Productivity in the U.S. Economy: Trends and Implications

By Steven P. Zell

In the January 1978 Economic Report to the President, the Council of Economic Advisors termed the slowdown in U.S. productivity growth "one of the most significant economic problems in recent years." The continued productivity slowdown during 1978 and the sharp decline in the first two quarters of 1979 have greatly increased the public's awareness of this problem, largely through numerous government reports and greatly increased coverage in newspapers and magazines. Yet, because the productivity issue is extremely complex, its discussion remains full of misconceptions and misunderstandings.

This article begins by addressing the question of just what productivity means. In the second section, general productivity trends are examined, with particular emphasis on the apparent shift in productivity behavior since 1967 and its implications for the economy. Section three analyzes the sources of the slowdown in productivity growth and their relative contributions to the slowdown. In particular, the effects on productivity of the weakness in U.S. investment spending is studied. The last section examines the behavior of productivity over the business cycle and discusses probable trends.

PRODUCTIVITY: WHAT DOES IT MEAN?

As used in economics, productivity is a measure of the relationship between output (goods and services) and one or more of the inputs (land, labor, capital, etc.) used to produce the output. Both output and inputs are measured in physical or real terms. While a variety of productivity measures may be defined, that most frequently seen is the concept of labor productivity, the ratio of output to labor input. Contrary to popular belief, labor productivity does not measure changes in the **efficiency** of labor in production. Because other input factors are also involved in production, output per hour may increase not only because of increased labor efficiency, but as other factors, such as capital, are substituted for labor. Increases in output per hour may best be viewed as reflecting the saving of labor per unit of output as the result of the joint effect of all inputs and the way they are combined.[1]

The concept of labor productivity has only one input in its denominator and as a result it

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1 John W. Kendrick, ***Understanding Productivity*** **(Baltimore, Johns** Hopkins Press, 1977), Chapter 2.

Table 1
PRODUCTIVITY GROWTH RATES FOR MAJOR SECTORS
(Annual Average Percentage Rates of Change)

Sector	1947-1967	1967-1972	1972-1978	1977:4-1979:2
Private Business	3.2	2.2	1.2	-0.3
Hours	0.5	1.1	1.8	3.5
Output	3.7	3.3	3.0	3.2
Nonfarm Business	2.6	1.9	1.9	-0.5
Farm*	5.7	5.2	2.1	N.A.
Manufacturing	3.0	3.0	1.8	1.4
Durable	2.7	2.5	1.2	0.7
Nondurable	3.3	3.6	2.6	2.6
Nonfinancial Corporations	3.2†	2.0	1.3	1.7‡

SOURCE: Bureau of Labor Statistics.

*From Joint Economic Committee Report 1979. No. 96-44, p. 56.
†1958-1967. Earlier years not available.
‡1977:4 to 1979:1.

is called a ***partial productivity*** measure. Other similar measures, such as capital productivity and land productivity, or yield per acre, may also be employed. To avoid the problem of having the level of productivity vary as one input is substituted for another, ***total factor productivity*** may be calculated. This index combines in its denominator a weighted sum of all of the inputs used in production. It thus measures the net saving of resource inputs and the increase in overall productive efficiency. Clearly, both partial and total productivity measures might be calculated for a firm, an industry, or for the economy as a whole. Labor productivity, however, remains the most widely used index. In part, this is because labor is by far the largest input, but mostly because it is the most measurable input. Not only is capital far more difficult to quantify, but there are great theoretical and empirical difficulties in aggregating the different inputs.[2]

PRODUCTIVITY TRENDS IN THE U.S.: WHY THE CONCERN?

Concern about the growth rate of productivity is well founded, for productivity growth is the major source of increase in our standard of living and one of the keys to the reduction of inflation. This statement becomes evident when the growth in real output is

2 In fact, there are difficulties in calculating any aggregate index. See "Output Per Employee-Hour Measures: Industries and the Federal Government," Bureau of Labor Statistics, ***Handbook*** of ***Methods,*** Bulletin 1910, Chapter 31; Jerome A. Mark, "Concepts and Measures of Productivity," in ***The Meaning and Measurement of Productivity,*** Bulletin 1714; and Kendrick, for discussion of how these measures are actually calculated.

Note that the economic meaning of productivity differs from work study measures, which compare the level of output to some present norm under the technology currently in use. Productivity, as used in economics, reflects not only labor efficiency, but technological change and other factors as well.

viewed as consisting of two parts, that due to the growth in inputs and that due to the growth in productivity, or output per unit of input.'

Looking at labor productivity and output in the private business sector, it may be seen that from **1947** to **1967, U.S.** business output rose at an annual rate of **3.7** per cent **(Table 1).** Over this same period, the number of people at work grew approximately 1.0 per cent per year. But because the number of hours per worker declined approximately 0.5 per cent per year, total hours worked rose only 0.5 per cent annually. The difference between average annual output growth of **3.7** per cent and hours growth of 0.5 per cent is accounted for by the **3.2** per cent average annual increase in productivity. Thus, almost 90 per cent of the growth in real output in the **U.S.** from the end of World War **II** through **1967** was due to increased productivity.

Growth in productivity in recent years, however, has been much less vigorous. This is vividly illustrated by Chart **1,** which contrasts the growth path of actual productivity in the private business sector from **1947** to **1979:2** with the trend rate of productivity growth between **1947** and **1967. Even discounting** the cyclical decline in productivity resulting from the **1973-1975** recession, there is no doubt that a distinct slowdown has taken place in the growth of productivity.

This slowdown is further illustrated in Table **1,** which presents labor productivity growth in several sectors of the economy for four time periods. Also provided are the growth rates of hours and output in the private business sector for the same periods. The marked slowdown in productivity growth in all sectors is obvious, as are its effects on the growth of output. In the private business sector, only the rapid growth in employment and hours worked kept the rate of output growth from slowing even more than it did. Over a 10-year period, the difference between productivity growth rates of **3.2** per cent (between **1947** and **1967)** and **1.2** per cent (in the **1972-78** period) equals **22** per cent of the final year's output per hour. Thus, had output per hour grown at the **1947-67** rate each year through **1978,** while hours grew at the rate they did, real **GNP** in **1978** would have been about **$250** billion above its actual level of nearly **$1,400** billion.

Some Other Implications of the Slowdown in Productivity

Besides the loss of potential output, the slowdown in productivity growth has several other negative implications. Foremost among these is a worsening of the rate of inflation. It may be shown that the growth rate of output prices is approximately equal to the difference between the growth rates of input prices and total factor productivity.' Thus, for any rate of change in input prices, a one percentage point fall in productivity growth must raise output prices by one percentage point.

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3 This is an identity. Where Y is output, I is input, △ represents change, and o is a subscript for the initial period,

1) $Y = Y/I \cdot I$ and

2) $\frac{\triangle Y}{Y_o} = \frac{\triangle(Y/I)}{(Y/I)_o} + \triangle I/I_o +$ a **residual.**

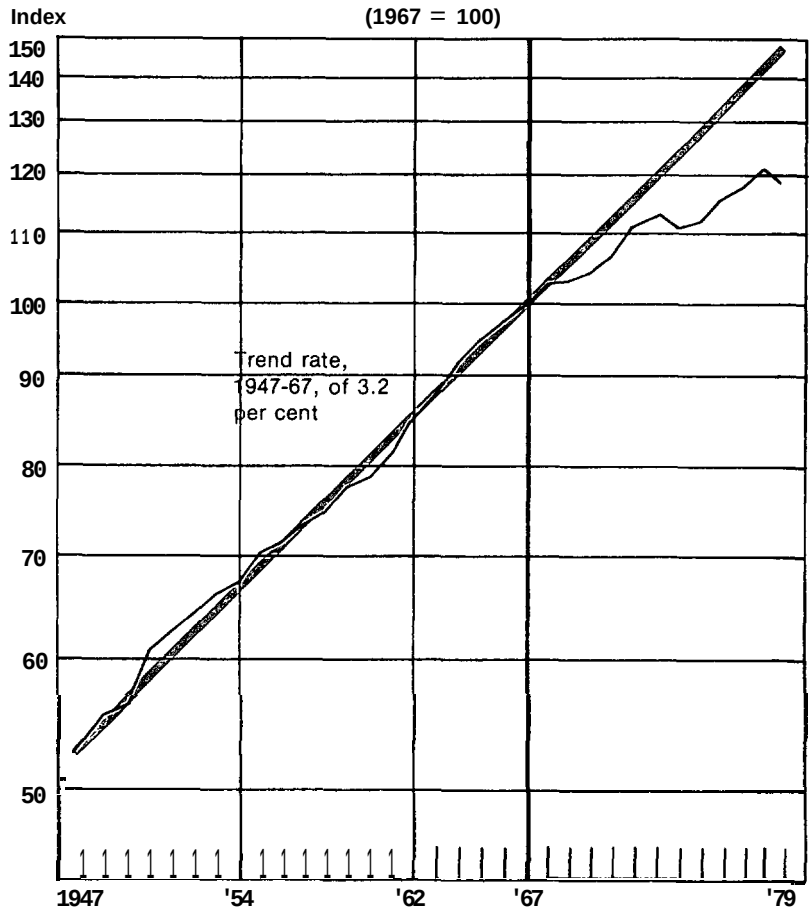
For an extensive use of this methodology, see Steven P. **Zell, *The Growth of Youth Unemployment: Characteristics and Causes* (Federal Reserve Bank of Kansas City, 1979), Chapter 2 and Appendix A.**

4 More precisely, subtracting indirect business taxes and subsidies, national business product, Y, must equal national income or gross factor costs. Deflating income by input prices, P_I, and product by output prices, P_O, yields real factor input I and real output O, respectively. Their ratio, O/I, is total factor productivity. Thus (from Kendrick, p.76)

$$\frac{O}{I} = \left(\frac{Y}{P_O}\right) \div \left(\frac{Y}{P_I}\right) = \frac{P_I}{P_O}$$

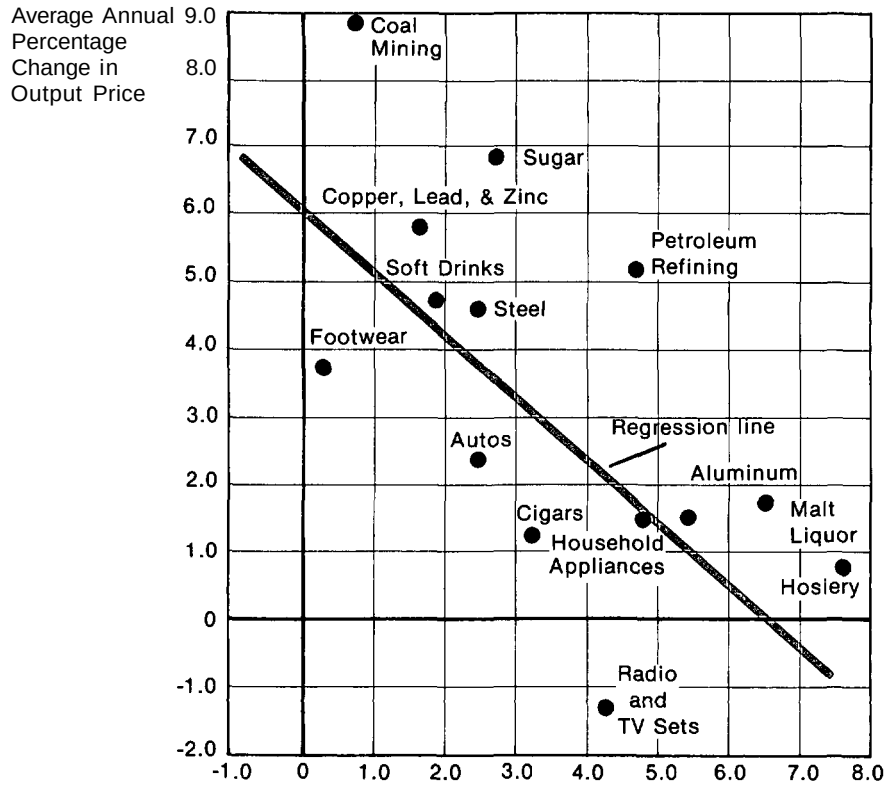
Because labor compensation costs have historically constituted about three-quarters of total factor costs, the relationship is also very close between the growth in output prices and the difference between the growth rates of labor compensation and labor productivity. This difference in growth rates, defined as the growth rate in unit labor costs, may thus be correctly viewed as the principal determinant of the rate of inflation. Though the effect of increases in unit labor costs on inflation may be temporarily offset by decreases in the costs of other factors, in the long run the price level must move with unit labor costs. It follows that any slowdown in labor productivity is ultimately translated into increases in the price level. Chart 2 illustrates that even at the level of individual industries, there is a strong negative correlation between productivity increases and price increases. That is, industries with high

Chart 1
OUTPUT PER HOUR IN PRIVATE BUSINESS ECONOMY, 1947-79 ACTUAL LEVELS AND 1947-67 TREND



SOURCE: Bureau of Labor Statistics
*1979 value estimated.

Chart 2
PRICES AND PRODUCTIVITY: AVERAGE RATES OF CHANGE, SELECTED INDUSTRIES
1960-75



SOURCE: **Productivity Perspectives,** American Productivity Center, Inc.

rates of productivity gain tend to have smaller price increases, and vice versa.[5]

SOURCES OF THE PRODUCTIVITY SLOWDOWN

Why has productivity growth behaved as it has during the post-war period? Productivity, measured as output per unit of labor input, ultimately increases for one of three reasons. Either the amount of physical capital per worker increases, the quality of labor improves, or the efficiency with which capital and labor are combined improves.[6] While many reasons

5 For a discussion of the impact of this effect, see Hendrick S. Houthakker, "Growth and Inflation: Analysis by Industry," *Brookings Papers on Economic Activity.* January 1979, pp. 241-57.

6 Solomon Fabricant, "Productivity Growth: Purpose, Process, Prospects, and Policy," in *Special Study on Economic Change,* Hearings before the Joint Economic Committee, Part 2, June 8, 9, 13, and 14, 1978, pp. 498-531.

for the productivity slowdown have been proposed, they all fall into one of these three categories.

The Work of Edward Denison

By far the most ambitious efforts to quantify the sources of productivity growth have been made by Edward F. Denison of the Brookings Institution.[7] Table 2 reproduces calculations made by him through 1976. Denison measures productivity as output per person employed in the nonresidential business sector, which includes agriculture but excludes imputed services of the housing stock. Adjusting for the effects of factors which affect productivity erratically, like bad weather, work stoppages, and intensity of demand (a proxy for which might be capacity utilization), a marked slowdown in the growth rate of labor productivity is observed, from 2.7 per cent per year from 1948 to 1969, to -0.6 per cent per year from 1973 to 1976.

Denison proceeds with his analysis by dividing the sources of productivity growth into two major categories. The first of these categories, ***factors affecting input quantity or quality,*** has two major components pertaining, respectively, to labor and to capital and land. These components are changes in labor characteristics and changes in capital and land per person employed. The second major category of sources of productivity growth consists of ***factors affecting how those inputs are combined,*** that is, of factors affecting output per unit of input.

Of the adjusted 2.7 per cent annual productivity increase from 1948 to 1969, changes in the characteristics of labor inputs contributed a net of 0.2 percentage points. This net labor impact was achieved in three ways. First, there was a decline in hours worked—mainly reflecting a shift to part-time work. Because the productivity statistic being explained is output per employee, this change reduced productivity. Second, particularly important in later years, there was a fall in measured output per employee due to a shift to women and teenagers making up a larger share of the work force. The contribution to output of a worker is measured by market value, and this differs by age and sex. The third labor factor, education changes, contributed positively to productivity because the average level of education increased.

The second set of factors affecting input quality or quantity is the growth in capital and land per person employed. Divided into the impact of the growth of tangible capital, inventories, and land, this source made a small net positive contribution of 0.4 percentage points to productivity over this period.

The remaining sources of productivity growth as measured by Denison are those that contribute to the efficient combination of labor and capital inputs. First, productivity grew over the 1948-69 period because resource allocation was improved. That is, resources that were overallocated to farming, self-employment, and other enterprises were moved into areas where they could be better utilized and where their output was higher. Productivity also grew because economies of scale were achieved in the economy from changes in the size of markets and from specialization. A third factor, the legal and human environment category, had no effect in the pre-1970 period, but an important negative effect recently. This category measures the impact on productivity from environmental, safety, and health regulations, and from the cost of crime. These output-per-unit-input factors together were responsible for 0.8

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[7] See Edward F. Denison, *Accounting for United States Economic Growth: 1929-1969,* (Brookings, 1974). Also, "The Puzzling Drop in Productivity," *Challenge,* May-June 1979, pp. 60-62, for Table 2 of the present article.

Table 2
SOURCES OF GROWTH OF NATIONAL INCOME PER PERSON EMPLOYED, NONRESIDENTIAL BUSINESS SECTOR
(Percentage Points)

	1948-69	1969-73	1973-76	Difference in Growth Rates, 1948-69 to 1973-76 (1-3)
	(1)	(2)	(3)	(4)
ADJUSTED GROWTH RATE	2.7	2.1	–0.6	– 3.3
FACTORS AFFECTING INPUT QUANTITY OR QUALITY				
Changes in Labor Characteristics:				
Hours at Work	–0.2	–0.3	– 0.5	–0.3
Age-Sex Composition	–0.1	– 0.4	– 0.3	–0.1
Education	0.5	0.7	0.9	0.4
Changes in Capital and Land Per Person Employed:				
Nonresidential Structures and Equipment	0.3	0.2	0.2	–0.1
Inventories	0.1	0.1	0.0	– 0.1
Land	0.0	0.1	0.0	0.0
FACTORS AFFECTING OUTPUT PER UNIT OF INPUT				
Improved Allocation of Resources*	0.4	0.1	0.0	– 0.4
Changes in Legal and Human Environmentt	0.0	–0.2	–0.4	– 0.4
Economies of Scale From Larger Markets	0.4	0.4	0.2	–0.2
Advances in Knowledge and Not Elsewhere Classified	1.4	1.6	–0.7	–2.1

SOURCES: Data for 1948-69 from Edward F. Denison, Accounting for United States Economic Growth, 1929-1969 (Brookings, 1974), with minor changes resulting from the measurement of output in 1972 prices in place of 1958 prices and from revisions in data. Data for 1969-73 and 1973-76, preliminary estimates by Edward F. Denison. Detail may not add to totals because of rounding.

*Includes only gains resulting from the reallocation of labor out of farming and out of self-employment in small nonfarm enterprises.
†Includes only the effects on output per unit of costs incurred to protect the physical environment and the safety and health of workers, and of costs of dishonesty and crime.

percentage points of the productivity growth rate in the 1948-69 period.

The majority of the increase in productivity from 1948 to 1973, however, is classified as the result of "advances in knowledge and not elsewhere classified." While this is a residual term, it is believed to measure the effects on output resulting "from the incorporation into production of new knowledge of any kind, regardless of its source; from the way knowledge is transmitted to those who can use it; or from the way it is incorporated into production."[8] In 1973-76, though, the effect of this index on productivity turned sharply negative. It is this shift in the contribution of advances in knowledge that Denison finds responsible for 2.1 points of the 3.3-point decline in productivity growth from the 1948-69 period to the 1973-76 period. Also contributing importantly to this decline, says Denison, is the large increase in resources necessary to satisfy environmental and health requirements and to combat crime and dishonesty.

Technological Change: Some Reasons for The Apparent Slowdown

Two important reasons given for the apparent slowdown in the rate of technological progress in the U.S. are a slowdown in the amount of research and development (R&D) work being done, and the effect of an insufficiency of capital investment on the transmission of technology.[9] Aging industrial plants, the use of managerial talent to adapt to new government rules, the increase in energy prices, and the slowdown in decisionmaking due to requirements for government approval and permits are also mentioned as factors.[10]

Growth in the stock of capital at a rate faster than the growth in labor is critical for technological progress and for the increase in labor productivity. New technology is largely transmitted to the economy when new equipment replaces old and the output of workers increases when they have both more and better capital to work with. Table 3 shows the relationship, between years containing post-war business cycle peaks, of growth rates in labor productivity, the capital-labor ratio, capital, and labor hours. The decline in the growth rate of capital in the two periods following 1969, coupled with the acceleration in the growth in labor hours in the 1973-78 period, has resulted in a sharp slowdown in the growth in the capital-labor ratio. The capital stock-labor force ratio in the U.S. peaked in 1974 at $10,604 ($1972) and declined nearly 3 per cent through 1978.[11] Partly as a result, growth in output per hour similarly declined.

The source of the slowdown in the growth of capital is a weakness in investment spending. Relative to real GNP, investment averaged 10.4 per cent from 1967 to 1976, but fell below 10 per cent in 1975-77 before rising to 10.1 per cent in 1978. Even these numbers are an overstatement as they do not consider the increasing share that pollution abatement equipment has represented of total plant and equipment spending (5 per cent in 1977). The importance of investment spending as a proportion of GNP is highlighted in Chart 3, which shows the

8 Denison, *Challenge.*

9 For further exposition of these views, see Kendrick, *Understanding Productivity.* pp. 68, 69, 74; *Joint Economic Committee Report 1979,* Report No. 96-44, pp. 59-61; *Review of the Economy.* October 1978, Joint Economic Committee, pp. 132-4; and Fabricant, Hearings, pp. 514-15, 528-31.

10 In "Explanations of Declining Productivity Growth," *Survey of Current Business,* U.S. Department of Commerce, August 1979, pp. 1-24, Denison is unable to attribute a large influence on the residual to any of 17 different factors, including those mentioned above. Other authors (Footnote 9) support a major role for R&D expenditures and investment on the slowdown.

11 *Joint Economic Committee Report 1979,* pp. 59-60. With labor measured in hours, the capital-labor peak was in 1975, and the decline has also been nearly 3 per cent.

Table 3
ANNUAL GROWTH RATES OF PRODUCTIVITY AND INPUTS BETWEEN BUSINESS CYCLE PEAKS
(Per Cent Per Year)

Between	Output Per Hour	Capital - Labor Ratio	Capital	Labor Hours
1948-53	3.65	4.21	4.59	0.36
1953-57	2.42	4.05	4.15	0.10
1957-60	2.45	2.91	2.68	-0.21
1960-69	3.07	3.29	4.65	1.32
1969-73	2.34	2.50	3.71	1.18
1973-78	1.11	1.32	2.69	1.35

SOURCE: Bureau of Labor Statistics.

strong positive relationship between this measure and the annual increase in productivity across countries.

A slowdown in expenditures for research and development is also likely to have had an important deleterious effect on productivity growth and technological change. In current dollars, the growth rate in total expenditures on R&D in the United States has declined from a yearly average of nearly 14 percent in 1953-61 to just under 6 per cent during 1967-77. In constant 1972 dollars, R&D outlays peaked at $31.1 billion in 1968 and fell to $28.5 billion in 1977.[12] While much of the decline was due to a 45 per cent drop in Federal support for basic research (partly for defense and space programs), private spending for basic research also fell in real terms.[13]

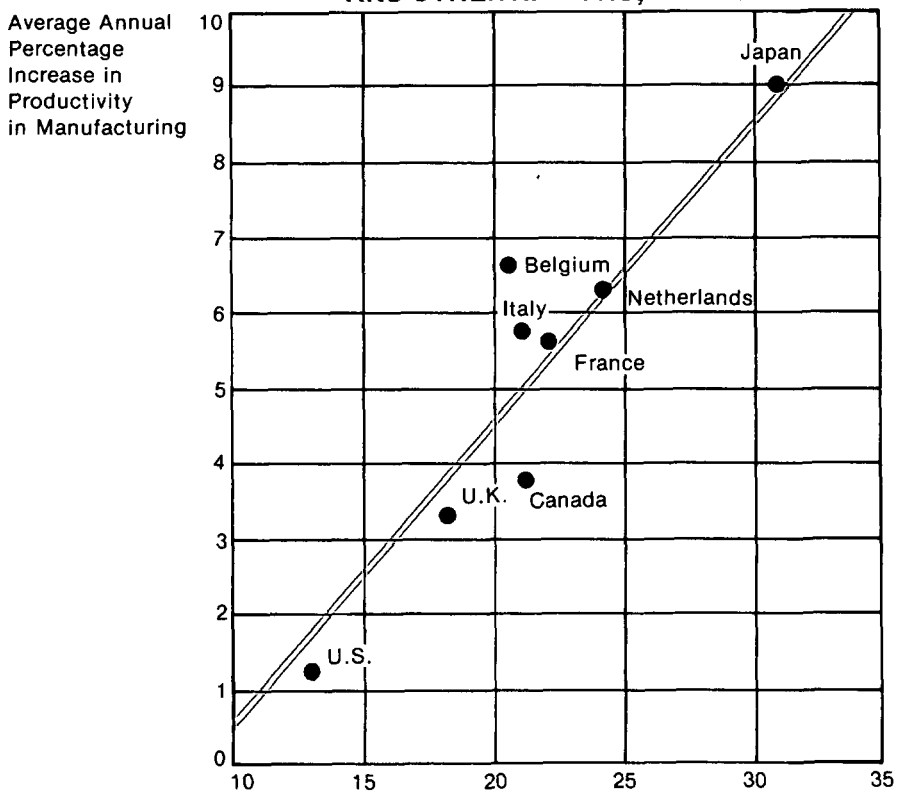
Substantially increased investment in tangible plants and equipment and in basic research and development clearly must be encouraged in the U.S. if productivity growth is to regain its momentum. Two important means for encouraging such investment are through a liberalization of the investment tax credit and a revision of the current depreciation rules. Professor Martin Feldstein of Harvard estimated that in 1973, the historic cost method of depreciation caused an understatement of corporate depreciation of $25 billion and thus an increase of corporate tax liability of $12 billion, or 20 per cent. This "inflation tax" amounted to a 23 per cent reduction in net 1973 corporate profits.[14] In comment, the Joint Economic

12 Productivity Perspectives, American Productivity Center, Inc., p. 60, and *Review* of the Economy. October 1978, Joint Economic Committee, p. 132.

13 Note that while the returns on R&D expenditures are generally agreed to be quite high, private investment in R&D is unlikely to be at the socially optimal level because of the high risk of failure, the difficulty of capturing the full return, and long and unpredicatable lag between outlay and return. Thus, achieving the optimal investment level may require substantial government support and participation rather than the declining expenditures experienced in the past decade. Review of the Economy. October 1978, Joint Economic Committee, p. 133.

14 Testimony of Martin Feldstein, 1978 Midyear Hearings of the Joint Economic Committee, United States Congress, July 11, 1978.

Chart 3
INVESTMENT AND PRODUCTIVITY IN THE UNITED STATES AND OTHER NATIONS, 1960-76



SOURCE: **Productivity Perspectives,** American Productivity Center, Inc.

Committee noted that:

> "Thus, under presently required accounting practices, a rise in the inflation rate raises real corporate tax liability, lowers real after-tax profits, and therefore reduces the real after-tax rate of return on fixed investment. This means that there is a direct adverse link between the rate of inflation and the level of capital spending, and this traps the economy in a vicious circle. Low investment and sluggish productivity help to raise the inflation rate, and the higher inflation rate helps to keep investment and productivity low."[15]

A high rate of inflation also results in high interest rates and reduced credit availability

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15 Review of the Economy, October 1978, Joint Economic Committee, p. 141.

which deter investment. Furthermore, inflation distorts business statistics and leads ultimately to the "roller coaster" behavior of the economy wherein uncertainty about the future certainly impedes planning and investment.

PRODUCTIVITY AND THE BUSINESS CYCLE

To understand the recent behavior of U.S. productivity, as well as to anticipate future performance, it is instructive to examine the behavior of productivity over past business cycles. How has productivity tended to react during cyclical downturns and in the subsequent phases of the cycle? What price and cost movements have been associated with these changes? What can be expected in the quarters ahead?

Productivity in Expansions and Contractions

The behavior of productivity over the post-war business cycles is presented in Table 4. Expansions (trough to peak) and contractions (peak to trough) are treated separately, divided into the annual growth rates for the first and second halves of each period presented.

As a general pattern, the absolute rate of change in labor productivity tends to be higher in expansions than in contractions. During expansions, productivity rose in all cases much faster in the first half of the period than in the

Table 4
AVERAGE ANNUAL RATES OF CHANGE IN LABOR PRODUCTIVITY (OUTPUT PER HOUR) DURING BUSINESS CYCLE EXPANSIONS AND CONTRACTIONS, PRIVATE BUSINESS SECTOR

Expansions			Contractions		
Period	Annual Rates of Change (Per Cent)		Period	Annual Rates of Change (Per Cent)	
(Year: Quarter)	First Half	Second Half	(Year: Quarter)	First Half	Second Half
1945:4 – 1948:4	—	3.0	1948:4 – 1949:4	-1.4	5.1
1949:4 – 1953:3	5.8	2.7	1953:3 – 1954:2	-1.2	1.2
1954:2 – 1957:3	3.5	2.2	1957:3 – 1958:2	2.0	2.4
1958:2 – 1960:2	4.4	1.3	1960:2 – 1961:1	-1.4	2.4
1961:1 – 1969:4	4.3	2.0	1969:4 – 1970:4	0.4	2.5
1970:4 – 1973:4	3.8	1.1	1973:4 – 1975:1	-4.0	-0.9
1974:4 – 1979:1*	4.0	0.6	— —	—	—

SOURCE: Bureau of Labor Statistics.

* Not yet officially designated a turning point by the National Bureau of Economic Research.

second half. During the first half of all contractions, however, productivity either rose slowly or fell. But in the second half of all but the last recession, productivity rose relatively rapidly. In fact, in four of six cases, output per hour rose more rapidly in the last half of the recession than in the second half of the preceding recovery.[16]

The 1973-75 recession and subsequent recovery present a special case. As Table 4 shows, while declines in productivity during recessions are not unusual (they occurred in the first half of three of the first five post-war recessions), the depth of the productivity decline in the 1973-75 recession is striking.[17] Most importantly, in no other business cycle did productivity also decline during the second half of the recession. Similarly, the recent second half expansion was substantially weaker than in all other second half recoveries, while the first half of the recovery was, at best, average. Given the depth of the productivity decline, this weakness in the recovery tends to confirm the belief that a fundamental shift has taken place in the behavior of productivity.

An Explanation of the Cyclical Behavior

During the four phases of expansion and contraction, the changing behavior of productivity is the result of very different economic forces dominating the operation of the economy. Historically, as the economy has moved out of a recession (the first half of recovery), output and productivity tend to rise sharply. Capacity utilization rises rapidly toward the most efficient rates from the sharp recession decline. Labor turnover is low, new hires may be chosen from among a pool of higher quality workers than when the economy is at full employment, and the "fixed" or overhead part of the labor force is spread over a larger volume of output. Rising labor compensation is offset by rising labor productivity, allowing profit margins to rise and further prolonging expansion.

In the second part of the expansion, productivity growth begins to slow as the economy becomes increasingly less efficient. Obsolete equipment may be brought on line and overtime increases, as do strikes, absenteeism, and turnover. Selective shortages of supplies increase, delivery times lengthen, and the scarcity of labor leads to the hiring of less efficient employees. The booming economy and high profit margins tend to reduce cost consciousness and resistance to labor demands.

As a result of tight markets, labor compensation accelerates at the same time that productivity growth slows. Thus, unit labor costs eventually start rising faster than prices. Profit margins then peak and decline, new investment commitments are reduced, the rate of inventory accumulation is lowered, and a recession begins.[18] Of course, the phases of every business cycle have their own particular pattern, but this generally describes what occurs as the economy moves into recession.

Typically, as the economy moves into the first half of a contraction, businessmen are unsure of the depth and length of the decline, or even whether it has actually begun. In order to avoid the high costs of unnecessary turnover, businesses tend to maintain the size of the employed labor force during these early stages. However, as employment remains constant or even grows, output weakens or falls, which results in a sharp decline in productivity.

In the second phase of the typical contraction, factors develop that tend to cause productivity to

16 This approach taken from Fabricant, p. 507.

17 Of course, the fall in output was also extremely severe, and a simultaneity problem exists in determining causation between output and productivity changes.

18 Kendrick, *Understanding Productivity,* pp. 84-89. *Also* Fabricant, pp. 517-18.

rise. Less efficient plants have been closed and less efficient workers laid off as cost-cutting measures are introduced by management. Voluntary labor turnover and strikes also decline. New equipment, introduced as the economy peaked and began declining, is "debugged" and begins adding to efficient production.[19] The slowdown in the rate of output growth begins to lessen, and this, coupled with the faster cutback in hours, typically leads to an upturn in productivity in the second contraction phase. As a result of the renewed growth in productivity, business costs are lowered, which helps to lead to the subsequent upturn.

The Outlook for Productivity

What can be expected of the behavior of productivity, labor costs, and inflation in the quarters ahead? Suppose that the economy were to follow the pattern of the typical business cycle, and that the present downturn should last through the first quarter of 1980. Productivity, which fell in the second quarter of 1979, might then be viewed as about equally likely to fall or rise in the third quarter, but would be virtually assured of a rapid increase in 1979:4 and, especially, in 1980:1.[20] In the subsequent business expansion, productivity would be expected to rise even more sharply for several quarters, and thereafter rise slowly until the next business cycle peak.

If the last business cycle is the model, however, productivity would be expected to fall sharply, and then at a lesser rate, through the entire downturn, before turning up at the trough. Its behavior during the subsequent expansion would be generally strong in the beginning but more erratic than in earlier recoveries, with a weaker second half and a greater likelihood of intermittent declines.

The behavior of labor compensation in the private business sector also appears to have changed in the last two cycles from that of earlier experience. In particular, labor compensation rose more rapidly during the past two recessions than during the previous expansion periods. That pattern was just the opposite of what might be expected given slack recessionary labor markets and, in fact, the opposite of earlier business cycle experience.[21]

Combined with the weakened recessionary behavior of productivity, the sharp increases in labor compensation also led to sharply faster growth in unit labor costs and in the implicit price deflator, both in the last recession and in the 1969-70 period. Given recent rapid increases in labor compensation and an apparent shift in the behavior of productivity, expectations that the current downturn might sharply slow the rate of inflation may not be well founded. Without decisive policy actions toward increasing the rate of investment, research, and thus productivity in the U.S. economy, rapid inflation will continue to be an integral part of the U.S. economic experience.

SUMMARY AND CONCLUSIONS

Since 1967, the U.S. economy has experienced a marked slowdown in its trend rate of productivity growth. The ramifications of this slowdown are quite serious, for almost 90 per cent of the growth in real output in the U.S. from the end of World War II through 1967 was due to increased productivity. Besides its role as the major source of growth in the U.S. standard of

19 Fabricant, pp. 517-18.

20 This date is chosen for illustrative purposes and is not intended as a forecast.

21 Approach suggested by J.R. Norsworthy and L.J. Fulco, "Productivity and Costs During Recession and Recovery," *Monthly* Labor Review, August 1978, pp. 31-34.

living, the behavior of productivity growth is a principal determinant of the rate of inflation. Consequently, the rapid inflation of the 1970s is a direct reflection of the productivity slowdown.

Extensive work has been done to quantify the sources of the productivity slowdown, most notably by Edward F. Denison of the Brookings Institution. Many factors, including new pollution, health, and safety requirements, are involved. But the largest source of the slowdown in productivity growth is a weakness in the contribution to this growth of advances in knowledge, or technological change. In turn, several researchers hold that two important sources of the slowdown in U.S. technological progress are a slowdown in the amount of research and development (R&D) and the effect of insufficient capital investment on the transmission of technology. An important means to encourage such investment in the future is through a liberalization of the investment tax credit and a revision of current depreciation rules.

In attempting to predict the behavior of productivity in the near future, it is instructive to examine the behavior of productivity over past business cycles. Such a study confirms the changing pattern of U.S. productivity growth. In particular, while productivity rose sharply during the second half of all prior recessions, it fell throughout the 1973-75 recession, and productivity growth in the subsequent expansion was much weaker than expected. Labor compensation also rose more rapidly during the last two recessions than in the preceding expansions. If the recent pattern for productivity growth and labor compensation continues to prevail, hopes for a substantial slowdown in the rate of inflation during the current economic downturn are unlikely to be realized.