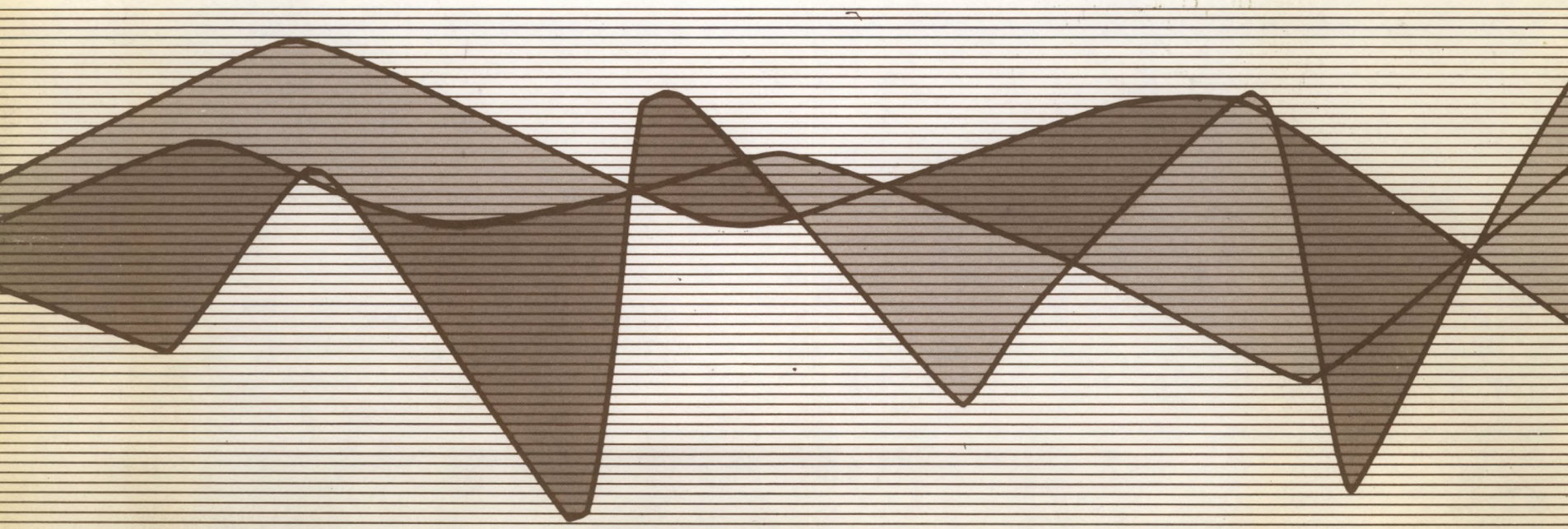
PRODUCTIVITY and the ECONOMY

Bulletin 1710

U.S. DEPARTMENT OF LABOR
Bureau of Labor Statistics



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U.S. DEPARTMENT OF LABOR
J. D. Hodgson, Secretary
BUREAU OF LABOR STATISTICS
Geoffrey H. Moore, Commissioner

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Preface

Productivity is involved in one way or another with most major issues of public and private policy. The need for information about productivity has been continuous, although the focus of attention has varied depending on the economic climate. During periods of economic slowdowns, emphasis has been placed on the relationship of productivity to unemployment, concentrating on the role of changing technology. On the other hand, during periods of rising prices, interest has centered on the problem of rising costs and the relationship between productivity and wages.

This report describes productivity movements and shows how they are related to incomes, costs, prices, and employment. The report is divided into four parts. The first part traces trends in the private economy and major sectors, the second deals with changes in specific industries, the third compares trends in the United States with those in other countries, and the fourth presents projected trends in productivity.

The report was prepared by the Office of Productivity and Technology of the Bureau of Labor Statistics.

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What Productivity is and How it is Measured

Productivity expresses the relationship between the quantity of goods and services produced—output, and the quantity of labor, capital, land, energy, and other resources that produced it—inputs.

Basically, productivity can be viewed in two ways. One way relates output (of an enterprise, industry, or economic sector) to a single input such as labor or capital; the other way relates output to a composite of inputs, combined to reflect their relative importance.

One of the most commonly used measures of productivity relates output to the input of labor time—output per man-hour. This measure is relevant to many economic problems and is especially useful for manpower and income analyses.

Of course, an index of output per man-hour does not imply that labor is solely or primarily responsible for productivity growth. In a technologically advanced society, labor effort is only one of many interrelated sources of improvement. The trend in output per man-hour thus reflects technological innovation, changes in capital stock and capacity utilization, scale of production, materials flow, management skills, the state of labor relations, the pressure of competition, and many other factors the contribution of which often cannot be measured separately.

One reason for the usefulness of a labor productivity measure is that labor input is readily measurable at several levels—the total private economy, the industrial sectors, industries, or plants. Labor input can be defined in various ways: It can refer to the number of persons working or the number of hours they work; it can cover the entire labor force, including proprietors, unpaid family workers, and employees, or it can be limited to selected groups of workers.

Output refers to the finished product or the amount of product added in the various enterprises, industries, sectors, or the economy as a whole. Output is measured for industries producing not only goods but also services that are difficult to quantify, such as health, insurance, and education.

Few plants or industries produce a single homogeneous commodity that can be measured simply by counting the number of units produced. Consequently, for the purpose of measurement the various units of a plant or industry's output are combined on some common basis—either their man-hour requirements in a base period or their dollar value. Further, when information on the amount of units produced is not available, as is often the case, output must be expressed in terms of the dollar value of production, adjusted for price changes.

How Productivity Growth Helps Stabilize the Economy

Increasing the rate of productivity improvement can contribute to cost and price stability. This potential aspect of productivity growth stems from the role of output per man-hour—an especially relevant productivity concept when dealing with unit labor costs—as a critical link between the cost of labor and the price of goods.

Each unit of output requires certain inputs—labor, materials, capital. Each of these inputs has a certain cost. The total of these costs, together with profit per unit, determines the price per unit of output.

In most industries, labor costs, including hourly rates of pay, overtime, and all types of fringe benefits, are the largest single cost element. Consequently, the trend of labor costs per unit of output affects the price level significantly.

Labor costs per unit of output represent the relationship between total compensation and output. The greater the increase in productivity relative to the increase in hourly compensation, the less pressure to increase prices, although changes in profits and in material costs per unit of output may offset, or partly offset, this effect.

On the other hand, changes in unit labor costs can be a result as well as a cause of price rises. Price rises that cause employee purchasing power to fall lead to pressure for higher wages. If the wage increases exceed productivity growth, unit labor costs will increase.

What's Been Happening to Productivity

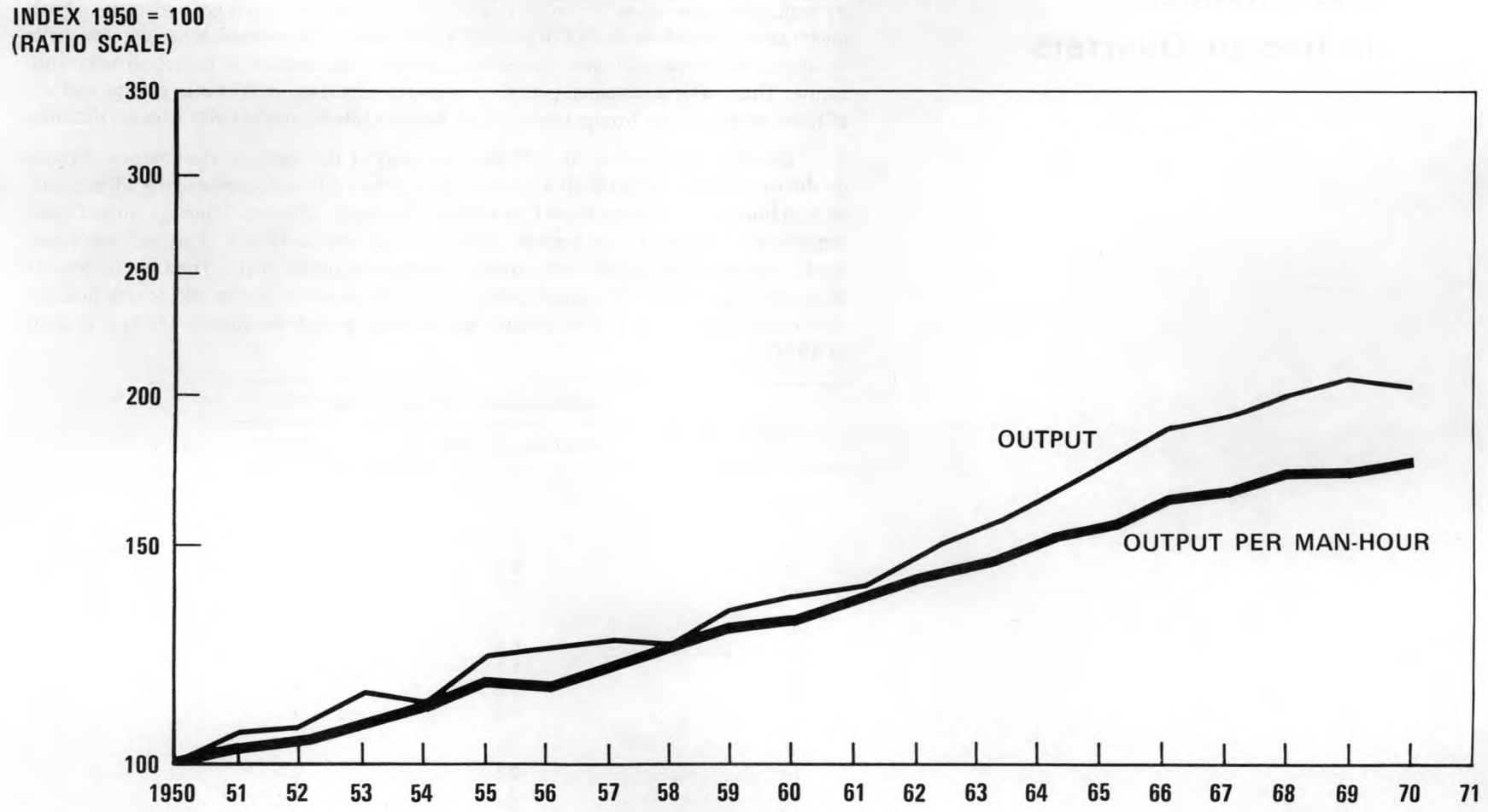
Between 1969 and 1970, productivity in the private sector grew by less than 1 percent, as it did between 1968 and 1969. As 1971 began, however, the rate of productivity growth accelerated. Over the last 5 years, productivity growth averaged 2.1 percent a year, compared with a 20-year average growth rate of 3.0 percent a year.

Annual changes in output per man-hour tend to fluctuate fairly widely, and generally are associated with variations in output. Output declined in 1970, the first decline since 1958, and productivity grew only because man-hours declined even more than output did.

Year and period	Average annual percent change	
	Output per man-hour	Output
1950-70	3.0	3.8
1950-60	2.8	3.0
1960-65	3.9	5.1
1965-70	2.1	3.3
1965-66	4.0	6.4
1966-67	2.1	2.3
1967-68	2.9	4.9
1968-69	0.7	2.9
1969-70	0.9	-0.5
1970-71[1]	3.5	1.3

[1] First quarter 1971 over first quarter 1970.

OUTPUT PER MAN-HOUR AND OUTPUT IN THE TOTAL PRIVATE ECONOMY, 1950-70



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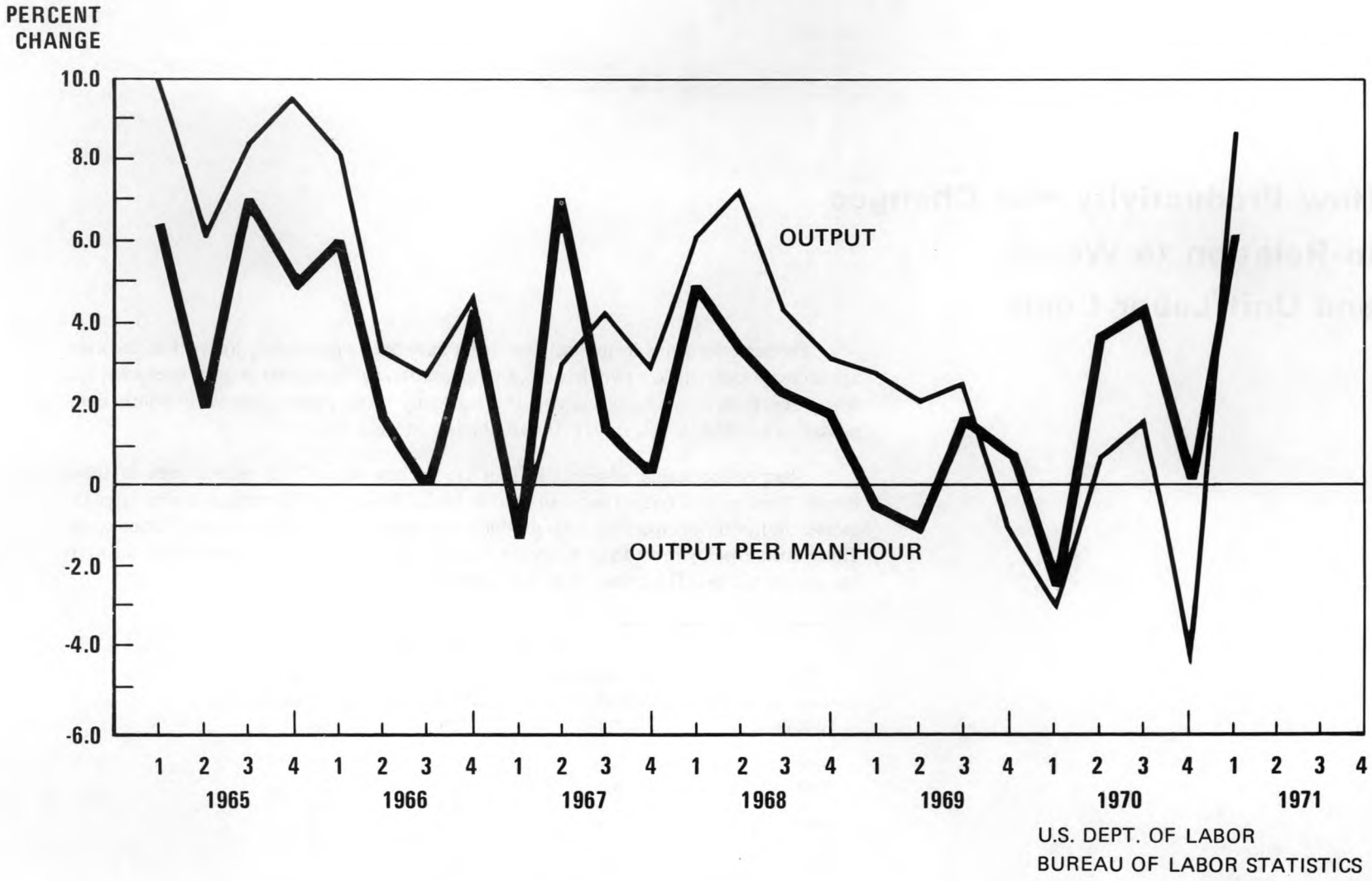
How Productivity Has Changed in Recent Quarters

Productivity is quite sensitive to shortrun changes in business activity. Typically, productivity movements follow a certain pattern in the course of a business cycle. When business activity starts to decline, output per man-hour generally drops sharply as capacity utilization falls below optimum rates. Once cost-cutting efforts get underway, adjustments are made and the decline in productivity is arrested or reversed. When activity picks up again, output per man-hour increases at a faster rate because of higher capacity utilization. Then, after a sustained period of production increase, bottlenecks emerge and less efficient resources are brought into use, so that the rate of productivity advance declines.

Quarterly movements in 1970 illustrate part of this pattern. The sharpest drop in productivity occurred in the first quarter when output fell and compensating adjustments in man-hours were not sufficient to offset the drop in demand. Although output grew somewhat in the next two quarters, producers cut their staffs and shortened the workweek, thus producing higher than average increases in productivity. The General Motors strike interrupted this movement and productivity declined during the fourth quarter. Accompanying a sharp rise in output, productivity growth resumed in the first quarter of 1971.

Year and quarter	Quarterly percent change at annual rates	
	Output per man-hour	Output
1968:		
1st	4.9	6.1
2d	3.4	7.2
3d	2.2	4.3
4th	1.8	3.1
1969:		
1st	-0.5	2.8
2d	-1.1	2.1
3d	1.6	2.5
4th	0.8	-1.0
1970:		
1st	-2.5	-3.0
2d	3.7	0.7
3d	4.3	1.6
4th	0.1	-4.4
1971:		
1st	6.1	7.6

OUTPUT PER MAN-HOUR AND OUTPUT IN THE PRIVATE ECONOMY, QUARTERLY CHANGES AT ANNUAL RATES, 1965-71



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How Productivity Has Changed in Relation to Wages and Unit Labor Costs

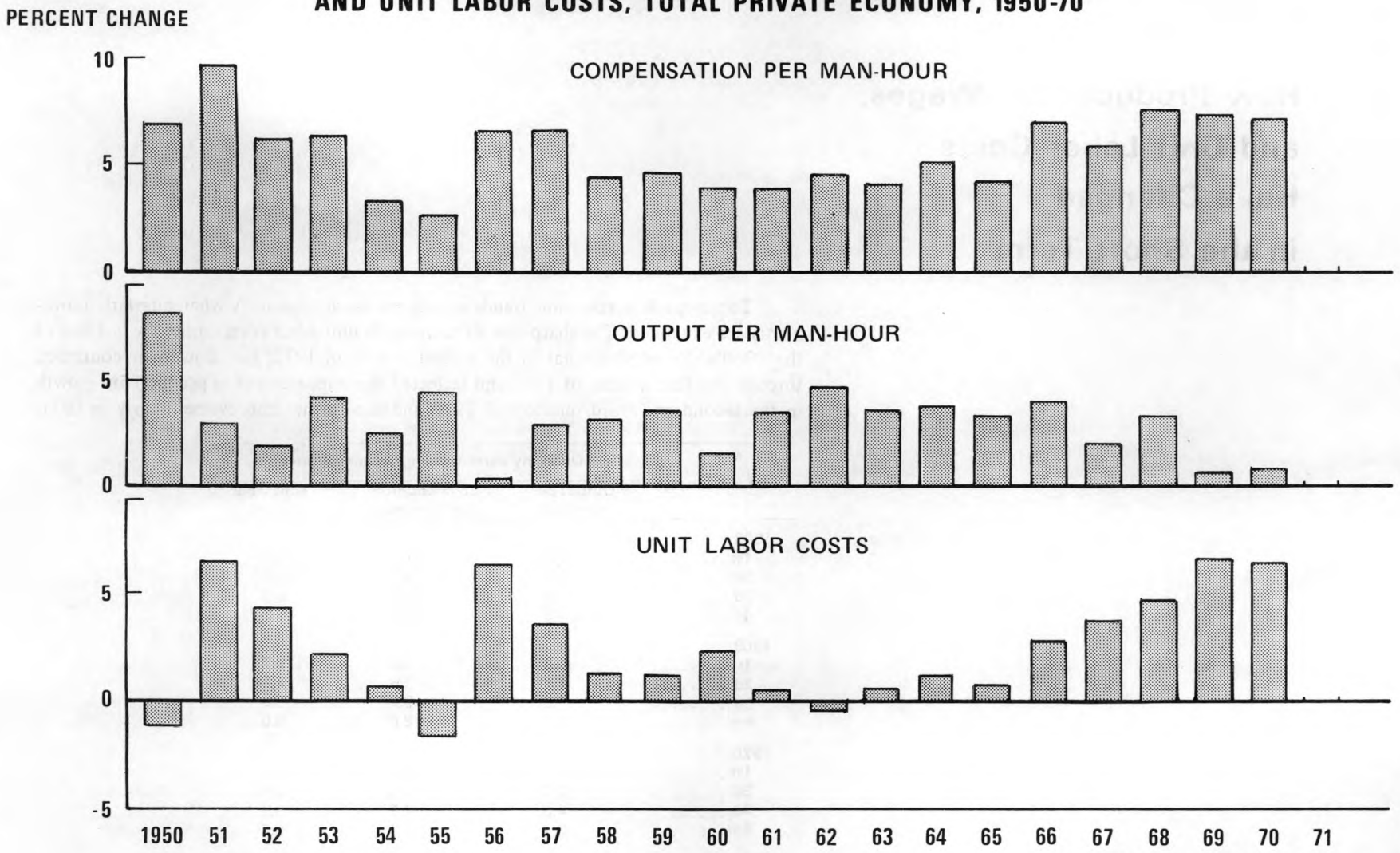
Productivity gains in the last few years have been significantly lower than the average increase over the last two decades. Compensation per man-hour (wages, overtime, and fringe benefits), however, has grown at a markedly faster pace. Increases in hourly compensation in 1968, 1969, and 1970 were the largest since 1951.

Sharply increasing advances in unit labor costs since 1965 reflect both of these trends. Small rises in output per man-hour in both 1969 and 1970 combined with large increases in hourly compensation to produce unusually large increases in unit labor costs. These costs rose by more than 6 percent in both 1969 and 1970, compared with the average post-World War II increase of about 2 percent a year.

Year ending	Year-to-year percent change		
	Compensation per man-hour	Output per man-hour	Unit labor costs
1960-65	4.3	3.9	0.4
1966	6.9	4.0	2.8
1967	5.8	2.1	3.7
1968	7.6	2.9	4.6
1969	7.2	0.7	6.5
1970	7.1	0.9	6.2
1971 [1]	7.4	3.5	3.8

[1] First quarter 1971 over first quarter 1970.

ANNUAL RATES OF CHANGE IN WAGES, PRODUCTIVITY, AND UNIT LABOR COSTS, TOTAL PRIVATE ECONOMY, 1950-70



Compensation includes wages and salaries and supplemental payments for employees and an estimate of the salaries and supplements for the self-employed.

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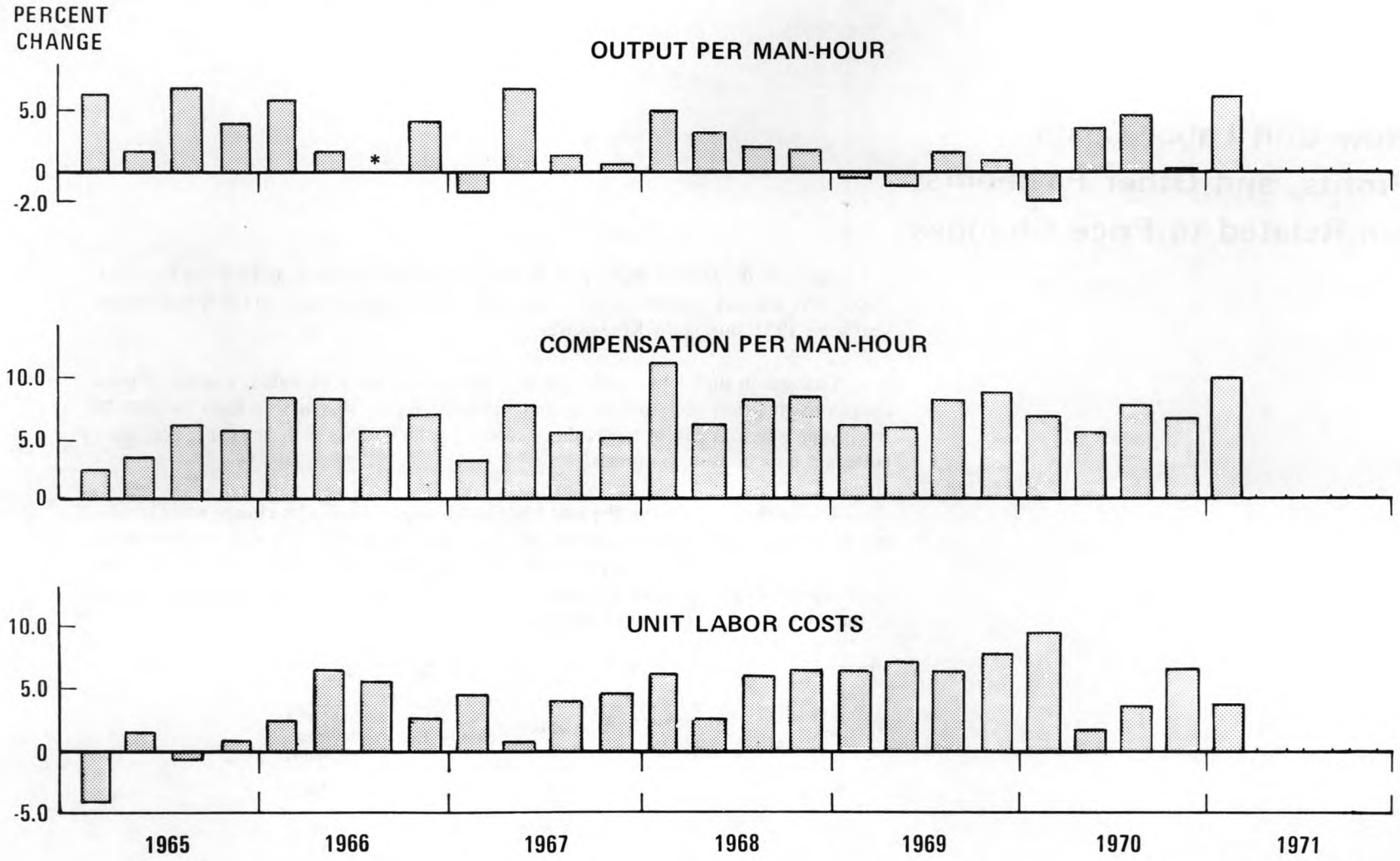
How Productivity, Wages, and Unit Labor Costs Have Changed in the Short Term

Turnarounds in economic trends usually are easier to identify when quarterly movements are examined. The sharp rate of increase in unit labor costs during the last half of the 1960's slowed somewhat in the second quarter of 1970; this slowdown continued through the first quarter of 1971 and reflected the improvement in productivity growth in the second and third quarters of 1970 and the further improvement early in 1971.

Year and quarter	Quarterly percent change at annual rates		
	Output per man-hour	Compensation per man-hour	Unit labor costs
1968:			
1st	4.9	11.2	6.0
2d	3.4	6.1	2.6
3d	2.2	8.4	6.0
4th	1.8	8.5	6.5
1969:			
1st	-0.5	6.2	6.7
2d	-1.1	5.9	7.1
3d	1.6	8.2	6.5
4th	0.8	8.8	8.0
1970:			
1st	-2.5	6.8	9.6
2d	3.7	5.3	1.5
3d	4.3	7.7	3.3
4th	0.1	6.7	6.7
1971:			
1st	6.1	9.9	3.6

PRODUCTIVITY AND LABOR COSTS IN THE PRIVATE ECONOMY, QUARTERLY CHANGES AT ANNUAL RATES, 1965-71



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How Unit Labor Costs, Profits, and Other Payments are Related to Price Changes

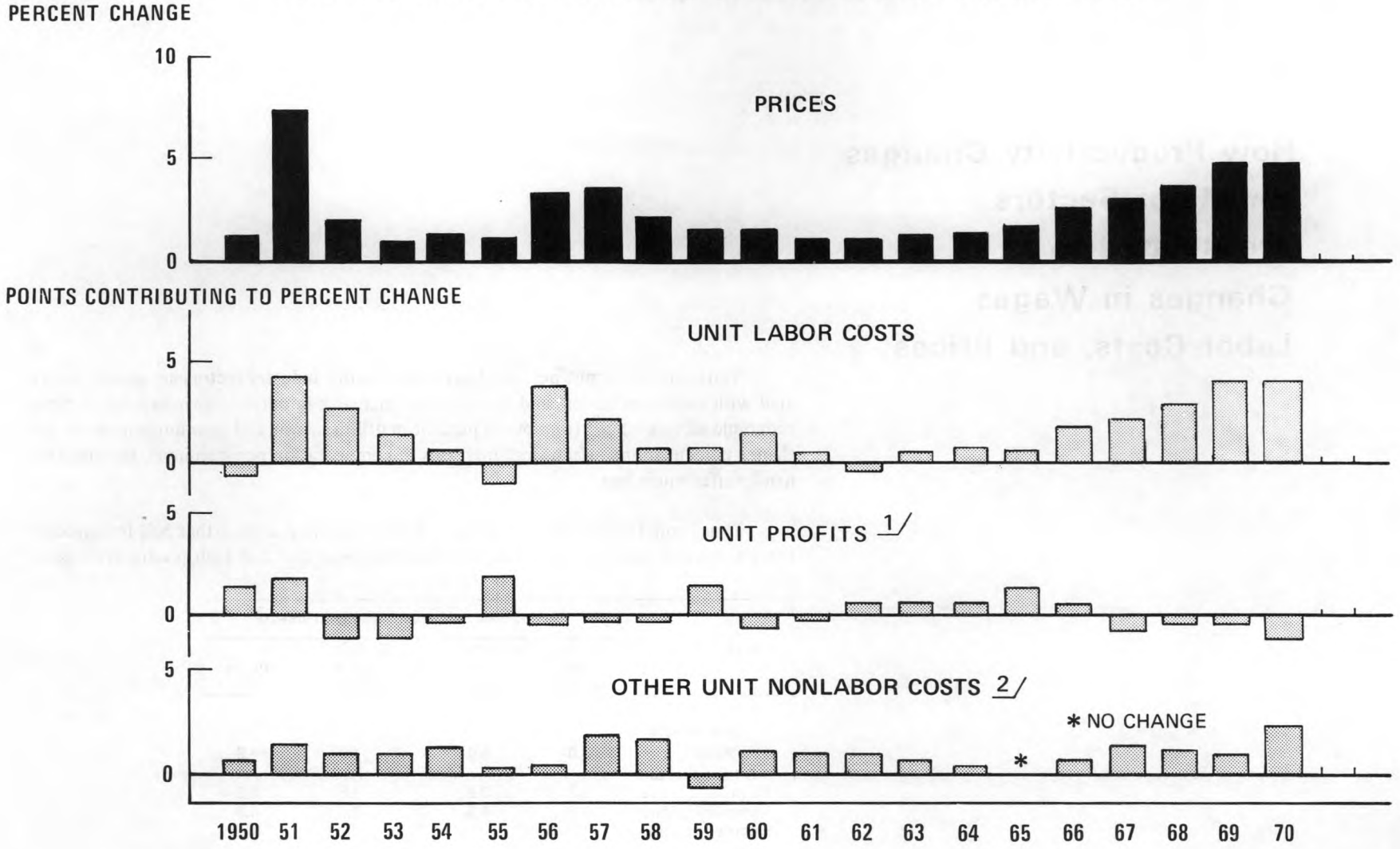
Prices in the United States rose in each of the last 20 years, and the rise has accelerated over the last 5 years. In 1969, and again in 1970, prices went up faster than in any year since 1951, during the Korean War.

Changes in unit labor costs can be considered a result as well as a cause of price rises. A rise in prices causes employee purchasing power to fall, and thus leads to pressure for higher wages. A rise in wages that exceeds productivity growth augments unit labor costs and puts pressure on prices.

During the early 1960's, the unit labor cost component of price change was slight—mainly because productivity increases kept pace with the growth in hourly compensation. As increases in productivity slowed over the last several years and increases in compensation speeded up, unit labor costs accelerated and thus represented a larger component of the price rises, particularly in 1969 and 1970.

Year and period	Annual percent change in prices	Composition of price change in percentage points		
		Unit labor costs	Unit profits	Other unit nonlabor payments
1960-65	1.2	0.4	3.9	4.0
1966	2.5	1.7	0.2	0.6
1967	2.9	2.2	-0.7	1.4
1968	3.6	2.8	-0.2	1.0
1969	4.5	4.0	-0.5	1.0
1970	4.7	3.9	-1.4	2.2

COMPOSITION OF PRICE CHANGES, TOTAL PRIVATE ECONOMY, 1950-70



1/ UNIT PROFITS INCLUDES CORPORATE PROFITS, ESTIMATED PROFITS OF UNINCORPORATED ENTERPRISES AND NET RENTAL EARNINGS OF OWNER OCCUPIED DWELLINGS.

2/ OTHER UNIT NONLABOR PAYMENTS INCLUDE DEPRECIATION, INTEREST AND INDIRECT TAXES.

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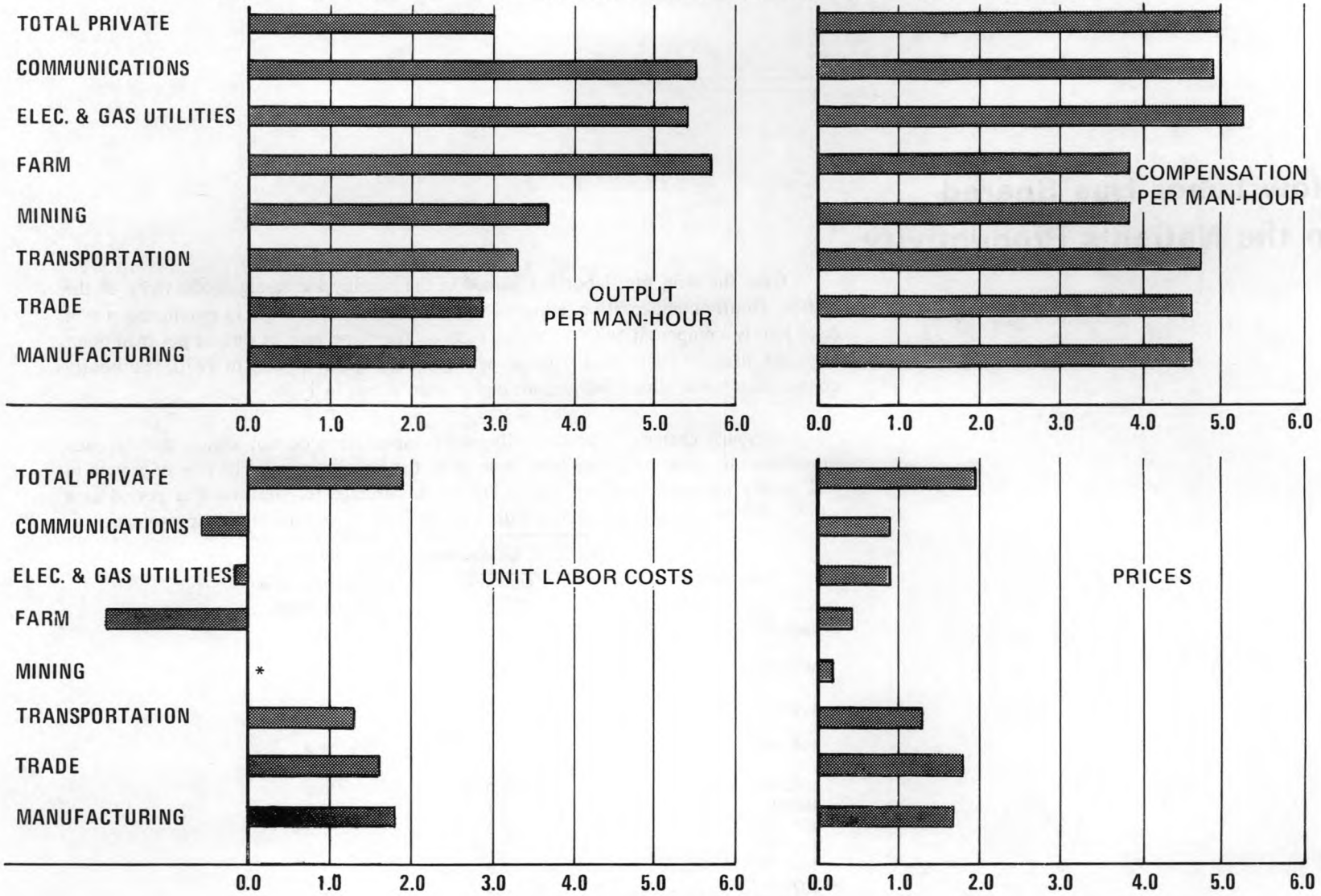
How Productivity Changes for Major Sectors are Related to Changes in Wages, Labor Costs, and Prices

Variations in output per man-hour trends among industry sectors are closely associated with variations in cost and price trends. Increases in output per man-hour in major economic sectors ranged from over 5 percent in utilities, farm, and communications to less than 3 percent in manufacturing. Increases in compensation per man-hour, on the other hand, varied much less.

Thus, unit labor costs and prices rose most in those sectors that had low productivity gains and rose least or actually declined in those that had high productivity gains.

Industry sector	Average annual percent change, 1950-70			
	Output per man-hour	Compensation per man-hour	Unit labor costs	Prices
Total private sector	3.0	5.0	1.9	1.9
Selected sectors				
Farm	5.7	3.8	-1.8	0.3
Communication	5.5	4.9	-0.6	0.8
Electric, gas, and sanitary services	5.4	5.2	-0.2	0.8
Mining	3.7	3.8	0.0	0.1
Transportation	3.3	4.7	1.3	1.2
Trade	2.9	4.6	1.6	1.7
Manufacturing	2.8	4.6	1.8	1.6

OUTPUT PER MAN-HOUR, HOURLY COMPENSATION, UNIT LABOR COSTS AND PRICES, PRIVATE ECONOMY AND SELECTED SECTORS—AVERAGE ANNUAL PERCENT CHANGE, 1950-70



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AVERAGE ANNUAL PERCENT CHANGE

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How Labor Has Shared in the Nation's Productivity

Over the long run, labor has shared in the steadily increasing productivity of the Nation. Hourly compensation, adjusted to take account of changes in purchasing power (real hourly compensation), has risen at about the same rate as output per man-hour. Over the past 20 years, both rose an average of 3 percent a year. In 1970, real hourly compensation was almost 80 percent higher than it was in 1950.

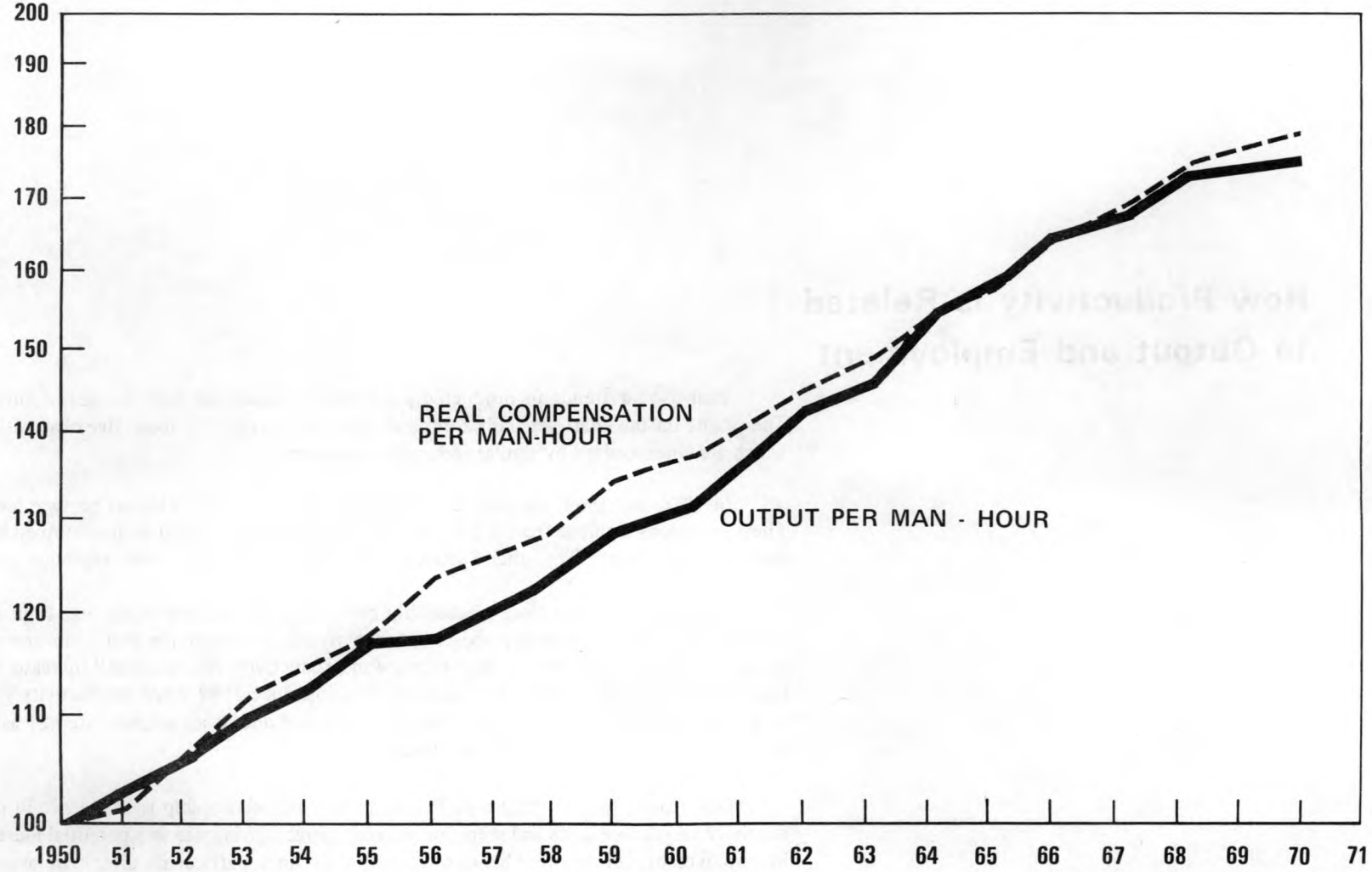
Although changes in productivity and compensation do not always parallel each other over the short run, they have done so in the last few years. The rate of growth in real hourly compensation had lagged behind the average for the post-War period as a whole; this situation is associated with the low rate of productivity improvement.

Year and period	Average annual percent change	
	Output per man-hour	Real compensation per man-hour
1950-70	3.0	3.0
1950-60	2.8	3.3
1960-65	3.9	3.0
1965-70	2.1	2.6
1965-66	4.0	3.9
1966-67	2.1	2.9
1967-68	2.9	3.3
1968-69	0.7	1.8
1969-70	0.9	1.1
1970-71[1]	3.3	2.4

[1] First quarter 1971 over first quarter 1970.

INDEX 1950 = 100
(RATIO SCALE)

OUTPUT PER MAN-HOUR AND REAL COMPENSATION PER MAN-HOUR, TOTAL PRIVATE ECONOMY,1950-70



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How Productivity is Related to Output and Employment

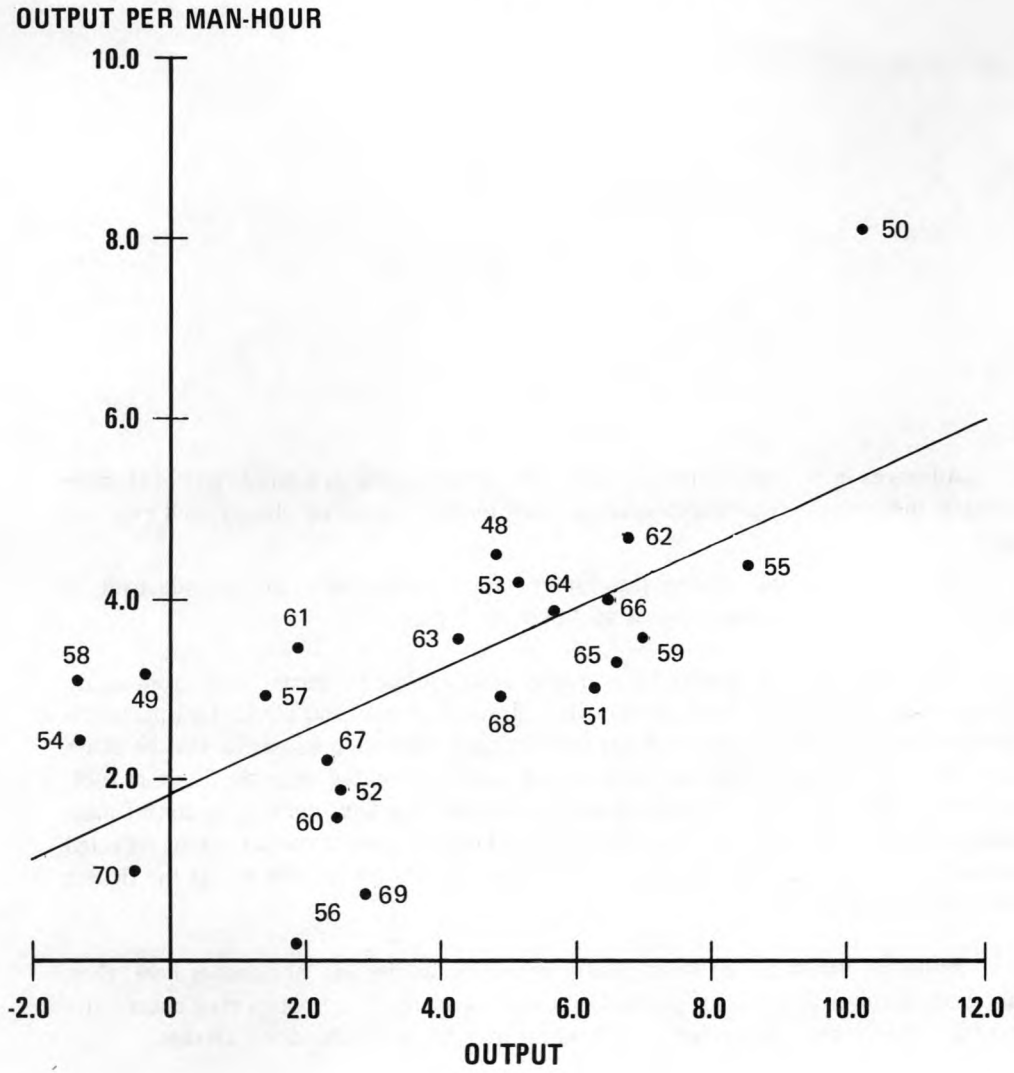
Year-to-year trends in productivity are closely associated with changes in output. The points on the chart generally form a straight line, except for about five observations which are characterized by similar economic conditions.

In 1956 and 1969, the rate of productivity change was at its lowest postwar levels. These situations resulted from a low rate of output growth coupled with continued high levels of employment. The other 3 years—1949, 1954, and 1958—were recession years.

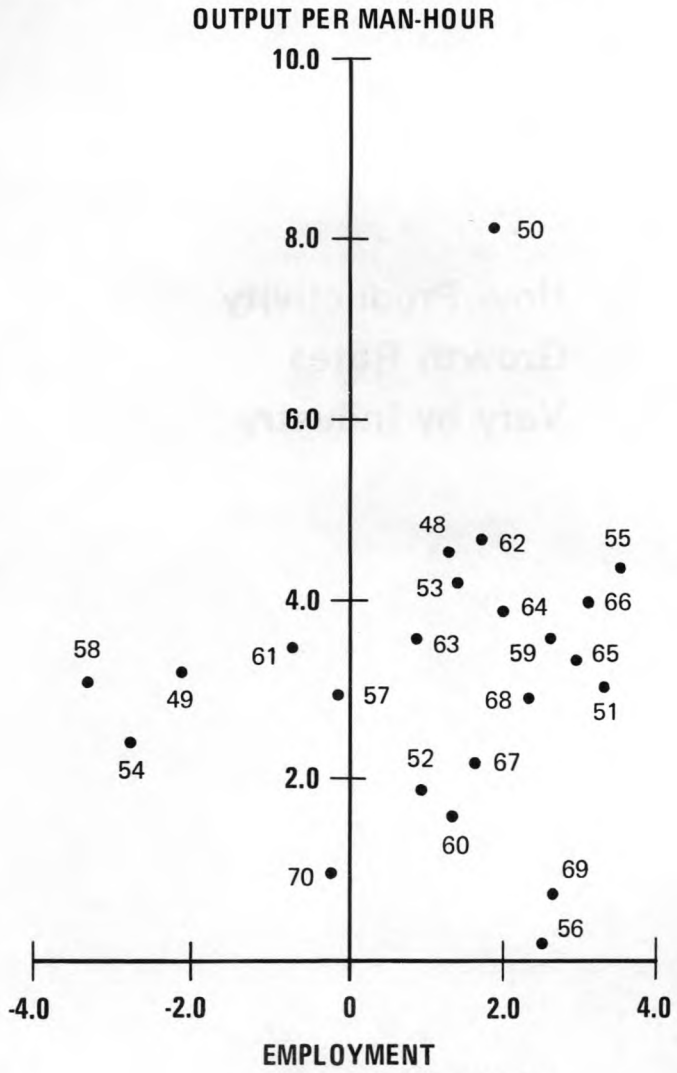
Although there is a close relationship between trends in output per man-hour and output, no similar relationship exists between trends in output per man-hour and employment. Some think that a large increase in productivity means a small increase or a decline in employment. Actually, on every occasion since 1947 when productivity grew at a rate of 4 percent or more, employment increased and at an average rate at least as great as when productivity rose less rapidly.

One reason for the failure of the simple inverse relationship is that a rise in productivity can reduce costs and stimulate output, thereby giving rise to a potential increase in employment. On the other hand, when output declines, particularly after high levels of activity, employers often are reluctant to adjust employment immediately. Contractual arrangements may cause employment reductions to be postponed, and employers may anticipate difficulties in rehiring trained workers once business improves.

ANNUAL PERCENT CHANGES IN OUTPUT AND PRODUCTIVITY IN THE TOTAL PRIVATE ECONOMY, 1947-70



ANNUAL PERCENT CHANGES IN EMPLOYMENT AND PRODUCTIVITY IN THE TOTAL PRIVATE ECONOMY, 1947-70



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How Productivity Growth Rates Vary by Industry

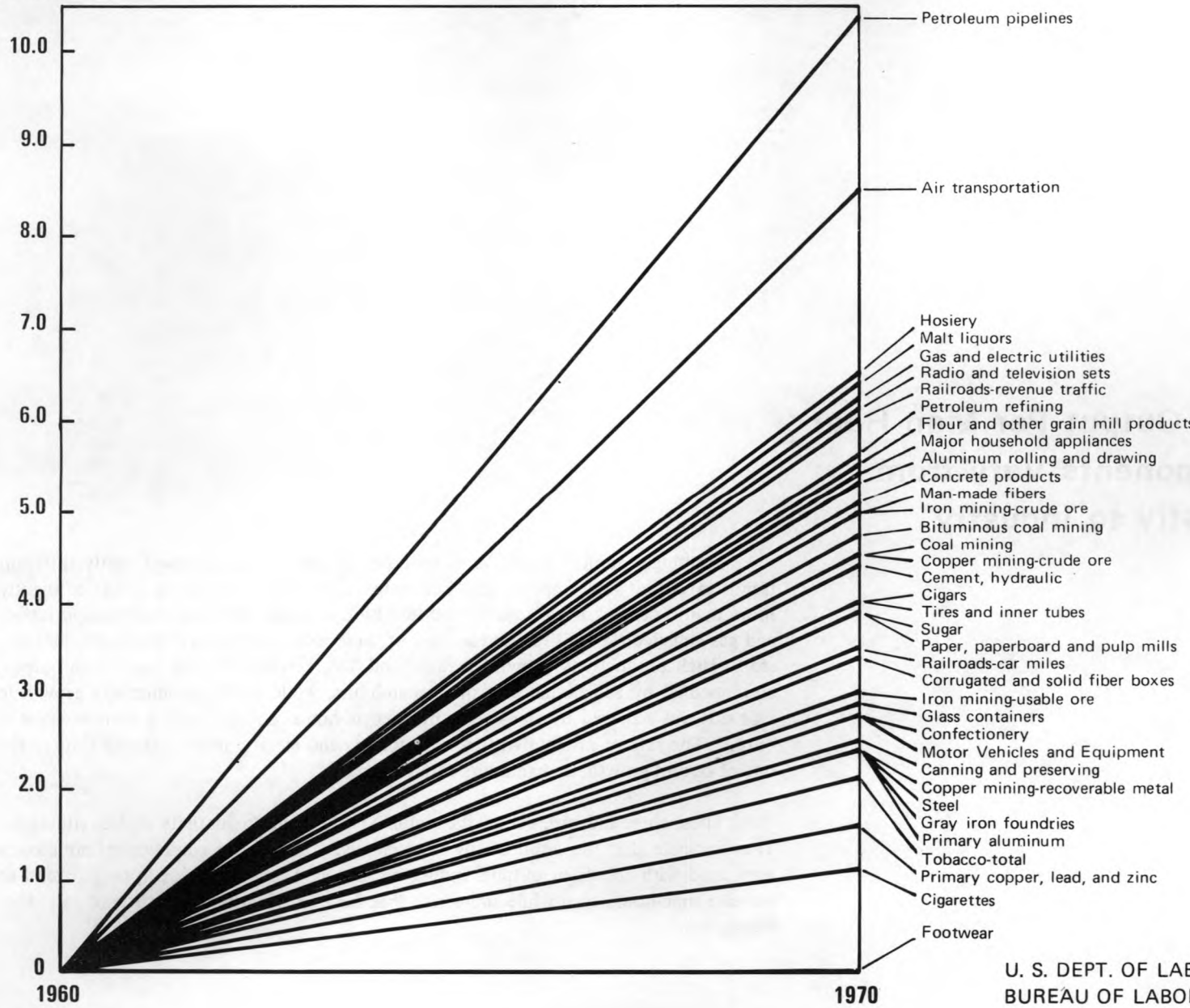
Advances in output per man-hour for the private sector as a whole reflect changes in many industries—large improvements, small improvements, no change, and even declines.

The extent of gain during the 1960's varied considerably among industries; it ranged from over 10 percent a year to less than 1 percent.

The differences in productivity growth rates among industries stem from many sources. For example, the large productivity advances of the 1960's in air transportation were produced by the adoption of jets and the great expansion in traffic. On the other hand, the lack of productivity in the footwear industry resulted from the fact that footwear producers deal with a variety of sizes and styles that have made adoption of mass production methods difficult. Similarly, low productivity gains in copper mining reflected a situation where operators were faced with less and less recoverable ore as the richest veins became exhausted.

Although variations between plants within industries are not shown here, they vary both in level and rate of productivity improvement. Some plants may exceed the trend for the industry significantly, and others may lag well behind the average.

GROWTH IN OUTPUT PER MAN-HOUR IN SELECTED INDUSTRIES, 1960-70



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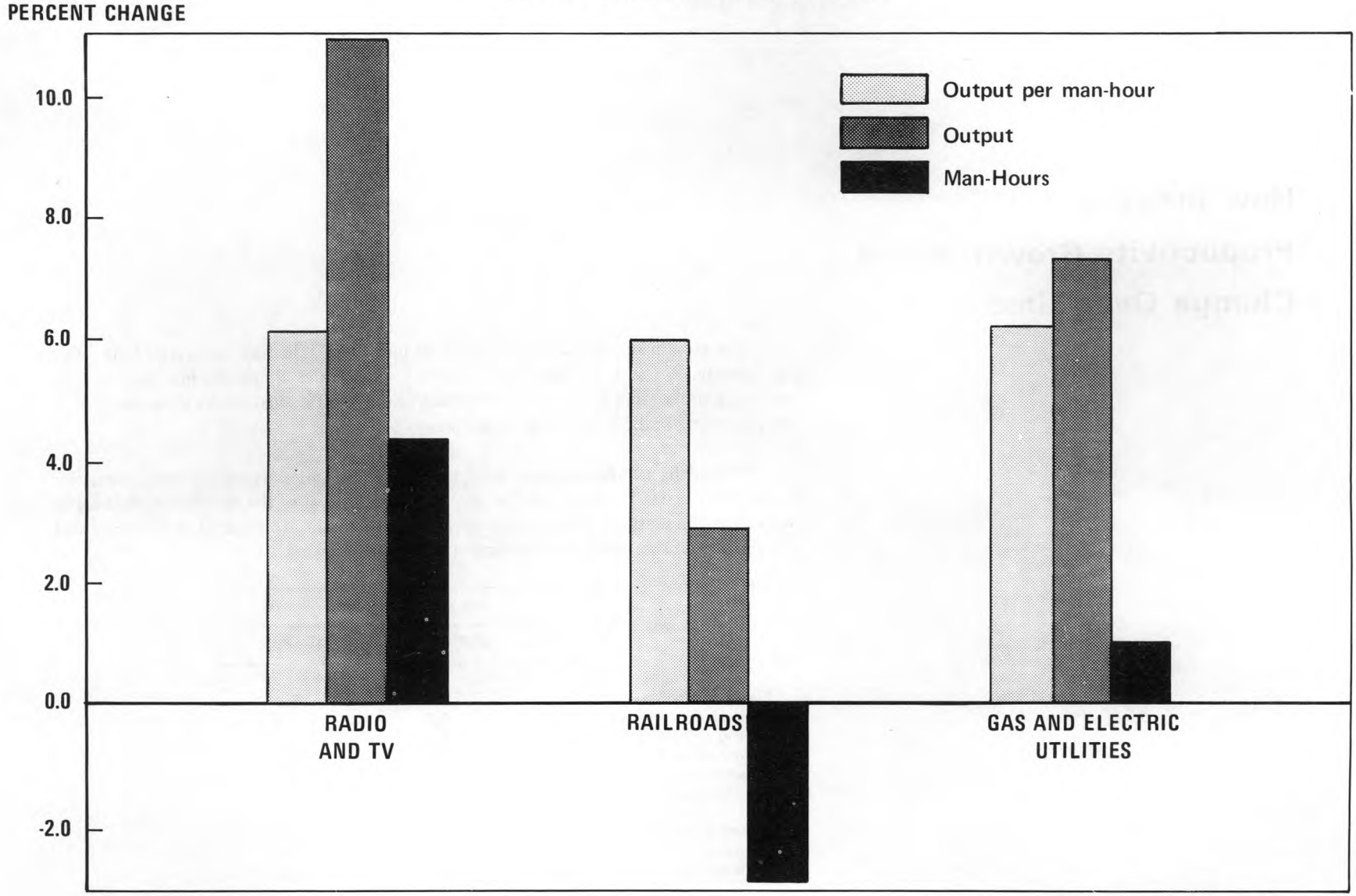
How Output Per Man-Hour Components Vary from Industry to Industry

Seemingly similar trends in output per man-hour can represent vastly different trends in output and employment. For instance, productivity grew at a rate of slightly more than 6 percent a year in radio and television manufacturing, railroad transportation, and gas and electric utilities, but each one of these industries tells a different productivity story. High productivity growth in radio and TV represented a big increase in output, accompanied by substantial growth in man-hours, while similar productivity growth in railroads was achieved by a large reduction in man-hours, coupled with a small increase in output. The rate of productivity increase for gas and electric utilities stayed close to the rate of output growth, as man-hours barely changed.

These three industries show the major types of high productivity growth situations. They indicate that the implications of productivity growth for employment are closely associated with trends in output. Industries that have large increases in output tend to increase man-hours too, while industries that have small output growth tend to reduce man-hours.

ANNUAL PERCENT CHANGE IN OUTPUT PER MAN-HOUR, OUTPUT, AND MAN-HOURS, SELECTED INDUSTRIES, 1960-70



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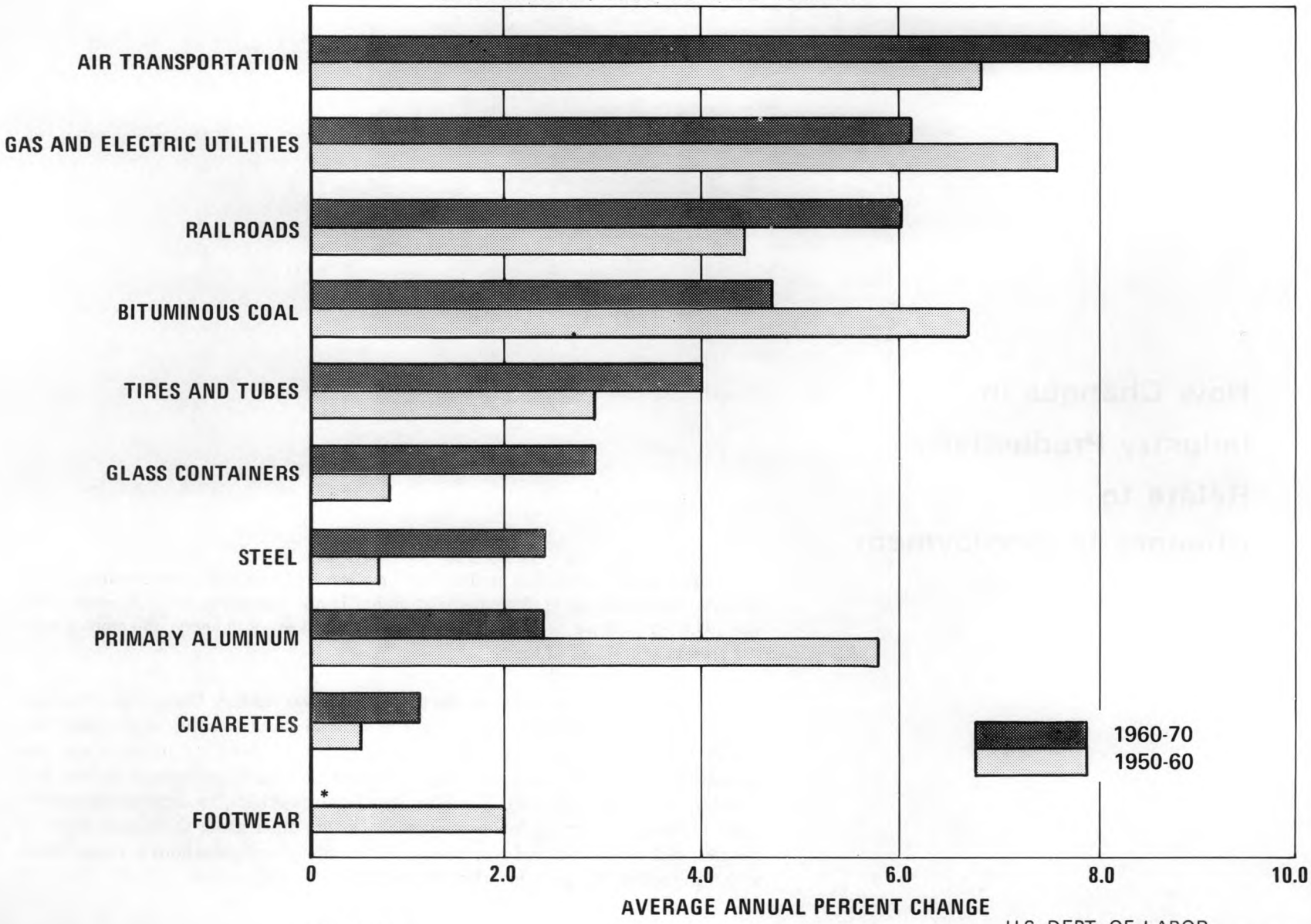
How Industry Productivity Growth Rates Change Over Time

The growth of output per man-hour in individual industries varies over time, often significantly. A few industries such as electric power and aluminum increased productivity at a more rapid rate in the 1950's than in the 1960's. Most others show much more rapid increases in the 1960's than in the previous decade.

Within the 1960's, trends in output per man-hour varied widely for most industries: Productivity growth fell off substantially in the latter half of the decade, largely because of cyclical fluctuations. These variations were particularly pronounced in industries such as steel, air transportation, and aluminum rolling and drawing.

Industry	Average annual percent change	
	1960-70	1950-60
Air transportation	8.5	6.8
Railroads	6.0	4.4
Gas and electric utilities	6.1	7.6
Bituminous coal	4.7	6.7
Tires and tubes	4.0	2.9
Glass containers	2.9	0.8
Steel	2.4	0.7
Primary aluminum	2.4	5.8
Cigarettes	1.1	0.5
Footwear	0.0	2.0

GROWTH IN OUTPUT PER MAN-HOUR FOR SELECTED INDUSTRIES, 1950-60 AND 1960-70



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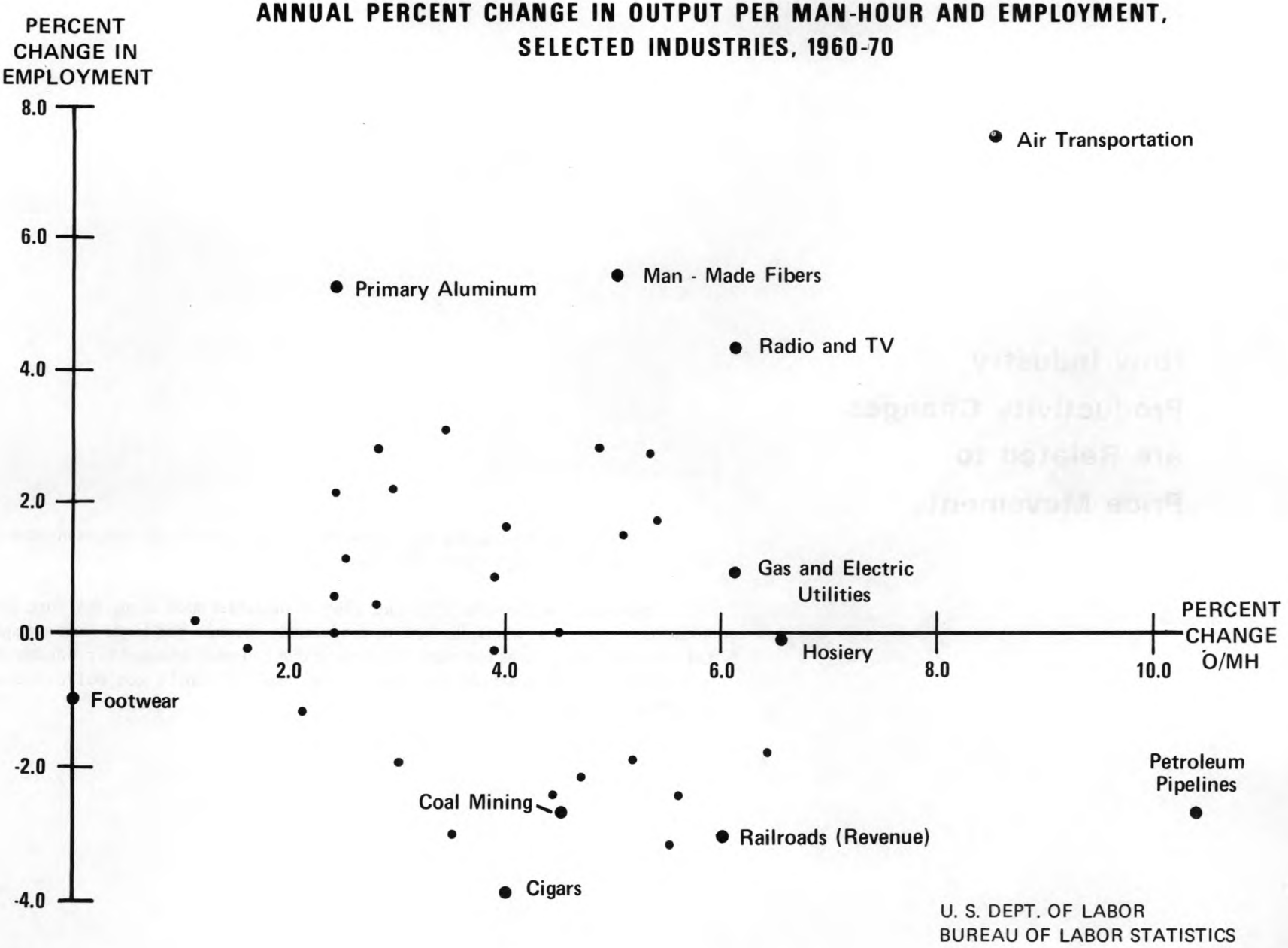
How Changes in Industry Productivity Relate to Changes in Employment

Many people think that productivity increases lead automatically to employment declines. The chart shows that this relationship is not necessarily true. Between 1960 and 1970, for example, productivity went up in almost every industry, and employment also grew in almost half of them.

Industries that have large productivity increases often have large output increases that lead to an expansion of employment. This situation occurred in the air transportation and the radio and TV industries. Productivity growth in petroleum pipelines also was associated with a large increase in output, but technological improvements enabled this industry, which has been highly mechanized from its origins, to expand production while reducing its already low employment. On the other hand, there were some industries, such as railroads and coal mining, where employment reductions were associated with high productivity gains in a climate of stable or declining output.

ANNUAL PERCENT CHANGE IN OUTPUT PER MAN-HOUR AND EMPLOYMENT, SELECTED INDUSTRIES, 1960-70



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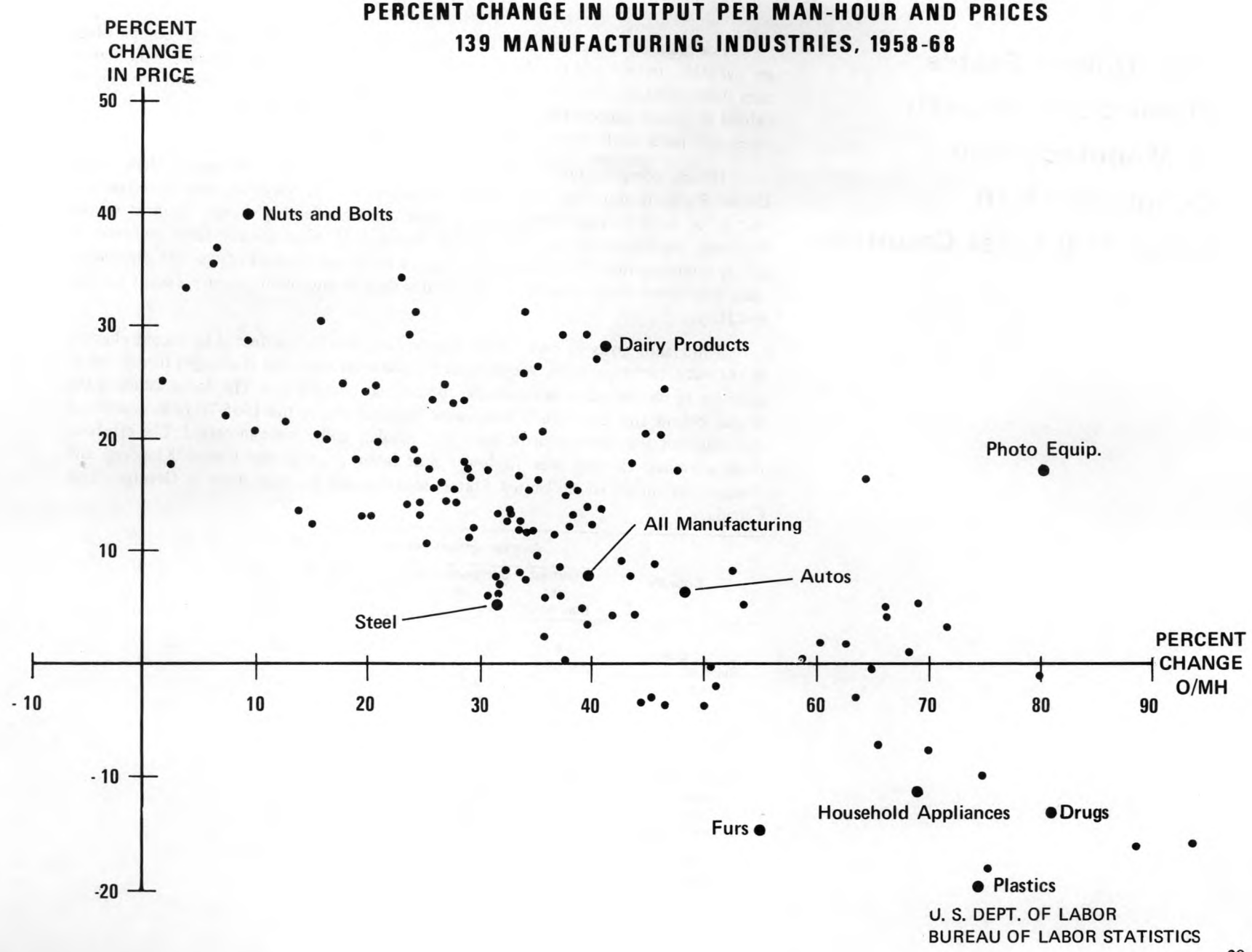
How Industry Productivity Changes are Related to Price Movements

A close inverse relationship exits between changes in prices and changes in productivity, particularly among manufacturing industries.

Prices declined between 1958 and 1968 in industries such as plastics, furs, and household appliances, where the rate of productivity increase was larger than average. On the other hand, prices increased in industries that had small advances in productivity, such as nuts and bolts. Several exceptions to this general rule can be seen, but the overall relationship is unmistakeable.

PERCENT CHANGE IN OUTPUT PER MAN-HOUR AND PRICES
139 MANUFACTURING INDUSTRIES, 1958-68



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How United States Productivity Growth in Manufacturing Compares With Other Industrial Countries

For manufacturing, the only industrial sector for which international comparisons are available, output per man-hour levels in the United States are probably still higher than those in other countries. However, the United States productivity growth rate lagged behind the gains registered by other industrial countries between 1965 and 1970. In most cases, and particularly with regard to Japan, the gap was substantial.

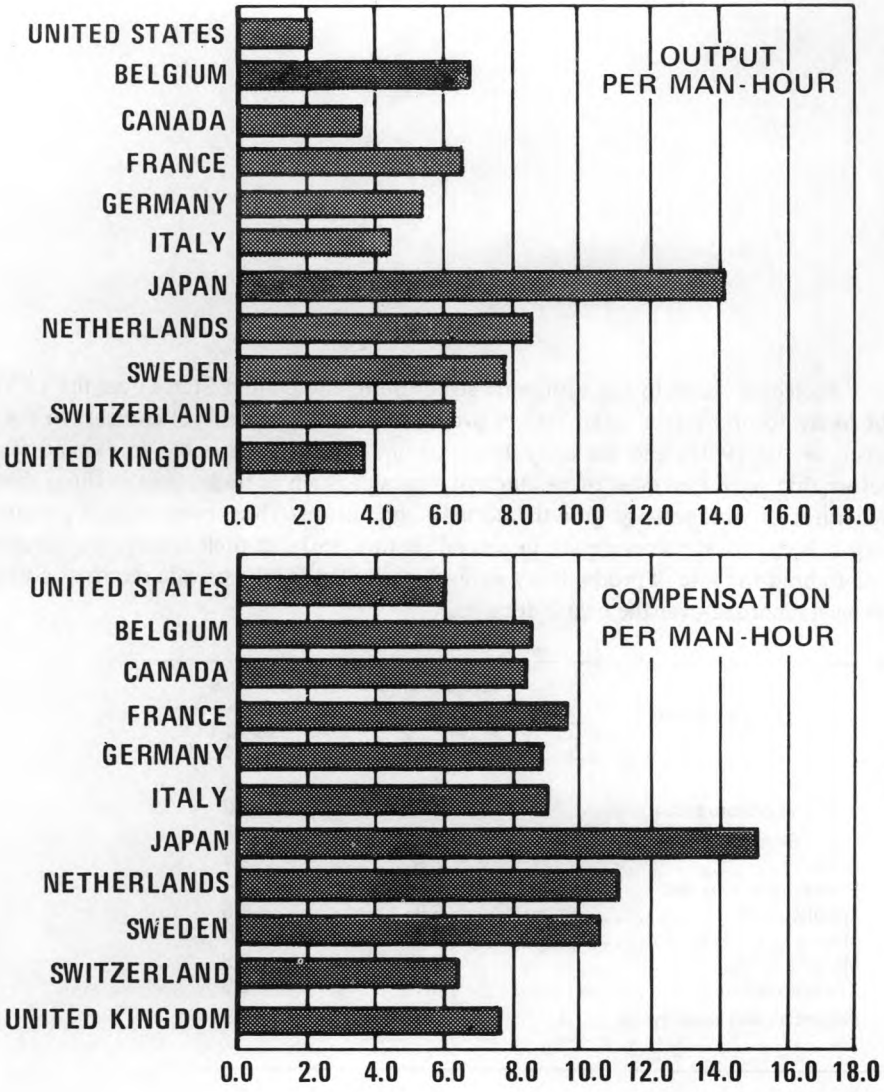
Hourly compensation in other countries also advanced more rapidly than in the United States; it outpaced the productivity growth rate in every case, and caused rises in unit labor costs in each country. Unit labor costs accelerated sharply in most of the European countries during 1970, mainly because of exceptionally large increases in hourly compensation. Nevertheless, because of its slower productivity growth, unit labor costs rose more sharply in the United States than in any other country except Canada and Italy.

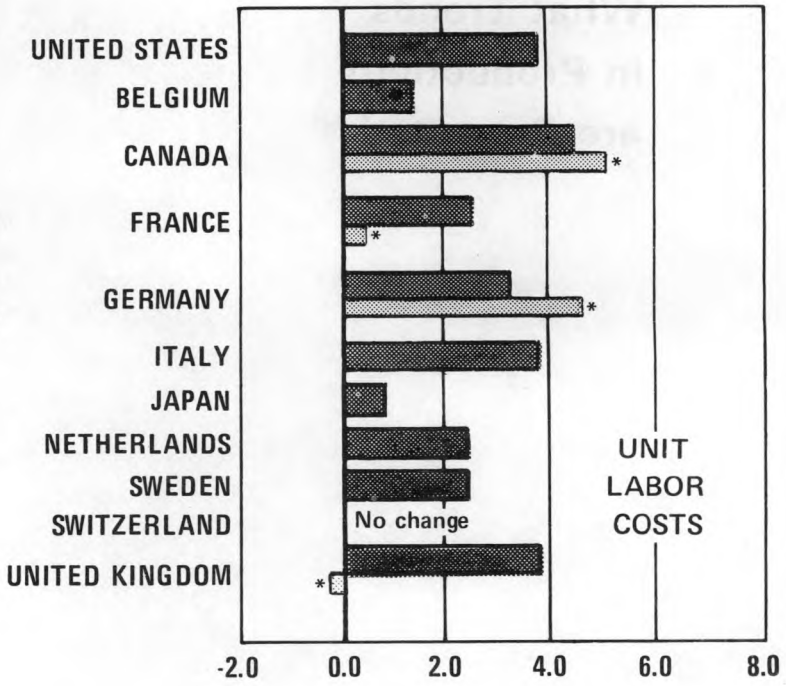
Unit labor costs in four of the foreign countries were affected by recent changes in currency exchange rates, which must be taken into account if changes in unit labor costs are to be related to international commercial competition. The dollar values of the British pound and the French franc were reduced within the 1965-70 period, whereas the values of the German mark and the Canadian dollar were increased. The effect of these currency changes was to lower unit labor costs in the United Kingdom and France—as measured in United States dollars—and to raise them in Germany and Canada.

Country	Average annual percent change, 1965-70			
	Output per man-hour	Compensation per man-hour	Unit labor costs	
			National currency	U.S. dollars
United States	2.1	6.0	3.9	3.9
Belgium	6.8	8.4	1.4	1.4
Canada	3.5	8.3	4.6	5.1
France	6.6	9.5	2.7	0.6
Germany	5.3	8.7	3.2	4.7
Italy	5.1	9.1	3.8	3.8
Japan	14.2	15.1	0.8	0.8
Netherlands	8.5	11.1	2.5	2.5
Sweden	7.9	10.6	2.5	2.5
Switzerland[1]	6.2	6.2	0.0	0.0
United Kingdom ..	3.6	7.6	3.8	-0.2

[1] Wage earners only.

RATES OF CHANGE IN OUTPUT PER MAN-HOUR, HOURLY COMPENSATION, AND UNIT LABOR COSTS FOR ALL EMPLOYEES IN MANUFACTURING, ELEVEN COUNTRIES, 1965-70





*Adjusted to U.S. Dollar basis

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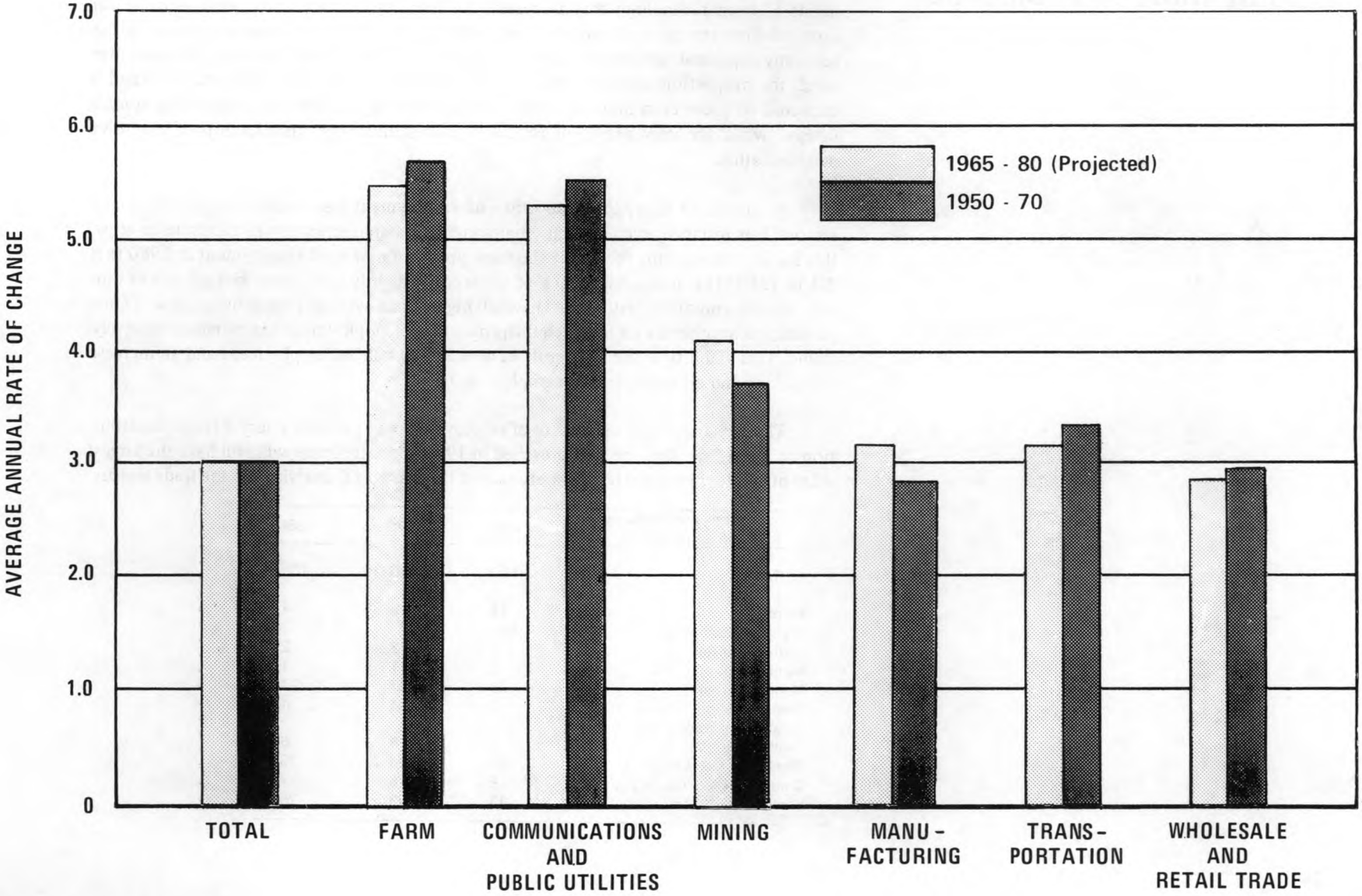
What Trends in Productivity are Projected

Projected shifts in the economic structure in the United States over the 1970's are not likely to promote a faster rate of productivity improvement, in contrast to the experience of the 1950's and the early 1960's. Employment is expected to expand faster in sectors that have low rates of productivity growth, such as trade, than in those that have high rates of productivity growth, notably agriculture. Thus, even though productivity growth is expected to accelerate in several sectors, shifts in their relative importance will tend to hold the rate of productivity advance projected for the private sector as a whole to the level recorded over the past 2 decades.

Industry group	Average annual percent change	
	1965-80 (projected)	1950-70
Total private sector	3.0	3.0
Selected sectors		
Farm	5.5	5.7
Communications and public utilities	5.3	5.5
Mining	4.1	3.7
Manufacturing	3.1	2.8
Transportation	3.1	3.3
Wholesale and retail trade	2.8	2.9

PRODUCTIVITY TRENDS TOTAL PRIVATE ECONOMY AND SELECTED SECTORS, 1950-70 AND 1965-80



What Distribution of Employment is Projected

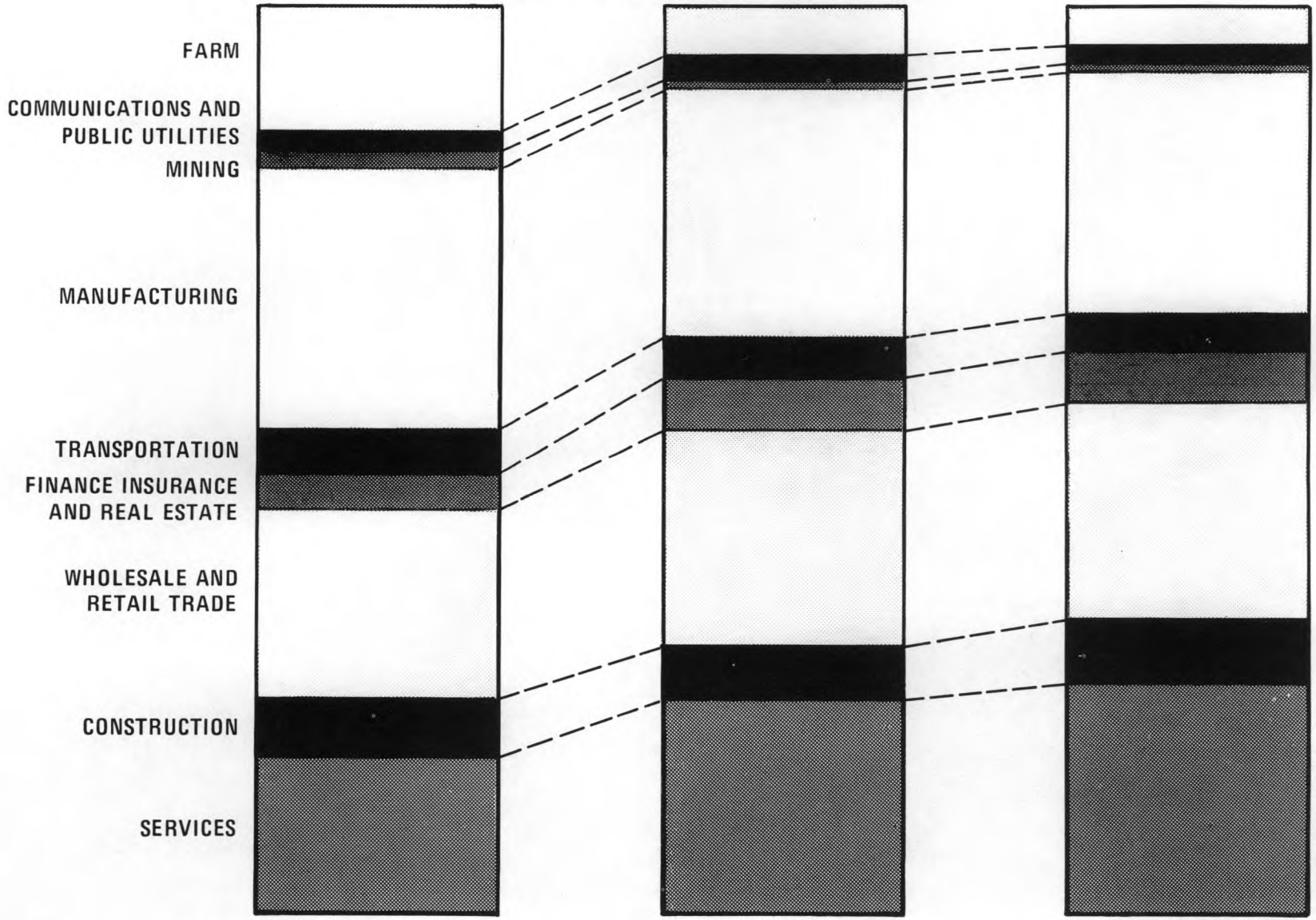
The distribution of employment is changing and will continue to do so, largely because productivity and demand change at different rates in different sectors. Employment in agriculture dropped substantially between 1950 and 1970, reflecting improvements in farm technology that increased the industry's productivity while demand for farm products remained relatively stable. Consequently, with employment going up in the economy in general, agriculture's share of total employment dropped sharply. On the other hand, the proportion of employment in services went up between 1950 and 1970 and is expected to grow even more by 1980. Demand for services has been expanding continuously, while the very nature of service activities limits the introduction of extensive mechanization.

At the same time, the proportion of employment has hardly changed for many sectors. For instance, even though employment in manufacturing will continue to grow, this sector will account for about the same proportion of total employment in 1980 as it did in 1950. This is a consequence of the sector's slightly lower-than-average rate of output growth combined with its somewhat higher-than-average productivity gain. Transportation is another sector in which the proportion of employment has remained relatively stable. This stability is the net result of a decline in railroad employment and an increase in trucking and air transportation employment.

These changes in the structure of employment will produce a very different distribution in 1980 than the one that prevailed in 1950. Manufacturing will still have the largest share of employment, but it will barely exceed the shares of the service and the trade sectors.

Relative importance of employment	1950	1970	1980
Total	100	100	100
Farm	14	5	4
Communications and public utilities	2	3	2
Mining	2	1	1
Manufacturing	28	27	27
Transportation	5	4	4
Finance, insurance, and real estate	4	6	6
Wholesale and retail trade	21	24	25
Construction	6	6	7
Services	17	23	26

RELATIVE IMPORTANCE OF EMPLOYMENT FOR MAJOR SECTORS, 1950, 1970 AND PROJECTED 1980



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