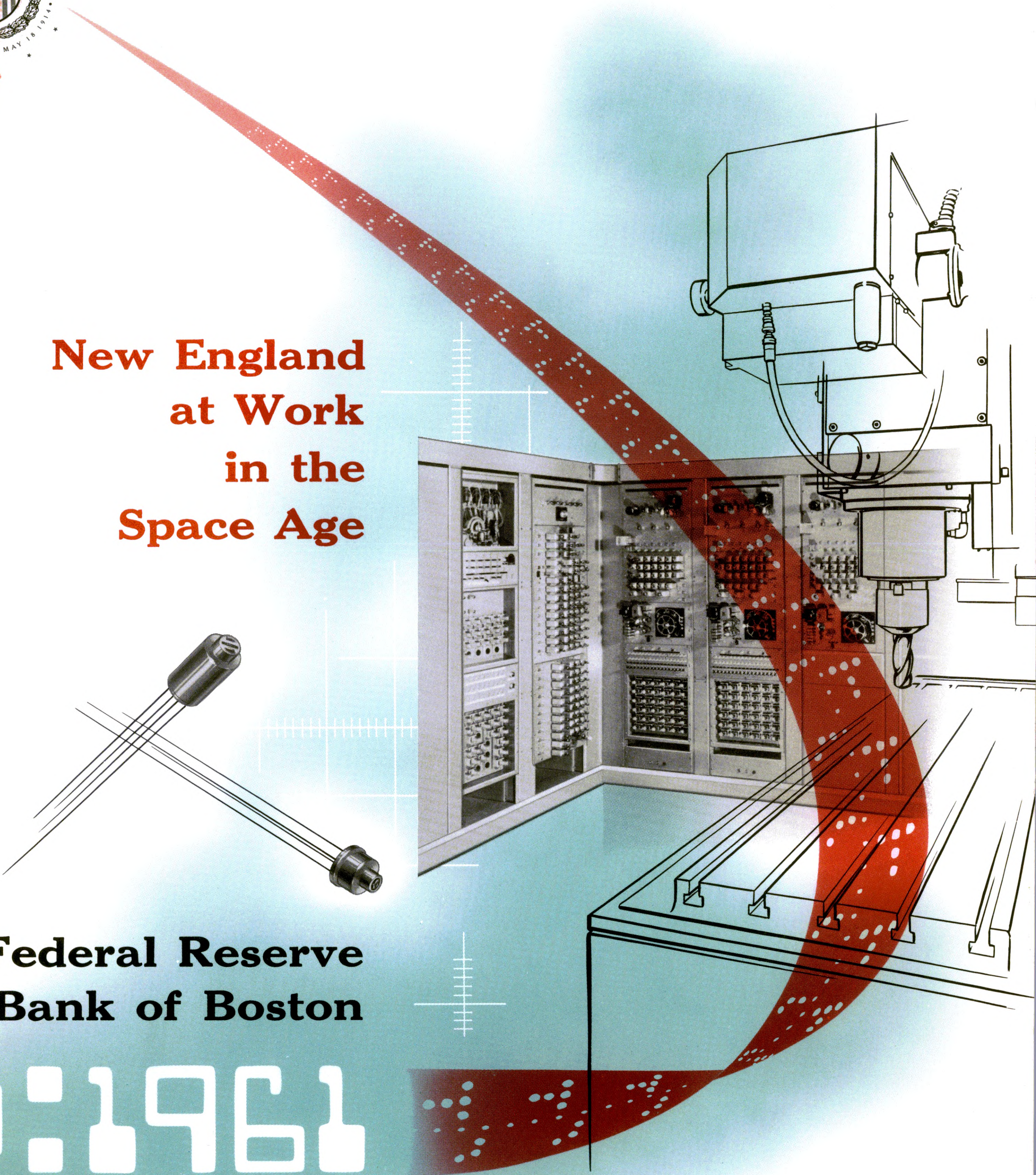
New England at Work in the Space Age



Federal Reserve Bank of Boston

1961

Annual Report

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New England at Work in the Space Age

To the Member Banks of the Federal Reserve Bank of Boston:

I am pleased to send you the 1961 Annual Report of the Federal Reserve Bank of Boston.

You will observe that, as in previous years, we have devoted much of the publication to analysis of some significant aspects of the New England economy.

In 1960 New England's per capita income exceeded that of the nation by more than 11 per cent. The following pages show that this high income is derived from the region's intensively developed manufacturing operations. They show further how New England industry has adjusted itself to major structural changes since World War II; how a relatively constant number of manufacturing workers have contributed importantly to the region's continuing economic expansion; and, finally, how New England manufacturers succeed in meeting competition in national markets despite their locational handicaps.

You will also find a special report which describes our new electronic check processing equipment and its probabilities for the future. The final pages present a summary of the Bank's operations during 1961.

As the special report on electronic processing reveals, 1961 was an eventful year in the operation of the Reserve Bank. It was also similarly eventful for many member banks. Our Directors join me in recording here our gratification for the continued efficient and dedicated service on the part of our officers and staff. We join also in thanks for the generous co-operation of our member banks in our mutual endeavor to provide an outstanding banking service to New England.

February 15, 1962

George H Ellis
President

Foreword

If he is visiting New England for the first time, the roving reporter and interpreter of the nation's business life is apt to find himself confused.

Here, he says, is a land with a brilliant tradition of economic, social, political and artistic innovation. Here is a region which led America into the industrial revolution and which has since served as an incubator of scientific discovery and technological change, and a bellwether of economic transformation. Here is an area which recently suffered a major industrial catastrophe but which now shows almost none of the scar tissue of that ordeal. Here is a land of diversified manufacturing in obvious good health, yet a land which appears to lack many of the prerequisites of such health.

As he travels about New England, talks with its people and digs into the record of its past and present, the reporter's perplexity is likely to be increased rather than resolved. Eventually the New England economy may seem to him a disturbing anomaly, like the bumblebee whose aerodynamics are such that theoretically it cannot fly.

Confronted with this economic mystery, the reporter-detective will draw up a fact sheet on the case. Among New England's assets he will find:

1. A regional per capita income now 11 per cent above that of the nation — a lead which, though varying with the years, has persisted for four-fifths of a century, the entire period for which there are reliable records.

2. Per capita liquid savings 34 per cent above the national average.

3. A standard of living which exceeds the nation's and those of most other regions by almost all accepted measures: New England is above the average in per capita ownership of capital stock and life insurance in force, in percentage of owner-occupied homes, in number of households with telephones, radios and television sets in operation, number of doctors per thousand of population, and so on.

4. A steady increase in population, with the natural birthrate supplemented by more people moving into the region than are moving out.

5. A constant expansion of the labor force and number of gainfully employed.

6. Such outward physical manifestations of well-being as new plant construction, expansion of suburban residential areas, new shopping centers and industrial parks, the rehabilitation of older urban areas, and the continuing growth of an already highly developed highway system.

The reporter's confusion, a condition which also confounds some New Englanders, arises out of his inability to equate this wealth and vigor with what seem to be almost crippling economic handicaps. These handicaps include:

1. New England's steadily declining share in most of the nation's economic activities and in most national vital statistics.

2. Its all-eggs-in-one-basket dependence on manufacturing for its livelihood.

3. The decline, both relative and absolute, in the size of its manufacturing workforce.

4. The handicaps imposed on its manufacturers by the region's basic lack of industrial raw materials, its higher than average costs of fuel and electric power, its distance from the na-

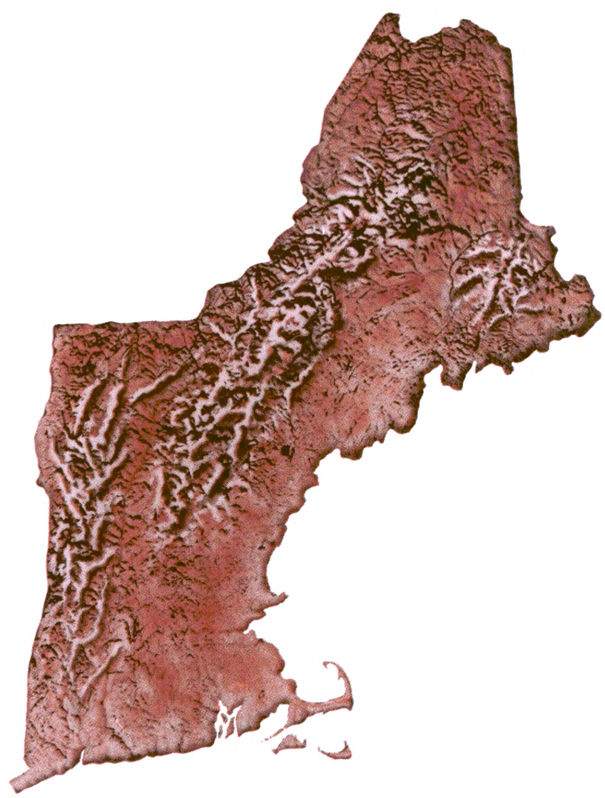
tion's population center and from rapidly expanding consumer markets.

5. The general antiquity of its overall manufacturing equipment and its lower than average investment rate in new capital equipment.

6. Its below average manufacturing wage and salary scale, its overall relatively lower "value added by manufacture," and the lower output per manhour of its manufacturing workers.

Here, says the bewildered reporter, is an enigma of the first order. Obviously the New England economic machine simply cannot work — and equally obviously it does.

The following pages attempt to explain New England's continuing high per capita income despite the decline in size of its manufacturing workforce and the handicaps imposed on the region's manufacturers by their geographical location.



Income in New England

If the total amount of personal income in the United States in 1960 was divided equally, each man, woman and child in the nation would have received $2,223. But on the other hand, if New Englanders divided their total personal income among themselves, the income of each New England resident would have been $2,471 — some 11 per cent more.

In short, New Englanders received more money per person than did the nation as a whole. And they did it in spite of the handicaps imposed by disadvantageous location and a general lack of natural resources.

In the quest for a *why* and a *how,* the region cannot point to above-average wages and salaries. In New England, where per capita personal income is 11 per cent above the nation's, workers in almost every type of economic activity earn less than their counterparts in the other seven regions of the country.

But if wages and salaries don't account for the New Englander's prosperity, at least part of the tale is told by other income factors.

High Proportion of Workers

The ratio of workers to total population is larger for New England than it is for the nation. This high rate of labor force participation is partly a result of New England's working women. Almost 40 out of every 100 women in the region over 14 years old earned wages or salaries in 1960. Nationally, the proportion was 36 out of every 100. New England's larger ratio of women workers has been traditional, due primarily to the types of jobs prevalent in the region — light manufacturing and the service industries are well suited to the abilities of women seeking to bolster the family income.

Low Agricultural Employment

Farming is less important in New England than in almost any other section of the country. And agricultural income, both nationally and regionally, is lower than per capita income in other occupations. Only 3.4 per cent of the New England labor force is in agriculture; and only about 1.1 per cent of its personal income, or $29 per capita, is derived from this source. In the nation, 10 per cent of the labor force are farmers, accounting for 3.7 per cent of the country's personal income, or $81 per capita.

In short, comparatively few New Englanders are employed in an activity which, of all the major sources of income, contributes the least. The New Englander's primary dependence on other sources of income is one factor that holds his per capita income comfortably above the national average.

Property Income

A sizable share of the New Englander's personal income comes from property ownership. Some 14.8 per cent of the region's personal income, or $365 per person, can be attributed to interest, rents and dividends as compared to 13 per cent, or $289 per person, for the nation.

New England, as a mature, industrialized society, has traditionally supplied capital for the development of other regions of the country and the world. In 1960 residents of the six New England states owned 10 per cent of the nation's capital stock although capital investment in the region was only about 6.6 per cent of the national figure.

Robert Frost, New England's poet laureate, tells of the Iowa farmer who stopped his Cadillac next to a Vermont field to watch the Yankee tilling his rocky soil. "Pretty hard way to make a living," commented the Iowan. "Oh, we get by," the Vermonter replied. "And what's left over we invest in Iowa farm mortgages."

As the rest of the country matured, the New Englander's property income lead diminished. The future is likely to see the gap grow narrower. But early industrial development and financial sophistication, combined with foresight and inbred thrift, still pay the New Englander a hefty share of rents and dividends.

Transfer Payments

Transfer payments from government play a proportionately large role in the makeup of regional income. The population of New England tends to be top-heavy. Currently, about 10.7 per cent of the region's population is 65 or older. In the nation, just 9.2 per cent are in this age group. As a result, New Englanders receive a proportionately larger share of social security and old-age benefits — almost 8 per cent of the area's personal income is derived from this source.

High Employment in Manufacturing

A discussion of these income factors leads through the back door to the fundamental answer to the enigma of New England prosperity. Property income and transfer payments are important to New Englanders, but important primarily as they augment the income of the region's manufacturing economy.

The manufacturing index continues to be an unfailing barometer of the region's economic well-being. Naturally, such service industries as insurance and finance, education and tourism help New England to pay for imported food and raw materials. But the region's bread-and-butter income depends on manufacturing, on workers who, with varying degrees of skill, turn metals, leather, fibers, plastics, pulp and other raw materials into distinctive and marketable finished products.

In terms of current production, manufacturing income accounts for 38 per cent of the area's nonagricultural current income, as compared to 30 per cent in the nation. More than 39 per cent of New England's nonagricultural labor force is in manufacturing, providing the region with a per capita wage and salary base of $677 — 40 per cent of all its wages and salaries, and 27 per cent of the region's total per capita personal income.

New England's dependence on manufacturing is clear: lacking its solid support, the economy of the region would founder.

Sources of Income in New England, per Capita 1960 Dollars

State & Region	Manufacturing Payroll	Trade and Services Payroll	Construction Payroll	Agricultural Income	Government Income Payment	All Other Sources
New England	$677	$474	$ 85	$ 29	$442	$764
Connecticut	920	510	111	27	365	930
Maine	426	303	65	100	418	588
Massachusetts	654	528	78	13	483	763
New Hampshire	576	340	77	30	425	626
Rhode Island	585	393	75	9	509	657
Vermont	384	327	77	113	345	613

Source: U.S. Department of Commerce, Office of Business Economics

New England Manufacturing

In 1880 New England stood third highest among the country's eight regions in per capita income. In 1960 it was still third highest — only $169 behind the states bordering the Pacific and $123 behind the second place mid-Atlantic group of New York, New Jersey and Pennsylvania.

All three of these regions are highly industrialized, but if they are measured in terms of their concentration on manufacturing, then the above order is reversed. In 1960 New England stood at the top with over 39 per cent of its nonagricultural employment in manufacturing; the mid-Atlantic maintained second place with 35 per cent; and the Pacific Coast stood third with 27 per cent. The U.S. average was 28 per cent. This same relationship prevailed with regard to 1960 manufacturing income. In New England more than 38 per cent of nonagricultural current income was derived from manufacturing; the mid-Atlantic was again second with 34; and the West Coast trailed with 27.

Clearly there is a correlation between high per capita income and a high degree of manufacturing activity. But the statistics create a paradox. One might anticipate that New England, the most intensively developed of these three industrialized regions, would stand first in per capita income instead of third. How does this disparity arise? Is it to be explained by the nature of New England's manufacturing activities, its comparative wage structure, its location with regard to raw material sources and consumer markets, or a combination of all three? How do these factors interact? How do they affect the ability of New England producers to maintain sales, profits and employment? What do they imply for the future?

New Englanders began making things for themselves and their neighbors in the very early years of the Colonies. In the 1640's the iron works at Saugus, Massachusetts, was producing some eight tons a week which went into kettles, anchors, cranes and wrought iron for blacksmiths. In a year when its entire population hardly exceeded that of a good-sized village, New Hampshire shipped abroad 20,000 tons of boards and 10 shiploads of masts. In 1700 a Salem vessel loaded for Spain and Portugal "12,000 feet of the noblest plank that ever was seen in America." Rhode Island butter, cheese, candles and pewter-ware were sold from Canada to the West Indies, and Caribbean sugar cane was turned into the New England rum which became famous in two hemispheres. The Yankee's early affluence grew out of a knack for making and trading things which was spurred by an invigorating climate and a religion which approved the accumulation of material wealth. In general, he was there first with the most.

The Long Head Start

Large scale manufacturing in America was the offspring of two major developments which occurred in New England in the 1790's, developments which set the pattern of regional industrialization until well into our time. One was the textile enterprise of Samuel Slater of Pawtucket, "the first in this country to set up a system of manufacture in which the successive steps of the skilled artisan were broken down into such simple components that a group of children could out-produce the finest craftsman." The second was the invention by Eli Whitney of New Haven of the system of interchangeable parts, the basic principle of mass production and the keystone of the whole edifice of modern industy.

Slater found the shortcut to quantity, says the historian, and Whitney joined quantity with quality.

In New England were born the machine tools which first helped transform the face of the region and then the face of the nation — the jig and fixture, the limit gauge, the milling machine, the copying lathe, the turret lathe, the automatic screw machine, the cylindrical and surface grinders. New England became the nation's machine shop, turning out for its own and manufacturers elsewhere a vast variety of specialized machinery for making textiles, shoes, guns, sewing machines, farm and household equipment, hardware, and a host of other necessities and luxuries demanded by a rapidly expanding population.

The Yankees made the most of the long head start given them by Slater, Whitney and their research-and-development-minded followers. Capitalizing their abundance of water power and mechanical ingenuity, drawing factory labor first from neighboring farms and then from abroad, they forced New England's industrialization at a steadily accelerating pace. The high cost of importing raw materials and exporting finished products was offset by constant innovation in manufacturing methods, by the increasing dexterity of their workers, by the drive and shrewdness of their salesmen. Success bred competition, competition bred progress. The proliferation of people, firms and products increased the demand for faster transportation facilities and swelled the rate of exchange of goods and services. Profits were plowed back and additional bank credit extended. More and more wheels turned faster.

New England soon became the country's first highly mechanized, highly diversified manufacturing area. Its industrial strength was drawn from three deep reservoirs: the persistent "accidents" of invention, the fertile imagination of its business management, its early and heavy investment in manufacturing plant and equipment. The interplay of these factors gave New England an industrial leadership which was not seriously challenged, and a momentum which was not slowed, until the early years of the 20th century.

With the development of steam and electric power, industrial management was largely released from the locational immobility imposed by the direct use of falling water as a source of power. Industry was freed to follow the westward-moving population center and take advantage of reduced delivery costs to fresher markets. It was freed to move closer to raw material sources and, in some cases, to supplies of cheaper labor. The geographic, economic and financial development of the nation proceeded with accelerating speed up to and especially after the Civil War. Railroads linked the East and West Coasts, and between the war years and 1893 more than 150 thousand miles of track were laid. There was large scale building of roads, factories, entire towns and cities. The corporate form became the dominant form of business enterprise. Technology not only increased production but brought into existence one new industry after another, with the telephone and internal combustion engine as outstanding examples. In many cases, instead of flowing back into old channels, profits were shifted to new enterprises in new areas. Finally, the enormous demands of World War I brought about unprecedented industrial expansion and relocation on a country-wide basis. Although its own manufacturing activities had grown constantly throughout the 19th century, New England's long lead was steadily whittled away.

New England's lead was cut down in other respects as well. In 1870 New Englanders comprised 9 per cent of the total national population. But 90 years later, New England could claim only 5.9 per cent despite an absolute gain of over 200 per cent. In 1899 New England had 18.5 per cent of the nation's manufacturing workers. The 1958 Census of Manufacturers, however, shows New England reduced to 8.9 per cent of the national total. Until recently, New England comprised 2.2 per cent of the nation's land area. When Alaska and Hawaii joined the Union, that figure dropped to 1.8 per cent. Similarly, New Englanders in 1880 received 11.4 per cent of the nation's total personal income. But in 1960 New England accounted for only 6.5

per cent, even though the region's personal income in constant (1929) dollars jumped during that span from \$1.7 billion to \$15.1 billion, a gain of 776 per cent.

The Years of Turmoil and Change

If one were to choose a single symbol to represent industrial New England at the end of World War I, that symbol would be the textile spindle. Despite the region's eminence in metalworking, its pre-eminence in shoe manufacture, and its otherwise amazing production diversity, nearly 30 per cent of its 1919 manufacturing employment was in textiles. In more than 100 cities and towns the textile industry was either the sole or the leading employer. Then came the years of the industrial locust. In the two decades from 1919 to 1939 New England lost 12.3 million cotton spindles, two-thirds of its total. Since the South's gain in this period was only 3.4 million, some nine million spindles were simply liquidated. With these went tens of thousands of Yankee jobs.

The United States' participation in World War II profoundly affected New England manufacturing. It slowed, temporarily, the 20-year erosion of textile production and employment. But of far greater significance, it began altering New England's manufacturing anatomy, changing production patterns which had long prevailed.

The instruments of warfare are mainly metal — fighting ships and fighting planes, land vehicles, guns and ammunition, torpedoes, bombs and missiles. New England was skilled in making many of these or their components, and under the bitter pressures of warfare, the region's principal metalworking industries were energized as never before. The ever broadening system of subcontracting fostered the growth of hundreds of smaller firms and upgraded the precision of their workmanship and their production techniques.

The need for constantly improving the quantity, quality, speed, range, accuracy and firepower of American weapons brought about an unprecedented collaboration by science and industry on research and development for the military. Government-sponsored programs ran into billions of dollars, with much of the work done by industry in its own laboratories or in conjunction with educational institutions. The frontiers of both pure and applied science were rapidly extended and many discoveries were promptly engineered into thousands of new devices and methods of producing them. Indeed, wartime research and development so influenced the American economy that one might say the arrival of peace saw the nation equipped with an almost wholly new technology.

New England was a prime contributor to the research and development as well as the straight production aspects of the war effort, especially through its metalworking wing. Old-line firms were reoriented and strengthened and new ones born in the manufacturing categories of machinery, electrical machinery (including electronics), instruments, transportation equipment (including aircraft and components) and others. The wartime shotgun wedding of research and industry settled down into a happy and fruitful marriage, particularly in the industrial subdivisions closely related to research in physics and chemistry — metallurgy, electronics, atomics, nucleonics, cryogenics and optics.

The nature and dimensions of the wartime metamorphosis of New England manufacturing are revealed in figures from the Census of Manufactures for 1939 and 1947. In 1939, employment in the metalworking industries was 316 thousand, 28 per cent of the region's manufacturing employment. By 1947 there were 558 thousand in metalworking, representing 38 per cent of all manufacturing jobs. In marked contrast, the region's textile employment was 281 thousand at both the beginning and end of the eight-year period, but during that time the number of textile

Table 1

Employment Changes, 1950-1960, in the United States

Industry	United States Employment 1950 (000)	United States Employment 1960 (000)	United States Percent Change 1950-1960	New England Employment 1950 (000)	New England Employment 1960 (000)	New England Percent Change 1950-1960
TOTAL, NONAGRICULTURAL	44,738	52,895 [6]	+ 18.2%	3,311.0	3,678.0 [1]	+ 11.1%
TOTAL, MANUFACTURING	14,967	16,336	+ 9.1%	1,453.5	1,421.3	− 2.2%
DURABLE GOODS	8,085	9,430	+ 16.6%	616.0	721.8	+ 17.2%
Ordnance	30	150	+400.0	13.2	26.9	+103.8
Primary Metals	1,200	1,186	− 1.2	56.0	50.1	− 10.5
Fabricated Metals	973	1,079	+ 10.9	104.4	93.2	− 10.7
Machinery (Except Electrical)	1,354	1,637	+ 20.9	160.9	167.0	+ 3.8
Electrical Machinery	877	1,305	+ 48.8	107.9	153.4	+ 42.2
Transportation Equip.	1,264	1,642	+ 29.9	52.8	105.1	+ 99.0
Instruments	248	350	+ 41.1	36.4	46.6	+ 28.0
Lumber and Wood Products	805	644	− 20.0	42.0	37.0	− 11.9
Furniture	369	388	+ 5.1	20.8	20.0	− 3.8
Stone, Clay and Glass	513	550	+ 7.2	21.6	22.5	+ 4.2
NONDURABLE GOODS	6,882	6,906	+ 0.3%	837.5	699.5	− 16.5%
Food	1,523	1,473	− 3.3	68.7	65.3	− 5.0
Textiles	1,292	946	− 26.8	273.3	125.5	− 54.1
Apparel	1,184	1,216	+ 2.7	84.8	84.7	− 0.1
Paper	485	562	+ 15.9	67.8	74.7	+ 10.2
Printing	738	894	+ 21.1	57.8	66.1	+ 14.4
Chemicals	682	875	+ 28.3	27.8	35.8	+ 28.8
Rubber and Plastics	246	259	+ 5.3	42.7	46.6	+ 9.1
Leather and Shoes	392	365	− 6.9	115.8	108.8	− 6.1
Miscellaneous	794	818	+ 3.0	98.8	92.0	− 6.9
TOTAL, NONMANUFACTURING [5]	29,771	36,559	+ 22.8%	1,857.5	2,256.7	+ 21.5%
Construction	2,333	2,771	+ 18.8	144.5	163.9	+ 13.4
Transportation and Other Public Utilities	3,977	3,902	− 1.9	211.6	205.5	− 2.9
Wholesale and Retail Trade	9,645	11,643	+ 20.7	638.5	724.8	+ 13.5
Finance, Insurance and Real Estate	1,824	2,485	+ 36.2	138.8	190.6	+ 37.3
Service and Miscellaneous	5,077	6,637	+ 30.7	347.2	503.9	+ 45.1
Government	6,026	8,456	+ 40.3	376.9	468.1	+ 24.2

[1] New England and Middle Atlantic States data has been adjusted for change in Standard Industrial Classification Code.

[2] Pacific States data has not been adjusted for change in Standard Industrial Classification Code.

[3] Pacific States industry data does not add to durable and nondurable totals because some individual industry data has been withheld.

[4] Middle Atlantic States data for Miscellaneous Industry includes Ordnance.

and in the New England, Mid-Atlantic, and Pacific Regions

Middle Atlantic			Pacific			
Employment 1950 (000)	Employment 1960 (000)	Percent Change 1950-1960	Employment 1950 (000)	Employment 1960 (000)	Percent Change 1950-1960	Industry
10,920.7	11,920.1 [1]	+ 9.2%	4,317.0	6,211.1 [2]	+ 43.9%	TOTAL, NONAGRICULTURAL
4,058.1	4,030.3	− 0.7%	1,069.1	1,676.3	+ 56.8%	TOTAL, MANUFACTURING
1,817.9	1,983.1	+ 9.1%	623.6 [3]	1,113.6 [3]	+ 78.6%	DURABLE GOODS
——	——	——	0.7	60.2	+8,500.0	Ordnance
391.5	365.0	− 6.8	54.0	64.1	+ 18.7	Primary Metals
247.7	272.8	+ 10.1	59.2	103.1	+ 74.2	Fabricated Metals
295.3	329.3	+ 11.5	58.9	96.6	+ 64.0	Machinery (Except Electric)
324.8	418.1	+ 28.7	29.5	169.0	+ 472.9	Electrical Machinery
164.3	186.3	+ 13.4	137.5	323.1	+ 135.0	Transportation Equip.
124.6	161.6	+ 29.7	8.6	25.4	+ 195.3	Instruments
47.8	37.3	− 22.0	190.7	171.4	− 10.1	Lumber and Wood Products
73.8	69.9	− 5.3	31.8	36.5	+ 14.8	Furniture
148.1	142.8	− 3.6	34.8	48.2	+ 38.5	Stone, Clay and Glass
2,240.2	2,047.2	− 8.6%	445.5 [3]	562.7 [3]	+ 26.3%	NONDURABLE GOODS
308.2	301.2	− 2.3	176.2	213.7	+ 21.3	Food
293.3	162.5	− 44.6	12.4	8.5	− 31.5	Textiles
651.2	556.2	− 14.6	51.2	65.6	+ 28.1	Apparel
125.3	135.7	+ 8.3	33.1	52.3	+ 58.0	Paper
234.4	267.0	+ 13.9	60.2	85.1	+ 41.4	Printing
203.2	226.0	+ 11.2	29.6	51.1	+ 72.6	Chemicals
42.3	43.1	+ 1.9	13.1	25.2	+ 92.4	Rubber and Plastics
115.6	101.4	− 12.3	5.4	5.5	+ 1.8	Leather and Shoes
266.7 [4]	254.1 [4]	− 4.7	63.0	53.3	− 15.4	Miscellaneous
6,862.6	7,889.8	+ 15.0%	3,247.9	4,534.8	+ 39.6%	TOTAL, NONMANUFACTURING [5]
472.6	512.0	+ 8.3	294.8	362.4	+ 22.9	Construction
960.9	918.3	− 4.4	412.3	455.0	+ 10.4	Transportation and Other Public Utilities
2,180.4	2,479.0	+ 13.7	1,040.9	1,397.0	+ 34.2	Wholesale and Retail Trade
581.1	722.6	+ 24.4	192.1	309.2	+ 61.0	Finance, Insurance and Real Estate
1,311.1	1,707.1	+ 30.2	546.4	862.1	+ 57.8	Service and Miscellaneous
1,165.1	1,478.0	+ 26.9	724.9	1,114.3	+ 53.7	Government

[5] Total Nonmanufacturing data includes Mining and other occupations.
[6] United States data for 1960 does not include Alaska and Hawaii.

Sources:

1) United States Department of Labor — A) United States Bureau of Labor Statistics; B) New England Bureau of Labor Statistics
2) State Bureaus of Employment Security in New Jersey, New York, Pennsylvania, California, Oregon and Washington.

jobs declined from 25 per cent of manufacturing employment in 1939 to only 19 per cent in 1947.

The opening of the 1950's once again involved the nation in open warfare and again brought on the pressures of war production. The decade continued with the resurgence and then the intensification of the cold war with communism and with the extraordinary build-up of the nation's defense capacity. It closed with the spectacular birth of the Space Age. With New England's men of science and industry working in increasingly close co-operation, the region's metalworking manufacturers played important roles in these developments. At the same time they demonstrated a singular facility in adapting the results of scientific research and development work — whether sponsored by the government or private industry — to the production of an ever lengthening list of hard goods for both industrial and individual consumers in a society which daily became more complex, mechanized, automated.

The 1950's saw continuation of the regional trends in manufacturing employment which had prevailed through the 1940's, with the decade reinforcing the dominance of metalworking in the industrial structure. The 642 thousand employed in the metalworking industries in 1960 represented 45 per cent of all maufacturing employment, a major increase over the 28 per cent of 1939. During the same period, the textile industry lost 148 thousand jobs and its percentage of manufacturing employment plummeted from 19 to only 8. These and other changes in the structure of regional manufacturing employment are shown in Table 1. In considering the 1950 and 1960 figures, it should be remembered that 1950 was a year of steadily expanding economic activity, while 1960 was the beginning of a recession.

The loss of the greater part of New England's once powerful textile industry — an industrial migration without parallel in the nation's history — brought adversity to dozens of the region's cities and towns and to tens of thousands of persons. Community and personal rehabilitation was difficult. The blaze of publicity given the textile situation and the problems it provoked frequently obscured New England's successful overall adaptation to changing economic conditions and needs at home and in the nation.

The textile decline could have been catastrophic. Had it not been for the gain of 111 thousand jobs in metalworking firms, unemployment in textiles undoubtedly would have spread to the service industries which depend for survival upon the expenditures of manufacturing employees. The net result might have been a total loss of well over 300 thousand jobs, widespread unemployment, depressed wages, and substantial outmigration. The facts are very different — unemployment declined and wages increased. There was even a small amount of immigration between 1950 and 1960.

By the end of the 1950's the region had all but counterbalanced its loss of textile jobs through expansion in other areas of manufacturing. Durable goods employment, paced by transportation equipment, electronics and other research-based industries, showed a gain over the decade of 17 per cent, as did the nation. In the standard categories of nondurables other than textiles, regional employment, as is seen in Table 2, showed gains everywhere except in shoes and leather, "miscellaneous," food and apparel.

Employment Changes and Their Significance

New England thus rode out the storm of the textile migration. In 1960 its total manufacturing employment averaged 1,421,300, a figure some 32 thousand below that of 1950. During that period, however, employment in trade, construction, finance, government and other service industries rose by 399 thousand. New England's growth in such areas during the decade was 21.5 per cent.

These regional employment figures for the 1950's

Table 2

New England Manufacturing Employment

	1950-1960 Employment Gain or Loss in thousands of jobs	1960 Average Hourly Wage
Growing Industries		
DURABLE GOODS		
Transportation Equipment	+52.3	$2.67
Electrical Machinery (and Electronics)	+45.5	2.04
Ordnance	+13.7	2.33
Instruments	+10.2	2.13
Machinery (Except Electrical)	+ 6.1	2.38
Stone, Clay, Glass	+ 0.9	2.31
NONDURABLE GOODS		
Printing	+ 8.3	2.57
Chemicals	+ 8.0	2.42
Paper	+ 6.9	2.13
Rubber (and Plastics)	+ 3.9	2.24
Declining Industries		
DURABLE GOODS		
Fabricated Metals	−11.2	2.15
Primary Metals	− 5.9	2.45
Lumber & Wood Products	− 5.0	1.59
Furniture	− 0.8	1.89
NONDURABLE GOODS		
Textiles	−147.8	1.72
Miscellaneous	− 6.8	1.76
Leather & Shoes	− 7.0	1.74
Food	− 3.4	2.00
Apparel	− 0.1	1.60

Source: U.S. Department of Labor, Bureau of Labor Statistics

raise a number of fundamental questions. Manufacturing is the mainstay of the New England economy and has been for more than a century. With no growth in the volume of manufacturing employment during the decade, indeed, in the face of a slight decline, how is one to account for the region's extensive economic expansion over the period? How could a diminishing number of manufacturing workers provide primary support for the region's 10-year increase of more than one million in population? How could this group so stimulate the economy as to assist in the creation of over a third of a million new jobs in nonmanufacturing? And how could they not only generally support more people on more jobs, but help them to an increase of almost 25 per cent in *real* per capita income over a single decade?

Part of the answer to these questions is that, in common with manufacturing workers throughout the nation, the New England manufacturing worker produced a greater volume of goods per hour worked and, thereby, experienced a substantial gain in real wages over the past decade. Expressed in constant dollars, average hourly earnings have risen by a fourth over the past decade for the production worker in New England's manufacturing sector, as shown in Table 3.

This gain in real wages came about largely as a result of the rise in output per manhour, or productivity, in manufacturing. Nationally, manufacturing output per manhour increased at an average rate of 2.9 per cent per year in the 1950's. New England's manufacturing sector participated substantially in this rise in productivity.

A portion of the wage gain was due to the employment shifts, shown in Table 2, that occurred over the past decade among the region's major manufacturing industries. During the 1950's there was a movement of workers from lower paying to higher paying jobs. In New England, as in the nation, workers in durable goods industries are paid a higher average hourly wage than are workers in nondurable goods.* Table 3 shows that in both

*The term *wage* is subject to varying interpretations. The wage may be considered the amount earned per hour, per week or per month. It may or may not include amounts paid into retirement funds or paid for vacations and other fringe benefits. In the following pages, most wage rate comparisons will be based upon average hourly earnings including overtime pay but excluding fringe benefits. Data limitations generally preclude a broader study. However, other wage data will be presented when they are available.

1950 and 1960 employees in durable goods manufacturing received, on the average, a higher average hourly wage than those in nondurable goods industries. It also shows that the wage differential has widened between the two sectors due to a greater increase in real wages in durables than in nondurables. Of course there is, and has always been, a wide range of hourly earnings within both the durables and nondurables groups, although the tops and bottoms of each are roughly comparable. And of course the relationship between annual take-home pay and average hourly wages varies widely not only throughout the nation but in its industries as well.

Over the past decade the relative importance of durable goods industries as a source of manufacturing employment has increased in both New England and the nation. New England employment increased in six of the 10 classifications of durable goods manufacturing from 1950 to 1960. It declined in four. The net change for the period was a gain of 105.8 thousand jobs, an increase, as noted above, of 17 per cent. About half of the new

Table 3
New England Increases in Real Average Hourly Wages

(In 1950 dollars)

Industry	1950	1960	Per Cent Increase
Total Manufacturing	1.35	1.70	25.9
Durable Goods	1.42	1.83	28.9
Ordnance	1.53	1.89	23.5
Lumber and Wood	1.05	1.29	22.9
Furniture	1.26	1.54	22.2
Stone, Clay and Glass	1.55	1.88	21.3
Primary Metals	1.61	1.99	23.6
Fabricated Metals	1.37	1.75	27.7
Machinery (Except Electrical)	1.51	1.93	27.8
Electrical Machinery	1.36	1.66	22.1
Transportation Equipment	1.62	2.17	34.0
Instruments	1.33	1.73	30.1
Nondurable Goods	1.30	1.57	20.8
Food	1.25	1.62	29.6
Textiles	1.31	1.40	6.9
Apparel	1.11	1.30	17.1
Paper	1.32	1.73	31.1
Printing	1.72	2.09	21.5
Chemicals	1.48	1.97	33.1
Rubber and Plastics	1.36	1.82	33.8
Leather and Shoes	1.24	1.41	13.7
Miscellaneous	1.21	1.43	18.2

Source: U.S. Department of Labor, Bureau of Labor Statistics

durable jobs, 52.3 thousand, came in transportation equipment (mainly in Connecticut's defense-stimulated aviation industry), which pays the highest average hourly wages in all New England manufacturing. The second largest gain in durables employment, 45.5 thousand, occurred in electrical machinery (mainly in electronics in Massachusetts), which pays wages below the average for the durables group.

The gain in New England's durables employment came in part out of, and helped to offset, severe losses in nondurables jobs, with textiles, as has been noted, the principal loser. Although there were employment increases in four of the nine nondurables classifications applicable to New England, losses in the other five resulted in an overall loss for all nondurables of 138 thousand jobs, a drop of 16.5 percent. Most of the New England losses occurred in the three nondurables categories paying the lowest wage.

It is estimated that the shift in the nature of the region's manufacturing employment shown in Table 2 accounted for 22.8 per cent of the gain in real wages which took place in New England in the 1950's. The comparable change for the United States was only 17.5 per cent.

The structural reorganization of New England manufacturing and the gains in real wages help to explain the region's present industrial strength. And they also help to explain manufacturing's substantial contribution to New England's continuing economic progress despite the decline in actual number of manufacturing workers.

While these changes were taking place within the manufacturing sector of the region's economy, 399 thousand new nonagricultural, nonmanufacturing jobs were created in New England. Indeed, all of the region's recent absolute employment growth has occurred in such private and public service industries as schools, hospitals, social agencies, communications, construction, recreation facilities, trade, the professions, finance, assorted business services and others. Most of these are steadily broadening the work opportunities of women. New England's increase in personal services and "miscellaneous" employment over the 1950's was 45 per cent against a national increase of only 31 per cent. Much of this expansion reflects the rising importance of social and personal services in a higher-income urban and suburban economy based on manufacturing.

Manufacturing Wage Differentials Within New England

This discussion of industrial New England has been conducted almost entirely in terms of the region as a whole. But while manufacturing is the largest single source of employment and income in each of the New England states, the states themselves are in different stages of industrial development, show considerable variety of manufactured products, have differing wage scales for comparable jobs, and have benefited or suffered in varying degrees from the industrial changes which have taken place in recent years. All six states were adversely affected by the textile decline, but Connecticut suffered little in contrast to Massachusetts. Maine and New Hampshire were the beneficiaries of the northward movement of the shoe and leather industry from Massachusetts. The great growth of the electronics division of New England metalworking took place largely in the Bay State. The region's 52 thousand new jobs in transportation equipment were created mainly in Connecticut as part of the nation's vast expansion of aviation for war and peace.

In general, labor is the largest single cost in manufacturing. Variations in labor costs clearly affect the location of industrial establishments within New England. They also play a vital part in enabling New England manufacturers to compete with producers elsewhere, as will be shown later.

The Boston Reserve Bank recently completed an extensive study of average hourly metalworking wages in New England cities and compared them with each other and with those of cities in other parts of the country. Space precludes a description of the techniques employed in the study, but here are some of the findings. As would be expected, metropolitan Boston's metalworking wage levels are among the highest of the cities in New England. But Boston is not New England. Wages for comparable work in Manchester and Concord, New Hampshire, in Burlington, Vermont, and southern Maine range between 10 to 30 per cent lower than Boston wages. The average in these northern cities is about 20 per cent below Boston's figure. Providence, Rhode Island, runs 3 to 4 per cent below Boston while the Worcester rate is only 2 to 3 per cent lower. Rates in New Haven, Connecticut, are almost identical with those of Boston, but the averages for Hartford and Spring-

Table 4

Largest Manufacturing Industry Groups

New England and Each New England State—1958

	Employees (Number)	Manufacturing Payroll ($000)	Establishments (Number)	Value Added by Manufacture ($000)
New England				
1. Machinery, except electrical	150,126	$765,380	2,695	$1,993,402
2. Textile mill products	124,037	449,569	1,270	704,240
3. Electrical machinery	118,489	542,503	755	1,005,877
4. Leather and leather products	108,625	368,868	1,085	573,158
5. Transportation equipment	98,831	560,878	453	873,274
6. Fabricated metals	96,038	454,934	2,308	766,543
7. Miscellaneous manufacturers	90,250	384,824	1,773	669,927
Maine				
1. Leather and leather products	21,519	68,246	115	101,125
2. Pulp, paper and products	17,019	98,305	44	179,121
3. Textile mill products	13,575	43,333	74	65,697
4. Lumber and wood products	12,997	38,688	1,529	59,684
5. Food and kindred products	11,462	37,131	385	86,209
6. Transportation equipment	5,324	25,732	81	42,901
New Hampshire				
1. Leather and leather products	20,256	65,843	117	97,339
2. Textile mill products	13,131	44,929	97	69,614
3. Electrical machinery	7,726	31,407	35	55,546
4. Machinery, except electrical	7,147	32,607	67	59,727
5. Pulp, paper and products	6,213	29,038	46	58,465
6. Lumber and wood products	5,289	17,580	435	24,680

Source: U.S. Department of Commerce, Bureau of the Census, Census of Manufacturers field-Holyoke in the Connecticut River Valley are about 5 per cent higher.

The significance to a manufacturer of these and other wage differentials in New England will vary according to the nature of his products and his production methods. For an assembly plant using predominantly semi-skilled workers, a northern New England location might bring savings of from 4 to 8 per cent of total costs as compared to Boston. Undoubtedly, lower labor costs have played an important part in leading a number of electronics and other light metalworking firms to establish plants in northern New England.

Against possible savings in labor costs, however, the manufacturer must balance the problem of a generally thinner labor market and the probable scarcity of specialized technicians, engineers and research scientists in northern New England.

	Employees (Number)	Manufacturing Payroll ($000)	Establishments (Number)	Value Added by Manufacture ($000)
Vermont				
1. Machinery, except electrical	6,134	29,538	54	41,155
2. Stone, clay and glass products	4,200	17,313	147	26,623
3. Lumber and wood products	3,826	11,168	386	17,786
4. Food and kindred products	2,876	11,651	139	34,294
5. Pulp, paper and products	2,364	10,358	22	25,116
6. Printing and publishing	2,178	8,788	91	14,244
7. Apparel and related products	1,882	5,053	28	7,672
Massachusetts				
1. Electrical machinery	73,352	339,410	414	607,868
2. Machinery, except electrical	66,266	346,693	1,266	558,375
3. Leather and leather products	61,062	215,004	751	342,203
4. Apparel and related products	59,586	178,071	1,246	282,747
5. Textile mill products	52,983	197,226	540	323,814
6. Food and kindred products	48,045	206,247	1,348	409,697
7. Fabricated metals	40,941	195,247	1,026	356,402
Rhode Island				
1. Textile mill products	27,980	101,662	253	147,394
2. Miscellaneous manufacturers	23,096	77,604	752	129,336
3. Primary metals	8,577	40,870	80	74,874
4. Machinery, except electrical	8,249	39,344	244	60,989
5. Fabricated metals	7,899	34,352	333	56,013
6. Rubber products	7,589	32,295	61	70,697
7. Food and kindred products	6,467	27,478	253	50,012
Connecticut				
1. Transportation equipment	70,612	399,899	154	586,552
2. Machinery, except electrical	59,468	302,701	973	493,082
3. Fabricated metals	43,496	208,542	808	324,734
4. Electrical machinery	31,687	150,474	253	302,857
5. Primary metals	25,501	137,066	220	244,344
6. Miscellaneous manufacturers	23,154	108,908	294	201,230
7. Apparel and related products	17,828	56,037	355	97,364

Skilled wage rates in greater Boston are among the highest in the entire region, yet many research-based industries and industrial research and development firms have moved to the Boston area in the last decade. In these fields the important consideration is said to be the availability rather than the cost of skilled labor and technicians.

Labor Migration Within New England

If the labor cost advantages offered the manufacturer by a northern New England location thus warrant his careful study, there appears to be little doubt about the advantages which southern New England offers the manufacturing worker. For decade after decade the northern tier of states has exported people to the southern tier. Although birthrates are higher in northern New England, population gains in Maine and Vermont have run below those of the southern states, as may be seen in Table 5.

The pattern of population changes within New England is generally similar to that of the country as a whole. There is constant migration from rural areas and small towns to the steadily expanding metropolitan areas. Of course there are exceptions — the densely populated urban state of Rhode Island (long heavily geared to the textile industry) has grown slowly in recent decades, while several urban areas in Vermont and New Hampshire have grown rapidly. A major stimulus of this continuing movement southward and cityward is probably the expectation of wider job opportunities at higher wages and salaries.

Table 5

New England Population Increases

1930-1960
(in 000's)

	1930	1940	Per Cent Change 1930-1940	1950	Per Cent Change 1940-1950	1960	Per Cent Change 1950-1960
New England . . .	8,166	8,437	+ 3.3	9,314	+10.4	10,509	+12.8
Maine	797	847	+ 6.3	914	+ 7.9	969	+ 6.0
New Hampshire . .	465	492	+ 5.8	533	+ 8.3	607	+13.9
Vermont	360	359	− 0.3	378	+ 5.3	390	+ 3.2
Massachusetts . . .	4,250	4,317	+ 1.6	4,690	+ 8.6	5,149	+ 9.8
Rhode Island . . .	687	713	+ 3.8	792	+11.1	859	+ 8.5
Connecticut . . .	1,607	1,709	+ 6.3	2,007	+17.4	2,535	+26.3

Source: U.S. Department of Commerce, Bureau of the Census, *Census of Population,* 1960.

The Region's Wage Advantage

The preceding pages have sketched the transformation which has taken place in New England manufacturing since World War II. They have discussed significant changes in the relative importance of the region's manufactured products; the ever broadening application of research and engineering to the development of both products and techniques for making them; rises in productivity; and the steady upgrading of the manufacturing workforce and the increases it has received in real purchasing power. By means of these, manufacturing has remained dominant in the region's economic life and contributed vigorous support to the expansion of New England's population, its rise in nonmanufacturing employment, and its increase in real per capita income.

But there is an issue which transcends all of this in importance. The New England manufacturer operates in a land with very few natural resources. He pays relatively high costs for importing raw materials and delivering finished products. In general, his fuel costs are 50 per cent higher and his electric power costs one third greater than the national average. What, then, is there in the New England industrial situation which enables him to meet national competition? Or, to put it another way, how does he manage to stay in business and provide profits and payrolls? Where and how does he trim other costs to counterbalance his special "locational" cost disadvantages?

New England's Labor Intensive Manufacturing Economy

It is a fairly safe generalization, subject to the usual numerous exceptions, that New England's present day manufacturing is *labor intensive*. In essence, this means that the nature of the products produced in New England and the methods used in producing them call for a higher ratio of people to machines than is customary for the nation's manufacturing as a whole. Technically, a labor intensive economy is one requiring a high input of manhours for each dollar of output. Such an economy is the antithesis of one which relies relatively more on the services of capital plant and equipment than on the services of labor. Examples of capital intensive manufacturing processes are the highly mechanized mass production of steel, automobiles, certain consumer appliances, television sets, and petroleum products. Apparel, shoes, printing, machinery, and transportation equipment other than automobiles are produced through labor intensive processes. An extreme example of the latter is the carefully tailored production of one-of-a-kind atomic submarines.

The intensity of an industry can be measured by dividing the number of dollars invested in plant and equipment by the number of production workers. In the capital intensive petroleum industry, the average per production worker is $119 thousand; while in the labor intensive apparel industry the average is only $3.4 thousand. The present average for all manufacturing in the nation is about $16 thousand of plant and equipment for each production worker.

There is no hard and fast division between capital intensive and labor intensive goods. A product may be either, according to its state of development and method of production. In the early 1950's, soon after its invention, the transistor was certainly a labor intensive product; its parts were largely hand made and hand assembled, and the price, in terms of the raw materials involved, was high. Later, machines were devised to do much of the manufacturing and quality testing formerly done by hand, greatly increasing production volume and decreasing the cost per unit. The number of units manufactured in 1961 rose 51 per cent over 1960, the sales dollars increased 2 per cent, and the average unit price dropped 31 per cent. In 1961 the average cost of the raw materials in a transistor was 12.5 cents and the average retail price was $1.66. As a result of invention and enormous expenditure for capital plant and equipment, the transistor in only a few years was changed from a labor intensive product to a mass produced, capital intensive product.

Since 1920 annual investment per production worker has been lower in New England than in the United States. In 1939 New England manufacturers invested at 70 per cent of the national rate. The proportion declined to 68 per cent in 1947, to 62 per cent in 1954, and rose again to 64 per cent in 1958. Since the region's share of the nation's manufacturing employment has dropped by less than 3 percentage points since 1939, it is unlikely that this decline in the amount of investment per production worker could have occurred without a corresponding decline in capital intensity. Thus, the evidence indicates that capital intensity has declined over a 20-year period.

There is additional evidence that New England industries are characterized by high labor intensity. The amount of value added to the product per manhour worked tends to be lower in New England industries than in their national counterparts. Lower labor productivity implies less capital intensity since the amount of labor saving machinery available per worker has a direct relationship to the worker's productivity. In 1947 value added per manhour in New England manufacturing was 11 per cent lower than in the United States. In 1958 the region was 19 per cent below the national average.

These facts are explained in part by the composition of manufacturing in New England. Capital intensive industries such as steel, petroleum and auto manufacturing are almost non-existent in the region. Labor intensive industries such as electronics and aircraft are expanding.

Even when adjustments were made to compensate for the difference in industrial structure of the region and the nation, New England's labor productivity in 1947 was 6 per cent lower than the nation's. The gap between the region and the country increased by 2 percentage points between 1947 and 1958. This means that New England's labor productivity is now about 8 per cent lower than that of the nation.

New England has become increasingly labor intensive in the postwar period. But this is not to imply that each of the region's industries has lower labor productivity and produces more labor intensive products than does its counterpart in the nation as a whole. For example, New England's textile and apparel operations are above the nation's in capital intensity and labor productivity.

Nor does this mean that New England has none of the relatively capital intensive industries such as fabricated metals, electrical machinery, paper, and stone, clay and glass.

New England's lower labor productivity is in no way a reflection on the basic skills and industriousness of the region's workers. It is the consequence, rather, of the nature of the goods produced, the degree of precision workmanship required, the time consumed in quality control and inspection, and similar factors. The production of a jet engine calls for a far greater expenditure of skilled manpower than the production of a carload of chewing gum.

National and Interregional Wage Differentials

For a variety of reasons, including tradition and experience, New England manufacturers in general now appear to be concentrating on the production of labor intensive goods. One of the reasons is the indubitable cost advantage which they derive from a wage scale pattern which is below those of the nation and most other regions. This low wage pattern helps substantially to offset the special costs imposed by New England's geographical position and its lack of natural resources and thus helps the region's producers to compete in national markets. The extent of this advantage can be seen in Tables 5 and 6.

In 1960 New England's average hourly wage for all manufacturing was 20 cents, or 8.7 per cent, below the average for the nation. It will be observed in Table 5 that in only two of the 10 classifications of durables manufacturing were New England wages above those of the nation. Regional employment in these two industries is relatively small, and New England's margin over the nation is also small. In nondurables, New England wages substantially exceeded those of the nation only in textiles and leather and shoes.

Table 6

Comparison of 1960 United States and New England Hourly Wages

Industry	U.S. Av. Hourly Wage	N.E. Av. Hourly Wage	Wage Differential N.E. and U.S. (cents)	Wage Differential N.E. and U.S. (per cent)
TOTAL MANUFACTURING	$2.29	$2.09	−.20	− 8.7%
DURABLE GOODS	2.43	2.25	−.18	− 7.4%
Ordnance	2.64	2.33	−.31	−11.7
Primary Metals	2.83	2.45	−.38	−13.4
Fabricated Metals	2.45	2.15	−.30	−12.2
Machinery (Except Electrical)	2.57	2.38	−.19	− 7.4
Electrical Machinery	2.30	2.04	−.26	−11.3
Transportation Equipment	2.76	2.67	−.09	− 3.3
Instruments	2.36	2.13	−.23	− 9.7
Lumber and Wood Products	2.03	1.59	−.44	−21.7
Furniture	1.86	1.89	+.03	+ 1.6
Stone, Clay and Glass	2.28	2.31	+.03	+ 1.3
NONDURABLE GOODS	2.08	1.93	−.15	− 7.2%
Food	2.18	2.00	−.18	− 8.3
Textiles	1.62	1.72	+.10	+ 6.2
Apparel	1.56	1.60	+.04	+ 2.6
Paper	2.28	2.13	−.15	− 6.6
Printing	2.77	2.57	−.20	− 7.2
Chemicals	2.51	2.42	−.09	− 3.6
Rubber and Plastics	2.52	2.24	−.28	−11.1
Leather and Shoes	1.64	1.74	+.10	+ 6.1
Miscellaneous	1.95	1.76	−.19	− 9.7

Source: U.S. Department of Labor, Bureau of Labor Statistics

Table 7 compares New England wages with those of the neighboring mid-Atlantic states and with the Southeast and the Pacific Coast. New England's wage advantage over two of these regions is clear-cut. For all manufacturing, mid-Atlantic wages are 11 per cent over New England's. They are higher in all categories but one, leather and shoes. The difference is even more marked on the Pacific Coast. Here the average for all manufacturing runs to 25.5 per cent above New England. In electrical machinery (including electronics) Pacific wages average 32 per cent above those of New England.

The New England-Southeast differential shown in Table 7 has long persisted, although the gap in textile wages is slowly narrowing. In 1960 the Southeast wage for all manufacturing was 25.6 per cent below the nation's and 18.7 per cent below New England's. This differential accounted in

Table 7

Comparison of 1960 Production Worker Average Hourly Earnings in the Mid-Atlantic, Pacific and Southeast Regions with New England Earnings

Industry	N.E. Av. Hourly Wage 1960	Mid-Atlantic Compared to N.E. (per cent)	Pacific Compared to N.E. (per cent)	Southeast Compared to N.E. (per cent)
ALL MANUFACTURING	$2.09	+11.0	+25.4	−18.7
DURABLE GOODS	2.25	+12.0	+19.1	−20.4
Ordnance	2.33	—	—	—
Primary Metals	2.45	+15.5	+16.3	+ 6.1
Fabricated Metals	2.15	+14.9	+27.0	− 4.7
Machinery	2.38	+ 8.0	+13.0	−21.4
Electrical Machinery	2.04	+12.7	+31.9	− 3.9
Transportation Equip.	2.67	+ 4.5	+ 3.7	− 8.2
Instruments	2.13	+21.1	+17.4	—
Lumber and Wood Products	1.59	+20.1	+61.6	−18.9
Furniture	1.89	+10.6	+29.6	−22.8
Stone, Clay & Glass	2.31	+ 4.3	+14.7	−22.5
NONDURABLE GOODS	1.93	+10.4	+29.0	−14.5
Food	2.00	+11.5	+22.5	−23.5
Textiles	1.72	+ 5.8	+10.5	−11.0
Apparel	1.60	+15.0	+ 8.8	−23.1
Paper	2.13	+ 2.8	+19.7	+ 8.4
Printing	2.57	+12.4	+30.0	− 7.8
Chemicals	2.42	+ 3.7	+13.6	− 6.6
Rubber	2.24	+ 8.0	+ 9.8	—
Leather & Shoes	1.74	− 6.3	+ 6.9	−15.5
Miscellaneous	1.76	+ 8.0	—	—

Source: U.S. Department of Labor, Bureau of Labor Statistics

large part for the loss of New England's textile industry to the South — the move was toward raw materials and substantially cheaper labor.

Although New England wages rose rapidly during the 1950-1960 decade, those of the nation moved up even faster, thereby increasing New England's wage advantage. The 8.7 per cent differential of 1960 was only 7.5 per cent in 1950.

The data clearly show that average wages in New England and the Southeast are not only lower but are rising more slowly than wages in the nation.

But should regional "averages" of manufacturing wages be compared? Are we comparing apples and pears? As we have seen, New England workers produce labor intensive goods while industrial workers in other regions except for the South are more likely to produce capital intensive goods. Wages in capital intensive manufacturing are typically higher than those in labor intensive operations, partly because labor is a less significant cost item and management is better able to pay higher wages and partly because unions in such industries are more highly organized.

If comparisons of regional and national wage scales are to be valid, then wage averages should be calculated on the basis of employees manning identical machines and turning out identical products. Such a process provides the kind of information a manufacturer would need in deciding the labor costs of alternative locations.

A particular manufacturer does not pay the average wage because he does not employ all types of workers. He requires specific skills which can most efficiently turn out a given product or group of products. To determine a firm's payroll costs in various locations, the Boston Reserve Bank devised a hypothetical metalworking firm with specific labor requirements and measured the cost of this labor package in 19 metropolitan areas throughout the nation. Table 7 gives the results

Table 8

National Wage Differences

(Representative Firm, 1960)

Index: 100 = wage bill for hypothetical metal-working firm in Boston

Detroit	120
Pittsburgh	117
San Francisco	116
Cleveland	113
Milwaukee	113
Portland, Ore.	112
Chicago	109
Buffalo	107
St. Louis	106
Los Angeles	104
Newark-Jersey City	104
Denver	104
New York	102
Philadelphia	102
Houston	101
Boston	100
Baltimore	99
Minneapolis	97
Dallas	85

of this study. It will be observed that only three cities offer the firm a wage advantage over Boston.

While New England's relative wage advantage is not as great as the raw statistics in Tables 6 and 7 would at first indicate, it is reasonably clear that the region long has been and continues to be a low wage area. If the wage disparities between New England, the nation and most other regions continue, New England manufacturers will be aided in meeting competition in many markets.

The Other Side of the Coin

For a New England manufacturer the region's generally lower wage scale is an undeniable asset. It helps him to maintain employment and profits. But how does the wage differential affect the New England manufacturing worker? Is there evidence that the differential is adversely affecting the region's labor market, building pressures within workers to seek the higher wage levels of other areas? Apparently not.

Despite the recent flight of textiles, New England's population has been increasing steadily for the last 300 years. Except for the Black Decade of the 1930's, the region has shown net population increases of at least 10 per cent in each decade since 1870.

Simply enough, the established New England worker appears unwilling to uproot and transplant his family for extra income amounting to 5 to 10 per cent of his present wage or salary. Apparently, the incentive would have to be considerably greater.

The worker's lack of reliable wage and job information, coupled with simple inertia, also contributes to this stability. Even within the relatively confined radius of a metropolitan area significant wage discrepancies prevail without causing any marked shifts in the labor force. A recent Reserve Bank study shows that within metropolitan Boston the average wage paid by various firms for the same jobs may differ by as much as 40 per cent. If employees were fully aware of such differences and were more willing to shift jobs within a 25 mile radius, firms at both ends of the wage scale might move closer to the average of all wage payments.

In recent full-employment years, some of the younger newcomers to the labor market have left New England; but still, their numbers have not been substantial. Analysis of Census data indicates that between 1940 and 1950, for example, about 3 per cent of New England's native-born white residents between the ages of 20 and 40 left the region — an annual average exodus of only about 6,500 out of 2.5 million residents in that age group. Obviously opportunities within the region have been attractive enough to prevent any large-scale migration of this highly mobile sector of the labor force. And the loss of those who do leave is traditionally balanced by immigration. Although foreign immigration has largely been curtailed by federal legislation, the influx continues to exceed the emigration of the region's native-born residents.

The Skill of Hand and Brain

Nearly a generation ago one of New England's distinguished citizens expressed a philosophy which increasingly characterizes the region's manufacturing enterprises.

"We cannot make tonnage products," he said. "But we can and will make the finest products, the most intricate mechanisms — anything in which the skill of hand and brain is taxed to the utmost."

If New England industry at the end of World War I was appropriately symbolized by the textile spindle, perhaps the symbol appropriate for the beginning of the 1960's would be the Hawk missile. The Hawk illustrates the shift of emphasis in New England manufacturing from "soft" goods to "hard." It is pre-eminently a product of the era of science in industry. It is the fruit of one of the fastest growing branches on the region's manufacturing tree. And it reflects the growing involvement of New England industry in the dangerous state of world affairs.

The Hawk missile is a pencil-shaped, supersonic, radar-eyed, computer-brained, rocket-driven instrument for self defense. It is practically infallible in seeking out and destroying aircraft attacking anywhere from ground zero to 10 miles above the earth. As weapons go these days, "the bullet with the brain" is small (16 feet long, 14 inches in diameter), and light (1,300 pounds). Rugged and completely weatherproof, the Hawk is easily transported in fast mobile launchers, and aided by an equally mobile radar, it can be fired from any site within moments of arrival. It has a high rate of fire against massed or widely dispersed enemy planes, and should these attempt evasive maneuvers, it recomputes and corrects its course for the kill. If desired, it can carry a nuclear warhead. The Hawk missile system is operational with the Army and Marine Corps and has been adopted by five European NATO nations.

In addition to representing the metalworking wing and exemplifying the research and development aspects of New England manufacturing, the Hawk has other characteristics which warrant its consideration as the symbol of today's industrial New England. These include:

1. It is unique — its design was company-funded and unsolicited, it was engineered and is produced by one of the region's largest manufacturing firms.

2. Through subcontracting its production involves an estimated 2,000 other New England manufacturers, many of them "small business." Of the Hawk's 3,500 separate parts of 1,500 different kinds, only 113 are made by the parent company. The cost of the six-year program now approximates \$900 million, with \$6.5 million spent each month for purchased parts and raw materials.

3. The Hawk is a labor intensive, high precision product. Hawk workers exhibit the low productivity which accompanies the manufacture of extremely complex goods in which quality control and constant inspection are vital. Money spent on inspecting and testing the Hawk's gyros and accelerometers equals that spent on their production.

4. The Hawk is an example of New England manufacturing's great contribution to, and its dependence on, the nation's defense effort.

Military Procurement in New England

Defense spending in New England in 1960 amounted to \$2.2 billion, according to a study made for the Boston Reserve Bank. This was 10 per cent of the national total and an increase of \$500 million over the 1954 level.

The bulk of federal defense spending occurs in four durable goods industries — ordnance, electrical machinery, transportation equipment and instruments. As Table 1 indicates, these industries led New England's employment growth during the 1950's and now account for 46 per cent of the region's durable goods employment.

New England's share of the nation's military procurement expenditures (as distinguished from payments to personnel) increased from 8.4 per cent in 1954 to 9.7 per cent in 1958, the study shows. At the same time, changing defense needs have varied the impact of procurement spending among the New England states. In the shift in emphasis from aircraft to missiles, Massachusetts was the gainer and Connecticut the loser. Adjusted contract figures indicate that from 1958 to 1960 procurement expenditures in Massachusetts increased 26 per cent while those in Connecticut showed but little change. In fiscal 1958, procurement expenditures in the region equaled 31 per cent of New England's manufacturing wages and salaries as against 17 per cent for the nation.

Industrial Research and Development

New England's heavy commitment to the nation's defense program has continued to underscore for the region's producers the technological benefits and competitive advantages to be derived from extensive research and development work. It is no accident that New England's three largest manufacturers, all of them primarily metalworkers, are also the region's largest spenders for research and engineering. By their example, and through their broad subcontracting operations, these and other firms provide a continuing stimulus to industrial research throughout the region. Today most manufacturers agree that "R and D" is practically a prerequisite not only to progress but to staying in business.

The Boston Reserve Bank estimated that in 1955 New England manufacturers spent more than $330 million on research and development — about two-and-a-half times the amount spent in 1950. Such expenditures reached $822 million in 1959. While no current figures are available, it is a fairly safe assumption that New England industrial research expenditures are now approaching a billion dollars a year.

Of the 1955 spending, the Bank found that about $220 million came from the operating incomes of private industries, while the balance was accounted for by federal government research and development contracts. In the communications equipment industry, respondents to the Bank's survey indicated that 77 per cent of their current sales were derived from products developed within 10 years. In the nonelectrical machinery, transportation equipment, instruments, chemical and industrial electrical equipment industries, more than 45 per cent of the respondents' sales were in products new within the decade. In textiles, new product sales accounted for 20 per cent of 1955 sales. The shoe and leather industry followed with 19 per cent. The six industries which allocated the largest amounts to research and development programs accounted for 85 per cent of the total expansion in employment among all manufacturing industries which recorded employment increases from 1950 to 1955.

One of the characteristics of a research-based economy is the ease and frequency with which large firms give birth to small ones. Some of New England's most successful young manufacturing enterprises have resulted from engineer-businessmen splitting off from existing companies to found new firms for making products developed from their research. It is estimated that at least 400 new research-based industries have come into existence in the region since World War II, many of them through the process described above. Their fields of activity include electronics, of course, and acoustics, optics, cryogenics, geophysics, telecommunication, new metals and alloys, advanced instrumentation and others. Several dozen of these are directly traceable to associations with Harvard University and Massachusetts Institute of Technology. It is significant that while manufacturing employment remained almost constant over the 1950's, the number of manufacturing establishments showed a substantial increase. And this growth in manufacturing firms was accompanied by the creation of numerous new companies offering assorted science-in-business advisory services.

New England's three-way combination of research facilities — the laboratories and services of professional consultants, of educational institutions and of individual firms — has built up a large reservoir of special talents and technical skills which is focused constantly on the future. The personnel of these agencies are drawn together by common interests and intermingle freely, with a corresponding cross-fertilization of ideas.

New England at Work in the Space Age

The foregoing pages have attempted to explain how New England has been able to sustain its high per capita income and provide better paying employment for its steadily expanding labor force despite the cost disadvantages imposed by its geographical location and its lack of industrial raw materials. They have described, too, the region's bitter but successful readjustment to a major industrial calamity, the liquidation and migration of most of its once leading industry. Such a readjustment is without precedent in the country's industrial annals. Some economists believe that New England's performance in this crisis has established guidelines which may be helpful to other regions should they be faced with comparable problems in their industrial maturity.

From its earliest days, New England's greatest resource has been its people — their energy, adaptability, resiliency and imagination. Those characteristics were severely tried in the periods just before and after World War II. Out of the trial emerged a stronger, more flexible economy.

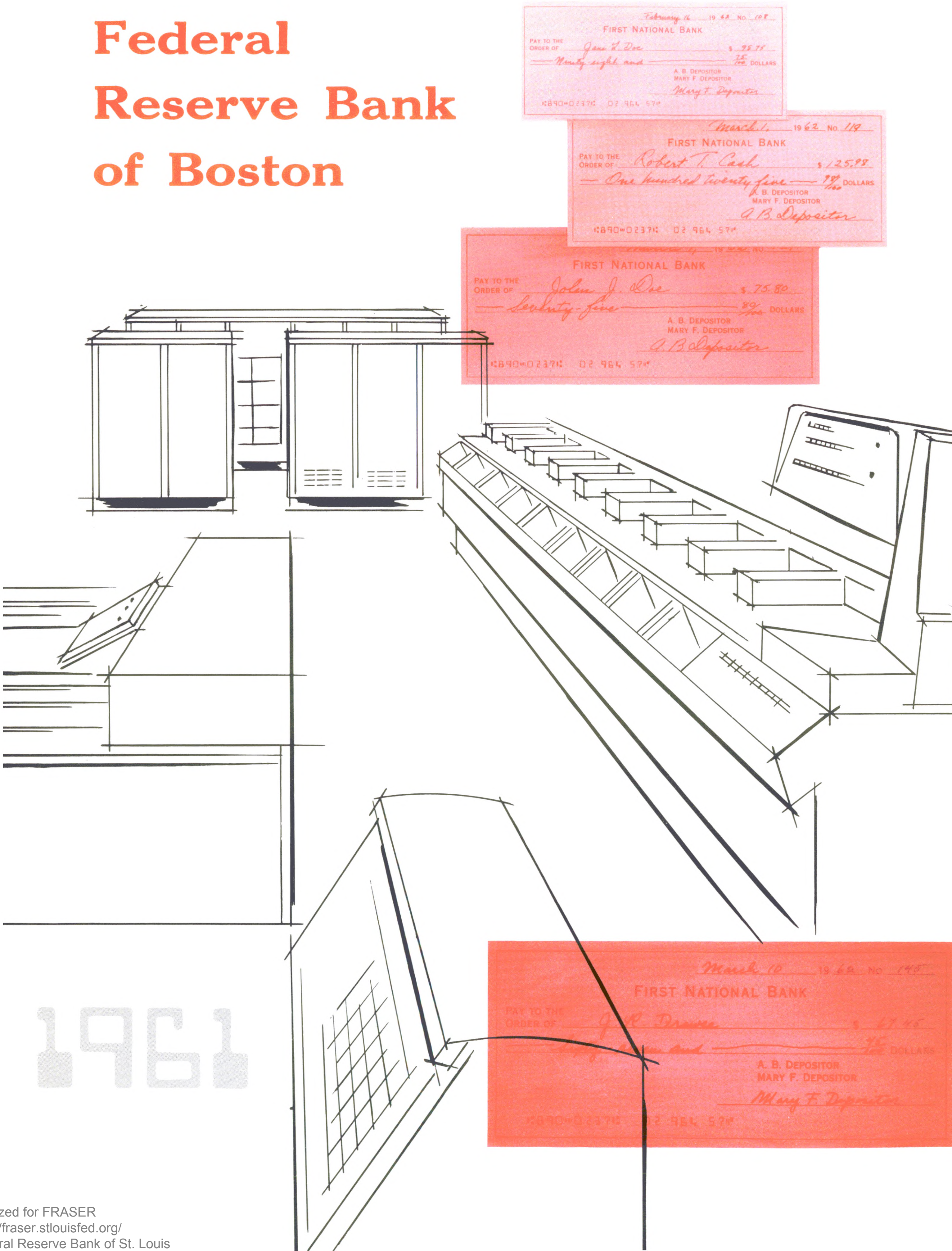
In its manufacturing-based society New England is making more intensive and better use of its people. Their industrial skills are being upgraded and rewarded accordingly. Increasingly they are turning relatively small quantities of raw materials into goods that are generally high in value, small in bulk, light in weight, high in skilled labor content. The wage differentials between New England and other regions, which are so important to management in meeting competition from other parts of the country, are not large enough to cause net migration of workers from New England. From the wage earner's point of view, interregional wage differentials seem not as important as the greater differentials which prevail among the New England states and even among the region's metropolitan areas. From New England's viewpoint, the interregional differentials may be regarded as the workers' contribution to maintaining the industrial enterprises which support and nourish the whole socio-economic complex of the six states.

New England's industrial history has repeatedly shown that the region's manufacturers can help counterbalance the extra costs imposed by their geographical location by concentrating on labor-intensive products which are unique or are superior in concept, function, design and workmanship. It is the job of New England's fast growing research and development community constantly to provide these for the benefit of the owners, managers and workers of New England industry.

The New England people working together have vigorously launched New England into the space age. Their continued co-operation can keep the economic ship at speed and on course.

The Boston Reserve Bank studies referred to in the preceding pages have been, or will be, presented in detail in the Bank's monthly publication The New England Business Review. *Copies of the Review may be obtained from the Research and Statistical Department, Federal Reserve Bank of Boston, 30 Pearl Street, Boston 6, Mass.*

Federal Reserve Bank of Boston



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The Language of Machines

Periodic revisions of the English dictionary clearly reflect our continually changing language. Each updated edition presents new words that have earned common acceptance and understanding.

One abundant and colorful source of these new words is the hundreds of trade languages used by specialized groups. Each group develops its own terminology — a jargon with common meaning for members of the group, but largely unintelligible to outsiders. Defense officials, for example, refer to "missile gaps," teen-agers to "cool" songs (a generation ago it was "hot"), bankers to "float," economists to a "rolling readjustment," and sports fans to "switchhitters" and "lonesome ends." It is in these trade languages that new words and new meanings often originate and serve their apprenticeship. If they are widely used, sooner or later they graduate into formal acceptance by standard dictionaries.

Recently, bankers welcomed a new language to their trade and christened it with a long name. But unlike other trade languages, Magnetic Ink Character Recognition is not unintelligible to outsiders. In fact, MICR can be read even by machines. It's a specialized language designed for communication with and between machines in electronic data processing systems.

The Banker's Topsy

Our interest in MICR, and electronic data processing systems in general, stems from the need of all banks to streamline routine paper handling and record keeping. Starting about the time of World War I, routine bank operations were gradually mechanized; but until the late 1930's many banks depended primarily on hand-sorting and hand-posting. Typewriters, adding machines and cash registers were first on the scene. Later, these basic machines were modified and combined into window posting machines, proof machines, and conventional bookkeeping machines. Still later, punch-card tabulating equipment was widely adopted for bank use.

But even with the introduction and widespread use of these and other new pieces of equipment, banks were barely able to keep abreast of the rising tide of paperwork. Since World War II the flood has worsened. Consumer installment, home mortgage and other loans requiring constant servicing have replaced government bonds as the principal component of bank assets. New services — revolving check credit, charge account plans, and in-plant banking — have been added or expanded. Wholesale servicing of commercial accounts continues, with new emphasis on *service*. Population is growing, so is economic activity; and these trends promise to compound the problem.

The use of checks is the best example we can give of the expansion in bank activity. Prior to World War II the number of checks written each year averaged about 3.5 billion. In 1952 about 8 billion checks were used. The 1960 national check volume was a staggering 13 billion a year, and this figure is expected to rise to 22 billion by 1970. That number of checks taped end to end would equal six round trips to the moon.

Until recently, improvements in machinery and methods failed to keep pace with the burgeoning volume. The only answer was more workers and more machines. Rising labor and machine costs, steadily expanding needs for space, and pressure on bank earnings intensified the search for new methods and machines.

Bankers have been casting a speculative eye at electronic computers since 1951 when one of the prototypes successfully tackled the massive job of compiling the Federal Census. The first use of computers in private business was made in 1953. Manufacturers immediately started to research, build, and test computers capable of meeting the needs of various types of business firms.

Mechanical brains quickly demonstrated that they could handle most of the routine bank clerical functions at amazing speeds. Besides the book-keeping functions they could read and sort checks, post individual accounts, analyze account activity, determine service charges, and assist with the analysis of research data. This ability to tackle the whole broad spectrum of record-keeping and analysis quickly appealed to bankers.

The Bank of America installed its famous ERMA in 1956; other large banks already were in the process of planning their installations. Smaller banks were interested, but the massive size and the cost of computer systems cooled their enthusiasm. The size problem was licked by the tiny transistor; but cost is still a major deterrent even though significant progress has been made in tailoring systems for small banks.

Fortunately, early recognition was given to the need for standardization. Most checks are handled by at least two banks before they're returned to the person who wrote them. Some must pass through as many as five banks. Obviously, a machine language had to be understood by the diverse equipment of various manufacturers for electronic equipment to achieve its full potential in the banking field. Standardization would also help reduce machine manufacturers' research and development costs.

Bankers, through the American Bankers Association, provided the leadership, with the Federal Reserve System, computer manufacturers, and check printers as primary partners. MICR, a new language for the banking industry, was the result.

MICR can be read by humans because it is printed in Arabic numerals, similar to standard type. And since it is printed in magnetic ink, it can also be read by the machines that feed information to the computer. The MICR program also specifies check size — 2¾ to 3⅔ inches in width and 6 to 8¾ inches in length. A band along the bottom of the front of the check, ⅝ of an inch wide, is reserved for the magnetic ink imprint.

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Computer manufacturers quickly redesigned their reading and sorting equipment to conform to MICR, although for some it meant writing off millions of dollars of research on other methods. Check printers agreed to provide the new checks even though the rigid specifications introduced an entirely new concept of quality control. Bankers began to revise their check forms, pre-encoding the routing symbol-transit number and adding individual customer account numbers.

When the American Bankers Association embanked on its program to develop a common machine language, the Federal Reserve System began to evaluate the possibility of automated check-handling. The System holds a key position in the check-routing system, handling annually about one-third of the total number of checks written in the nation.

The Paper Giant

On an average working day in 1961 the Federal Reserve Bank of Boston processed 1.3 million checks — a stack considerably higher than Boston's tallest building. The largest volume handled on a single day during the past year was 1.75 million checks, while the smallest was 900 thousand. Efficient use of employees and machines is especially difficult because daily schedules must be maintained despite the wide variation in the number of checks deposited each day.

A Federal Reserve bank receives batches of checks from member banks and U.S. government agencies for collection. The checks are drawn on any of the 14 thousand banks in the country, and must be proved, sorted, and forwarded for payment. The depositing member bank or agency is then paid by the Federal Reserve bank for its deposit according to a published time schedule. Proof machines, backbone of the present check-clearing system, add, sort, list, and endorse the enormous daily volume of checks. Operators list the amount of each check, select the proper sorting compartment, and feed the checks into the machine — a major improvement over the hand-sorting and adding machine listing methods used only 10 years ago.

About 560 workers and an average of 157 proof machines handled the volume at the Boston Reserve Bank in 1961. Annual proof machine rentals approached $335 thousand; floor space occupied by the machines equalled almost three-quarters of an acre. In spite of strenuous efforts to improve efficiency, each expansion of check volume seemed to call for more machines, more operators, more space and higher costs.

All Federal Reserve banks faced similar problems. Eventually, these conditions would slow the entire check collection system, imposing a drag on the national economy. The obvious need to stop this overwhelming paper snowball led the System to launch its study of automated methods.

Partners in Progress

In 1957 the Stanford Research Institute began to assist us in studying our check-handling requirements. Subsequently, Stanford developed engineering specifications. Machine designs were developed and submitted to equipment manufacturers. Pilot operations were set up to test the equipment of the five manufacturers who submitted acceptable proposals.

Five Federal Reserve banks were selected to conduct the test, Boston among them. We were chosen primarily because a System study showed that commercial banks in the First Federal Reserve District would be among the earliest and largest users of pre-printed and amount-encoded checks.

Equipment of the National Cash Register Company was installed at the Boston Reserve Bank in February, 1961. Could it meet the engineering specifications established by Stanford? Would it fulfill the operational requirements of the System?

The official testing period started in April when the manufacturer formally turned the equipment over to bank personnel. The new machinery performed the same sorting, listing, endorsing and totaling functions as a proof machine; but, thanks to MICR, it worked many times faster. Live checks, rather than dummies, were used to provide a more realistic test of the equipment.

Check Encoding

Only *fully qualified* items — checks with both the routing symbol-transit number and amount in the new magnetic language — were handled by the computer. Checks from other Federal Reserve banks provided the bulk of the volume, but one commercial bank in the First District also supplied fully qualified checks. Additional volume for test purposes was obtained by having Boston Reserve Bank personnel encode the amount on a limited number of incoming checks during the regular clearing process.

The official test period ended in October, 1961. During the test, 87 thousand checks was the maximum output for any single day. Eventually, the new equipment with one sorter-reader should handle 100 thousand checks a day on a one-shift operation. Even though the formal test by the Reserve System has been completed, the automated check processing unit is still operating well below capacity due to the limited number of incoming checks that are fully qualified.

By December, 1961, checks encoded with the routing symbol-transit number amounted to 63 per cent of total daily volume. (As this report goes to press, all New England commercial banks are preprinting some of their checks with the routing symbol-transit number.) Amount encoding is expanding, too, but at a slower pace. Since the amount isn't known when the check is printed, it must be added by some bank during the routing process. Estimates indicate that the volume of fully qualified checks (encoded with routing symbol-transit number *and* amount) will be about 40 per cent of our daily volume by the end of 1962.

Of course, most banks will amount encode their checks only as rapidly as they can automate or semi-automate their own internal operations. Some banks may wait until they can justify a completely automated setup, while others apparently intend to develop their systems on a building-block principle and will probably amount encode as soon as the necessary equipment is within their reach.

A number of additional banks will be submitting fully qualified checks early in 1962. We will reciprocate by fully qualifying all checks we send to them. The banking system won't enjoy the full value of the MICR program until checks are encoded by the first bank that receives them.

Automation for Small Banks

We know that the smaller banks are anxious to co-operate in improving the check-handling system — many are willing to provide checks encoded with routing symbol-transit numbers before their own operations are automated. Obviously, the satisfaction of helping to maintain an efficient system, plus the potential benefits of speedier collection, fewer misdirected checks, and prompt return of dishonored checks, have been sufficient inducements for most New England bankers.

Machine manufacturers are well aware that most of the commercial banks in the United States are small. Numerous machines designed for their use are already available, including low-speed encoders (the same machines used by larger data processing units for preparing checks that lack necessary encoding). These are hand-fed printers which automatically position the check and enter the appropriate MICR characters. New adding machines will encode checks, as well as add and list. And today's workhorse, the proof machine, has already been modified to amount encode while adding, sorting, listing and endorsing.

Other equipment that shows promise for small banks belongs to the familiar *tronics* family. These machines can be automated with punched paper tape created by a special adding machine.

Surveys indicate that many large banks have already made the one great leap from older equipment to complete automation. Others will follow suit. For these banks the only delays will be in reviewing their present system, programming and in perfecting one step before moving on to the next. For smaller banks the big change will involve several intermediate steps. Others won't attempt to install their own automated data processing systems but will depend on processing centers maintained by other banks or by equipment manufacturers. Still others will utilize the services offered by correspondent banks.

The high cost of automated equipment, the pace of rapidly changing machine design, and the time required to convert, means that automation in banking will proceed slowly and deliberately. Most of the larger commercial banks and all the Federal Reserve banks already have at work or on order a computer and its allied equipment. These institutions were able to make the big leap early because of the number of operations that could be automated and the large volume in each operation. Improvements in design, the development of lower cost models, and the economies of mass production, will continue to increase the number of banks that find automation practicable.

The Cloudy Crystal Ball

Since machines and methods are improving at such a rapid pace, we can't predict the make-up of the machine complex that will eventually handle your checks at the Boston Fed. Right now, we'd guess that one or two general purpose computers will form the heart of the system, each supplemented by two or more magnetic sorter-readers. Any excess volume will probably be absorbed by a battery of smaller, less expensive units, some of which are already being tested in the Reserve System.

The initial cost of the high-speed equipment will offset any savings in personnel or space over the first few years. For some time, we'll continue to perfect methods rather than reach for maximum volume. The long-run objective is to arrest the steady growth in labor required for check collection. All the present automated check handling equipment is being operated by employees transferred from other operations. This reflects a firm bank policy to avoid the loss of jobs during the changeover by retraining staff members. Many jobs will be upgraded as a result of the special training and knowledge required to handle the computer and its equipment. Transition time, normal employee turnover, and future growth in the volume of work will further reduce the impact of automation on personnel.

To steal a phrase from the economists, the changeover to automation is a *rolling readjustment* — methods shift constantly to fit the capabilities of new machinery. For example, the computer we now use is no longer being manufactured. A new and faster model will reach the market in the spring of 1962, one of which will replace our present equipment. Another high-speed computer, the IBM 1401, is now at work on the Fed's accounting, payroll, and fiscal agency operations. A third stage will be entered when an IBM 1620 computer system is installed in our research department sometime during the summer of 1962.

The Paper Giant Felled

Successful automation at large commercial and Federal Reserve banks clearly demonstrates its potential benefit to the whole banking system. Development of MICR, and the proven ability of sorter-reader and computer to handle all checks at high speeds, provide the means to automate the largest and fastest growing aspect of bank paperwork. Even those banks that cannot yet justify their own data processing center can now begin by pre-printing their checks, reviewing internal procedures, and investigating the possibilities of co-operative use of equipment.

The operation of high-speed check-handling equipment was carefully reviewed after nine months of use at the Boston Reserve Bank. Many problems arose during the test period and undoubtedly more will present themselves during the transition to come. But from these problems emerge new ideas and better methods. It is now apparent, we happily report, that this new language of bankers, Magnetic Ink Character Recognition, will result in faster and more economical check collection, paying dividends not only to banks, but to every component of the national economy.

Comparative Statement of Condition

	December 31st 1961	December 31st 1960
Assets		
Gold Certificate Reserves	$1,005,388,165.73	$ 894,814,699.97
Federal Reserve Notes of Other Federal Reserve Banks	35,506,250.00	52,712,675.00
Other Cash	20,345,933.27	25,464,381.30
Discounts and Advances	935,000.00	592,000.00
U.S. Government Securities — System Account	1,350,880,000.00	1,450,136,000.00
Cash Items in Process of Collection	569,249,911.95	483,292,071.20
Bank Premises	3,554,801.61	3,912,905.88
Other Assets	11,315,571.29	11,073,297.22
Total Assets	$2,997,175,633.85	$2,921,998,030.57
Liabilities		
Federal Reserve Notes	$1,703,484,675.00	$1,624,943,220.00
Deposits:		
Member Bank Reserve Accounts	789,011,743.51	778,469,630.55
U.S. Treasurer-Collected Funds	15,720,569.36	35,817,536.30
Foreign	12,985,000.00	10,486,000.00
Other	3,742,670.65	4,097,232.97
Total Deposits	821,459,983.52	828,870,399.82
Deferred Availability Cash Items	406,226,342.52	406,188,006.81
Other Liabilities	2,836,632.81	1,501,103.94
Total Liabilities	$2,934,007,633.85	$2,861,502,730.57
Capital Accounts		
Capital Paid In	$ 21,056,000.00	$ 20,165,100.00
Surplus	42,112,000.00	40,330,200.00
Total Capital Accounts	$ 63,168,000.00	$ 60,495,300.00
Total Liabilities and Capital Accounts	$2,997,175,633.85	$2,921,998,030.57

Comparative Statement of Earnings and Expenses

	1961	1960
Current Earnings:		
Advances to Member Banks	$ 113,283.90	$ 540,421.15
Foreign Loans on Gold	6,264.83	11,332.81
U.S. Government Securities — System Account	49,919,318.83	58,235,551.17
All Other	20,532.37	28,070.34
Total Current Earnings	50,059,399.93	58,815,375.47
Net Expenses	10,785,103.93	10,279,955.99
Current Net Earnings	39,274,296.00	48,535,419.48
Additions to Current Net Earnings:		
Profit on Sales of Government Securities (net)	184,955.68	131,058.20
Transferred from Reserves for Contingencies	0	1,112,403.63
All Other	842.22	2,026.02
Total Additions	185,797.90	1,245,487.85
Deductions from Current Net Earnings	2,835.27	2,636.68
Net Additions	182,962.63	1,242,851.17
Net Earnings before payment to U.S. Treasury	$39,457,258.63	$49,778,270.65
Dividends Paid	$ 1,236,205.16	$ 1,183,067.96
Paid U.S. Treasury (Interest on Federal Reserve Notes)	36,439,253.47	46,597,202.69
Transferred to Surplus	1,781,800.00	1,998,000.00
	$39,457,258.63	$49,778,270.65

Volume Figures for Years 1960 and 1961

Transaction	VOLUME IN PIECES OR UNITS (Daily Average) 1961	1960	VOLUME IN DOLLARS (Annual Total) 1961	1960
Discounts and Advances	3	7	$ 475,082,000	$ 1,449,287,158
Currency Sorted and Counted	1,146,273	1,126,519	1,972,493,888	1,894,934,310
Coin Counted and Wrapped	4,317,414	4,002,820	107,248,450	102,702,350
Check Collections	1,274,662	1,217,913	82,023,632,273	76,944,818,981
Noncash Collections:				
Notes, Drafts, and Coupons (except U.S. Government)	4,456	4,278	499,744,025	380,184,085
Safekeeping of Securities:				
Pieces Received and Delivered	848	922	8,690,605,758	11,289,183,600
Coupons Detached	2,020	1,919	46,016,761	44,768,820
Orders to Sell or Buy Securities Executed for Member Banks	8	7	284,961,150	225,148,000
Transfer of Funds	482	458	88,266,639,324	84,227,566,875
Issues, Redemptions and Exchanges:				
U.S. Securities (Direct Obligations)	1,392	1,530	16,363,947,852	15,023,917,925
U.S. Savings Bonds	38,975	39,697	587,250,521	628,623,870
All Other	17	31	51,832,500	83,143,500
U.S. Government Coupons Paid (Direct Obligations)	2,827	2,832	197,919,757	189,472,326
Federal Taxes: Depositary Receipts and Direct Remittances	3,071	2,987	2,076,908,509	2,023,214,302
Currency Verified and Destroyed	226,171	221,192	78,934,000	76,552,000
Deposits and Withdrawals — Treasury Tax and Loan Accounts	541	539	7,097,216,299	7,677,248,692

Summary of Principal Changes

Statement of Condition

At the end of 1961, this bank had total assets of $3 billion of which $1.3 billion represented holdings of U.S. government securities. Gold certificates accounted for $1 billion. The principal liabilities were $1.7 billion of Federal Reserve notes and $821 million of deposits. Over the year, the dollar volume of total assets showed little change — an increase of $75 million or 2.6 per cent.

There were, however, some large shifts in the distribution of certain assets. These changes reflected an increase of about $100 million in gold certificates which was offset by a decline of almost an equal amount of U.S. government securities.

Unusually large temporary interdistrict transfers on private commercial and financial accounts were made by member banks in response to year-end adjustments in the money market. To compensate for these transfers, the relative amount of this bank's participation in U.S. government securities held in the System open market account was reduced through exchange of securities for gold.

A relatively sharp increase occurred in uncollected cash items ($86 million or 18 per cent) as check float set a new record in the nation. The rise reflected not only a peak volume of checks but some abnormal delays in processing due partly to severe weather in many Federal Reserve districts.

Discounts and advances to member banks showed little change, reflecting continuation of relative ease in System credit policy. The increase in other assets is due mainly to interest accruals.

The only significant change in liabilities during 1961 was in Federal Reserve notes. Total notes of this bank in circulation increased $78.5 million or 4.8 per cent, moderately more than in the nation. This reflects both the adjustment by member banks to System policy, established in November, 1960, crediting all vault cash to required reserves, and to the additional currency needed as the business recovery progressed. This bank's notes continued to circulate in other districts through trade and travel.

Total capital accounts increased about 4.4 per cent during the year, reflecting both the purchase of additional Reserve Bank stock by member banks, and the amount transferred to surplus to maintain the account at twice paid in capital. At the year-end, these accounts were about 2 per cent of total resources.

Earnings and Expenses

Total current earnings of the bank in 1961 were $8.7 million below 1960. The principal cause of the decline was an $8.3 million reduction in the amount of interest received on the bank's share of U.S. government securities held in the System open market account, which in turn reflected a lower average rate of return on the portfolio. Earnings on discounts and advances to member banks also declined, reflecting a lower average volume of borrowing as System policy supplied reserves through open market operations.

Gross expenditures of the bank in 1961 rose moderately while the amount of reimbursable expenditures showed little change, causing an increase in net expenses of about 5 per cent. Salary payments to the staff and most other costs of conducting business were higher.

Net earnings after all adjustments amounted to $39.4 million out of which the statutory dividend of 6 per cent was paid member banks on outstanding Federal Reserve Bank stock. Of the remainder, $1.8 million was transferred to surplus and the balance was paid to the U.S. Treasury as an interest charge levied by the Board of Governors under Section 16 of the Federal Reserve Act on Federal Reserve notes not covered by gold certificates.

Volume of Operations

The volume of operations in most departments of the bank showed moderate increases over the previous year, reflecting in part the recovery in business which began during the second quarter of 1961. During the year, over 320 million checks were processed, amounting to about $82 billion — an increase of 5 per cent in number and 7 per cent in dollar volume. Despite the record volume, the average float was lower, and the monthly fluctuations smaller largely because of increased productivity of the check department.

The dollar volume of currency and coin received, counted, and sorted by this bank increased also. The volume of shipments received from district banks has risen steadily since the close of the war, but the rate of increase has slowed during the last several years. The dollar volume of checks handled has increased about 130 per cent since the close of the war and the volume of district banks' currency and coin shipments has risen about 80 per cent with an accompanying increase in the number of pieces counted.

Despite the decline in the number of units handled by the Fiscal Agency department as compared with the previous year, the burden of work increased. Use by the U.S. Treasury of advance refundings, and cash or exchange offers as opposed to straight exchanges, the introduction of *strip* bills, as well as exchanges of certain F and G savings bonds for marketable securities, added to the detail of the department's work.

The dollar volume of wire and mail transfers of funds, other than treasury transfers and interdistrict funds settlements, reached a new high. This continued increase in part reflects broadened participation by district banks in federal funds transactions with New York and other cities.

As a result of easier credit conditions, the volume of discounts and advances contracted sharply, and the number declined by more than half. As well, fewer banks used the discount facilities.

Over the year as a whole, the larger volume of work was carried out by about the same number of employees. The staff averaged 1356 employees and turnover was slightly below 1960.

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PRINTED IN U.S.A.

FEDERAL RESERVE BANK OF BOSTON
INCORPORATED MAY 18 1914
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