and Wood Products, except Furniture 2/	0.7	1.3	0.8	0.5	0.5	0.6	0.5	0.5	0.5
26	Paper and Allied Products 2/	0.1	--	--	--	--	0.2	0.3	0.3	0.4
28	Chemicals	--	--	--	--	--	--	--	--	--
35 & 36	Machinery and Electrical Machinery	0.9	0.9	1.9	2.4	2.8	3.4	4.1	4.8	5.7
37	Transportation Equipment	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1
19,20,31,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	1.9	2.0	2.6	3.2	3.3	3.6	4.0	4.4	4.8
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	7.8	9.3	11.0	13.5	16.8	21.6	27.2	34.2	42.3
	TOTAL EMPLOYMENT	13.1	14.9	17.1	20.3	24.2	30.1	36.8	44.9	54.4
	TOTAL POPULATION	39.9	42.5	44.7	52.2	63.1	78.6	93.7	111.1	131.6
	Urban	13.5	14.7	15.3	18.9	23.8	30.1	36.0	43.6	51.9
	Rural	26.4	27.8	29.4	33.3	39.3	48.5	57.7	67.5	79.7

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.
2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.
3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.
4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.
5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-15

EMPLOYMENT AND POPULATION IN VERMONT SUBAREA Vt-1, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 5/	1950 5/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	12.5	12.2	11.0	12.4	14.1	15.4	17.4	19.2	21.2
A,B	Primary Resource Industries	4.6	3.8	2.2	2.1	2.1	2.0	1.9	1.8	1.8
A.(01-09)	Agriculture, Forestry and Fisheries	4.6	3.8	2.2	2.1	2.1	2.0	1.9	1.8	1.8
(01-07)	Agriculture 1/	4.5	3.7	2.2	2.0	2.0	1.9	1.8	1.7	1.7
08	Forestry 2/	0.1	0.1	--	0.1	0.1	0.1	0.1	0.1	0.1
09	Fisheries			--	--	--	--	--	--	--
B.(10-14)	Mining	--	--	--	--	--	--	--	--	--
D.(19-39)	Manufacturing	7.9	8.4	8.8	10.3	12.0	13.4	15.5	17.3	19.4
24	Lumber and Wood Products, except Furniture 2/	1.2	2.0	1.4	1.1	1.0	1.0	0.9	0.9	0.8
26	Paper and Allied Products 2/	0.2	0.4	0.4	0.4	0.8	1.1	1.5	1.8	2.1
28	Chemicals	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
35 & 36	Machinery and Electrical Machinery	2.6	2.2	3.6	4.5	5.4	6.3	7.5	8.6	10.0
37	Transportation Equipment	--	--	--	--	--	--	--	--	--
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	3.9	3.7	3.3	4.2	4.7	4.9	5.5	5.9	6.4
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	12.0	14.0	16.5	19.9	24.4	29.1	34.7	41.5	48.9
	TOTAL EMPLOYMENT	24.5	26.3	27.6	32.3	38.5	44.5	52.2	60.7	70.1
	TOTAL POPULATION	65.7	69.6	72.3	82.3	99.1	114.7	131.6	149.5	169.8
	Urban	22.4	21.9	25.5	31.9	43.4	54.5	66.2	78.6	92.8
	Rural	43.3	47.7	46.8	50.4	55.7	60.2	65.4	70.9	77.0

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-16

EMPLOYMENT AND POPULATION IN VERMONT SUBAREA Vt-2, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 5/	1950 5/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	8.9	8.7	7.1	7.6	8.2	9.0	9.8	10.7	11.9
A,B	Primary Resource Industries	5.8	4.8	2.9	2.9	2.9	2.9	2.9	2.8	2.8
A.(01-09)	Agriculture, Forestry and Fisheries	5.7	4.6	2.8	2.8	2.7	2.7	2.7	2.7	2.7
(01-07)	Agriculture 1/	5.6	4.5	2.8	2.8	2.7	2.7	2.7	2.7	2.7
08	Forestry 2/	0.1	0.1	--	--	--	--	--	--	--
09	Fisheries			--	--	--	--	--	--	--
B.(10-14)	Mining	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
D.(19-39)	Manufacturing	3.1	3.9	4.2	4.7	5.3	6.2	6.9	7.9	9.2
24	Lumber and Wood Products, except Furniture 2/	0.8	1.0	0.5	0.5	0.4	0.5	0.5	0.4	0.4
26	Paper and Allied Products 2/	0.5	0.4	0.5	0.7	1.0	1.3	1.4	1.9	2.5
28	Chemicals	--	--	0.1	0.1	0.1	0.1	0.1	0.1	0.1
35 & 36	Machinery and Electrical Machinery	0.6	0.9	1.0	1.0	1.0	1.2	1.4	1.6	1.9
37	Transportation Equipment	--	--	--	--	--	--	--	--	--
19,20,21,22,23, 25,27,29,30,31, 32,33,34,38,39	Other Manufacturing 3/	1.2	1.6	2.1	2.5	2.9	3.1	3.5	3.9	4.3
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	7.7	8.4	9.0	10.0	11.3	13.5	16.1	19.3	22.7
	TOTAL EMPLOYMENT	16.6	17.1	16.1	17.7	19.5	22.5	25.9	30.0	34.6
	TOTAL POPULATION	47.9	47.3	44.9	47.4	52.4	59.9	66.6	74.5	83.8
	Urban	7.4	7.4	6.8	7.6	9.1	10.9	12.3	13.9	15.6
	Rural	40.5	39.9	38.1	39.8	43.3	49.0	54.3	60.6	68.2

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals; Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

TABLE A-17

EMPLOYMENT AND POPULATION IN VERMONT SUBAREA Vt-R, 1940-2020

(Thousands of Persons in Census of Population Equivalents)

SIC	INDUSTRY	1940 5/	1950 5/	1960	1970	1980	1990	2000	2010	2020
A,B,D	COMMODITY INDUSTRIES	38.4	40.1	35.1	37.8	39.9	43.1	47.5	51.1	54.9
A,B	Primary Resource Industries	21.9	18.7	12.7	12.9	12.9	12.9	13.0	13.0	13.1
A.(01-09)	Agriculture, Forestry and Fisheries	20.6	17.1	11.8	11.9	11.9	11.9	12.0	12.0	12.0
(01-07)	Agriculture 1/	20.5	16.9	11.6	11.8	11.8	11.8	11.9	11.9	12.0
08	Forestry 2/	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1
09	Fisheries			--	--	--	--	--	--	--
B.(10-14)	Mining	1.3	1.6	0.9	1.1	1.1	1.1	1.1	1.1	1.1
D.(19-39)	Manufacturing	16.5	21.4	22.4	24.8	27.0	30.1	34.5	38.0	41.7
24	Lumber and Wood Products, except Furniture 2/	2.2	3.3	2.9	2.2	2.1	2.0	1.8	1.7	1.6
26	Paper and Allied Products 2/	0.7	1.0	1.4	1.9	2.7	3.4	4.1	4.2	4.3
28	Chemicals	0.1	0.2	0.3	0.4	0.4	0.4	0.5	0.6	0.5
35 & 36	Machinery and Electrical Machinery	0.6	2.2	3.4	4.3	5.1	5.9	7.0	8.0	9.3
37	Transportation Equipment	--	0.5	0.4	0.5	0.6	0.8	0.8	0.7	0.5
19,20,21,22,23, 25,27,29,30,31, 32 33,34,38,39	Other Manufacturing 3/	12.9	14.2	14.0	15.6	16.2	17.7	20.3	22.9	25.6
C.(15-17), E.-J.(40-99)	SERVICE INDUSTRIES 4/	45.6	53.8	62.9	76.1	93.7	111.5	133.3	159.3	187.7
	TOTAL EMPLOYMENT	84.0	93.8	98.0	113.9	133.7	154.6	180.8	210.4	242.6
	TOTAL POPULATION	245.7	260.8	272.7	304.9	357.9	410.7	465.2	523.2	587.1
	Urban	93.4	108.3	114.6	140.9	183.3	224.3	264.6	305.8	351.0
	Rural	152.3	152.5	155.1	164.0	174.6	186.4	200.6	217.4	236.1

1/ Based on projections furnished by U.S. Department of Agriculture, Economic Research Service.

2/ Projections and estimates of 1950 and 1960 furnished by U.S. Department of Agriculture, Forest Service.

3/ Includes: Ordnance; Food; Tobacco; Textiles; Apparel; Furniture; Printing and Publishing; Petroleum and Coal Products; Rubber and Plastics; Leather; Stone, Clay and Glass; Primary Metals, Fabricated Metals; Instruments; and Miscellaneous Manufacturing.

4/ Includes: Contract Construction; Transportation, Communications, and Utilities; Wholesale and Retail Trade; Finance, Insurance, and Real Estate; Services; Government; and Nonclassified.

5/ The subarea data for 1950 and 1940 are based on the Census of Population for 1950 and 1940 respectively and may not add to 1940 and 1950 revised state totals shown in Projective Economic Study of the States in New England, which were obtained from the 1960 Census of Population.

Details may not add to totals because of rounding.

-- Fewer than 50 persons.

APPENDIX B

SUBAREA PROJECTIONS OF PRODUCTION AND EMPLOYMENT IN LUMBER (SIC 24), PAPER (SIC 26), AND FORESTRY (SIC 28)

(Summary of a Report submitted by the Forest Service, Northeastern Forest Experiment Station, United States Department of Agriculture)

APPENDIX B - SUBAREA PROJECTIONS OF PRODUCTION AND EMPLOYMENT IN LUMBER (SIC 24), PAPER (SIC 26), AND FORESTRY (SIC 28)

(Summary of a Report submitted by the Forest Service, Northeastern Forest Experiment Station, United States Department of Agriculture)

1. INTRODUCTION

New England has long been an important producer of the major forest products -- lumber, and woodpulp and paper. These products are the basis for two major manufacturing industry groups, Lumber and Wood Products (SIC 24) and Paper and Allied Products (SIC 26). In addition, the forest provides employment for those engaged in gathering some miscellaneous products of the forest and in managing the forest; they are grouped as Forestry (SIC 08).

2. METHOD OF PROJECTION

The U.S. Forest Service periodically makes projections of future consumption and production of major forest products in the nation. The most recent set of projections was published in March, 1965.[1/] National projections of production of lumber, woodpulp, and paper and board were successively disaggregated to the level of New England, states in New England, and, for this report, to sub-state areas in New England. Thus, these latter projections are consistent with the major national projections of production of these goods.

Historical trends in production were used to arrive at New England production projections; these were modified where necessary by known industrial expansion plans and changing timber availability. For the subarea breakdowns, expansion plans, expected changes in forest land use and the resulting changes in timber availability, and expected changes in economic advantages obtained greater importance than historical trends, for which the data are poorer.

3. PROJECTION RESULTS

The timber resource is the most important single factor affecting the location of the lumber and paper industries. It will be an important factor in bringing about the projected changes in the distribution of

1/ U.S. Forest Service, Timber Trends in the United States, Forest Resource Report, No. 17 (U.S. Government Printing Office, Washington, D.C., 1965). 235 pp.

these industries in New England. Although the timber resource will affect shifts in the overall location of these industries in New England, on the basis of presently and potentially available supplies of timber it does not appear that any area of New England will face an absolute shortage of timber.

Generally, the production projections show a relative shift away from southern New England toward northern New England (Tables B-1, B-2, B-3). Declines in the production of lumber are expected in southern New England and small increases are projected for northern New England (Table B-1). Major expansions of woodpulp, paper, and board are expected in all parts of New England, but the largest increases will be in the northern parts of the northern three states (Tables B-2, B-3).

a. Employment in Lumber (SIC 24) and Paper (SIC 26). - Employment was projected for primary and secondary segments of each of the two manufacturing industries and for the forestry group. The primary segment of each industry was identified by the type of raw material it uses. For the lumber industry, the primary segment's major raw material is sawlogs; this segment is defined to include logging camps and logging contractors (SIC 241), and sawmills and planing mills (SIC 242). For the paper industry, the major raw materials of the primary segment are pulpwood and woodpulp; this segment is defined to include pulp mills (SIC 261), paper mills (SIC 262), paperboard mills (SIC 263), and building paper and building board mills (SIC 266). The remaining three-digit industries in each major industry are considered to be the secondary segment.

Employment projections for the primary segments of the two industries are based on projected production. The employment projections are made by relating projected productivity in terms of annual output per employee to the projected levels of production of lumber, woodpulp and paper and board (Tables B-4 and B-6). Employment projections for the secondary portion of each major industry were made by projecting historical trends in employment in these industries and considering the degree of spatial association between primary and secondary segments in each industry (Tables B-5 and B-7).

In the lumber industry as a whole, projected employment will be spatially associated with projected production of lumber. A relative shift in employment is projected toward the northern portions of the northern three states in New England (Tables B-4 and B-5). In the primary segment of the paper industry, the major increases in employment will be associated with projected increases in woodpulp, paper, and paperboard production. Such increases are expected to occur primarily in northern Maine (Me-1), northern New Hampshire (NH-3) and all Vermont subareas (Table B-6).

Major employment increases in the secondary segment, on the other hand, will take place closer to population centers. Major increases are projected for southern Maine (Me-2), southern New Hampshire (NH-1), the

Connecticut Valley in Massachusetts (M-1), and the Boston area (M-3).

b. Employment in Forestry (SIC 08). - Employment in forestry in New England is minor. It includes employment in the management of forest tracts and nurseries not included elsewhere under manufacturing industries or government and employment in collecting and gathering very minor forest products. It declined from about 2,100 in 1950 to about 1,800 in 1960 and is projected to decline to 1,500 in 1970 and then remain at that level. It is probable that shifts are taking place in the type of employment in the major group away from gathering forest products toward the management of forest tracts and nurseries.

With this as a basis, projections of the shares by state of New England employment in forestry have been made to reflect a relative shift away from northern New England toward southern New England. Employment in forestry within the states has been and can be expected to continue to be centered in those areas where major forest industry land holdings are lacking, where individual forest landowners can be expected to manage timber tracts, or where a recreation industry fosters development of forestry activities that are connected with the aesthetic interests of owners. Thus, Me-2 can be expected to contain the greatest number employed in the forestry category (Table 8).

In New Hampshire, NH-R is expected to contain the bulk of forestry employment. In Vermont, employment in forestry is at present nearly evenly distributed among the three regions; however, Vt-1 is expected to contain the majority by the year 2020. In southern New England, because more of this employment is expected to concern itself with aesthetics and the management of private forest holdings largely for aesthetic reasons, employment in forestry will continue to center in the more populous sections of these states.

TABLE B-1

PRODUCTION AND PROJECTED PRODUCTION OF LUMBER IN NEW ENGLAND BY STATE AND ECONOMIC SUBAREA FOR SELECTED YEARS

State and economic subarea	Year						
	1950	1960	1970	1980	1990	2000	2020
	Million board feet						
MAINE							
Me-1	95	75	95	120	140	170	170
Me-2	116	62	50	35	40	30	30
Me-R	220	166	165	165	180	170	180
TOTAL	431	303	310	320	360	370	380
NEW HAMPSHIRE							
NH-1	130	81	53	35	32	34	33
NH-2	46	33	27	30	31	34	33
NH-3	83	65	64	77	82	75	73
NH-R	42	27	16	18	25	27	31
TOTAL	301	206	160	160	170	170	170
VERMONT							
Vt-1	63	44	43	44	51	49	49
Vt-2	33	19	19	16	25	28	25
Vt-R	85	66	58	60	64	63	66
TOTAL	181	129	120	120	140	140	140
MASSACHUSETTS							
M-1	48	25	9	9	15	11	11
M-2	11	11	9	9	10	5	6
M-3	51	44	35	28	20	17	12
M-R	11	11	17	14	15	17	11
TOTAL	121	91	70	60	60	50	40
CONNECTICUT							
C-1	13	15	10	8	4	5	5
C-2	7	9	7	8	3	5	5
C-R	2	3	3	4	3	1/	1/
TOTAL	22	27	20	20	10	10	10
RHODE ISLAND	3	3	-	-	-	-	-
GRAND TOTAL	1059	759	680	680	740	740	740

1/ Less than 500,000 board feet

TABLE B-2

PRODUCTION AND PROJECTED PRODUCTION OF WOODPULP IN NEW ENGLAND BY STATE AND ECONOMIC SUBAREA FOR SELECTED YEARS

State and economic subarea	Year						
	1950	1960	1970	1980	1990	2000	2020
	Thousand tons						
MAINE							
Me-1	315	644	740	860	1005	1170	1330
Me-2	448	528	650	750	890	1090	1210
Me-R	420	494	570	670	785	920	1040
TOTAL	1183	1666	1960	2280	2680	3180	3580
NEW HAMPSHIRE							
NH-1	-	-	-	25	30	35	35
NH-2	-	-	-	45	60	75	80
NH-3	177	1/	250	330	440	575	670
NH-R	-	-	-	-	10	15	15
TOTAL	177	1/	250	400	540	700	800
VERMONT							
Vt-1	-	-	-	30	50	90	130
Vt-2	-	-	13	60	110	190	240
Vt-R	-	-	12	30	60	110	150
TOTAL	1/	1/	25	120	220	390	520
MASSACHUSETTS							
M-1	-	-	-	10	40	79	110
M-2	-	-	-	-	5	6	10
M-3	-	-	45	50	55	63	75
M-R	-	-	-	-	-	2	5
TOTAL	1/	1/	45	60	100	150	200
CONNECTICUT							
C-1	-	-	5	15	30	40	50
C-2	-	-	-	-	-	5	15
C-R	-	-	-	5	10	15	15
TOTAL	1/	1/	5	20	40	60	80
RHODE ISLAND	1/	1/	15	20	20	20	20
GRAND TOTAL	1458	1839	2300	2900	3600	4500	5200

1/ No figures given in U.S. Bureau of the Census Report because of disclosure regulations.

TABLE B-3

PRODUCTION AND PROJECTED PRODUCTION OF PAPER AND PAPERBOARD IN NEW ENGLAND BY STATE AND ECONOMIC SUBAREA FOR SELECTED YEARS

State and economic subarea	Year						
	1950	1960	1970	1980	1990	2000	2020
	Thousand tons						
MAINE							
Me-1	274	566	815	1015	1320	1420	1890
Me-2	484	567	735	855	990	1110	1430
Me-R	570	673	700	810	840	1040	1380
TOTAL	1328	1806	2250	2680	3150	3570	4700
NEW HAMPSHIRE							
NH-1	33	46	50	80	100	110	170
NH-2	47	61	80	100	120	160	250
NH-3	183	237	280	400	520	630	960
NH-R	-	-	-	-	10	10	20
TOTAL	263	344	410	580	750	910	1400
VERMONT							
Vt-1	-	50	60	100	130	175	320
Vt-2	-	30	70	90	110	150	230
Vt-R	-	90	130	170	260	335	510
TOTAL	1/	170 2/	260	360	500	660	1060
MASSACHUSETTS							
M-1	240	291	325	390	470	550	680
M-2	162	196	195	240	300	320	430
M-3	235	287	280	310	340	380	490
M-R	81	96	100	110	140	150	200
TOTAL	718	870	900	1050	1250	1400	1800
CONNECTICUT							
C-1	94	108	120	130	195	250	445
C-2	84	86	105	135	170	190	250
C-R	138	142	135	135	135	140	145
TOTAL	316	336	360	400	500	580	840
RHODE ISLAND	1/	26 2/	20	30	50	80	200
GRAND TOTAL	2771 3/	3552 3/	4200	5100	6200	7200	10000 3/

1/ No figures given in U.S. Bureau of the Census Reports because of disclosure regulations.

2/ Estimated by Northeastern Forest Experiment Station.

3/ Column does not add to total because of rounding.

TABLE B-4

EMPLOYMENT AND PROJECTED EMPLOYMENT IN THE PRIMARY LUMBER INDUSTRY (SIC 241 & 242) IN NEW ENGLAND BY STATE AND ECONOMIC SUBAREA FOR SELECTED YEARS

State and economic subarea	Year						
	1950	1960	1970	1980	1990	2000	2020
	Thousands						
MAINE							
Me-1	3.1	2.3	2.6	2.8	2.9	3.0	2.5
Me-2	3.8	1.9	1.4	0.8	0.8	0.6	0.5
Me-R	7.2	5.1	4.5	3.9	3.6	3.1	2.6
TOTAL	14.1	9.3	8.5	7.5	7.3	6.7	5.6
NEW HAMPSHIRE							
NH-1	2.5	1.5	1.0	0.6	0.5	0.5	0.4
NH-2	0.9	0.6	0.5	0.5	0.5	0.5	0.4
NH-3	1.6	1.2	1.2	1.3	1.3	1.1	0.9
NH-R	0.8	0.5	0.3	0.3	0.4	0.4	0.4
TOTAL	5.8	3.8	3.0	2.7	2.7	2.5	2.1
VERMONT							
Vt-1	1.7	1.2	0.9	0.8	0.8	0.7	0.6
Vt-2	0.9	0.4	0.4	0.3	0.4	0.4	0.3
Vt-R	2.3	1.9	1.2	1.1	1.0	0.9	0.8
TOTAL	4.9	3.5	2.5	2.2	2.2	2.0	1.7
MASSACHUSETTS							
M-1	1.3	0.7	0.2	0.2	0.3	0.2	0.2
M-2	0.3	0.3	0.2	0.2	0.2	0.1	0.1
M-3	1.4	1.2	0.8	0.6	0.4	0.3	0.2
M-k	0.3	0.3	0.4	0.3	0.3	0.3	0.2
TOTAL	3.3	2.5	1.6	1.3	1.2	0.9	0.7
CONNECTICUT							
C-1	0.8	0.5	0.3	0.2	0.1	0.1	0.1
C-2	0.4	0.3	0.2	0.2	0.1	0.1	0.1
C-R	0.1	0.1	0.1	0.1	0.1	1/	1/
TOTAL	1.3	0.9	0.6	0.5	0.3	0.2	0.2
RHODE ISLAND	0.3	0.2	1/	1/	1/	1/	1
GRAND TOTAL	29.8 2/	20.1 2/	16.2	14.2	13.7	12.3	10.3

1/ Less than 50 persons.
2/ Column does not add to total because of rounding.

TABLE B-5

EMPLOYMENT AND PROJECTED EMPLOYMENT IN THE SECONDARY LUMBER AND WOOD PRODUCTS INDUSTRY (SIC 243 & 244) IN NEW ENGLAND BY STATE AND ECONOMIC SUBAREA FOR SELECTED YEARS

State and economic subarea	Year						
	1950	1960	1970	1980	1990	2000	2020
	Thousands						
MAINE							
Me-1	0.4	0.4	0.7	0.8	0.8	0.7	0.6
Me-2	1.1	1.1	1.0	1.0	0.9	0.9	0.8
Me-R	3.1	3.9	4.4	4.0	3.7	3.4	2.4
TOTAL	4.6	5.4	6.1	5.8	5.4	5.0	3.8
NEW HAMPSHIRE							
NH-1	1.3	1.0	0.9	0.8	0.8	0.7	0.7
NH-2	0.5	0.4	0.3	0.2	0.2	0.2	0.1
NH-3	0.5	0.3	0.2	0.2	0.1	0.1	1/
NH-R	0.5	0.3	0.2	0.2	0.2	0.1	0.1
TOTAL	2.8	2.0	1.6	1.4	1.3	1.1	0.9
VERMONT							
Vt-1	0.3	0.2	0.2	0.2	0.2	0.2	0.2
Vt-2	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Vt-R	1.0	1.0	1.0	1.0	1.0	0.9	0.8
TOTAL	1.4	1.3	1.3	1.3	1.3	1.2	1.1
MASSACHUSETTS							
M-1	0.6	0.5	0.1	0.1	0.1	0.2	0.4
M-2	0.6	0.6	0.6	0.6	0.5	0.4	0.2
M-3	2.8	2.5	1.8	1.3	1.0	0.7	0.4
M-R	1/	1/	1/	1/	1/	0.1	0.1
TOTAL	4.1 2/	3.6	2.5	2.1	1.7 2/	1.4	1.1
CONNECTICUT							
C-1	0.5	0.4	0.3	0.3	0.3	0.3	0.2
C-2	0.5	0.4	0.3	0.3	0.2	0.2	0.2
C-R	0.1	0.1	0.1	0.1	0.1	0.1	0.1
TOTAL	1.1	0.9	0.7	0.7	0.6	0.6	0.5
RHODE ISLAND	0.4	0.3	0.3	0.2	0.2	0.2	0.1
GRAND TOTAL	14.5 2/	13.5	12.5	11.5	10.5	9.5	7.5

1/ Less than 50 persons
2/ Column does not add to total because of rounding.

TABLE B-6

EMPLOYMENT AND PROJECTED EMPLOYMENT IN PRIMARY PULP AND PAPER PRODUCTION (SIC 261, 262, 263 & 266) IN NEW ENGLAND BY STATE AND ECONOMIC SUBAREA FOR SELECTED YEARS

State and economic subarea	Year						
	1950	1960	1970	1980	1990	2000	2020
	Thousands						
MAINE							
Me-1	3.5	5.8	6.7	7.2	7.9	6.9	8.6
Me-2	5.8	5.6	6.0	6.1	6.3	7.3	6.9
Me-R	6.6	6.2	5.5	5.6	5.4	6.5	6.4
TOTAL	15.9	17.6	18.2	18.9	19.6	20.7	21.9
NEW HAMPSHIRE							
NH-1	0.7	0.7	0.5	0.7	0.7	0.6	0.9
NH-2	1.2	1.1	0.8	1.0	0.9	0.9	1.2
NH-3	4.1	3.8	3.5	3.8	4.4	5.1	5.5
NH-R	-	0.0	0.0	0.0	0.1	0.1	0.1
TOTAL	6.0	5.6	4.8	5.5	6.1	6.7	7.7
VERMONT							
Vt-1	0.4	0.3	0.3	0.5	0.6	0.9	1.2
Vt-2	0.3	0.2	0.4	0.6	0.8	1.0	1.1
Vt-R	0.7	0.6	0.6	0.8	1.1	1.4	2.0
TOTAL	1.4	1.1	1.3	1.9	2.5	3.3	4.3
MASSACHUSETTS							
M-1	4.3	4.9	5.4	5.0	5.3	5.7	5.3
M-2	2.9	3.3	3.2	3.0	3.2	3.3	3.2
M-3	4.5	5.0	4.8	4.1	4.1	4.1	3.8
M-R	1.5	1.6	1.7	1.5	1.4	1.5	1.4
TOTAL	13.2	14.8	15.1	13.6	14.0	14.6	13.7
CONNECTICUT							
C-1	0.6	1.0	0.8	0.9	1.1	1.3	1.8
C-2	0.5	0.8	0.8	0.8	1.0	1.0	1.0
C-R	0.8	1.2	1.0	0.9	0.7	0.8	0.7
TOTAL	1.9	3.0	2.6	2.6	2.8	3.1	3.5
RHODE ISLAND	0.4	0.4	0.5	0.5	0.6	0.7	0.9
GRAND TOTAL	38.8	42.5	42.5	43.0	45.6	49.1	52.0

TABLE B-7

EMPLOYMENT AND PROJECTED EMPLOYMENT IN SECONDARY PAPER PRODUCTS PRODUCTION (SIC 264 & 265) IN NEW ENGLAND BY STATE AND ECONOMIC SUBAREA FOR SELECTED YEARS

State and economic subarea	Year						
	1950	1960	1970	1980	1990	2000	2020
	Thousands						
MAINE							
Me-1	0.0	0.1	0.2	0.5	0.7	1.2	2.0
Me-2	0.5	0.9	1.9	3.2	5.0	6.6	7.4
Me-R	0.0	0.0	0.0	0.0	0.1	0.2	0.4
TOTAL	0.5	1.0	2.1	3.7	5.8	8.0	9.8
NEW HAMPSHIRE							
NH-1	0.8	1.4	2.2	3.6	4.8	5.2	5.2
NH-2	0.1	0.1	0.1	0.2	0.2	0.3	0.4
NH-3	0.5	0.5	0.5	0.7	0.7	1.3	2.7
NH-R	0.0	0.0	0.0	0.0	0.1	0.2	0.3
TOTAL	1.4	2.0	2.8	4.5	5.8	7.0	8.6
VERMONT							
Vt-1	1/	0.1	0.1	0.3	0.5	0.6	0.9
Vt-2	0.1	0.3	0.3	0.4	0.5	0.4	1.4
Vt-R	0.3	0.8	1.3	1.9	2.3	2.7	2.3
TOTAL	0.4	1.2	1.7	2.6	3.3	3.7	4.6
MASSACHUSETTS							
M-1	5.4	6.1	6.9	7.1	7.6	8.2	10.7
M-2	1.8	2.3	3.0	2.8	2.7	2.5	2.9
M-3	11.2	9.6	9.4	9.3	9.4	9.4	11.9
M-R	0.9	1.2	0.9	1.0	0.8	0.7	0.3
TOTAL	19.3	19.2	20.2	20.2	20.5	20.8	25.8
CONNECTICUT							
C-1	2.0	2.2	2.2	2.0	1.9	2.0	2.5
C-2	1.5	1.4	1.3	1.2	1.3	1.3	1.6
C-R	1.4	1.6	1.7	1.6	1.4	1.3	1.6
TOTAL	4.9	5.2	5.2	4.8	4.6	4.6	5.7
RHODE ISLAND	1.2	1.6	1.6	1.6	1.7	2.3	2.9
GRAND TOTAL	27.7	30.2	33.6	37.4	41.7	46.4	57.4

1/ Less than 50 persons.

TABLE B-8

EMPLOYMENT AND PROJECTED EMPLOYMENT IN FORESTRY (SIC 08) IN NEW ENGLAND BY STATE AND ECONOMIC SUBAREA FOR SELECTED YEARS

State and economic subarea	Year					
	1960	1970	1980	1990	2000	2020
	Thousands					
MAINE						
Me-1	0.1	0.1	0.1	0.1	1/	1/
Me-2	1/	1/	1/	1/	1/	1/
Me-R	0.3	0.2	0.1	0.1	0.1	0.2
TOTAL	0.4	0.3	0.2	0.2	0.2	0.2
NEW HAMPSHIRE						
NH-1	1/	1/	1/	1/	1/	1/
NH-2	1/	1/	1/	1/	1/	1/
NH-3	0.1	0.1	0.1	1/	1/	1/
NH-R	0.1	0.1	0.1	0.1	0.1	0.1
TOTAL	0.3	0.2	0.2	0.2	0.2	0.2
VERMONT						
Vt-1	1/	0.1	0.1	0.1	0.1	0.1
Vt-2	1/	1/	1/	1/	1/	1/
Vt-R	0.2	0.1	0.1	0.1	0.1	0.1
TOTAL	0.3	0.2	0.2	0.2	0.2	0.2
MASSACHUSETTS						
M-1	0.1	0.1	0.1	0.1	0.2	0.2
M-2	1/	0.1	0.1	0.1	0.1	0.1
M-3	0.4	0.3	0.3	0.3	0.2	0.2
M-R	1/	1/	1/	1/	1/	1/
TOTAL	0.5	0.5	0.5	0.5	0.5	0.5
CONNECTICUT						
C-1	0.1	0.1	0.1	0.1	0.1	0.1
C-2	1/	1/	0.1	0.1	0.1	0.1
C-R	1/	1/	1/	1/	1/	1/
TOTAL	0.2	0.2	0.3	0.3	0.3	0.3
RHODE ISLAND	0.1	0.1	0.1	0.1	0.1	0.1
GRAND TOTAL	1.8	1.5	1.5	1.5	1.5	1.5

1/ Less than 50 persons.

APPENDIX C

SUBAREA PROJECTIONS OF AGRICULTURAL EMPLOYMENT

(Summary of a Report submitted by the Economic Research Service, United States Department of Agriculture)

APPENDIX C - SUBAREA PROJECTIONS OF AGRICULTURAL EMPLOYMENT

(Summary of a Report submitted by the Economic Research Service, United States Department of Agriculture)

1. INTRODUCTION

This appendix is a summary of the third Economic Research Service Report on agriculture in the New England economy. In the first report agricultural production and labor use were described and projected for New England as an entity. In the second report these projections were broken down to the six states comprising the New England Region. In the third report the state projections were distributed among sub-state economic areas on the basis of historical trends within each state.

2. METHODOLOGY

The present report represents a further breakdown of the state projections to sub-state economic areas. These sub-state areas were designated to obtain relatively homogeneous economic areas for more intensive study. The availability of adequate statistical data only on a county basis necessitated that these areas be whole counties or aggregates of counties. A total of seventeen sub-state economic areas were designated.[1/]

In distributing future agricultural production and employment among these areas, historical shifts in production of each commodity were used as a basis for projecting the proportion of total state production expected in each area.

This preliminary distribution of production of each commodity was then checked for consistency of trend over the projection period. A further check on the projections was made by comparing pairs of contiguous areas with similar characteristics. For example, the areas on the Vermont and New Hampshire sides of the Connecticut River have the common characteristics of soil, climate, and relative concentration of agriculture in the river valley. Similarly, any difference between the Connecticut Valley in Massachusetts and the Connecticut Valley in Connecticut can be ascribed more to urban expansion and industrial pressures than to any differences in soil, climate, or topography.

The following specific steps were used in making these sub-state economic area projections:

1/ See Figure 1 and Table 1 in Chapter I for designated sub-state economic areas.

(1) An areal distribution of production by commodity from the United States Census of Agriculture between the sub-state areas was determined for the years 1944, 1950, 1954, and 1959.

(2) The trend of this distribution was determined and projected for each future decade. This step produced a percent distribution matrix of commodity production by sub-state areas for each state for each benchmark year.

(3) These matrices were multiplied by their respective vectors of total state production of each commodity for each benchmark year. This step provided preliminary distributions of production for each commodity.

(4) The fourth step consisted of making checks and revisions necessary to provide greater internal consistency over the projection period and between contiguous areas. The influence of factors external to the agricultural sector were also considered in making these revisions. Examples of such external factors are: Urban expansion, industrial pressure on the labor force, expansion of recreation, off-farm employment alternatives, and the migration of people.

(5) To make the projections of labor requirements for each area, the final percent distribution of production matrix, as modified in Step 4, was multiplied by the vector of labor requirement by commodity for each date in the projection period.

In making these projections care was taken to achieve both internal consistency and consistency within the constraints of the state and New England region projections. Occasionally these ends conflicted; however, the extent to which these conflicts were resolved is shown by the consistency of the final projections. It is felt that these projections conform to both the historical trends and to the expected influence of locational factors such as urban expansion, population changes, and industrial and residential demands on the land.

3. PRODUCTION BY STATES AND BY SUB-STATE ECONOMIC AREAS

In describing the projected distribution of production, the term "shift" will be used. This term is meant to convey the idea of differential rates of directional change in production between areas rather than to quantify rates of change.

Absolute production figures and shifts may or may not coincide in either direction or magnitude. If both production of a commodity in absolute terms and the percent of total state production in an area are increasing (decreasing), then an absolute upward (downward) shift in production has occurred in that area. A relative upward shift occurs when

the percent of state production increases while the absolute level of production declines or remains constant. Similarly, a relative downward shift occurs when the percent of total state production decreases while the absolute level of production increases or remains constant. The final possibility is that no shift occurs. A constant percentage of state production results in no shift regardless of the direction of change in absolute production.

a. Maine. - Area Me-1, Aroostook and Penobscot Counties, is projected to have an upward shift in the production of cattle and calves, broilers, and vegetables both for processing and for fresh market. Other commodities are expected to maintain an almost constant percent of total Maine production.

Area Me-2, southern Maine, is expected to show relative upward shifts in hogs, broilers, vegetables for fresh market, and apples. Relative downward shifts are expected in farm chickens, eggs, and turkeys. Cattle and calves, sheep and lambs, potatoes, and vegetables for processing are projected to maintain a constant or slightly decreasing share of total Maine production.

Area Me-R is a rather heterogeneous area comprising Maine's eastern coastal counties of Knox, Lincoln, Waldo, Hancock, and Washington, and the northern forest counties of Oxford, Franklin, Somerset, and Piscataquis. The expected changes in this area include relative upward shifts in farm chickens, eggs, and turkeys in the coastal counties bordering area Me-2, and downward shifts in all other agricultural commodities.

b. New Hampshire. - Changes in the distribution of production of the various commodities show very diverse patterns in all areas of New Hampshire. Area NH-1, southern and coastal New Hampshire, is projected to experience upward shifts in broilers, farm chickens, eggs, turkeys, hogs, fresh market vegetables, and apples. Eggs, fresh market vegetables, and apples are expected to show absolute upward shifts. Relative downward shifts are expected in dairy products, cattle and calves, and sheep and lambs. Potatoes and vegetables for processing are expected to maintain a constant proportion of total state production.

Area NH-2, the southern Connecticut Valley in New Hampshire is expected to show an absolute upward shift in both dairy products and cattle and calves. Relative upward shifts are projected for sheep and lambs, and turkeys; however, both of these classes will remain of extremely minor importance in this area as in New Hampshire as a whole. Relative downward shifts are projected for apples and vegetables for fresh market in this area. Absolute downward shifts are expected in farm chickens, eggs and hogs. No shift is projected fro broilers and potatoes even though the level of production of both of these commodities is declining.

Area NH-3, the northern Connecticut Valley and the north country of New Hampshire, is projected to show absolute upward shifts in dairy

products and cattle and calves. A relative upward shift is expected in sheep and lamb production which, again, is of extremely minor importance. A relative downward shift is projected for apple production even though the level of apple production is expected to remain constant. An absolute downward shift is expected in hogs, farm chickens, and eggs in area NH-3. Broilers and potatoes are expected to show no shift while declining in absolute levels of production.

Area NH-R is comprised of two central counties, Belknap and Carroll. This area can be classed as essentially non-agricultural except for forestry. It is projected to have a small and declining proportion of the production of all commodities except potatoes, apples, and vegetables for processing. The proportion of production in these commodities is small but constant. Absolute production levels are projected to decline in all commodities except apples, dairy products, cattle and calves, and fresh market vegetables.

c. Vermont. - Area Vt-1 the southern Connecticut Valley in Vermont, is projected to experience a downward shift in all important agricultural commodities. Upward shifts are expected in sheep and lambs, turkeys, potatoes, and fresh market vegetables; but these are not economically important in this area or in the state as a whole. Farm chickens and eggs are expected to maintain their present proportion of total state production in area Vt-1.

Area Vt-2, the northern Connecticut Valley in Vermont, is expected to have a similar future. Downward shifts are expected for cattle and calves, sheep and lambs, dairy products, and apples. Upward shifts are expected for hogs, farm chickens, eggs, turkeys, potatoes, and fresh market vegetables. Commercial broilers will show no shift in area Vt-2.

Area Vt-R, the western half of the state, contains much of the more productive land in Vermont. This area is expected to show upward shifts in cattle and calves, dairy products, broilers, and apples. Downward shifts are projected for farm chickens, eggs, turkeys, potatoes, and fresh market vegetables. Hogs and sheep and lambs are expected to show no shift.

d. Massachusetts. - Area M-1, the Connecticut Valley in Massachusetts, is projected to show upward shifts in cattle and calves, dairy products, hogs, farm chickens, eggs, potatoes, and vegetables both for fresh market and for processing. Downward shifts are expected in sheep and lambs and broilers. Apple production is expected to show no shift in area M-1.

Area M-2, Worcester County, is projected to show upward shifts in cattle and calves, dairy products, hogs, sheep and lambs, farm chickens, eggs, broilers, apples, and vegetables both for processing and for fresh market. Only in potatoes is there a downward shift projected. Turkey production is expected to show no shift.

Area M-3, eastern Massachusetts exclusive of Cape Cod and the Islands, is projected to show downward shifts in the production of cattle and calves, dairy products, hogs, farm chickens, eggs, apples, and vegetables. Production of sheep and lambs and cranberries are expected to show upward shifts in this area. No shift is projected for either broilers or turkeys.

The rest of the state makes up area M-R. This area includes Cape Cod, the Islands of Martha's Vineyard and Nantucket, and Berkshire County on the western border. This area is expected to show downward shifts in cattle and calves, dairy products, broilers, farm chickens, eggs, potatoes, vegetables for fresh market, and cranberries. Upward shifts are projected for hogs, turkeys, and apples. No shift is expected in vegetables for processing.

e. Connecticut. - Area C-1, western Connecticut, is projected to show a downward shift in all commodities. Only dairy products is projected to increase in its absolute level of production. All other commodities are projected to show a drop in production in response to commercial, industrial, and residential pressures of urban expansion.

Area C-2, The Connecticut Valley, is projected to show a relative upward shift in potatoes, and vegetables for fresh market. Tobacco will experience a relative upward shift until 1980. After 1980, however, production is expected to become negligible. All other commodities are projected to show a downward shift in area C-2.

Area C-R, eastern Connecticut, is projected to show a downward shift in potatoes, tobacco, and fresh market vegetables. Turkeys are expected to show no shift in area C-R. All other commodities are expected to show an upward shift. This upward shift is not in response to superior conditions but rather in response to less severe urban pressures.

4. PROJECTED FARM LABOR REQUIREMENTS

Farm labor requirements are summarized for each state and sub-state economic area in Tables 2 through 7. In these tables farm labor requirements are presented in man-year equivalents and as index numbers with 1960 as a base year.

All states and areas show declining farm labor requirements over the next 50 years except area Vt-R, the western half of Vermont. The highest projected labor requirement in the year 2020 is in area Vt-R which has an index number of 100.9. The lowest projected index is in Rhode Island which has a value of 49.9. Both of these extremes appear reasonable when weighing the type of farming presently carried on and projected for these areas. The high labor requirement in area Vt-R is the result of expanded production favored by land characteristics and the absence of great urban pressures. These projections are expressed in full-time, man-year equivalents with allowances for part-time employment in agriculture.

Table C-1. Farm Labor Requirements in Man Year Equivalents[1/]: 1960 with Decennial Projections to 2020

MAINE by Sub-State Economic Area

Year	Farm Labor Requirements				Index of Labor Requirements			
	Area Me-1	Area Me-2	Area Me-R	Total	Area Me-1	Area Me-2	Area Me-R	State
	Man Years							
1960	5088	5585	5376	16049	100.0	100.0	100.0	100.0
1970	4734	5693	5300	15727	93.0	101.9	99.5	98.0
1980	4429	5808	5230	15487	87.0	104.0	97.7	96.5
1990	4433	5655	5196	15284	87.1	101.3	96.7	95.2
2000	4404	5521	5159	15084	86.6	98.9	96.0	94.0
2010	4194	5518	5161	14874	82.4	98.8	96.0	92.7
2020	4046	5497	5115	14658	79.5	98.4	95.1	91.3

1/ Implicit man year equivalent = 2254 Man hours, 1960
2008 Man hours, 1970
1936 Man hours, 1980
1899 Man hours, 1990
1785 Man hours, 2000
1744 Man hours, 2010
1595 Man hours, 2020

Table C-2. Farm Labor Requirements in Man Year Equivalents 1/: 1960 with Decennial Projections to 2020

NEW HAMPSHIRE by Sub-State Economic Area

	Farm Labor Requirements					Index of Labor Requirements				
	Area NH-1	Area NH-2	Area NH-3	Area NH-R	Total	Area NH-1	Area NH-2	Area NH-3	Area NH-R	State
	Man Years									
1960	3495	657	984	398	5530	100.0	100.0	100.0	100.0	100.0
1970	3461	651	985	377	5474	99.0	100.0	100.1	94.7	99.0
1980	3403	648	982	368	5401	97.4	99.5	99.8	92.5	97.7
1990	3331	646	975	349	5301	95.3	99.2	99.1	87.7	95.8
2000	3245	644	972	338	5199	92.8	98.9	98.8	84.9	94.0
2010	3159	641	972	320	5092	90.4	98.5	98.8	80.4	92.1
2020	3065	638	971	309	4983	87.7	98.0	98.7	77.6	90.1

1/ Implicit Man Year Equivalent = 2254 Man hours, 1960
2171 Man hours, 1970
1984 Man hours, 1980
1847 Man hours, 1990
1706 Man hours, 2000
1623 Man hours, 2010
1536 Man hours, 2020

Table C-3. Farm Labor Requirements in Man Year Equivalents 1/: 1960 with Decennial Projections to 2020

VERMONT by Sub-State Economic Area

Year	Farm Labor Requirements				Index of Labor Requirements			
	Area Vt-1	Area Vt-2	Area Vt-R	Total	Area Vt-1	Area Vt-2	Area Vt-R	State
	Man Years							
1960	1778	2316	10847	14941	100.0	100.0	100.0	100.0
1970	1655	2311	10945	14911	93.1	99.8	100.9	99.8
1980	1615	2267	10935	14817	90.8	97.9	100.8	99.2
1990	1530	2251	10933	14714	86.1	97.2	100.8	98.5
2000	1447	2235	10928	14610	81.4	96.5	100.7	97.8
2010	1379	2207	10933	14520	77.5	95.3	100.8	97.2
2020	1328	2166	10945	14440	74.7	93.5	100.9	96.6

1/ Implicit Man Year Equivalent = 2254 Man hours, 1960
2219 Man hours, 1970
2004 Man hours, 1980
1958 Man hours, 1990
1842 Man hours, 2000
1786 Man hours, 2010
1692 Man hours, 2020

Table C-4. Farm Labor Requirements in Man Year Equivalents 1/: 1960 with Decennial Projections to 2020

MASSACHUSETTS by Sub-State Economic Area

Year	Farm Labor Requirements					Index of Labor Requirements				
	Area M-1	Area M-2	Area M-3	Area M-R	Total	Area M-1	Area M-2	Area M-3	Area M-R	State
	Man Years									
1960	4044	3362	6926	1162	15494	100.0	100.0	100.0	100.0	100.0
1970	3670	3354	6859	1158	15041	90.8	99.8	99.0	99.7	97.1
1980	3304	3272	6811	1164	14553	81.7	97.4	98.3	100.2	93.9
1990	2994	3162	6746	1152	14054	74.0	94.0	97.4	99.1	90.7
2000	2912	3076	6449	1111	13548	72.0	91.5	93.1	95.6	87.4
2010	2817	2948	6208	1070	13043	69.7	87.7	89.6	92.1	84.2
2020	2708	2846	5981	1003	12539	67.0	84.7	86.4	86.3	80.9

1/ Implicit Man Year Equivalent = 2254 Man hours, 1960
2027 Man hours, 1970
1769 Man hours, 1980
1536 Man hours, 1990
1391 Man hours, 2000
1325 Man hours, 2010
1287 Man hours, 2020

Table C-5. Farm Labor Requirements in Man Year Equivalents 1/: 1960 with Decennial Projections to 2020

CONNECTICUT by Sub-State Economic Area

Year	Farm Labor Requirements				Index of Labor Requirements			
	Area C-1	Area C-2	Area C-R	Total	Area C-1	Area C-2	Area C-R	State
	Man Years							
1960	4418	5080	4892	14390	100.0	100.0	100.0	100.0
1970	4161	4825	4881	13867	94.2	95.0	99.8	96.4
1980	4018	4500	4874	13392	90.9	88.6	99.6	93.1
1990	3879	4215	4836	12930	87.7	83.0	98.8	89.8
2000	3744	3918	4818	12480	84.7	77.1	98.5	86.7
2010	3610	3634	4788	12032	81.8	71.5	97.9	83.6
2020	3475	3360	4749	11583	78.7	66.1	97.1	80.5

1/ Implicit Man Year Equivalent = 2254 Man hours, 1960
1927 Man hours, 1970
1769 Man hours, 1980
1581 Man hours, 1990
1479 Man hours, 2000
1404 Man hours, 2010
1383 Man hours, 2020

APPENDIX D

COMPARISONS BETWEEN SUBAREA AND STATE ECONOMIC STRUCTURE AND EMPLOYMENT GROWTH, 1950-1960

APPENDIX D - COMPARISONS BETWEEN SUBAREA AND STATE ECONOMIC STRUCTURE AND EMPLOYMENT GROWTH, 1950-1960

1. INTRODUCTION

This appendix compares the economy of each New England subarea with the economy of the state in which it is located. The comparisons are made with respect to both "economic structure" (as summarized in Table D-1), and employment growth by industry (as summarized in Tables D-2 through D-6). The basis and results of these comparisons are summarized below.

2. INDICES COMPARING THE 1960 SUBAREA AND STATE ECONOMIC STRUCTURE

To analyze the economic structure of each subarea we first divided industries <u>at the state level</u> into three categories: (1) "growth" industries--those industries for which employment grew faster than total state employment between 1950 and 1960; (2) "slow-growth" industries--those industries for which employment grew, but at a rate slower than the growth of total state employment; and (3) "declining" industries--those industries for which employment actually declined absolutely in the 1950-1960 period. After classifying the industries, we computed the percent of total state employment falling into each of the three industry categories. In Massachusetts, for example, we found that 48 percent of the state's 1960 total employment was in growth industries, 13 percent was in slow-growth industries, while the remaining 39 percent was in declining industries. For each of the state's subareas we then asked, how does the subarea's share of total employment in each of the three categories compare with the state's share of employment in the same category? To answer this we computed the ratio of subarea share to state share for each of the three industry-growth categories and expressed the results as an index number. Thus an index number of 1.00 indicates the subarea has the same proportion of its employment in a given category as does the state, while index numbers of greater or less than one indicate the subarea's proportion of employment in the category is greater or less than the state's. The results of these computations are shown in Table D-1. Returning to the example of Massachusetts, we see that the M-1 subarea has a lesser proportion of growth industries, a higher proportion of slow-growth industries, and an equal proportion of declining industries relative to the state.

3. COMPARATIVE GROWTH INDICES, 1950-1960

The preceding structural analysis provides only a partial view of the character of a subarea's economy. We also need to examine the comparative growth performances of subareas on an individual industry basis. To achieve this, we computed the index numbers presented in Tables D-2 through D-6. The sign of the index number is determined by the subarea employment growth between 1950 and 1960; a positive

number indicates an employment increase while a negative number indicates an employment decline. The absolute value of the index for an industry is the ratio of the percent change in employment in the subarea to the percent change in the state. For example, Table D-2 indicates that employment in Agriculture, Forestry, and Fisheries declined more rapidly than the state in subareas M-1, M-2, and M-R, each of which has an index with a negative sign and an absolute value greater than one. In contrast, employment in this sector decreased less rapidly than the state in subarea M-3, which also has a negative index but an absolute value less than one. Starred indices indicate that employment in the subarea industry either grew when the state industry declined or declined when the state industry grew. For example, Table D-2 shows that mining employment grew in subarea M-1 although it declined in the state.

TABLE D-1

INDICES COMPARING SUBAREA AND STATE ECONOMIC STRUCTURE, 1960

Subareas and States	A Growth Industries	B Slow-Growth Industries	C Declining Industries
Massachusetts:			
M-1	.93	1.29	1.00
M-2	.84	1.58	1.01
M-3	1.04	.89	.99
M-R	.99	.73	1.10
Connecticut:			
C-1	.96	1.03	1.06
C-2	1.07	.99	.77
C-R	1.04	.84	1.34
Maine:			
Me-1	.99	None	1.04
Me-2	1.05	" "	.84
Me-R	.91	" "	1.29
New Hampshire:	1.01	1.02	.92
NH-1	1.07	.81	1.21
NH-2	.84	1.18	1.12
NH-3	1.08	.82	1.13
NH-R			
Vermont:			
Vt-1	1.07	.51	.86
Vt-2	.90	.68	1.35
Vt-R	1.00	1.19	.98

NOTES: Column A:

$$\text{Index} = \frac{\text{Percent of 1960 Subarea Employment in Growth Industries}}{\text{Percent of 1960 State Employment in Growth Industries}}$$

where "growth industries" are those in which employment grew more rapidly in the state than total state employment between 1950 and 1960.

Column B: Indices of "slow growth industries" (those which grew less rapidly in the state than total state employment between 1950 and 1960).

Column C: Indices of declining industries (those which lost employment at the state level between 1950 and 1960).

TABLE D-2

INDICES COMPARING SUBAREA EMPLOYMENT GROWTH WITH THAT IN THE STATE, 1950-1960

$$\text{Index} = \left[\frac{\text{Percent Growth in Subarea's Employment in an Industry, 1950-1960}}{\text{Percent Growth in State Employment in the Same Industry, 1950-1960}}\right]$$

SIC	INDUSTRY	MASSACHUSETTS M-1	M-2	M-3	M-R
A.(01-09)	AGRICULTURE, FORESTRY, FISHERIES	-1.04	-1.06	- .96	-1.06
B.(10-14)	MINING	2.63*	-2.90	- .72	-4.39
D.(19-39)	MANUFACTURING	- .45*	- .39*	1.73	-1.59*
20	Food and Kindred Products	.84	1.33	.98	1.46
22	Textile Mill Products	- .76	- .77	-1.07	-1.15
23	Apparel	- .16*	2.55	1.01	.47
24 & 25	Lumber and Wood Products, and Furniture	- .47	-1.44	- .83	- .10
27	Printing and Publishing	1.15	1.33	.92	1.48
28	Chemicals	14.69	50.69	-6.09*	40.33
33	Primary Metals	-1.79*	.15*	3.38	5.32
19(exc.194),34	Fabricated Metals	.58	.38	1.45	1.76
35	Machinery, except Electrical	.66	- .11*	1.66	10.42
36	Electrical Machinery	- .60*	.88	1.63	- .10*
37	Transportation Equipment	4.56	-1.59*	.79	3.75
21,26,29-31	Other Nondurable Goods	-2.64	9.35*	-2.31	1.57*
194,32,38,39	Other Durable Goods and Miscellaneous Manufacturing	2.11	-3.77*	2.38	27.56
C.(15-17) E.-J.(40-99)	SERVICE INDUSTRIES	1.21	1.21	.91	1.69
C.(15-17)	Construction	-1.31	.47*	-1.43	2.27*
E.(40-49)	Transportation, Communication, Utilities	- .68	- .40	-1.14	- .20
F.(50-59)	Wholesale and Retail	2.79*	-1.86*	-2.39	11.16*
G.(60-67)	Finance, Insurance, & Real Estate	1.59	1.67	.85	1.85
H.(70-89)	Services	1.08	1.13	.95	1.41
I.(91-93)	Government	.30	1.39	.99	2.65
J. 99	Nonclassified	1.04	.72	1.06	.56
	TOTAL EMPLOYMENT	.81	.71	1.07	.12

* Indicates that either 1) subarea employment in a given industry is growing, while that in the state is declining, in which case the index is entered as a positive number; or 2) subarea employment in a given industry is declining, while state employment is growing in which case the index is entered as a negative number.

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1960.

TABLE D-3

INDICES COMPARING SUBAREA EMPLOYMENT GROWTH WITH THAT IN THE STATE, 1950-1960

$$\text{Index} = \left[\frac{\text{Percent Growth in Subarea's Employment in an Industry, 1950-1960}}{\text{Percent Growth in State Employment in the Same Industry, 1950-1960}}\right]$$

SIC	INDUSTRY	CONNECTICUT C-1	C-2	C-R
A.(01-09)	AGRICULTURE, FORESTRY, FISHERIES	- 1.17	- .71	- 1.07
B.(10-14)	MINING	1.79	.15	.21
D.(19-39)	MANUFACTURING	.76	1.23	1.68
20	Food and Kindred Products	.80	1.37	1.43
22	Textile Mill Products	- .99	- 1.16	- .94
23	Apparel	- .86	- 1.78	- .82
24 & 25	Lumber and Wood Products, and Furniture	- .30*	- 1.11*	9.98
27	Printing and Publishing	.84	1.32	1.35
28	Chemicals	- .04*	1.37	5.88
33	Primary Metals	- 1.37	1.19*	11.01*
19(exc.194),34	Fabricated Metals	2.10*	- 7.96	7.72*
35	Machinery, except Electrical	.47	1.40	3.43
36	Electrical Machinery	1.56	- .09*	.76
37	Transportation Equipment	1.63	.64	1.97
21,26,29-31	Other Nondurable Goods	.52	- 1.61*	9.11
194,32,38,39	Other Durable Goods and Miscellaneous Manufacturing	.50	15.24*	19.79
C.(15-17) E.-J.(40-99)	SERVICE INDUSTRIES	1.04	.94	.97
C.(15-17)	Construction	.84	1.46	.70
E.(40-49)	Transportation, Communication, Utilities	.82	1.95	- .04*
F.(50-59)	Wholesale and Retail	.96	.88	1.60
G.(60-67)	Finance, Insurance, & Real Estate	1.37	.71	1.67
H.(70-89)	Services	.98	.99	1.11
I.(91-93)	Government	1.20	.86	.65
J. 99	Nonclassified	1.15	1.05	.40
	TOTAL EMPLOYMENT	.97	1.04	1.06

* Indicates that either 1) subarea employment in a given industry is growing, while that in the state is declining, in which case the index is entered as a positive number; or 2) subarea employment in a given industry is declining, while state employment is growing in which case the index is entered as a negative number.

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1960.

TABLE D-4

INDICES COMPARING SUBAREA EMPLOYMENT GROWTH WITH THAT IN THE STATE, 1950-1960

$$\text{Index} = \left[\frac{\text{Percent Growth in Subarea's Employment in an Industry, 1950-1960}}{\text{Percent Growth in State Employment in the Same Industry, 1950-1960}}\right]$$

SIC	INDUSTRY	MAINE Me-1	Me-2	Me-R
A.(01-09)	AGRICULTURE, FORESTRY, FISHERIES	- .97	- .88	- 1.10
B.(10-14)	MINING	- 1.55	- .36	- 1.14
D.(19-39)	MANUFACTURING	8.45	- 1.52*	3.01
20	Food and Kindred Products	2.41	1.30	.06
22	Textile Mill Products	.25*	- 1.15	- .54
23	Apparel	2.03	1.06	.69
24 & 25	Lumber and Wood Products, and Furniture	- 1.11	- 1.91	- .50
27	Printing and Publishing	.97	.90	1.41
28	Chemicals	- .02*	- .03*	2.62
33	Primary Metals	- 2.19	- .81	- 1.25
19(exc.194),34	Fabricated Metals	2.31	1.14	.13
35	Machinery, except Electrical	1.91*	- 1.42	2.58*
36	Electrical Machinery	1.46	.69	2.97
37	Transportation Equipment	1.35	1.25	.19
21,26,29-31	Other Nondurable Goods	1.54	.64	1.48
194,32,38,39	Other Durable Goods and Miscellaneous Manufacturing	- 1.33	1.10*	- 2.52
C.(15-17) E.-J.(40-99)	SERVICE INDUSTRIES	1.27	1.01	.73
C.(15-17)	Construction	1.58	.71	1.19
E.(40-49)	Transportation, Communication, Utilities	- 2.24	- .13	- 1.42
F.(50-59)	Wholesale and Retail	1.87	.65	1.02
G.(60-67)	Finance, Insurance, and Real Estate	1.45	.85	1.12
H.(70-89)	Services	1.34	1.06	.59
I.(91-93)	Government	2.63	.56	.67
J. 99	Nonclassified	.35	1.58	.50
	TOTAL EMPLOYMENT	1.89	1.09	- 7.75*

* Indicates that either 1) subarea employment in a given industry is growing, while that in the state is declining, in which case the index is entered as a positive number; or 2) subarea employment in a given industry is declining, while state employment is growing in which case the index is entered as a negative number.

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1960.

TABLE D-5

INDICES COMPARING SUBAREA EMPLOYMENT GROWTH WITH THAT IN THE STATE, 1950-1960

$$\text{Index} = \left[\frac{\text{Percent Growth in Subarea's Employment in an Industry, 1950-1960}}{\text{Percent Growth in State Employment in the Same Industry, 1950-1960}}\right]$$

SIC	INDUSTRY	NEW HAMPSHIRE NH-1	NH-2	NH-3	NH-R
A.(01-09)	AGRICULTURE, FORESTRY, FISHERIES	- 1.04	- .85	- .98	- 1.05
B.(10-14)	MINING	7.05	- 5.88*	- 5.39*	176.26
D.(19-39)	MANUFACTURING	1.03	.77	.69	1.94
20	Food and Kindred Products	.93	.77	1.77	1.66
22	Textile Mill Products	- 1.21	- .59	.22*	.77*
23	Apparel	1.90	- 3.06*	.35*	4.52
24 & 25	Lumber and Wood Products, and Furniture	- .77	- 1.27	- .89	- 1.54
27	Printing and Publishing	.91	1.41	1.89	.43
28	Chemicals	.79	2.84	1.10	- 1.63*
33	Primary Metals	.88	1.63	- 1.20*	1.00
19(exc.194),34	Fabricated Metals	2.75	- .36*	- .04*	1.55
35	Machinery, except Electrical	1.02	.76	3.01	1.17
36	Electrical Machinery	.99	7.15	.41	1.06
37	Transportation Equipment	1.02	.04	- .61*	.71
21,26,29-31	Other Nondurable Goods	3.53*	-10.86*	25.47	-2.35*
194,32,38,39	Other Durable Goods and Miscellaneous Manufacturing	.80	3.86	- 1.56*	1.84
C.(15-17) E.-J.(40-99)	SERVICE INDUSTRIES	1.08	1.30	.65	.72
C.(15-17)	Construction	1.64	1.23	- .54*	- .23*
E.(40-49)	Transportation, Communication, Utilities	- .72	1.09*	- 2.81	- 2.07
F.(50-59)	Wholesale and Retail	1.02	1.29	.58	1.16
G.(60-67)	Finance, Insurance, & Real Estate	1.05	1.03	.74	.77
H.(70-89)	Services	1.08	1.12	.95	.42
I.(91-93)	Government	1.15	.28	.38	1.48
J. 99	Nonclassified	1.01	1.23	.58	1.68
	TOTAL EMPLOYMENT	1.10	1.08	.48	.94

* Indicates that either 1) subarea employment in a given industry is growing, while that in the state is declining, in which case the index is entered as a positive number; or 2) subarea employment in a given industry is declining, while state employment is growing in which case the index is entered as a negative number.

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1960.

TABLE D-6

INDICES COMPARING SUBAREA EMPLOYMENT GROWTH WITH THAT IN THE STATE, 1950-1960

$$\text{Index} = \left[\frac{\text{Percent Growth in Subarea's Employment in an Industry, 1950-1960}}{\text{Percent Growth in State Employment in the Same Industry 1950-1960}}\right]$$

SIC	INDUSTRY	VERMONT Vt-1	Vt-2	Vt-R
A.(01-09)	AGRICULTURE, FORESTRY, FISHERIES	- 1.24	- 1.13	- .91
B.(10-14)	MINING	- .72	- 1.26	- .97
D.(19-39)	MANUFACTURING	.89	1.56	.94
20	Food and Kindred Products	1.81	.48	.96
22	Textile Mill Products	- .85	- 1.24	- 1.07
23	Apparel	- 4.27*	2.25	1.23
24 & 25	Lumber and Wood Products, and Furniture	- 1.64	.06*	- 1.00
27	Printing and Publishing	2.47	1.54	.54
28	Chemicals	- .44*	4.15	1.14
33	Primary Metals	- 2.91*	- 1.00*	4.68
19(exc.194),34	Fabricated Metals	.41	.26	1.06
35	Machinery, except Electrical	1.46	.34	.65
36	Electrical Machinery	8.90	- .21*	1.04
37	Transportation Equipment	2.60*	10.41*	- 1.14
21,26,29-31	Other Nondurable Goods	1.00	- .43*	1.64
194,32,38,39	Other Durable Goods and Miscellaneous Manufacturing	- 1.09*	53.37	.50
C.(15-17) E.-J.(40-99)	SERVICE INDUSTRIES	1.12	.39	1.07
C.(15-17)	Construction	.91	.35	1.14
E.(40-49)	Transportation, Communication, Utilities	.88*	- 1.18	- 1.22
F.(50-59)	Wholesale and Retail	.79	.66	1.11
G.(60-67)	Finance, Insurance, and Real Estate	1.24	1.36	.92
H.(70-89)	Services	1.25	.60	.99
I.(91-93)	Government	- 1.10*	- 1.38*	1.94
J. 99	Nonclassified	1.32	.68	1.12
	TOTAL EMPLOYMENT	1.51	- 1.97*	1.40

* Indicates that either 1) subarea employment in a given industry is growing, while that in the state is declining, in which case the index is entered as a positive number; or 2) subarea employment in a given industry is declining, while state employment is growing in which case the index is entered as a negative number.

Source: U.S. Bureau of the Census, Census of Population, 1950 and 1960.