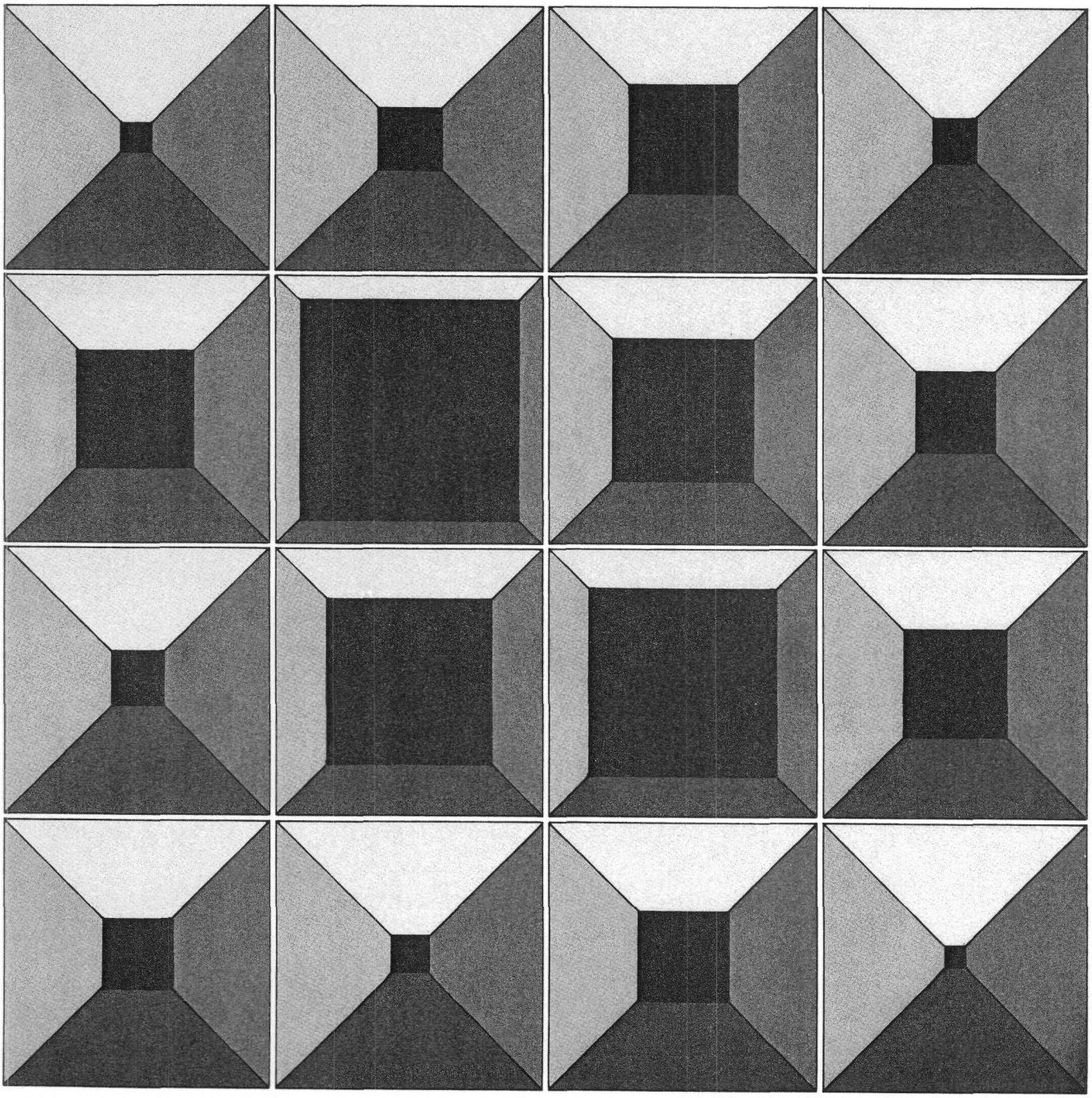
A CBO Study

The Productivity Problem:

Alternatives for Action

January 1981

Congress of the United States
Congressional Budget Office



THE PRODUCTIVITY PROBLEM: ALTERNATIVES FOR ACTION

The Congress of the United States
Congressional Budget Office

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NOTES

The latest revisions to the National Income and Product Accounts, released by the U.S. Department of Commerce on December 23, 1980, were not available in time to be incorporated into this report.

The bill numbers given in this report are those of bills introduced in the 96th Congress, unless otherwise stated.

CONGRESSIONAL BUDGET OFFICE
U.S. CONGRESS
WASHINGTON, D.C. 20515

Alice M. Rivlin
Director

ERRATA SHEET

THE PRODUCTIVITY PROBLEM:
ALTERNATIVES FOR ACTION

Page 57, third sentence of first paragraph should read: "In addition, the distribution of training funds is based on criteria, such as past unemployment rates, that may not conform to the need to retrain workers."

Page 63, eighth line should read: "the funding under the Labor Management Cooperation Act of 1978 (Section 6 of the Comprehensive Employment and Training Act Amendments of 1978), which provides support for"

PREFACE

This study of productivity in the U.S. economy was prepared at the request of the House Budget Committee. It analyzes the reasons for the recent slowing in productivity growth and examines a wide range of policies aimed at reversing the trend. In keeping with the mandate of the Congressional Budget Office (CBO) to provide objective and nonpartisan analysis, the report makes no recommendations.

The report was prepared by members of CBO's Fiscal Analysis Division under the direction of William J. Beeman. George Iden, Marvin Phaup, and Frank Russek were the principal authors. Susan R. Helper, Joseph A. Ritter, John W. Straka, and Robert W. Staiger provided research assistance. Earlier drafts received helpful scrutiny from Alan Blinder of Princeton University, Anthony Yezer of George Washington University, J.R. Norsworthy of the U.S. Department of Labor's Bureau of Labor Statistics, Rolf Piekarz of the National Science Foundation, and Frederick O. Ribe of CBO's Tax Analysis Division. The report was typed by Debra M. Blagburn. Francis S. Pierce and Robert L. Faherty edited the manuscript.

Alice M. Rivlin
Director

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SUMMARY

Productivity growth, which is the increase in goods and services produced per hour of work, slowed to a crawl in the United States during the 1970s. Continued weak growth in productivity could have profound implications for American society: it could mean greater inflationary pressures as aggregate demand increases faster than the goods and services needed to satisfy it; heightened conflict among social groups struggling for improvements in their living standards; and a diminished capacity to pursue new objectives of importance to the nation and to individuals.

Government policies can affect productivity growth. But it is essential to recognize that the root causes of productivity growth are complex, interdependent, and ramify into almost every economic activity. The decisions of individuals and business enterprises concerning how much to save or invest, and in what form, affect productivity. So do decisions to acquire training or education, to have and rear children, to seek employment, to move from one area to another, to adopt a different production technique, or to use a particular form of transportation. The same holds for national decisions to change defense policies, to raise barriers against foreign goods, or to enforce antipollution standards.

Government cannot and should not attempt to influence all of the private decisions affecting productivity. Nor can it hope to have a single, all-inclusive "productivity policy" that could be applied to all of the channels through which government decisions affect productivity.

Productivity and the Economic Environment

Policies to encourage faster growth in productivity cannot be pursued in isolation from general macroeconomic policies. What happens in the economy as a whole will have an important effect on productivity growth. The major determinants of productivity--the quality of the labor force, the accumulation of capital, and the pace of technological change--are strongly affected by the economic environment. For example, unemployment adversely affects the

acquisition of skills through work experience and training, as well as the mobility of workers. Economic slack also undermines the incentive to invest in new plant and equipment, and to develop and adopt new technology. Inflation may also increase business uncertainty, thus diminishing innovation and investment. Hence, a more stable economic environment would in itself make a major contribution to productivity growth. 1/

Criteria for Choosing Specific Policies

A practical strategy probably requires concentrating efforts on a small number of specific productivity-enhancing policies. In choosing among the many measures that may be advanced to improve productivity, what should be the criteria? A first consideration is the extent to which the federal government can influence the factors governing productivity with some degree of predictability. For example, the real cost of energy over time is probably relatively unresponsive to government economic policy. On the other hand, the composition and perhaps the level of saving and investment--important determinants of productivity--can be influenced by changes in tax law. Less susceptible to control by policy are the size and quality of the work force, and the pace of technological innovation, which are highly important in determining productivity growth.

A second criterion is the degree to which the goal of increasing productivity may conflict with other goals--such as more equal income distribution and a better environment. For example, productivity could be increased by lightening the burden of regulation imposed upon industry; this would free workers and resources for use in production, but it might involve other costs in reduced industrial safety or environmental pollution.

A third criterion is that of political feasibility--whether policies to increase productivity can overcome a political tendency

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1/ The problem of inflation is discussed in several other reports by the Congressional Budget Office: Inflation and Growth: The Economic Policy Dilemma (July 1978); The Fiscal Policy Response to Inflation (January 1979); and a forthcoming report on government policies to reduce inflation.

that works in the opposite direction. For instance, growth in productivity can be influenced by antitrust policies, by policies affecting particular industries, and by the lowering of trade barriers. In the past, however, much legislation in these areas reduced rather than stimulated productivity growth.

A fourth criterion is administrative simplicity. Proposals that would significantly add to the existing complexity of the tax system or that would impose heavy legal and/or administrative burdens are of questionable merit.

Policy Options

Given the above criteria, an agenda for productivity growth legislation might include:

- Modification of the tax laws to encourage saving and investment;
- Redesigning of government regulations to minimize their negative effects on productivity;
- Consideration of new measures to stimulate research and development (R&D), diffusion of modern technology, and improvement of the economic climate for small, high-technology businesses;
- Modification of federal policies to encourage the development of workers' skills and adaptiveness; and
- Examination of policies toward specific industries, focusing on their long-run productivity effects.

Tax Policies to Encourage Capital Formation. The present tax system was not designed for an era of inflation. The interaction of inflation and the tax system has encouraged consumption at the expense of saving and investment. Proposals that seem likely to counteract this include: reducing the marginal tax rate on interest and dividend income; excluding net additions to savings held in financial assets from taxable income until the saver retires; and limiting the deductibility of interest payments by consumers and homeowners. (Economists are uncertain whether such changes will

lead to an increase in total saving, but believe that they can increase the portion of saving that is channeled into business capital formation.) On the investment side, a number of proposals would increase incentives to invest in new plant and equipment, including faster depreciation and tying the amount of depreciation to the rate of inflation.

Government Regulations. The current approach to social regulation frequently emphasizes a single purpose, such as pollution control, without regard to the consequences for productivity. Some argue that a better outcome is possible by tilting more in the direction of economic incentives, and less in the direction of regulation. The incentive approach, such as taxing firms in relation to their pollution, is not without its problems; but it does allow a maximum of flexibility that is important for productivity growth.

Policies to Encourage New Technologies. These policies involve three areas: research and development, the diffusion of new technologies, and the special role of small, high-technology businesses. A general stimulus would be provided by a tax credit for R&D spending, or accelerated depreciation on capital used for R&D. But in some areas, such as basic research or sectors of the economy characterized by small firms, more direct government involvement may be required to achieve a significant expansion of R&D. A higher rate of business investment would help to spur diffusion of new technologies, as would more specialized measures such as liberalizing patent rights for government contractors. Finally, the economic situation of small, high-technology businesses is especially volatile; it could be improved by a variety of tax and credit measures to encourage risk capital and by changes in regulatory measures to reduce financial and administrative burdens.

Improving the Skills and Adaptiveness of Workers. Federal policies do not, as a rule, have a direct impact on this aspect of the labor force, but some have an indirect effect. For example, the structure of the unemployment insurance system might be modified to encourage a more continuous relationship between workers and employers to further skill maintenance and development during cyclical downturns. Also, the Trade Adjustment Assistance program, which seems to emphasize assistance rather than economic adjustment, could be modified to encourage more retraining and increased mobility. In addition, the Comprehensive Employment and Training Act (CETA) programs might be modified to shift their emphasis from public service employment to training.

Industrial Policies. The economic successes enjoyed by some countries that have undertaken to encourage the development of particular industries have stimulated interest in an "industrial policies" approach for the United States. But informed opinion on this is quite divided. For both technical and political reasons, such policies may be difficult to apply in this country. Even so, the United States has many existing policies that bear in different ways upon the industrial structure. These might be reexamined in the light of their long-run implications for productivity growth.

Expected Impact

The above policies would likely boost economic growth significantly, but slowly. No policy or combination of policies can be expected to have a prompt, dramatic effect on productivity growth. Nor would they provide an easy answer to the problem of inflation, particularly the recent very high rates of inflation. Productivity growth, which averaged about 3 percent a year in the postwar period up to the last decade, declined during the 1970s to the point where it has averaged less than 1 percent since 1973. Studies of productivity suggest that federal policies--particularly regulatory and tax policies--do not account for the bulk of the slowdown. Nor is it likely that a change in federal policies alone could restore productivity growth to the postwar trend. Nevertheless, the small gains that might be expected--perhaps 1/2 of 1 percent after several years--are important. Their cumulative impact on living standards over the next decade would be substantial.

The multitude of policy actions taken in the next several Congresses might be modified to make productivity growth a high-priority national goal. Critical areas of concern include: the level and composition of saving and investment; the quality and flexibility of the labor force; the rate of technological advance; the degree and method of industrial regulation; the relative price of energy; and the structure of industry. Most of the policy measures currently under discussion tend to involve increases in investment of one kind or another--such as in plant and equipment, research and development, and training--and adjustments of policies to permit and encourage markets to function more efficiently. Most of the policy options also have their costs, such as the diversion of resources from consumption to investment, or the compromise of other goals such as clean air. While such policies cannot, as a rule, be expected to have large immediate effects, their long-run benefits would be considerable.

CHAPTER I. INTRODUCTION

Growth in output per worker-hour, sometimes called labor productivity, declined dramatically in the United States during the 1970s. After increasing at an average annual rate of more than 3 percent from the end of World War II to 1965, labor productivity growth slowed to 2.2 percent a year in 1965-1973 and to 1.0 percent a year in 1973-1978. Productivity declined in 1979 by almost one percent (see Table 1).

TABLE 1. LABOR PRODUCTIVITY GROWTH RATES IN THE UNITED STATES, BY SECTOR, SELECTED PERIODS, 1947-1979 (Percent changes at annual rates)

Periods	Total Private Business	Farm	Total Nonfarm Business	Manufacturing	Nonfarm Nonmanu-facturing
1947-1955	3.5	6.4	2.7	3.6	2.2
1955-1965	3.0	5.1	2.6	2.8	2.4
1965-1973	2.2	5.2	1.9	2.4	1.7
1973-1978	1.0	2.8	0.9	1.5	0.6
1978-1979	-0.8	4.7	-1.0	0.8	-2.0

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

This slowdown has retarded improvement in living standards, increased costs of production, and diminished the long-term prospects for the U.S. economy. The gravity of these developments has prompted an urgent search for policy measures to strengthen labor productivity. This report is a part of that search.

DETERMINANTS OF PRODUCTIVITY GROWTH

What are the factors that determine productivity growth in the long run? 1/ One of the most important factors is the amount of physical capital--such as tools, machinery, and other work-facilitating equipment--available for use by each worker, or the capital/labor ratio for short. Higher capital/labor ratios are associated with increased output per hour worked. The amount of capital available depends on the extent of saving and investment in the past, while the number of workers is determined by population size and structure and by the decisions of people to enter the labor force. Also important in determining productivity are the quality and composition of the capital stock--that is, the degree to which the capital stock embodies the best technology and is allocated to its most productive uses.

A second major determinant of labor productivity is the skill level and health (or human capital) of the work force. Better trained, more knowledgeable, healthier workers mean higher productivity. As with capital, the efficient allocation of labor also contributes to higher productivity.

A third factor in the increase of productivity involves innovation, or the development and use of efficient technologies. Investment in research and development contributes to innovation, but it is only one aspect of a much broader process.

A fourth factor adversely affecting productivity in the 1970s was the tenfold rise in international oil prices from $3 a barrel in 1973 to $30 in 1979. This price change reduced labor productivity in several ways, including: (a) rendering a significant amount of the capital stock unprofitable to use, thus reducing the effective capital/labor ratio; (b) inducing firms to use more labor and capital for energy conservation rather than production; and (c) adding to inflation, which among other things induced governments to adopt restrictive policies. This adverse effect on productivity of higher energy prices has been observed in most of the major industrialized market economies of the world (see Table 2).

1/ Short-term cyclical factors can cause sharp variations in productivity, but they are not the concern of this report.

TABLE 2. ANNUAL GROWTH IN GROSS DOMESTIC PRODUCT PER EMPLOYED WORKER IN MAJOR INDUSTRIAL COUNTRIES, 1965-1979 (Percent changes at annual rates)

Country	1965-1973	1973-1979 a/
United States	1.6	0.3
Canada	2.4	0.4
United Kingdom	3.4	1.1
Italy	5.8	1.7
France	4.5	2.9
West Germany	4.3	3.1
Japan	9.1	3.4

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, unpublished data.

a/ Data for 1979 are preliminary.

Finally, the extent and type of government regulation has an effect on labor productivity--partly because much of the benefit of this regulation is not included in measures of output. 2/

2/ Measurement problems make it especially difficult to assess productivity data. For example, output growth for several significant sectors of the economy--including construction and services--tends to be understated because suitable price indexes are not available. Thus construction is said to have accounted for as much as one-fifth of the slowdown in average productivity growth between the period 1947-1965 and the period 1965-1978, but a considerable part of the decline in construction productivity growth may be apparent rather than real because of measurement difficulties. Another reason that output or gross national product (GNP) may be understated is that some kinds of technological change are not fully reflected in price indexes. Improvements in computers that increase their capacity, and increases in the energy efficiency of

THE EFFECT OF GOVERNMENT POLICIES

The second step toward effective productivity-enhancing measures is to identify existing policies that may have reduced productivity growth--for example, policies that have reduced the growth in the capital/labor ratio, adversely affected the quality and/or composition of the stock of human and physical capital, or worsened the impact of energy price increases. Then, ways of modifying or removing these policy impediments to productivity growth can be devised. Positive measures can also be pursued to raise the effective capital/labor ratio, improve the quality of the capital stock, and mitigate energy price shocks.

This report identifies a number of policies of both types: existing policies that have contributed to a slowing in productivity growth, and proposed ones that might work toward higher labor productivity. For example, the effective capital/labor ratio has probably been reduced by the failure to adjust the federal tax code for the effects of inflation. Saving in forms conducive to capital formation has been discouraged by the taxation of nominal interest income as though it were real income. Consider the bondholder who receives a 9 percent rate of interest, on which he pays a tax rate of 40 percent, while the rate of inflation exceeds 10 percent. Investment in plant and equipment has also been hampered by the failure to adjust historical cost depreciation rules for the inflated cost of replacement equipment. The effective capital/labor ratio has also been reduced by environmental, health, and safety regulations that have tended to divert capital from use in the production of goods and services to the production of cleaner air and water, a healthier environment, and safer working conditions. While these latter uses of capital are of real

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2/ (Continued)

aircraft, are two examples of quality change that are not reflected in their total value as measured for GNP.

Measurement problems, however, do not seem to explain the general decline in productivity growth. Most of the factors that give productivity indexes a downward bias were also operating in the past, and there is little reason to suppose that, in the aggregate, they became more important around 1965. See Albert Rees, "Improving Productivity Measurement," American Economic Review (May 1980), pp. 340-42.

value, the results of using capital in these ways do not get counted in output, production, or productivity indexes.

Policies to promote productivity growth include various tax incentives that would work in the following directions: increasing the portion of savings going into financial assets, increasing business investment (including research and development), and promoting the allocation of labor and capital to their most efficient uses.

PLAN OF THE REPORT

This report is structured around the determinants of productivity growth discussed above: saving, investment, technology, labor quality, energy prices, and regulation. Each chapter describes the relationship between one of these determinants and a range of public policy options. A final chapter discusses industry-specific policies. This structure reflects the judgment that no single policy change seems likely to reverse the productivity slowdown. Rather, to stimulate productivity growth significantly, policies may be needed to increase saving and investment and the pace of technological advance and the reallocation of resources to more productive uses. The report offers a menu of alternatives in each of these policy areas.

CHAPTER II. TAX PROPOSALS TO CHANGE THE COMPOSITION AND RATE OF PERSONAL SAVING

One of the frequently cited reasons for the U.S. productivity growth slowdown is that Americans consume, rather than save, too large a portion of current output. In fact, however, American households save a large fraction of their income. The slowing in productivity growth is probably more directly related to the form in which savings are held, particularly the small portion channeled into business capital formation. This chapter examines recent patterns of U.S. saving and considers several proposed tax policies designed not only to direct saving into more productive uses but also to raise the saving rate. 1/

THE NATIONAL INCOME ACCOUNT MEASURE OF PERSONAL SAVING

From an individual saver's perspective, saving means deferring consumption to the future by accumulating stocks of assets. From the national perspective, saving means adding part of current output to the stock of capital--that is, to the goods needed to produce other goods.

The claim that Americans save too little is often justified by two observations: that the U.S. saving rate is lower than that of other industrialized countries, and that the U.S. saving rate has been declining. Tables 3 and 4 present these commonly cited data.

An assessment of this argument requires that one examine the definition of saving used in the national income account (NIA) statistics, from which the tables are drawn. In fact, the NIA estimates of personal saving do not measure all of consumption deferred or capital accumulated. In the NIA statistics, saving is

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1/ In this paper, saving (singular) refers to the flow of income and production into uses other than current consumption. Savings (plural) designates the accumulated stock of saving. Saving rates refer to the flow of saving as a fraction of income.

TABLE 3. PERSONAL SAVING (NIA BASIS) AS A PERCENT OF DISPOSABLE PERSONAL INCOME FOR SELECTED COUNTRIES, 1978

United States	4.9
Canada	10.4
United Kingdom	12.8
West Germany	13.7
Japan	19.1

SOURCE: Federal Reserve System, Board of Governors.

TABLE 4. U.S. PERSONAL SAVING (NIA BASIS) AS A PERCENT OF DISPOSABLE PERSONAL INCOME, 1948-1979

1948-1955	5.8
1955-1965	5.8
1965-1974	6.9
1974	7.3
1975	7.7
1976	5.8
1977	5.0
1978	4.9
1979	4.5

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis.

a residual, equal to disposable income less current personal outlays for goods, services (including the estimated value of housing services), interest, and transfers to foreigners. The NIA concept of personal saving does not include durable consumer goods, which permit consumption in the future, or the changes in market value of existing assets such as real estate and jewelry. Thus the NIA statistics understate the amount of consumption deferred. On the other hand, because they include the purchase of new houses,

and for other reasons, the NIA statistics overstate the flow of personal saving into business capital accumulation. 2/

WHAT AND WHY IS PERSONAL SAVING?

Saving is a decision about the timing of consumption. To save is to give up present consumption in exchange for future consumption. People choose to defer consumption for several reasons: to smooth consumption rates over a life cycle in which income is expected to vary, to make bequests (and hence to defer consumption to one's heirs), and to accumulate reserves against unexpected contingencies. But, for the purpose at hand, it is not necessary to know precisely why people save or the factors that cause them to change their total saving rates. 3/ Instead, it is only necessary to know that people do save and that this choice requires them to accumulate assets of lasting value.

Savings can be held in numerous alternative forms. Adding to one's bank or thrift account or buying stocks, bonds, annuities, and other financial assets out of current income constitutes personal saving. But, in addition, the purchase of a house, other real estate, a car, a washing machine, a radio, or some other durable good permits the deferral of consumption. A durable asset provides a stream of present and future consumption services. The

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2/ For some of these other reasons, see Philip Howrey and Saul Hymans, "The Measurement and Determination of Loanable Funds Saving," Brookings Papers on Economic Activity (1978:3), p. 658.

3/ This is fortunate because the factors affecting saving rates are not completely understood and are currently the subject of intense dispute. See, for example, M.J. Boskin, "Taxation, Saving and the Rate of Interest," Journal of Political Economy, vol. 86, no. 2, pt. 2 (April 1978), pp. S3-S27; Howrey and Hymans, "The Measurement and Determination of Loanable Funds Saving," pp. 655-85, and discussion of Howrey and Hymans, pp. 686-705; Martin Feldstein, "Social Security, Induced Retirement, and Aggregate Capital Accumulation," Journal of Political Economy, vol. 82, no. 5 (September/October 1974), pp. 905-26; and Michael Darby, The Effects of Social Security on Income and the Capital Stock (American Enterprise Institute, 1979).

present value of that future consumption has been saved. Other forms of saving include expenditures for education and health. Skills and good health acquired in the present permit a higher level of consumption later.

HOW MUCH DO AMERICANS REALLY SAVE?

One measure of saving that includes the accumulation of durable goods may be obtained from the Federal Reserve's Flow-of-Funds (FoF) accounts. FoF saving for a specified time period is equal to the increase in household stocks of durable goods, nonfarm homes, and noncorporate assets, less depreciation of these assets, plus net investment in financial assets, less increases in household debt. The composition and behavior of this measure of household saving is shown in Table 5.

TABLE 5. SAVING BY HOUSEHOLDS (FLOW-OF-FUNDS BASIS) AS A PERCENT OF DISPOSABLE PERSONAL INCOME, 1970-1979

	Increase in Tangible Assets	- Depreciation	+ Increase in Financial Assets	- Increase in Household Debt	= Total Household Saving a/
1970	16.6	11.6	11.0	3.5	11.8
1971	18.1	11.7	13.2	6.4	12.6
1972	19.7	11.7	15.1	8.7	12.2
1973	19.3	11.4	15.7	8.4	13.8
1974	17.3	11.9	12.7	5.1	11.5
1975	16.7	12.2	14.0	4.7	11.6
1976	18.6	12.3	15.6	8.1	10.8
1977	20.0	12.3	16.5	10.9	10.6
1978	20.4	12.4	16.7	11.2	10.8
1979	19.4	12.7	15.7	10.2	9.4

SOURCES: Federal Reserve System, Board of Governors; U.S. Department of Commerce, Bureau of Economic Analysis.

a/ Because of the methods used in estimating household saving in the FoF accounts, total household saving differs substantially from the sum of its components.

The FoF saving rate is more than double the NIA rate. Declines in the FoF rate appear in 1974, 1976, and 1979. The latest drop in the FoF saving rate consists of a decline in the demand for financial assets by households coupled with a slowing in the accumulation of tangible assets.

Although measures of saving that include durable goods accumulation are superior to the NIA measure of personal saving as indicators of consumption deferred, FoF household saving is far from a comprehensive measure. Personal and government expenditures for some medical care and education might legitimately be included, as well as business expenditures for research and development, and also retained corporate earnings that raise the value of a firm and the wealth of its shareholders. In addition, when government builds a highway or improves a harbor, resources are diverted from consumption now to consumption later. Table 6 displays estimates of these components of U.S. saving, broadly defined, for the last 20 years. Thus defined, saving rises to more than 40 percent of disposable personal income.

Even though Americans save much more than is indicated by the NIA personal savings measure, evidence indicates that savings rates are still higher in some other industrialized countries, notably in Germany and Japan (see Table 7).

DEARTH AMIDST PLENTY: PRIVATE NONRESIDENTIAL FIXED INVESTMENT AND U.S. SAVING

A more important question is how savings are used. Although Americans have exhibited a marked propensity to defer consumption, only a small share of this saving gets transformed into additional private, nonresidential investment in plant and equipment. As indicated in Table 8, less than 4 percent of current after-tax income is used to increase the stock of private investment in nonresidential structures and equipment. Thus, even though the NIA personal saving rate understates saving in the sense of consumption deferred, it overstates saving in the sense of output allocated to increasing the stock of private business capital.

Household saving can be transformed into productive business plant and equipment only to the extent that savers choose to

TABLE 6. TYPES OF SAVING AS A PERCENT OF DISPOSABLE PERSONAL INCOME, 1955-1978

	Private and Gov't. Expenditures for Medical Care	Private and Gov't. Expenditures for Education	Undistributed Corporate Profits	Research and Development Expenditures	Federal, State, and Local Gov't. Expenditures for Nonmilitary Construction and Durable Goods a/ Minus the Budget Deficit	Total	Total Plus FoF Household Saving
1960-1966	7.7	7.3	4.0	4.1	5.9	29.0	37.3
1967-1973	9.3	9.8	3.3	3.8	5.1	31.3	41.8
1974-1978	11.1	10.4	4.2	3.2	2.9	31.8	42.9

SOURCES: U.S. Department of Commerce, Bureau of Economic Analysis; National Science Foundation; and Federal Reserve System, Board of Governors.

a/ These are gross figures, that is, depreciation has not been deducted. In addition, some expenditures for construction are also counted in the columns showing government expenditures for medical care and education.

TABLE 7. GROSS SAVING BY HOUSEHOLD, CORPORATE, AND GOVERNMENT SECTORS AS A PERCENT OF GROSS DOMESTIC PRODUCT FOR SELECTED INDUSTRIALIZED COUNTRIES, 1960-1977

	Household a/	Corporate b/	Government c/	Total
United States	8.5	8.0	1.9	18.6
United Kingdom	6.5	8.4	3.5	18.7
Canada	8.2	10.8	3.6	21.9
West Germany	10.2	10.8	5.6	26.1
Japan	17.2	12.5	5.6	35.8

SOURCE: Estimated by Machinery and Allied Products Institute from Organization of Economic Cooperation and Development (OECD) data.

a/ NIA personal saving, capital consumption (depreciation) of household assets, and net income and depreciation of unincorporated enterprises.

b/ Retained earnings and depreciation of privately and publicly owned enterprises, including limited liability partnerships.

c/ Gross revenues less current expenditures.

finance that investment. As shown in Table 9, U.S. savers have increasingly favored tangible assets such as housing and durable goods over financial assets. In fact, during the 1970s when individuals were increasing the proportion of saving devoted to housing and other durable goods, they reduced, in nominal dollar terms, their direct holdings of corporate equity shares. Moreover, of the $173 billion in securities (credit market instruments and corporate equity) acquired by households in 1976-1979, $111 billion or about 64 percent was issued by government or government agencies rather than by private business.

TABLE 8. PRIVATE NONRESIDENTIAL FIXED INVESTMENT (NET OF DEPRECIATION) AS A PERCENT OF DISPOSABLE PERSONAL INCOME, 1955-1979

1955-1964	3.48
1965-1973	4.92
1974	4.49
1975	2.00
1976	2.00
1977	2.76
1978	3.62

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis.

TABLE 9. NET INVESTMENT IN OWNER-OCCUPIED HOMES AND CONSUMER DURABLES AS A PERCENT OF INDIVIDUALS' SAVING, FoF BASIS, 1970-1979

	1970	1974	1979
Owner-Occupied Homes	13.6	17.9	28.0
Consumer Durables	23.5	22.2	26.5
Total	37.1	40.1	54.5

SOURCE: Federal Reserve System, Board of Governors.

WHY IS SO LITTLE AMERICAN SAVING DEVOTED TO PRODUCTIVE CAPITAL FORMATION?

Rates of return on alternative assets after allowing for inflation and taxes are important in determining the ways in which people save. People prefer more income to less, so they

prefer higher yields (adjusted for risk) to lower yields. For the last 10 years or so, investment in housing has provided one of the highest rates of return available to most savers. For example, a home-buyer who purchased a $40,000 house in 1970 with a 10 percent equity down payment had increased the value of his equity by 600 percent in 1979 if the price of his house merely kept pace with the rise in the price of the average owner-occupied dwelling. Rates of return on assets used to finance business capital formation, by contrast, have not only been relatively low but in many cases negative. An investor subject to a marginal tax rate of 30 percent who purchased a high-quality corporate bond in 1970 with a nominal annual yield of 8 percent earned an annual after-tax rate of return of about minus (-) 2 percent per year on average through the 1970s. The real value (adjusted for inflation) of the Standard and Poor's common stock index has declined to less than 60 percent of its 1970 level. (Dividends, which averaged about 4 percent of the stock price per year over this period, reduced the loss somewhat.)

One of the reasons that housing and, to a lesser extent durable goods have been so attractive to savers is the favorable tax treatment they have received. 4/ Interest paid on loans is fully deductible for calculating income taxes, while the flow of services from durable goods and housing is not taxed at all. Capital gains on owner-occupied housing are taxed at very low rates, and frequently escape taxation altogether. Income from financial assets--and the capital goods that underlie them--is taxed more heavily, even though some relief is provided by features of the tax code such as accelerated depreciation allowances and the tax deferrals permitted with Individual Retirement Accounts (IRAs) and Keogh plans. One provision of the Windfall Profits Tax of 1980 broadens the existing $100 dividend income exclusion to include interest income, and raises the ceiling to $200 per taxpayer.

4/ Frank de Leeuw and Larry Ozanne, "Investment in Housing and the Federal Income Tax," in Henry J. Aaron and Joseph A. Pechman, eds., How Taxes Affect Economic Behavior (Brookings Institution, forthcoming).

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Many countries provide stronger tax incentives for savers to acquire financial assets than does the United States. 5/ Canada, for example, permits savers to defer taxes on up to $3,500 of income per year under an IRA-type plan, even if they participate in an employer-funded pension plan. Canada also exempts the first $1,000 of domestic interest income from taxation. Moreover, interest rates paid by financial institutions are not subject to regulated ceilings as they are in the United States.

WHAT MIGHT BE DONE?

Before considering, in some detail, policies that might induce households to increase the share of savings held in financial assets, two other possible means of promoting the flow of saving into business capital accumulation require mention: reducing the federal deficit and increasing corporate saving.

Reducing the Federal Deficit

If federal outlays were in balance with federal tax revenues, the federal government would no longer be a major claimant on the flow of savings. More funds would be available to finance business enterprise, and the cost of those funds would be lower. A difficulty with this argument is that balancing the budget would require either higher taxes or lower expenditures. Both types of budget adjustment would initially tend to reduce income and the total flow of saving. Once the temporary effect on income of balancing the budget was over, however, the total flow of saving and the saving rate would be higher with budget balance. To minimize the chances that a balanced budget would reduce the flow of saving, the required changes in taxes and spending should be designed to lower the proportion of income consumed.

5/ For a country-by-country tabulation of various measures to promote personal saving, see William J. Byrne, "Fiscal Incentives for Household Saving," International Monetary Fund Staff Papers, vol. 23, no. 2 (July 1976), pp. 455-89. This section draws heavily on the Byrne article.

Increasing Corporate Saving

From a capital accumulation perspective, an advantage of corporate, as opposed to personal, saving is that it is already in the hands of those whose investment activity is so important to productivity growth. Possible measures to increase business saving include lower corporate income taxes and accelerated depreciation. Both of these are discussed in Chapter III.

Changing the Composition of Household Saving

A general approach to shifting the composition of personal saving away from real estate, durable goods, and other tangible assets toward financial assets would be to raise the after-tax rate of return on the latter and to lower it on the former. Five specific changes will be discussed here: a higher interest income exclusion, a reduction in the maximum marginal tax rate on investment income, a saving exclusion, a threshold saving tax credit, and abolition of the interest-expense tax deduction.

A Higher Interest Exclusion. The recently enacted $200 interest and dividend exclusion is unlikely to affect savings behavior substantially because the ceiling is low relative to current levels of interest income. About half of all taxpayers currently receive at least $200 in interest and dividends annually, and over 97 percent of all interest and dividends are earned by those whose capital income exceeds the exclusion limit. Thus, for most moderate- and high-income savers, the $200 exclusion offers no incentive to increase holdings of financial assets. A larger exclusion could provide these incentives. In the limiting case, all interest and dividend income could be made exempt from income taxation.

A Reduction in the Maximum Marginal Tax Rate on Investment Income. At present, investment income is subject to a maximum marginal federal tax rate of 70 percent, whereas labor income is subject to a maximum tax rate of 50 percent. Under one variant of this proposal, the maximum rate on investment income would be reduced to 50 percent.

A Saving Exclusion. This approach would permit additions to savings held in financial assets to be excluded from taxable income until retirement, at which time the taxpayer could be expected to

be in a much lower tax bracket. One method of implementing such a plan would be to give every taxpayer the right to establish an Individual Retirement Account (IRA) whether or not he is an active participant in a qualified or government retirement plan. Currently, IRAs are available only to persons not otherwise participating in a pension plan. Under current law, nonworking spouses have no opportunity for IRA participation unless the working spouse is eligible. Those authorized to establish an IRA can exclude a maximum of $1,500 per year per working person, or $1,750 per year in the case of a joint return and joint IRA if only one spouse is employed.

A variation on the saving exclusion would be to permit unlimited contributions to IRA/Keogh accounts.

The Threshold Saving Tax Credit. One proposal introduced in the 96th Congress would have provided a 50 percent tax credit for financial and some forms of noncorporate investment (excluding consumer durable goods and owner-occupied homes) above a threshold level that would increase with income.

A person with a modified adjusted gross income of $30,000, for example, would have to save 5 percent or $1,500 each year before beginning to earn the credit. After crossing the threshold, income-financed net additions to holdings of deposits in financial institutions, U.S. government securities, equity shares, and corporate debt would qualify for a 50 percent tax credit. Contributions to retirement plans (excluding Social Security), life insurance premiums, investments in commercial real estate, and increases in the taxpayer's share of the book value of noncorporate businesses would also count as eligible savings, provided these were financed out of income and not by borrowing. The various threshold saving rates in this proposal are shown in Table 10.

The tax credit would be recaptured if the savings were not held in eligible assets for at least five years. Dissaving for the purpose of paying medical bills or tuition (investment in human capital) would not be penalized, however. The recapture would be waived for retired persons. It should be noted here, however, that the administration of recapture provisions and "permissible dissaving" would create enormous enforcement difficulties for the Internal Revenue Service.

Abolition of the Interest-Expense Tax Deduction. At present, interest payments on home mortgages and consumer credit may be

TABLE 10. THRESHOLD SAVING RATES

If the modified adjusted gross income a/ is:	The threshold saving rate is:
Not over $10,000	0%
Over $10,000 but not over $12,000	1%
Over $12,000 but not over $15,000	2%
Over $15,000 but not over $20,000	3%
Over $20,000 but not over $25,000	4%
Over $25,000 but not over $50,000	5%
Over $50,000 but not over $100,000	6%
Over $100,000 but not over $200,000	8%
Over $200,000	10%

SOURCES: S. 18, H.R. 169.

a/ Modified adjusted gross income is adjusted gross income (as defined in the tax code) minus deductions permitted for personal exemptions.

deducted without limit from income when computing personal income taxes. This feature of the tax code provides a substantial incentive for people to borrow rather than to accumulate funds in advance of purchase. Disallowing the interest deduction on new borrowing ("grandfathering" existing debt obligations), would reverse this incentive and severely reduce the expected after-tax rate of return on many nonfinancial forms of saving, especially housing. To prevent this policy from increasing the overall tax burden, it could be coupled with an across-the-board personal tax cut.

EFFECTS OF THESE PROPOSALS ON AFTER-TAX RATES OF RETURN

The first four proposals would reduce tax rates on some saving and savings income. But they differ significantly in the degree to which they would raise after-tax rates of return on different levels of saving and for different income groups.

Start with the conceptually simplest proposal: to exempt all personal interest and dividend income from taxation. The only way to increase further the after-tax rate of return on financial assets would be to pay bounties on interest income or saving. The bounty approach is incorporated in the saving tax credit. The 50 percent credit would double the after-tax rate of return on above-threshold saving for those taxpayers able to use the entire non-refundable credit. By comparison, a general saving exclusion would not directly raise the after-tax rate of return on financial assets but would provide incentives to accumulate assets as a means of sheltering current income. The incentive provided by an exclusion increases with the marginal tax rate. That is, the higher the tax rate, the greater the value of the exclusion and the more likely the exclusion will increase the demand for financial assets.

A complete interest or saving exclusion would probably succeed in changing the composition of saving and in increasing the availability of funds for business capital formation (provided that qualified "saving" is defined to include increased holdings of corporate equities and debt and to exclude consumer durables and housing). 6/ However, the appeal of the savings and interest exclusion proposals (and some tax credit plans) is limited by the substantial budget cost of these measures. A total interest exclusion would probably reduce annual federal tax revenues by $50 billion; a saving exclusion, by $22 billion.

The threshold tax credit plan would contain the revenue loss by restricting the credit to above-threshold saving. But the most frequently mentioned approach to limiting the loss of tax revenues is capping the interest or saving exclusion. Unfortunately, such caps would severely limit the incentive effects of the exclusion and mostly reward existing saving. The reason a low-capped

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6/ This ignores two potential problems: (1) Will other tax rates be raised so that government revenues are unchanged? If so, which taxes will be increased and what will be the economic effects of doing so? (2) Will investment by foreigners in the United States be changed? Will U.S. investment in foreign countries change? If so, how will this affect U.S. business capital formation? For a more complete discussion of the interaction of taxation and domestic capital accumulation, see David F. Bradford, "The Economics of Tax Policy Toward Savings," in George M. von Furstenberg, ed., The Government and Capital Formation (Ballinger, 1980), pp. 11-71.

exclusion would be an ineffective inducement to saving is that most high-income persons (who do most of the personal saving) already earn relatively large amounts of interest.

A low-capped interest and dividend exclusion significantly raises the after-tax rate of return on additions to financial savings only for the few high-bracket savers who do not now earn at least the ceiling amount of interest. For low-bracket savers who earn less than the maximum exclusion, it raises after-tax rates of return to a lesser extent, because the value of an exclusion decreases with the marginal tax rate.

The proposal for reducing the maximum marginal tax rate on investment income would raise after-tax rates of return on financial savings (old as well as induced) but only for high-bracket savers. This might be justified on the grounds that these are the people who do much of the nation's saving and who at present have strong tax incentives to invest in tax sheltered activities rather than in the most productive uses.

Judged in terms of their effect in increasing rates of return on financial assets and in promoting the use of saving for domestic capital formation, the complete exclusion of saving or interest income, and the threshold saving tax credit plans, would probably be superior to the other proposals. Lowering the maximum rate on investment income, and universal IRA/Keogh plans, would probably be moderately effective. Low-capped (less than $500) interest exclusions would be the least effective options.

Disallowing the interest-paid deduction would change the composition of household asset holdings by significantly increasing the after-tax cost of financing real estate and durable goods. This, in turn, would decrease the expected rate of return on these assets. Because a deduction is worth more at higher tax rates, the proposal would especially reduce the demand for real estate by middle and upper tax-bracket households.

EFFECTS OF THESE PROPOSALS ON TAX REVENUES

Without detailed knowledge of the response of savers to these tax changes, revenue loss estimates must be extremely rough. Errors of at least 20 percent should be expected. The following generalizations are based on the information at hand:

- Estimates by the Treasury and the Joint Committee on Taxation suggest that the $200 interest exclusion would cost at current income and price levels about $2.5 billion per year before induced changes in saving behavior or revenue feedbacks. Under similar assumptions, a $500 exclusion would cost less than $4 billion.

- A total interest exclusion would cost $50 billion per year and a total saving exclusion would cost $22 billion, again before induced saving and before feedbacks.

- Reducing the maximum tax rate on investment income from 70 percent to 50 percent would reduce revenues by $5 billion.

- The revenue loss associated with the threshold saving tax credit is highly responsive to the level of the thresholds and the amount of the tax credit. However, adopting the proposed thresholds and assuming that about 25 percent of existing NIA saving would qualify for a 50 percent tax credit, the threshold plan would have reduced Treasury revenues by about $9 billion in 1978. To be consistent with other estimates, this assumes no increase in saving. However, a notable feature of this plan is that it would increase saving $2 for every $1 of revenue loss on induced saving.

- The proposal to raise the present IRA contribution ceiling to $3,000 per year and to extend participation to all would cost $3 billion per year.

- Disallowing the personal interest deduction would increase revenues by $16 billion.

THE COST AND DIFFICULTY OF ADMINISTERING THE PROPOSALS

With respect to their ease of administration, the proposals fall into two distinct categories: those that would require little or no change in existing record-keeping requirements for tax purposes, and those that would substantially increase record-keeping and reporting requirements.

The proposals for interest exclusion, reducing the maximum marginal rate on investment income, and disallowing the interest

deduction would require little or no change in existing procedures. The administrative and compliance hurdles for IRA/Keogh plans have already been crossed, at least for low levels of participation.

On the other hand, substantial changes and costs would be involved in adopting a saving exclusion or a tax credit. The heart of the matter is that to measure saving it would be necessary to measure changes in qualified asset holdings and changes in debt. The accumulation of assets financed by an equal amount of borrowing is not saving. Therefore, to ensure that only saving would be rewarded, data would have to be maintained by taxpayers on asset holdings and debt outstanding. This would not be impossible, but the costs, especially at the outset, would be very large. In addition, recapture of tax credits in case of ineligible dissaving would be very difficult to achieve.

THE EFFECT OF CHANGING THE COMPOSITION OF SAVING ON AGGREGATE DEMAND

The consequences of changing the composition of saving markedly toward financial assets would be substantial. If, for example, the 50 percent threshold savings tax credit were adopted, or the deductibility of interest payments on new debt incurred by individuals were to be disallowed, the effect on the level and composition of aggregate demand could be wrenching. The demand for debt-financed consumer durables and housing would drop sharply. The demand for financial assets, including deposits in financial institutions, corporate debt and equity, noncorporate equity, and government securities, would increase. Employment in housing construction and consumer durables would fall. Put another way, resources now being devoted to less "productive" forms of saving and investment would be released for use in forms that would enhance productivity growth.

The redeployment of these resources would be a costly, time-consuming process. Workers would lose jobs in some industries and have to find new jobs elsewhere. During the interim, income would fall.

In order to facilitate the adjustment and mitigate its cost, it might be necessary to use expansive monetary and fiscal policies to increase investment in plant and equipment at the same time that

the demand for financial assets was increasing. The adjustment would also be aided by falling interest rates and lower capital costs for business enterprises. The impact might be spread over a longer period and, probably, reduced in magnitude--at the cost of deferred gains in productivity--by phasing in the policy change gradually. For example, the threshold tax credit could be set initially at 10 percent and increased five percentage points a year. The interest deduction cap could also be reduced annually from a relatively high starting level.

The essential point, however, is that the basic structure of an economy cannot be changed without resource shifts, painful as they may be. The only way to move to a more capital-intensive, productive economy is to change the composition of saving and the pattern of resource use.

THE EFFECTS OF SAVING TAX INCENTIVES ON THE STOCK OF CAPITAL AND PRODUCTIVITY

The likely effects of tax incentives that succeeded in increasing saving or in changing its composition may be summarized as follows:

- Measures raising the overall saving rate would not have a large effect on the capital stock or on productivity for a number of years.

- Measures changing the composition of savings would have a quicker effect on capital and productivity, although the early-year effects would still be quite modest.

- Over 10 years or more, however, tax policies raising the saving rate and/or directing a larger portion to investment in the productive capital stock would have a substantial effect on productivity and real per capita income.

These conclusions can be established by considering the arithmetic of saving, investment, and capital accumulation.

The Short-Run Effect of Raising the Saving Rate. Even if one assumes that very large tax incentives would be provided for saving and that the responsiveness of saving to changes in real after-tax rates of return would be relatively high, induced annual increases

in saving would be small relative to the existing capital stock. For example, the adoption of a 50 percent tax credit on above-threshold saving would double the after-tax rate of return. Assuming that the responsiveness of saving to changes in the after-tax rate of return has been correctly identified by Michael Boskin, who found that a one percent increase in the rate of return leads to a 0.4 percent increase in saving, a 100 percent increase in the after-tax rate of return would cause a 40 percent increase in saving. 7/ In 1979, personal saving on a flow-of-funds basis was $121.0 billion. A 40 percent increase would add about $48.4 billion per year to the capital stock, which currently totals about $4,000 billion (including housing and consumer durables). Thus, under assumptions favorable to the discovery of a big impact on capital, the first-year induced increase in the capital stock would be less than 1.5 percent.

The Short-Run Effect of Changing the Composition of Saving. Portfolio composition--the form in which individuals hold their savings--appears to be much more responsive to changes in relative rates of return than total saving is to changes in the overall after-tax rate of return. Whenever the rate of return on a particular asset rises relative to other similar assets, savers shift into the higher-yielding alternative. This is made plain by the U.S. experience with "disintermediation"--the withdrawal of funds from financial institutions and the increase in direct investment by households in marketable securities whenever open-market interest rates exceed the maximum rates banks and thrift institutions are permitted to pay. The "gold rush" of 1979 is another example of how changes in expected rates of return can trigger large shifts in the composition of savings.

Thus, if tax policy were to offer savers significant incentives to finance business capital formation rather than to hold durable goods and commodities, the increased flow of funds to investment would probably be much greater than is indicated by estimates of the responsiveness of total saving to changes in after-tax rates of return. For example, in 1979 the net investment in tangible assets by individuals was $118.8 billion and the

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7/ Boskin, "Taxation, Saving and the Rate of Interest." Other studies have found the repercussions on saving to be much less. See, for example, Howrey and Hymans, "The Measurement and Determination of Loanable Funds Saving."

increase in household debt (about three-fourths of which was for real estate and consumer credit) was $211.6 billion. If the deductibility of mortgage and consumer credit interest payments were to be disallowed and the first $10,000 of capital income made tax-free, the induced demand for financial assets might easily exceed twice the $48.4 billion increase in total saving projected from a doubling of after-tax rates of return.

Accordingly, it is reasonable to expect a larger short-run effect on the capital stock and therefore a faster effect on productivity from changing the composition of saving than from increasing the saving rate. The short-run effect on productivity, however, would probably still be rather modest.

The Long-Run Effects of Increasing Saving and Changing Its Composition. While it is important not to overestimate the short-run effects of increased saving on productivity, it is essential to recognize that the longer-term effects of a small increase in the saving rate could be quite large. If, for example, the rate of business fixed capital formation were to increase by one percentage point, say from 2.5 percent per year (the average for the 1970s) to 3.5 percent, the capital stock would be $700 billion larger by the year 2000 than with the slower growth path. This amounts to approximately one-third of the current U.S. capital stock. That alone might be sufficient to increase labor productivity by 5 to 10 percent in the year 2000.

SAVING AND CAPITAL ACCUMULATION IN AN OPEN ECONOMY

Policies that tend to increase saving or shift saving toward corporate investment are often criticized on the grounds that an increase in domestic saving is neither necessary nor sufficient for an increase in investment. In an open economy, increases in saving can be invested abroad and domestic investment can be financed by foreign saving. Thus, it may be that an increase in domestic saving will only increase foreign capital accumulation, while domestic investment may not be constrained by domestic saving.

As conceptual possibilities, both propositions are unassailable. The limited evidence available, however, strongly suggests that incremental saving tends to be invested in the home

country. 8/ Feldstein and Horioka find that there is a strong positive association across countries between saving and investment rates--perhaps because of the greater risk of long-term investments abroad.

Thus, an increase in the domestic saving rate is likely, but not certain, to lead to a corresponding increase in domestic investment. Even if an increase in the U.S. saving were directed toward foreign investment, however, Americans would have increased their claim on future world output.

8/ Martin Feldstein and Charles Horioka, "Domestic Savings and International Capital Flows," National Bureau of Economic Research Working Paper 310 (January 1979).

CHAPTER III. POLICIES TO INCREASE THE STOCK OF PHYSICAL CAPITAL

An important determinant of labor productivity is the amount of physical capital per worker. For this reason, proposals to increase productivity often emphasize measures to increase capital investment. This chapter discusses the relationship between capital investment and productivity growth, the factors that contribute to capital investment, and the ways in which tax incentives can be used to stimulate it.

CAPITAL FORMATION AND PRODUCTIVITY GROWTH

The relationship between capital investment, or capital formation, and gains in productivity has been the subject of considerable study. This research has produced substantially different estimates of the contribution made by capital to productivity growth. 1/ Using a combination of gross and net measures of the capital stock, Edward F. Denison has estimated that increases in the amount of capital per worker contributed about 0.34 of a percentage point to the annual growth in national income per worker in the nonresidential business sector during the 1948-1978 period (see Table 11). In contrast, J.R. Norsworthy, Michael J. Harper, and Kent Kunze have calculated that increases in the net capital stock per manhour accounted for roughly 0.67 of a percentage point of the average annual growth in output per manhour in the private business sector during the same period. Still others such as Peter K. Clark have arrived at different estimates, based on somewhat different measures of capital, labor, and output.

1/ The contribution of capital formation to productivity growth generally is calculated as the percentage change in the capital-labor ratio weighted by the share of output or income attributable to capital. Quantitative estimates of the contribution can differ because of alternative approaches to the measurement of capital, labor, and output.

TABLE 11. ESTIMATES OF THE EFFECT OF CAPITAL FORMATION ON PRODUCTIVITY GROWTH, 1948-1978

Period	Average Annual Productivity Growth (percent)	Productivity Growth Resulting from Capital Formation (percent)
	(Edward F. Denison)	
1948-1953	2.83	0.48
1953-1964	2.82	0.40
1964-1969	1.81	0.35
1969-1973	1.63	0.28
1973-1978	0.31	0.13
1948-1978 a/	2.08	0.34
	(J.R. Norsworthy, Michael J. Harper, and Kent Kunze)	
1948-1965	3.32	0.76
1965-1973	2.32	0.75
1973-1978	1.20	0.21
1948-1978 a/	2.70	0.67
	(Peter K. Clark)	
1948:III - 1955:IV	2.71	0.48 - 1.15
1955:IV - 1965:II	2.94	0.54 - 1.29
1965:II - 1973:II	2.34	0.26 - 0.62
1973:II - 1976:IV	1.19	0.10 - 0.25
1948:III - 1976:IV a/	2.49	0.39 - 0.94

(Continued)

Despite the conceptual and methodological differences among these studies of the contribution made by capital to productivity growth, it is clear that they all attribute a significant role to capital accumulation. It is also apparent that the estimated contribution of capital has declined substantially in recent years, although there is some disagreement about when the decline began.

TABLE 11. (Continued)

NOTE: Growth in labor productivity is measured by Denison as the growth in national income per person employed in the nonresidential business sector. The use of national income as the measure of output excludes the replacement of capital (depreciation) from the labor-productivity measure, and reduces the weight assigned to capital in determining its contribution to productivity growth. In contrast, Norsworthy, Harper, and Kunze measure labor productivity in terms of gross domestic product (GDP) per hour worked in the private business sector. Since GDP includes capital depreciation, their calculation assigns relatively more importance to capital formation in the determination of productivity growth. Finally, while Clark includes depreciation in his measure of output in the nonfarm business sector, his approach differs from those of the other two studies in that he attempts to adjust statistically for cyclical variations in the use of capital.

SOURCES: Edward F. Denison, Accounting for Slower Economic Growth (Brookings Institution, 1979); J.R. Norsworthy, Michael J. Harper, and Kent Kunze, "The Slowdown in Productivity Growth: Analysis of Some Contributing Factors," in Brookings Papers on Economic Activity (1979:2), pp. 387-421; and Peter K. Clark, "Capital Formation and the Recent Productivity Slowdown," The Journal of Finance, vol. 33, no. 3 (June 1978), pp. 965-75.

a/ These figures were calculated as time-period weighted averages of the subperiod estimates.

Variations over time in the contribution of capital to labor productivity growth primarily reflect changes in the growth rate of the capital-labor ratio. Differences in the way capital and labor are measured lead to different estimates of when the growth in this ratio began to decline. Most estimates agree that, while capital and labor in the nonfarm, nonresidential business sector

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both grew more slowly during the 1973-1978 period, the slowdown in the rate of capital formation was more pronounced, and hence growth of the capital-labor ratio was retarded (see Table 12). Whether or not slower growth in the capital-labor ratio began earlier (in the 1965-1973 period) depends on how labor is measured. During that earlier period, the growth of both capital and labor accelerated, but the number of hours worked grew substantially slower than the number of full-time and part-time employees. As a result, the growth of the capital-hours ratio accelerated, while the growth of the capital-employment ratio slowed. Those who measure labor in terms of hours worked (such as Norsworthy, Harper, and Kunze) thus conclude that the contribution of capital to labor productivity did not begin to decline until the 1973-1978 period. 2/ In contrast, those such as Denison, who measure labor in terms of the number of employees, report that the contribution of capital began to decline earlier. From a policymaking viewpoint, however, the issue of when capital formation began to contribute less to productivity is not as important as the observation that its contribution has diminished.

INVESTMENT TRENDS AND THE DETERMINANTS OF INVESTMENT

Increases in the capital stock are made through investment. Various measures of the performance of investment in the post-World War II period are presented in Table 13.

2/ Although hours worked is the measure employed by the Bureau of Labor Statistics to calculate labor productivity, its use can result in movements of the capital-labor ratio that may not be related to labor productivity. As noted by Clark, a decline in the average workweek during the 1965-1973 period caused hours to grow sufficiently less than employment so that the growth of capital per hour worked actually increased, even though the growth in the capital-employment ratio declined. Yet, a decrease in average weekly hours represents a less intensive use of available capital rather than a move to a more capital-intensive production process. See Peter K. Clark, "Issues in the Analysis of Capital Formation and Productivity Growth," in Brookings Papers on Economic Activity (1979:2), pp. 423-31.

TABLE 12. VARIOUS MEASURES OF THE GROWTH IN CAPITAL AND THE RATIO OF CAPITAL TO LABOR IN THE NONFARM, NONRESIDENTIAL BUSINESS SECTOR (Average annual rate of growth, in percent)

Measure	1948 to 1965	1965 to 1973	1973 to 1978
Gross Capital Stock a/	3.40	4.52	3.24
Gross Capital Stock per:			
Hour worked	2.44	2.83	1.71
Full- and part-time employee	2.19	2.08	1.14
Net Capital Stock a/	3.92	4.81	2.87
Net Capital Stock per:			
Hour worked	2.96	3.12	1.34
Full- and part-time employee	2.71	2.37	0.77

SOURCE: CBO calculations based on Table 1 in Peter K. Clark, "Issues in the Analysis of Capital Formation and Productivity Growth," in Brookings Papers on Economic Activity (1979: 2), pp. 423-31.

a/ The gross capital stock measure assumes that an asset with a useful life of, say, 10 years is equally as productive in the first and tenth year. The net capital stock measure assumes that the same asset becomes 10 percent less productive each year. The net stock of capital grew faster than the gross stock in both the 1948-1965 and the 1965-1973 periods, but increased less rapidly in the most recent period. In large part, this relative decline reflects the pattern of investment, because exclusion of depreciation from the net capital stock measure makes it relatively more sensitive to cyclical swings in investment.

The average of annual growth rates of all major components of real gross fixed investment declined between 1966-1973 and 1974-1979. The largest decline was in residential investment, a category especially sensitive to business cycles. Of particular importance to the productivity issue, however, is nonresidential

TABLE 13. TRENDS IN INVESTMENT SPENDING

	1949 to 1965	1966 to 1973	1974 to 1979
Average of Annual Growth Rates (percent)			
Gross fixed investment	3.8	4.2	1.7
Nonresidential investment	4.0	4.2	2.4
Nonresidential equipment	3.6	5.7	3.1
Nonresidential structures	4.8	1.8	1.3
Residential investment	3.9	4.9	0.7
Percent of Gross National Product			
Gross fixed investment	14.1	14.6	13.8
Nonresidential investment	9.2	10.3	9.9
Nonresidential equipment	5.3	6.4	6.8
Nonresidential structures	3.8	3.9	3.2
Residential investment	4.9	4.3	3.9
Percent of Gross Fixed Investment			
Nonresidential equipment	38.0	43.7	49.0
Nonresidential structures	27.2	27.1	23.0
Residential investment	34.8	29.3	28.0

NOTE: Percentages based on data in constant 1972 dollars.

SOURCE: CBO calculations based on Commerce Department data.

investment. Its average rate fell from 4.2 percent in 1966-1973 to 2.4 percent in 1974-1979. Within the nonresidential category, the average of annual growth rates for equipment investment fell by 2.6 percentage points, while that of structures declined by 0.5 percentage points.

The fraction of gross national product (GNP) devoted to investment declined to 13.8 percent during the 1974-1979 period, but the ratio of equipment investment to GNP rose to 6.8 percent--

the highest ratio observed for the periods shown in the table. Equipment investment accounted for 49.0 percent of gross investment during this period, compared to a 23.0 percent share for nonresidential structures and a 28.0 percent share for residential investment. Between 1949-1965 and 1974-1979, the ratio of equipment investment to total fixed investment increased by 11.0 percentage points, while the comparable ratios for nonresidential structures and residential investment declined by 4.2 percentage points and 6.8 percentage points, respectively.

Determinants of Business Investment

What are the major influences determining business fixed investment? The determinants of investment have been the subject of many studies. They are thought to include both nonfinancial factors, such as changes in the demand for goods and services and the rate of capacity utilization, and financial considerations, such as the rate of return on capital investments and the cost and availability of funds.

Although there is general agreement about the importance of the nonfinancial factors, there is considerable debate among economists about the magnitude of the financial influences. The issue is an empirical one that has not yet been resolved. The weight of the evidence, however, indicates that financial considerations do have a significant effect on business investment. Therefore, policy measures that reduce the cost of capital would likely be effective in stimulating productivity growth.

General agreement about the importance of nonfinancial factors for business investment decisions suggests that, during periods of economic slack, policies to promote capital accumulation might best be concentrated on returning the economy to high levels of production. In general, investment subsidies are not considered to be the most effective stabilization tools. Increased federal purchases and personal tax cuts generally have larger and quicker impacts on output and employment. As the economy approaches high levels of employment, however, such policies tend to contribute more to inflation and less to real growth in demand. As a result, the positive impact on investment dissipates, and may even become negative.

Policies to raise the capital intensity of production at high-employment levels of output (or at constant levels of resource

utilization) must include measures that reduce the cost of capital. In the absence of sufficient foreign sources of financing, however, the success of such policies requires either a decrease in the proportion of private saving devoted to residential investment or an increase in the national rate of saving. 3/ Without such changes in the rate or composition of saving, interest rates are likely to rise and offset the effect of investment incentives on the overall level of business investment. 4/ The composition of investment, however, is likely to change in favor of the specific types of investment being subsidized.

TAX INCENTIVES FOR BUSINESS INVESTMENT

A variety of investment tax incentives can be used to stimulate capital formation. These include: reducing corporate tax rates, raising the existing investment tax credit, and increasing depreciation deductions either by indexing them to the rate of inflation or by shortening depreciation periods. While all these tax changes tend to stimulate investment by reducing the cost of capital, their impact on different forms of investment can vary. This is an important consideration, because policies to stimulate capital formation will not achieve the maximum effect on productivity if they divert some capital resources away from their most productive uses by artificially raising the profitability of some investments relative to other, more productive, ones. In some cases, there may be good reasons for favoring some forms of investment over others, but the biases of particular investment subsidies should be intentional rather than inadvertent.

The corporate income tax has a nonneutral influence on investment decisions. It is biased against corporations relative to unincorporated businesses, and favors debt financing over equity financing. The main reasons for these results are that corporate

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3/ National saving includes personal saving, business saving (retained earnings and capital consumption allowances), and government surpluses. The rate of saving in this discussion is the ratio of national saving to high-employment GNP.

4/ Policies that stimulate foreign investment in the United States can, however, raise the investment-output ratio without a corresponding rise in the national saving rate at full employment, provided such investment is financed abroad.

income is subject to "double taxation" (once at the corporate level and again at the stockholder level when paid out in dividends), and that interest costs are deductible whereas dividend payments are not.

A flat-rate investment tax credit of the type now available for most equipment purchases lowers the effective tax rate proportionately more for short-lived than for long-lived investment. 5/ Thus, it encourages investment in industries such as construction and motor vehicle manufacturing, which are heavy users of short-lived equipment, relative to industries such as primary metals, communications, and utilities. Also, the current investment tax credit favors investment in equipment rather than in structures, since the latter does not qualify for the credit.

The distorting effects of the investment tax credit are offset somewhat by the lack of an inflation adjustment for depreciation deductions. The use of historical cost depreciation discourages investment in general, but has a relatively greater impact on short-lived investments. A simplified explanation for this is that the average annual effect of inflation on depreciation costs (a factor affecting the rate of return) is greater for assets with relatively short useful lives. 6/

5/ An intuitive explanation is that the average yearly value of a credit equal to x dollars is greater for short-lived investments than for long-lived investments. The nonneutral character of the current investment tax credit and other investment subsidies is discussed more fully in Jane G. Gravelle, Depreciation Policy Options, Congressional Research Service, Report No. 80-182E (October 10, 1980). See also Jane G. Gravelle, The Capital Cost Recovery System and the Corporate Income Tax, Congressional Research Service, Report No. 79-230E (November 26, 1979).

6/ Consider two different $100 investments with useful lives of one year and two years, respectively. Assuming straight-line depreciation and an annual inflation rate of 10 percent, the average annual impact of inflation on depreciation costs would be $10 for the one-year asset (0.10 x $100) and $7.75 for the two-year asset (0.10 x $50 plus 0.21 x $50)/2, where the numbers 0.10 and 0.21 are the decimal expressions for percentage impacts of inflation on depreciation costs in the first and second years, respectively.

The Simplified Cost Recovery System. A prominent proposal to reduce the impact of inflation on capital cost recovery by increasing the size of depreciation deductions was introduced by the Senate Finance Committee in its Tax Reduction Act of 1980. 7/ Under this proposal, known as the "Simplified Cost Recovery System," equipment investment would be assigned to one of four depreciation categories corresponding to useful lives of two, four, seven, and ten years. 8/ Most property now eligible for the Accelerated Depreciation Range (ADR) system would be assigned to a useful life category that is at least 40 percent shorter, except that no recovery period would be shorter than two years.

The bill also would introduce "open-ended accounting" in each category. Under open-ended accounting, all assets in each category would be lumped together into a total which itself would be "depreciated" each year, instead of the present method of depreciating each asset separately. The taxpayer would have a choice among three depreciation methods: 200 percent declining balance, 150 percent declining balance, and straight-line depreciation. In the seven-year account, for example, the straight-line approach would allow 1/7 (approximately 14 percent) of the balance in the account to be written off annually. The 200 percent and 150 percent declining balance depreciation methods would permit deductions of 29 percent (2.0 times 1/7) and 21 percent (1.5 times 1/7).

Finally, the bill would modify the investment tax credit. A 2-1/2 percent credit would be provided for the two-year class, a 6 percent credit for the four-year class, and a 10 percent credit for both the seven-year and the ten-year classes. 9/

7/ This bill was introduced as H.R. 5829. It resembles the Tax Restricting Act of 1980 (H.R. 7015), a bill introduced by Chairman Ullman of the House Ways and Means Committee.

8/ The bill would not change the depreciation of public utility property, except that the variance in the depreciation range for such property would be increased from 20 to 30 percent.

9/ Currently, equipment with useful lives of at least seven years is eligible for a 10 percent credit, while equipment with useful lives of at least five years but less than seven years is limited to a 6-2/3 percent credit, and equipment with useful lives of three to five years is restricted to a 3-1/3 percent credit. Shorter-lived equipment is not eligible for a credit.

The Congressional Budget Office used three large-scale econometric models to simulate the impact of this depreciation proposal on the level of business fixed investment, output, and productivity. In each simulation, monetary policy was assumed to be conducted in a manner that held nonborrowed reserves constant, thus allowing interest rates to change. The simulation results are shown in Table 14.

TABLE 14. THREE ECONOMETRIC ESTIMATES OF THE IMPACTS OF THE SIMPLIFIED COST RECOVERY SYSTEM (1981-1985 annual averages)

Area of Impact	DRI a/	Chase b/	WEFA c/
Business Fixed Investment			
Equipment (increase in billions of 1972 dollars)	8.5	1.8	1.9
Structures (increase in billions of 1972 dollars)	3.0	0.9	0.8
Level of Real GNP (percent change from baseline)	0.8	0.3	0.5
Level of Productivity (percent change from baseline)	0.6	0.3	0.3

SOURCE: Congressional Budget Office.

a/ Data Resources, Inc.
b/ Chase Econometrics, Inc.
c/ Wharton Econometric Forecasting Associates, Inc.

According to the DRI model simulations, the Simplified Cost Recovery System would produce an average annual increase of $11.5 billion (8.8 percent) in the level of real business fixed investment during the 1981-1985 period. The Chase and WEFA model simulations show much smaller gains of $2.7 billion. The DRI model estimated that the average annual level of real GNP would be 0.8

TABLE 15. EFFECTIVE TAX RATES ON VARIOUS ASSETS UNDER CURRENT LAW AND UNDER H.R. 5829 AT DIFFERENT INFLATION RATES

Asset Class a/	Inflation Rate 6 Percent		Inflation Rate 12 Percent	
	Current Law	H.R. 5829	Current Law	H.R. 5829
Trucks, Buses, and Trailers	0.09	-0.04 b/	0.42	0.12
Construction Machinery	0.06	-0.03 b/	0.34	0.09
General Industrial Equipment	0.16	0	0.36	0.19
Industrial Steam Machinery	0.31	0.19	0.44	0.34
Commercial Structures	0.48	0.38	0.51	0.44

NOTE: The effect of current law and proposed revisions on effective tax rates is derived from a complex formula, and the results may not be intuitive. The formula for the effective

(Continued)

percent higher as a result of the new depreciation rules. The comparable estimates from the simulations with the Chase and WEFA models are 0.3 percent and 0.5 percent, respectively. Finally, the DRI model simulation results suggest that the average annual level of productivity would increase by 0.6 percent, while the Chase and WEFA models both estimate productivity gains of 0.3 percent.

A drawback to the Simplified Cost Recovery system is that it would not be neutral with respect to assets of different longevities (see Table 15), and thus would not maximize productivity gains. Tax rates on short-lived equipment (for example, motor

TABLE 15. (Continued)

tax rate is $(r^* - r)/r^*$, where r^* is the real pre-tax return and r is the real after-tax return. r^* is in turn determined by the formula:

$$r^* = \frac{(r + d)(1 - uz - k)}{(1 - u)} - d$$

where d is the economic depreciation rate, u is the tax rate, z is the present value of depreciation deductions (discounted at the rate r + p, where p is the inflation rate, except in the case of indexing, where depreciation deductions are discounted at the rate r), and k is the value of the investment credit.

SOURCE: Jane G. Gravelle, Depreciation Policy Options, Congressional Research Service, Report No. 80-182E (October 10, 1980), Table 2, p. 19.

a/ These asset classes are representative of investments with different durability. For example, trucks, buses, and trailers have a shorter useful life than construction machinery, which in turn has a shorter useful life than general industrial equipment.

b/ A negative effective tax rate results when the present value of depreciation deductions and the investment tax credit is worth more than immediate expensing.

vehicles and construction equipment) would fall proportionately more than tax rates on long-lived equipment and structures, and in some cases would become negative. This would increase the bias of the current tax law. Moreover, because the proposal does not directly relate depreciation deductions to the rate of inflation, the tax rate distortions among industries with assets that differ in durability would remain sensitive to the rate of inflation.

Alternative Investment Tax Incentives. An alternative to the Simplified Cost Recovery System would be to index depreciation deductions for inflation. A simplified version of indexation would

not necessarily be difficult to administer. Indexing depreciation would, however, magnify the existing bias of the tax code in favor of short-lived equipment, unless the investment tax credit were repealed or transformed into one that varied inversely with the life of an asset and that was available to structures as well as to equipment. Moreover, to reduce current distortions between debt-financed and equity-financed investment, indexing of depreciation deductions should be accompanied by an inflation adjustment for net interest payments and capital gains. Comprehensive indexing of this nature might pose difficult administrative problems.

Another way to stimulate capital formation would be to lower tax rates on corporate profits. 10/ In general, however, a corporate tax rate cut is thought to be a less effective investment incentive than accelerated depreciation, because a rate cut lowers taxes on the returns to existing as well as to new capital investments. But it would help to make the tax system more neutral: a cut in corporate tax rates would reduce both the existing distortion between corporate and noncorporate investment and the bias in favor of corporate debt financing over corporate equity financing. A corporate tax rate reduction, however, would not be especially effective in dealing with the impact of inflation on capital consumption costs, since effective tax rates would continue to vary with inflation.

A novel approach to the problem of adjusting depreciation deductions for inflation is the First Year Capital Recovery System proposed by Alan J. Auerbach and Dale W. Jorgenson. 11/ Under this plan, businesses would be given the entire depreciation deduction for each asset in the year it is purchased. The amount of the deduction would be reduced or discounted, however, to reflect the fact that the deductions in the earlier years of an asset's life are more valuable to the taxpayer than those taken in later years. The total deduction in the first year would thus

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10/ The Tax Restructuring Act of 1980, H.R. 7015, included a proposal to lower the maximum corporate tax rate to 36 percent.

11/ Alan J. Auerbach and Dale W. Jorgenson, The First Year Capital Recovery System, Hearings of the Subcommittee on Taxation and Debt Management of the Senate Finance Committee (October 22, 1979).

be less than the sum of the deductions that would be taken over a number of years under the present system. This system of discounting also would provide different first-year deductions for assets with different useful lives, with longer-lived assets receiving smaller first-year deductions. The First Year System, as proposed, would replace both the current depreciation system and the investment tax credit.

An advantage of this approach is that it results in effective tax rates that are equal for assets that differ in durability. Also, effective tax rates would not depend on the rate of inflation. Thus, it would reduce the biases of the current tax structure, and would make the allocation of capital more productive.

A major drawback of the First Year Capital Recovery System is that for several years it would have a large impact on the budget deficit because it "front loads" all deductions for an investment into the first year. 12/ If this proposal were phased in over a five-year period, however, its short-run cost would be less than that of the Simplified Cost Recovery System, but still would exceed the cost of indexing depreciation allowances (see Table 16). 13/ In the long run, the First Year System would produce revenue gains, while indexing and the Simplified Cost Recovery System both would continue to produce large losses, even after 10 years.

12/ Another disadvantage is that, because this proposal calls for repeal of the investment tax credit, it could discourage equipment investment in some cases.

13/ In response to a phase-in, however, businessmen might postpone some investment to take advantage of larger tax benefits.

TABLE 16. IMPACT ON TAX REVENUES OF ALTERNATIVE DEPRECIATION PROPOSALS (In billions of dollars)

Year	First Year Capital Recovery System		Senate Finance Committee (H.R. 5289)	Indexation a/
	No Phase-In	5-Year Phase-In		
1981	-35.6	-5.8	-10.1	0
1982	-25.9	-13.0	-23.0	-1.1
1983	-17.1	-17.5	-26.1	-3.0
1984	-9.2	-20.4	-26.3	-5.9
1985	-2.8	-24.7	-26.3	-10.4
1986	1.3	-14.2	-27.0	-13.7
1987	13.4	-4.3	-27.3	-18.4
1988	17.5	3.7	-27.8	-24.4
1989	24.0	11.2	-26.3	-31.6
1990	32.0	19.6	-30.3	-39.8

NOTE: Because these projections were prepared at different times and with slightly different assumptions in some cases, the figures should be regarded as general comparisons rather than exact estimates.

SOURCES: Jane G. Gravelle, The First Year Capital Recovery System: Revenue Estimates for Alternative Phase-In Schemes, Congressional Research Service (May 8, 1980), p. 7, Table 1; and Depreciation Policy Options, Congressional Research Service, Report No. 80-182E (October 10, 1980), Table 3.

a/ These estimates assume a prospective inflation rate of 8 percent.

CHAPTER IV. POLICIES TO IMPROVE LABOR QUALITY

Labor productivity is importantly affected by the rate of growth in the quantity of labor and changes in the quality of labor. An increase in the rate of growth in the labor supply tends to reduce productivity growth because it lowers the growth in the amount of capital available per hour or per worker. An improvement in the quality of labor--including skills, health, and work effort--tends to raise productivity. Barriers to skill development, such as discrimination or poverty, tend to lower productivity.

Several recent trends have had important effects on productivity growth. The especially rapid growth in labor supply beginning in the mid-1960s contributed significantly to the slowdown in productivity, although the labor force is expected to grow more slowly in the 1980s. In addition, several factors affected labor quality: The proportion of young and inexperienced workers increased, tending to reduce productivity. On the other hand, workers acquired more years of schooling and this tended to increase productivity (although there is considerable uncertainty as to the importance of this). Although some claim that productivity growth has been hurt by reduced work effort, there is not much quantitative evidence to suggest an erosion of work effort.

The potential role of federal government policy toward labor in increasing productivity appears to be somewhat limited, at least in the near term. In some areas where policy might play a role, such as higher education, development is already far advanced. Occupational training is very important, but here the policy levers are not very direct. The discussion that follows examines policy options that might make a moderate contribution to productivity growth. In sum, it suggests the usefulness of focusing budget resources on training and on helping workers to adjust to economic change. Also, the encouragement of new ways of organizing work and improved cooperation between labor and management might supplement more conventional measures to stimulate productivity.

This chapter is divided into four sections, each of which focuses on an aspect of labor in relation to productivity and considers some possible policy options. The first section reviews

changes in the quantity and demographic composition of labor. Other sections examine education and training; worker mobility and adaptation to economic change; and work effort and work effectiveness.

LABOR FORCE GROWTH AND DEMOGRAPHIC COMPOSITION

Impact on Productivity

Changes in the quantity as well as in the quality of the employed labor force influence the pace of productivity growth. If employment grows rapidly, the rate of growth in the amount of capital per worker tends to slow down, causing productivity growth to slow. In addition, since the official productivity data are not adjusted for quality changes in the labor force, an influx of inexperienced workers or workers with low productivity in general tends to slow measures of productivity growth. 1/

As shown in Table 17, the labor force grew at an increasing rate after 1965. 2/ Total hours worked in the private business sector grew markedly faster in the 1973-1978 period than in the period before 1965. In the future, however, labor force growth is expected to slow--a development that should help to increase productivity growth.

1/ This suggests a need to interpret productivity data with extreme caution. For example, if employment of low-productivity workers increases, this lowers the average productivity of workers. The denominator in calculating the official productivity measure is unadjusted for changes in the mix of employment.

2/ The labor force grew much more rapidly after 1965 because the postwar baby boom reached working age, and also because the labor force participation rates of youths and women increased more rapidly. One factor that may have contributed to increases in labor force participation rates is the productivity slowdown. Additional family members may have been prompted to seek work because of slower growth in real earnings of the primary earner.

TABLE 17. TRENDS IN THE CIVILIAN LABOR FORCE AND IN HOURS WORKED IN THE PRIVATE BUSINESS SECTOR (Average annual growth, in percent)

Period	Civilian Labor Force	Hours Worked in the Private Business Sector
Actual		
1947-1955	1.1	0.4
1955-1965	1.4	0.5
1965-1973	2.2	1.4
1973-1978	2.5	1.5
Projected a/		
1980-1985	1.7	b/
1985-1990	1.1	b/

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

a/ Intermediate level of projected growth in the labor force, as described in Paul D. Flaim and Howard N. Fullerton, Jr., "Labor Force Projections to 1990: Three Possible Paths," Monthly Labor Review (December 1978), pp. 25-35.

b/ The BLS projections of hours worked in the private business sector are not presented here because such projections are significantly affected by the business cycle and by numerous assumptions, some of which may no longer be appropriate.

Rapid increases in the number of inexperienced workers are thought to have contributed to the slowdown in productivity growth since 1965. In particular, youths between the ages of 16 and 24 increased from 21.5 percent of the labor force in 1970 to 24.3 percent in 1977 (see Table 18). In general, youths are less productive and earn lower wages than more experienced workers.

The female proportion of the labor force also has been increasing, but it is not clear what this means for productivity,

TABLE 18. LABOR FORCE DISTRIBUTION, BY SEX AND AGE, 1970-1990 (In percent)

Sex, Age	1970	1977	1985 a/	1990 a/
Men, ages 16 and over	61.9	59.0	55.8	54.6
16 to 24	11.7	13.2	11.0	9.3
25 to 54	38.7	36.7	37.0	38.4
55 and over	11.2	9.1	7.7	6.8
Women, ages 16 and over	38.1	41.0	44.2	45.5
16 to 24	9.8	11.1	10.6	9.4
25 to 54	22.0	24.3	28.7	31.6
55 and over	6.3	5.6	4.9	4.5

SOURCE: Flaim and Fullerton, "Labor Force Projections to 1990: Three Possible Paths," p. 31.

a/ U.S. Department of Labor, Bureau of Labor Statistics, "intermediate growth" projections.

particularly in the longer run. In earlier years, an influx of female workers probably had some depressing effect on productivity to the extent that they were less experienced than men. But the experience differential should diminish in the future. The share of youths in the labor force is expected to decline in the coming decade because the size of the population ages 16 to 24 will be falling. The share of women in the labor force is expected to continue to rise, although at a reduced rate compared with the 1965 to 1978 period.

The wage rates of women and youths are considerably below those of adult males. Some analysts assume that such differences in wage rates reflect differences in labor productivity based on experience. Also, to a significant extent, youth participation in the labor force is on a part-time basis. But the differences in wage rates may reflect labor market discrimination rather than differences in productivity, particularly in the case of women.

According to one study, changes in the age-sex composition of the employed labor force reduced total factor productivity growth

by an average of 0.4 percentage points from 1966 to 1973, and 0.2 percentage points from 1973 to 1978. Over the 1980 to 1990 period, this study projected that demographic shifts would have a slightly positive influence on productivity growth (0.1 percentage point annually). 3/

Policy Options

Government policies may have some limited effect on the growth and demographic composition of the labor force. Changes in immigration policies could have an impact on the growth and composition of the labor supply. 4/ Government tax and income transfer programs also affect the growth and composition of the labor force. For example, studies of labor supply suggest that lowering tax rates at the margin might increase the labor supply of married women. Transfer programs such as the welfare system and the Social Security system might be restructured to encourage more work. 5/ That would contribute to higher productivity broadly

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3/ John W. Kendrick, "Productivity Trends and the Recent Slowdown: Historical Perspective, Causal Factors, and Policy Options," in William Fellner, ed., Contemporary Economic Problems (American Enterprise Institute, 1979), p. 33.

4/ Census Bureau data suggest that legal net immigration accounted for approximately one-fifth of total population growth during the late 1970s. The contribution of illegal immigration to population and labor force growth is unknown, but probably not insignificant. See U.S. Bureau of the Census, Projections of the Population of the United States: 1977 to 2050, Current Population Reports, Series P-25, No. 704 (1977), p. 22.

5/ Several features of the Social Security system may diminish the quality mix of the labor force by encouraging early retirement of skilled workers. First, earnings before retirement are subject to both income and Social Security taxes, but Social Security benefits are not taxed. Second, persons receiving Social Security retirement benefits may be discouraged from working because their net (after tax and after transfer) wage may be quite low. Third, the particular way that the Social Security system is indexed for inflation encourages early retirement, when the Consumer Price Index rises more rapidly than average wage rates.

defined in terms of the overall population, but it might actually lower the average productivity per hour of work. Finally, other considerations besides productivity may militate against the use of such measures.

INVESTMENTS IN HUMAN CAPITAL: EDUCATION AND TRAINING

How Important Is Education?

Investments that increase the education, training, health, and mobility of the labor force tend to enhance labor productivity. Education and training make workers more skilled and therefore more productive. In addition, education--particularly basic or general education--helps workers to adjust to new technologies. Expenditures in these areas are a kind of investment because they yield an economic return over a period of time. But it is very difficult to assess the precise contribution of these factors to productivity growth. For example, there is great uncertainty about the effect of added years of schooling on labor productivity, and the time lag between the investment and the effect is relatively long. During the late 1950s and 1960s, there was much research on the role of human capital in economic growth. 6/ This attention may have been a contributing factor in the rapid increases in U.S. investments in education, training, and health. In more recent years, however, some students of the subject have become skeptical as to the degree to which such investments actually increase productivity. 7/ In

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6/ See, for example, Theodore W. Schultz, "Investment in Human Capital," American Economic Review, vol. 51, no. 1 (March 1961), pp. 1-17; Gary S. Becker, "Underinvestment in College Education?" American Economic Review Papers and Proceedings, vol. 50, no. 2 (May 1960), pp. 346-54; and Edward F. Denison, The Sources of Economic Growth in the United States (Committee for Economic Development, 1962).

7/ Lester C. Thurow and Robert E.B. Lucas, The American Distribution of Income: A Structural Problem, prepared for the U.S. Congress, Joint Economic Committee (1972), Chapters IV and V; Herbert Gintis, "Education, Technology, and the Characteristics of Worker Productivity," American Economic Review Papers and Proceedings (May 1971), pp. 266-79; and Henry M. Levin, "Economic Democracy, Education, and Social Change" (Center for Educational Research, School of Education, Stanford University, June 1979; processed).

the United States in particular, investment in human capital may have reached the point of diminishing returns in some cases.

The schooling of U.S. workers increased substantially during the postwar period (see Table 19). The proportion of the labor force with four or more years of higher education increased from 11.7 percent in 1965 to 17.7 percent in 1978. In addition, the proportion of workers at the bottom of the education scale declined. Many workers, however, still lack basic skills, such as literacy. While every country has its proportion of very unskilled workers, that group in the United States may be relatively larger than in some other industrialized countries, such as Germany, France, and Sweden.

There is disagreement as to the relative importance of education in improving productivity. According to one study, it was one of the most important factors contributing to productivity increases in the postwar period--considerably more important than investments in physical capital. 8/ But most estimates of the impact of education on productivity are based on cross-section studies of the relation between earnings and years of school completed at a point in time. This ignores other factors, such as ability and family background, which tend to be quite highly correlated with the number of years of schooling achieved. 9/

8/ Edward F. Denison, Accounting for Slower Economic Growth (Brookings Institution, 1979), p. 94. Educational upgrading was estimated to have raised productivity growth by an estimated 0.52 percentage point per year from 1948 to 1973, and 0.88 percentage point per year from 1973 to 1976. By comparison, physical capital was estimated to have contributed 0.39 percentage point and 0.27 percentage point, respectively. The Denison study assumes that some 40 percent of the difference in earning associated with schooling is due to other factors. But in actuality their importance could be more or less than 40 percent, and that would affect the conclusion about the contribution of education to productivity growth.

9/ Some analysts believe that employers use education merely as a screening device for hiring and that, after some point, more schooling may even have a counterproductive impact on productivity in some situations. See Ivar Berg, The Great Training Robbery (Beacon Press, 1971).

TABLE 19. SCHOOL YEARS COMPLETED BY THE LABOR FORCE

	Percent Distribution by School Years Completed					Median School Years Completed
		High School		College		
	8 or Less	1-3	4	1-3	4 or More	
1940	49.6	18.4	19.7	6.5	5.7	9.1
1957	31.8	19.8	30.5	8.8	9.2	11.8
1965	22.0	19.4	36.4	10.6	11.7	12.2
1973	12.8	15.9	41.5	15.0	14.7	12.5
1978	9.0	13.9	41.4	17.9	17.7	12.7

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, Educational Attainment of Workers--Some Trends from 1973 to 1978, Special Labor Report 225 (1979), Table A.

To the extent that education does have an important bearing on the productivity of workers at one point in time, the question remains how much increases in the schooling of workers over time affect productivity. Unless more and more jobs require increased education, a substantial and growing proportion of young college graduates may have to accept jobs that in the past were filled by workers with less education.

But schooling itself may have less substance than it formerly did. A good many employers seem to think that the quality of education has declined, and some standardized test scores tend to support this view. For example, average scores on the Scholastic Aptitude Test given to students entering college have shown a downward trend since the mid-1960s. Some of the decline can be explained by the fact that an increased proportion of students--and consequently a less select group--are continuing on to college. But even after taking account of the changes in the socioeconomic composition of students, a substantial part of the decline in test

scores remains to be explained. 10/ A particular grade level of schooling today apparently carries a lower educational performance than it did 15 or 20 years ago.

Another argument made against further investment in higher education is that the economic returns from higher education may have declined in recent years--in part because of the very rapid growth in the number of new college graduates. 11/ Evidence on this is mixed. The Current Population Survey suggests that the income of young college graduates declined relative to that of young high school graduates between the late 1960s and the 1970s. But some analysts maintain that the decline was not related to education and that, after allowing for noneducational factors that affect earnings, there has been no decline in the earnings differential enjoyed by college graduates. 12/

But even if the private returns from a college education have not declined, the social returns may have. This is because the private returns depend to a large extent on the differential in earnings associated with college graduation. However, if persons with less education are bumped down the job ladder to accommodate an influx of college graduates, the social returns from higher education may have fallen even if the private returns have not. There has clearly been an increase in the proportion of college graduates working at jobs that in the past did not require a

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10/ See College Entrance Examination Board, On Further Examination, Report of the Advisory Panel on the Scholastic Aptitude Test Score Decline (1977).

11/ See Richard B. Freeman, "Overinvestment In College Training?" Journal of Human Resources, vol. X, no. 3 (Summer 1975), pp. 287-311. The decline in the proportion of youths enrolled in college after the late 1960s may be an indication that the economic returns from college may have diminished, although the end of the draft may also have been a contributing factor.

12/ See, for example, Russell W. Rumberger, "The Economic Decline of College Graduates: Fact or Fallacy?" and the response by Richard B. Freeman, in Journal of Human Resources, vol. XV, no. 1 (Winter 1980), pp. 99-112 and 124-42.

college education. (In some cases, however, jobs can be upgraded to take advantage of more skilled workers, for example, by adopting more sophisticated technology.)

The current labor market situation for college graduates shows imbalances in particular sectors that make generalization difficult. Overall, there is little indication of underinvestment in higher education. According to one recent study, the number of jobseekers with higher education in the decade ahead is likely to grow considerably more rapidly than the number of jobs that have traditionally been filled by college graduates. 13/ At the same time, there seem to be shortages in some highly skilled occupations such as engineers and certain kinds of scientists.

The labor market for highly skilled workers is flexible, but adjustment takes time. In occupations where there are shortages, as among engineers and certain types of scientists, salaries have been increasing more rapidly than in others. Correspondingly, the number of students majoring in engineering is growing, and persons with some engineering training who were not previously working as engineers are now shifting to engineering jobs. The process of market adjustment to the scarcity of engineers also includes considerable on-the-job training. 14/

Training

In addition to formal education, training and work experience are also important factors that influence labor productivity. But it is very difficult to measure such investments or to isolate their economic returns. Economists distinguish two types of training: "general training" that makes a worker more valuable to businesses in general, and "specific training" that increases the productivity of the worker but only to his employer. In

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13/ Janet L. Norwood, "The Outlook for College Graduates Through 1990," Occupational Outlook Quarterly, vol. 23, no. 4 (Winter 1979), pp. 2-7.

14/ For a discussion of the labor market for engineers, see Glen G. Cain, Richard B. Freeman, and W. Lee Hansen, Labor Market Analysis of Engineers and Technical Workers (Johns Hopkins University Press, 1973).

general, the employer pays for investments in specific training and the employee pays for general training.

One important factor that influences an employer's decision to invest in training for an employee is the likelihood of a continuous relationship. In turn, this depends on whether the worker seems likely to quit after a short period of time or whether the employer may wish to lay off workers because of a recession.

In addition, training and other forms of worker-upgrading are importantly affected by the amount of slack or tightness in labor markets. 15/ During boom periods, workers and firms invest heavily in training. Conversely, when labor markets are slack as they have been during a substantial part of the period since 1973, the incentives for investing in training are weakened. This may lead to underinvestment in training from a longer-run perspective.

Finally, the way some government income transfer programs are structured may discourage investments in training to the extent that they inadvertently encourage high turnover among employees or encourage layoffs during slack periods.

Policy Options

One may conclude that increased federal spending on higher education does not appear to be a very effective way of increasing productivity. In part, education has probably reached the point of diminishing returns. It is important for productivity that literacy rates be high, but there is no reason to suppose that college-educated workers make better production workers. And, part of federal spending on higher education supports education of a kind that does not contribute to productivity growth.

To some extent, current federal policy may overemphasize higher education compared with investments in training or in secondary education. Thus, the Middle Income Student Assistance

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15/ See Arthur M. Okun, "Upward Mobility in a High Pressure Economy," Brookings Papers on Economic Activity (1973:1), pp. 207-61.

Act makes all full-time students in postsecondary education eligible for subsidized loans--an expenditure of resources that might, from the standpoint of economic growth, be better employed elsewhere.

Instead of increasing outlays, an alternative strategy would be to reallocate expenditures within the human resources area of the budget, with more devoted to investments in training, improving the quality of secondary education, and selective areas of higher education.

Some policies that might encourage skill development include:

- Increased training--more funding for Title II B and C of the Comprehensive Employment and Training Act (CETA), and for remedial education and training for youths to help them get jobs. H.R. 6711, which passed the House, would have authorized approximately $2 billion for youth employment-education programs; 16/

- Liberalization of the Basic Educational Opportunity Grant (BEOG) program to include students who are enrolled in education or training programs less than half time;

- Measures to encourage investment in training, such as tax credits for firms;

- Modification of government programs to encourage continuous employment with the same firm--for example, by paying unemployment benefits to employees working on a reduced work week.

Changes in CETA. The current emphasis of programs under CETA is on creating jobs for the disadvantaged. Increased emphasis might be placed on training and skill development for the disadvantaged. In addition, eligibility might be broadened to provide retraining for workers being displaced by economic forces such as technological change, import competition, or changes in energy prices.

16/ For a discussion of federal policy in the area of youth employment, see Congressional Budget Office, Youth Employment and Education: Possible Federal Approaches (July 1980).

The use of CETA Title II funds for this purpose might require some modifications in eligibility standards and in the distribution of funding. Title IIC now provides funds to prime sponsors for retraining or upgrading displaced workers, but only a small proportion of Title II training funds can be used for IIC. In addition, the workers who benefit must be unemployed, a requirement that may not conform to the need to retrain workers. Finally, the prime sponsors who currently administer the CETA funds are primarily municipal and state governmental bodies that tend to focus on the disadvantaged rather than on the regular labor force.

Evaluations of the government's training programs suggest that they tend to increase the earnings of those who are trained. 17/ It is not clear, however, whether they increase earnings enough to justify the cost of the programs, based on economic criteria alone.

Liberalization of BEOGs. The BEOG program provides grants to lower-income students to continue their postsecondary education or training, but only to those who are enrolled at least half time. If eligibility were extended to persons enrolled less than half time, it would probably include more students engaged in applied training than it does at present.

Tax Credits for Training. A tax credit to business firms for their training expenses might be a means of encouraging firms to invest more in skill development. Small firms in particular may lack incentive to invest in training because their workers are more likely to leave for better jobs elsewhere. A difficulty with the tax credit approach is that it might raise administrative problems--for example, determining what is a legitimate training expense. 18/

17/ See, for example, Michael E. Borus, "Assessing the Impact of Training Programs," in Eli Ginzberg, ed., Employing the Unemployed (Basic Books, 1980), pp. 25-40; and Mathematica Policy Research, Inc. Evaluation of the Economic Impact of the Job Corps Program, prepared for the U.S. Labor Department (April 1980).

18/ Current law provides an "employment tax credit" to cover some of the cost of hiring certain groups of disadvantaged workers, including low-income youths. See the Revenue Act of 1978.

Changes in Unemployment Insurance. Some government programs inadvertently encourage turnover in the labor market, and thereby discourage training and skill retention. For example, the unemployment insurance system, as it currently operates, encourages firms to lay some workers off completely during cyclical downturns, rather than go on a reduced workweek. This is because in most states unemployment benefits are reduced dollar-for-dollar if the recipient works part time, or may be discontinued entirely if the worker goes on a slightly reduced workweek. California has been experimenting with an unemployment insurance program that in certain cases permits plants to go on a reduced workweek, with workers entitled to prorated unemployment benefits. H.R. 7529 would encourage other states to follow the California model.

HELPING WORKERS ADAPT TO ECONOMIC CHANGE

The process of economic growth and of productivity growth involves major adjustments on the part of workers and businesses to economic change--adjustments that are frequently painful. In the postwar period, economic change has led to the exodus of millions of workers from U.S. agriculture, and of thousands from the New England textile industry. Such structural changes are brought about by the rise of foreign competition, by technological change, and by changes in the demand for goods. Understandably, workers and businesses frequently fear these changes and seek to avoid them or slow them down, or to cushion their impact.

Government policies in this area tend to reflect several competing objectives: those of adapting to economic change, of mitigating hardship, or of attempting to prevent or slow the changes. One way to promote productivity growth would be to strengthen policies and programs that aid in the process of adjustment and to modify existing policies that may be inhibiting long-run adjustments to economic change. This would stimulate productivity in at least two ways: by raising the productivity of displaced workers, and by encouraging workers to accept new technologies without fear of unemployment as a consequence. 19/

19/ Some observers believe that the emphasis on job security in some other industrialized countries, such as Japan, encourages greater willingness on the part of labor to accept technological change than in the United States.

Training Programs. In the field of training, some existing programs might be modified. As noted above, the current focus of CETA programs is on the disadvantaged, but it could be modified to include workers experiencing difficulties in adjusting to technological change. 20/ Currently, Title IIC of the Comprehensive Employment and Training Act (CETA) provides training for workers displaced by technological change, although it constitutes a rather small part of the CETA programs compared with providing work experience and public service employment.

Another program that could be modified to give increased emphasis to retraining is the Trade Adjustment Assistance program. The program provides income assistance and training for workers unemployed because of international competition. As it has functioned, however, not many workers have been retrained so far. 21/

Migration Assistance. Many unemployed workers might be able to find jobs in other parts of the country. Several pilot projects were undertaken during the 1960s to test the feasibility of assisting workers in relocating through placement, training, and relocation grants. But the results were inconclusive, in part because the experience of the migrants could not be followed over a sufficiently long period of time. Most of the migrants experienced increases in earnings--for one thing they had to have a job in the new area before they were assisted in moving--but two months after migration about one-sixth of them had returned to their original communities. What happened in ensuing months is not known. For this kind of investment to "pay," the migrants would have to

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20/ The rationale for the original Manpower Training and Development Act (MDTA) was to assist workers in adjusting to technical change. During the 1960s, the focus of employment policy changed to the problems of the disadvantaged. In addition, the general prosperity of the 1960s may have obscured longer-run problems of economic adjustment.

21/ For an analysis of this program, see Government Accounting Office, Restricting Trade Act Benefits to Import-Affected Workers Who Cannot Find a Job Can Save Millions (1980).

experience higher earnings than the control group for several years. 22/

Unemployment Insurance. The payment of unemployment insurance benefits over an extended period of time can deter workers from making job adjustments that in the long run would improve productivity. One proposal that has not yet gained favor would seek to minimize this effect by replacing monthly payments with a lump sum grant. If a displaced worker did not find a job after a specified period, reduced monthly payments might then begin. Another approach would be to offer training along with the benefits.

Reducing Barriers to Opportunities. Policies that help to remove barriers to developing and using skills can also help to raise labor productivity. These barriers include:

- o Lack of access to adequate schools;
- o Location in depressed labor markets;
- o Monopoly practices that prevent free entry of labor into occupations and industries; and
- o Discrimination based on race, sex, or age.

WORK EFFORT AND EFFECTIVENESS

Some observers feel that worker attitudes may be a factor in the productivity slowdown. One line of thought is that higher taxes have impaired peoples' interest in working hard or taking on increased responsibility. Another is that people have become less attentive to their jobs--a reflection of changing social attitudes. But there is not much hard evidence to suggest a deterioration of worker effort. For example, the rate of absenteeism for full-time nonfarm workers--admittedly an indirect measure of work effort--was roughly the same in 1978 as in 1973 (see Table 20). Another indicator, the quit rate among workers in manufacturing,

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22/ Charles K. Fairchild, Worker Relocation: A Review of U.S. Department of Labor Demonstration Projects, Final Report to the Manpower Administration, U.S. Department of Labor (April 1970; Contract No. 87-34-69-01).

TABLE 20. ABSENCE RATES FOR FULL-TIME NONFARM WAGE AND SALARY WORKERS, BY REASON, MAY 1973 AND MAY 1978

	May 1973	May 1978
Number of Absences per 100 Workers		
Total (all reasons)	6.5	6.6
Illnesses or Injury	4.1	4.1
Miscellaneous reasons	2.4	2.5
Hours Absent per 100 Hours Usually Worked	3.5	3.5

SOURCE: Daniel E. Taylor, "Absent Workers and Lost Work Hours, May 1978," Monthly Labor Review (August 1979), p. 50.

does not appear to have changed significantly over the last 30 years. 23/

It is possible that nonwork values may have become relatively more important than in the past and that workers may have become less satisfied with their jobs. Some survey data suggest that workers may value leisure relatively more, and their careers less, than formerly, and that workers may also attach relatively more importance to nonpecuniary aspects of their jobs. 24/ One study

23/ Multiple regression was used to test whether there was a statistically significant time trend from 1948 to 1978 in the manufacturing quit rate, after adjusting for the cycle. The coefficient on the time variable was negative, although not statistically significant.

24/ See Jerome M. Rosow, "Changing Attitudes to Work and Life Styles," Journal of Contemporary Business, vol. 8, no. 4; and Work In America, Report of a Special Task Force to the Secretary of Health, Education, and Welfare (1974).

reports an appreciable drop in the overall job satisfaction of workers between 1973 and 1977, particularly among lower-income workers. 25/ The effect of high tax rates on work effort remains an open question. 26/

New approaches to organizing work, as well as more cooperation between labor and management in matters relating to productivity, may offer some promise. 27/ One example is the Scanlon plan approach to dividing the economic gains of productivity improvements between workers and the firm. Another example is the community effort in Jamestown, New York--which appeared to be a mature declining area--where labor-management cooperation helped in raising productivity and turning the situation around. More

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25/ Robert P. Quinn and Graham L. Staines, The 1977 Quality of Employment Survey (University of Michigan, Institute for Social Research, 1979), pp. 303-09.

26/ Most research on the relation between labor supply and taxation has focused on quantitative rather than qualitative aspects. For a review of the literature, see Congressional Budget Office, An Analysis of the Roth-Kemp Tax Cut Proposal (October 1978), Chapter III.

27/ There have been numerous experiments or instances in which increased worker participation in decisionmaking or worker sharing in the benefits of increases in efficiency seem to have improved productivity. See, for example, National Center for Productivity and the Quality of Working Life, Recent Initiatives in Labor-Management Cooperation (1976); Raymond A. Katzell and others, A Guide to Worker Productivity Experiments in the United States, 1971-1975 (New York University Press, 1977); Edgar Weinberg, "Labor-Management Cooperation: A Report on Recent Initiatives," Monthly Labor Review, vol. 99, no. 4 (April 1976), pp. 13-22; and The Human Resources Development Act of 1977, Hearings before the Subcommittee on Economic Stabilization of the Committee on Banking, Finance and Urban Affairs, House of Representatives, 95:2 (1977). Such measures might improve the quality of life of workers in addition to improving productivity.

recently, the steel industry has taken steps to involve labor and management in cooperative efforts to raise productivity. 28/ The bulk of the case studies seem to suggest that such private-sector efforts tend to increase productivity.

Initiatives such as these are basically private-sector matters, outside the sphere of direct federal action. The government can, however, lend support. One possibility would be to increase the funding under Section 6 of CETA, which provides support for innovative approaches in labor-management relations. Certain changes in government policies might help to create a more favorable environment for labor-management cooperation. For example, modifying the unemployment insurance system to encourage work-sharing arrangements rather than layoffs during slack periods might improve the climate for worker-managment cooperation. In addition, the slack time could be used to form problem-solving committees or to implement other approaches to production problems.

While these may be promising approaches to increasing productivity, there is no way of estimating their likely impact. In addition, they may be limited by institutional factors. Traditionally, management has guarded its prerogatives in decision-making, while labor unions have been skeptical of programs to raise productivity. 29/

CONCLUSIONS

Two of the factors that have tended to slow productivity growth since the mid-1950s are beginning to slow or reverse: The labor force will probably expand much more slowly in the 1980s, and the proportion of inexperienced workers in the labor force will

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28/ According to one recent source, this approach greatly increased productivity in a particular steel plant in Louisville, Ohio, run by the Jones and Laughlin Co. See "Worker Ideas Lift Steel Output," New York Times, October 17, 1980.

29/ This kind of "industrial democracy" seems to be more prominent in Western Europe and in Japan than in the United States, at least to date. In the United States, unions have tended to focus on wages and working conditions but not profit sharing, or measures to enhance the meaning of the job.

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likely decline. These two factors together might contribute as much as half of one percentage point to the productivity growth rate in the latter half of the decade.

Among policies affecting the labor force, those that would encourage training and better-quality secondary education seem likely to be a more effective means of stimulating productivity than would an across-the-board increase in investment in higher education. In addition, the federal government might employ a number of approaches--some experimental--to encourage the private sector in skill-development and more effective utilization of human resources.

CHAPTER V. POLICIES TO ENCOURAGE EFFICIENT TECHNOLOGIES

Innovation--the development of more efficient technologies and their application in industry--is one of the most important determinants of productivity growth. The innovative process, while not well understood, is believed to be influenced by such basic factors as the prospect of economic gain, the degree of uncertainty surrounding economic decisions, and the quality of business management. The government plays a secondary role in this process, but its actions influence the climate for innovation and it can encourage or discourage innovation through its policies in areas such as taxation, regulation of business, patent law, support for scientific investigation, and the dissemination of information. 1/

This chapter examines trends in innovation, to the extent that they can be gauged. A number of policy measures might improve the climate for innovation. Research and development could be encouraged by further tax incentives or by more direct forms of government involvement such as grants, loans, or price guarantees. Diffusion of new technologies could be encouraged by tax measures that would stimulate business capital spending. Small, high-technology businesses would benefit from targeted tax, credit, or regulatory measures.

TECHNOLOGICAL INNOVATION AND PRODUCTIVITY GROWTH

The importance of technological innovation in stimulating productivity growth is generally recognized by students of the

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1/ In this report, "innovation" is used to mean technological progress--a broader meaning than is usually implied when economists use the term. It will include not only the phases of invention and of first commercial application, but also the phase of diffusion of an invention throughout an industry. Economists generally use "innovation" to mean the first two of these phases. See, for example, Edwin Mansfield, Technological Change (W.W. Norton, 1971), chap. 4.

subject. 2/ There is less agreement, however, about the importance of expenditures for research and development (R&D) or particular kinds of innovation, such as innovation by the small business firm, as determinants of productivity growth. Some investigators have attached much importance to R&D, and have seen it as a factor in the productivity slowdown after the mid-1960s. According to one source, as much as 0.9 percentage points of the productivity growth rate in the 1948 to 1966 period, as well as a substantial part of the slowdown after 1966 (0.3 percentage points), can be attributed to changes in the amounts spent on research and development. 3/ Some analysts, however, stress that R&D is only one aspect of innovation and that a substantial part of it--as in national defense--has little to do with measured productivity. According to this view, the slowdown in R&D spending was not an important factor in the overall productivity slowdown. 4/

In comparing specific industries and firms, however, researchers have found a relationship between the amounts spent on R&D and the rate of productivity growth. Variations in R&D spending over time within an industry or firm seem to influence productivity growth, although there is considerable uncertainty about the size and timing of such effects. 5/

2/ According to Edward Denison, the category of determinants "advances in knowledge and not elsewhere classified" accounted for as much as two-thirds of the growth in productivity in the 1948 to 1973 period. See Edward F. Denison, Accounting for Slower Economic Growth (Brookings Institution, 1979), p. 108.

3/ John W. Kendrick, "Productivity Trends and the Recent Slowdown: Historical Perspective, Causal Factors, and Policy Options," in William Fellner, ed., Contemporary Economic Problems (American Enterprise Institute, 1979), p. 33.

4/ Denison, Accounting for Slower Economic Growth, pp. 122-26.

5/ See Roger Brinner, Technology, Labor, and Economic Potential (Data Resources, Inc., 1978), chap. 1; Zvi Griliches, "R&D and the Productivity Slowdown," American Economic Review (May 1980), pp. 343-47; and M. Ishaq Nadiri, "Sectoral Productivity Slowdown," American Economic Review (May 1980), pp. 349-52.

Other evidence can be marshaled. The economic returns to businesses investing in research and development appear to be relatively high compared with alternative investments--at least as high as, and probably somewhat higher than, the returns from investments in plant and equipment. In addition to the increase in profits for the innovating firm, there are benefits accruing to other firms and to consumers. The social returns from R&D investments, which include private as well as external benefits, may be much higher than the private returns to the firm undertaking the R&D--according to some estimates as much as double the private returns. 6/ (These generalizations are based on experience before 1970. However, one paper that includes more recent data from the 1970s period suggests that the measured economic returns from R&D investments may have declined as compared with the 1960s.) 7/

TRENDS IN INNOVATION

A major difficulty in the study of innovation is that there is no direct measure of innovation that is meaningful for the economy. There are only indirect measures such as R&D spending, the number of patents awarded, or imports and exports in "high technology industries." It would be tempting to use the readily available figures for R&D as "a measure of the pace of innovation." But that

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6/ See, for example, Edwin Mansfield, "Federal Support of Research and Development Activities," in Priorities and Efficiency in Federal Research and Development, Joint Economic Committee (1976), pp. 85-113; Brinner, Technology, Labor, and Economic Potential, pp. 95-100; Zvi Griliches, "Return to Research and Development Expenditures in the Private Sector," in J.W. Kendrick and B.N. Vaccara, eds., New Developments in Productivity Measurement and Analysis (University of Chicago Press, 1979), pp. 419-54; and A. Pakes and M. Schaukerman, "The Rate of Obsolescence of Knowledge, Research Gestation Lags, and the Private Rate of Return to Research Resources," National Bureau of Economic Research, Inc., Working Paper No. 346 (1979).

7/ Griliches, "R&D and the Productivity Slowdown." The paper also raises the possibility that there may have been an increase in the proportion of R&D that is devoted to either noneconomic purposes or to economic purposes that are not measured in the GNP accounts.

would be a mistake. Innovation is a comprehensive process that involves creative insight, commercial development, and diffusion of technology throughout an industry. R&D is an input to this process--not an end result. In some cases, a new technology can be copied from firms in another country without the need for R&D. Moreover, in some industries, R&D represents considerably less than half of the cost of developing a new technology. Finally, the diffusion or spread of the new technology throughout an industry is critical for productivity growth, yet that phase may take years or decades. This section discusses trends in several elements of the innovative process.

Trends in Research and Development Spending

Research and development activity in the United States increased sharply from the mid-1950s to the mid-1960s but slowed markedly afterward. As shown in Table 21, real R&D spending slowed to a growth rate of only 1.0 percent a year in 1965-1973 and 1.8 percent in 1973-1978. The slowdown in government spending for R&D--the government finances about one-half of total R&D--was considerably more pronounced than that in R&D financed by the private sector. The more rapid growth in privately financed R&D spending in 1978-1979 may indicate some resurgence.

TABLE 21. GROWTH IN REAL SPENDING FOR RESEARCH AND DEVELOPMENT, BY SOURCE OF FUNDS, 1953-1979 (Percent annual growth in 1972 dollars)

Period	Total R&D	Private Industry R&D	Federal Government R&D
1953-1965	9.9	7.2	11.7
1965-1973	1.0	4.5	-1.5
1973-1978	1.8	3.3	0.4
1978-1979	3.4 a/	4.5 a/	2.3 a/

SOURCE: National Science Foundation, National Patterns of Science and Technology Resources 1980, NSF 80-308 (1980), Table 5.

a/ Preliminary.

Expressed as a percent of GNP, total R&D spending increased from 1.6 percent in 1955 to 2.9 percent in 1965, and then declined to 2.3 percent in 1978 (see Table 22). R&D funded by private industry has continued at approximately 1.0 percent since the early 1960s.

TABLE 22. RESEARCH AND DEVELOPMENT SPENDING AS A PERCENT OF GROSS NATIONAL PRODUCT, SELECTED YEARS, 1955-1978

Year	Total a/	Carried Out by Industry b/	Funded by Industry
1955	1.55	1.16	0.62
1960	2.67	2.08	0.89
1965	2.91	2.06	0.95
1970	2.64	1.84	1.06
1973	2.35	1.63	1.02
1974	2.34	1.62	1.05
1975	2.32	1.58	1.04
1976	2.29	1.59	1.04
1977	2.26	1.58	1.04
1978	2.27	1.57	1.05

SOURCES: National Science Foundation and U.S. Department of Commerce.

a/ Includes government and private nonprofit sectors.

b/ Includes research and development carried out by private industry but financed by government.

In industry, the composition of R&D spending has shifted away from basic research and toward more applied research. Basic research made up approximately 7.0 percent of total R&D financed by private industry in 1965 but only 4.6 percent in 1973 and 4.3 percent in 1978. Considering all sources of funding, however, basic research did not decline as a share of total R&D spending.

(One reason is that federal R&D spending became more focused on basic research.) 8/

Total real spending for basic research (private and public) did not increase at all from the late 1960s through 1977, and it dipped substantially during the middle of this period. Trends in federal R&D spending contributed to the weakness during that period. Federal government spending for basic research, which accounts for about two-thirds of all spending for basic research, declined from $2.8 billion in 1968 (in 1972 dollars) to a low point of $2.5 billion in 1975, before returning to about $2.9 billion in 1978. In the private industry sector, real spending for basic research declined slightly in the 1968-1978 period. Nonprofit institutions increased their funding of basic research in this period, from $520 million to $660 million. 9/

The significance of the slowdown in R&D spending is difficult to interpret, since much of it has been associated with defense and space programs. While some breakthroughs in defense R&D have had very important commercial applications, economists believe that government-financed R&D tends to have a smaller direct impact on productivity than R&D financed by private industry. 10/ For example, a substantial part of federal R&D is support for such objectives as health, which are not measured in the national accounts. Also, government-sponsored R&D may have indirect effects on productivity in the industries that purchase goods and services from defense and space industries.

Inevitably, there is a lag between any change in R&D spending and its impact on productivity. For this reason, some analysts feel that the full impact of the slowdown in R&D spending, particularly on basic research, is yet to be felt.

8/ National Science Foundation, National Patterns of Science and Technology Resources 1980, NSF 80-308 (1980), Table 7.

9/ Ibid.

10/ See Nestor Terleckyj, "Direct and Indirect Effects of Industrial Research and Development on the Productivity Growth of Industries," in Kendrick and Vaccara, New Developments in Productivity, pp. 359-86.

International comparisons show that the United States still spends more on R&D in absolute terms than its major trading partners. But several of these countries have been increasing R&D spending at a more rapid rate and, relative to GNP, have about caught up with the United States (see Table 23). Both Germany and Japan spend more on nondefense R&D relative to GNP than the United

TABLE 23. RESEARCH AND DEVELOPMENT EXPENDITURES IN LEADING INDUSTRIAL COUNTRIES AS A PERCENT OF GROSS NATIONAL PRODUCT, 1963-1977

	1963	1967	1973	1977
United States	2.9	2.9	2.3	2.3
Canada	0.9	1.3	1.1	1.0
France	1.6	2.1	1.8	1.8
Germany	1.4	2.0	2.3	2.3
Japan	1.4	1.5	1.9	1.9 a/
United Kingdom	2.3 b/	2.3	2.1 c/	NA
USSR	2.8	2.9	3.7	3.5

SOURCE: National Science Foundation, Science Indicators 1978, p. 140.

a/ 1976.
b/ 1964.
c/ 1975.

States (see Table 24). Within the private sector, enterprise-funded research and development as a percent of GNP is about the same in Germany as in the United States, but it is higher in Japan. In 1973, the latest year for which published estimates seem to be available, privately financed research and development in manufacturing was a larger percent of value added in the United States than in Germany, but about the same as in Japan. If defense research carried out by manufacturing industry and financed by

TABLE 24. RESEARCH AND DEVELOPMENT EXPENDITURES EXCLUDING DEFENSE IN LEADING INDUSTRIAL COUNTRIES AS A PERCENT OF GROSS NATIONAL PRODUCT, 1961-1976

	1961	1967	1976
United States	1.3	1.9	1.6
France	1.0	1.6	1.5
Germany	NA	1.8	2.2
Japan	1.4	1.5	1.9 a/
United Kingdom	1.5	1.7	1.5 a/

SOURCES: U.S. Bureau of Labor Statistics and National Science Foundation, cited in Committee for Economic Development, Stimulating Technological Progress (1980), p. 26.

a/ 1975.

government is included, the United States outranked both Germany and Japan by a large margin (see Table 25).

Thus, conclusions drawn from international comparisons depend on what kind of R&D spending is being compared. U.S. government spending on R&D is relatively more concentrated on defense than is that of major U.S. trading partners; and other types of R&D spending by the U.S. government are relatively less focused on economic growth objectives (see Table 26).

Trends in Patents Granted

Another indicator of innovation is the number of U.S. patents granted per year, although that is a very crude measure because patents vary in their significance. The number of patents granted has declined substantially since 1973, and is at roughly the same

TABLE 25. RATIO OF RESEARCH AND DEVELOPMENT EXPENDITURES TO VALUE ADDED IN MANUFACTURING IN LEADING INDUSTRIAL COUNTRIES, SELECTED YEARS, 1963/1964 TO 1973 (In percent)

	Enterprise-Funded					Total				
	1963/1964	1967	1969	1971	1973	1963/1964	1967	1969	1971	1973
United States	2.7	2.7	3.2	3.3	3.1	6.3	5.8	5.9	5.6	5.0
Canada	1.1	1.4	1.3	1.2	1.2	1.3	1.7	1.6	1.5	1.6
France	1.4	NA	1.6	1.8	1.9	2.2	3.3	2.8	2.7	2.8
Germany	2.0	2.2	2.3	2.6	2.3	2.1	2.6	2.6	3.0	2.9
Italy	1.3	1.5	1.5	1.9	1.3	1.3	1.6	1.6	2.1	1.5
Japan	2.2	2.2	2.5	2.8	3.6	2.2	2.2	2.6	2.8	3.7
United Kingdom	NA	NA	NA	NA	2.0	NA	NA	NA	NA	3.5

SOURCES: Sumiye Okubo, Rolf Piekarz, Eleanor Thomas, "International Comparison of Enterprise-Funded R&D in Manufacturing" (paper presented at the Engineering Foundation Conference, Easton, Maryland, 1977); reproduced in National Science Foundation, Science and Technology: Annual Report to the Congress (August 1978), p. 77.

TABLE 26. DISTRIBUTION OF GOVERNMENT RESEARCH AND DEVELOPMENT EXPENDITURES AMONG SELECTED OBJECTIVES IN LEADING INDUSTRIAL COUNTRIES (In percent)

	United States a/	France b/	Germany b/	Japan c/	United Kingdom d/
National Defense	51	30	12	2	46
Space	13	5	5	5	2
Energy	9	9	11	8	7
Economic Development	9	23	13	23	20
Health	10	4	3	3	3
Community Service	5	2	5	3	2
Advancement of Knowledge	4	26	51	55	20

SOURCE: National Science Foundation, Science Indicators 1978, pp. 146-47.

a/ 1976-1977.
b/ 1976.
c/ 1974-1975.
d/ 1975-1976.

level as in 1961 (Table 27). By contrast, the number of U.S. patents granted to foreigners grew rapidly from the 1960s to the early 1970s.

TABLE 27. U.S. PATENTS GRANTED, BY TYPE OF OWNER, SELECTED YEARS, 1961 TO 1977

	All Patents	U.S. Government	U.S. Corporations	U.S. Individuals	Foreign
1961	40,154	1,460	27,382	11,233	79
1965	50,332	1,522	35,698	13,032	80
1973	51,509	2,078	36,515	12,677	239
1977	41,452	1,479	29,522	10,247	204

SOURCE: National Science Foundation, Science Indicators 1978, p. 219.

Diffusion of Efficient Technologies

New technologies become significant in economic development only to the extent that they are adopted throughout an industry or economic sector. It is difficult to determine whether the diffusion of new technologies slowed during the 1970s. Studies of particular kinds of new technologies suggest that diffusion became more rapid in the period after World War II. 11/ But there are no detailed studies of the most recent decade.

Certain indirect indicators suggest that diffusion may have slowed down. First, there has been a slowing in investment in new plant and equipment--a critical factor in the diffusion of some kinds of technologies. Second, economic uncertainty has probably been intensified by escalating prices of raw materials--particularly oil--and inflation in general. Third, some types of government regulations may have acted as deterrents by adding to

11/ Edwin Mansfield, Industrial Research and Technological Innovation (Norton, 1968), chap. 7 and 8.

uncertainty or by applying more stringent standards to new facilities than to old.

THE DETERMINANTS OF INNOVATION

Even though the process of innovation takes place throughout the economy, research and development appears to be quite highly concentrated. In 1974, about 85 percent of all industrial research and development was accounted for by six industries: communication equipment and components, machinery, aircraft and parts, guided missiles and spacecraft, motor vehicles and other transportation equipment, and chemicals. About 90 percent of all research and development in the private sector was done by only 200 firms. 12/

The Role of Small Business Firms

Some analysts believe that small businesses play an especially critical role in innovation, even though they spend relatively little on research and development. One study estimates that small businesses and independent operators played a significant role in as many as half of all important innovations during a recent period. 13/ The role of small businesses was found to be particularly important in the early stages of an innovation, although at the stage of commercial development larger firms tended to assume more of the burden.

Several characteristics of small businesses may tend to favor certain types of innovation. For one thing, the great number of

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12/ National Science Foundation, Science Indicators 1976; and National Patterns of Research and Development Resources 1978.

13/ National Science Foundation, Science Indicators 1976, chap. 4. There is substantial disagreement about the relative importance of small businesses in the innovative process. Some investigators have held that modern innovation requires so many resources that only very large firms can undertake them. Others disagree. Quantitative studies tend to suggest that smaller firms play an important, though by no means a dominant, role. See Mansfield, Industrial Research and Technological Innovation, chap. 5.

small businesses increases the opportunities for innovation. For another, small firms tend to be less rigid and possibly more receptive to new ideas than large corporations. Finally, large firms are more likely to be producers of a product or users of a process that would be adversely affected by the innovation.

Factors That Influence Business Decisions

Economists believe that the factors influencing the decisions of businesses to spend on R&D and to innovate are similar to those influencing their decisions regarding investment in general. The prospect of earning a profit from the R&D expenditure is crucial. But the profit outlook for R&D investments depends on many things, including sales, the cost of funds, and government regulations.

Economic Conditions. The general state of the economy is believed to be a major determinant of innovation. If the economic environment is favorable to investment and risk-taking, it is conducive to innovation.

A number of studies suggest that the economic returns from investments in R&D were relatively high in the 1960s, and the rapid growth in private-sector R&D is consistent with those observations. 14/ But why did the growth slacken considerably during the 1970s? A good deal of circumstantial evidence suggests that the climate for innovation, and the prospective returns for R&D in particular, may have deteriorated during the 1970s. First, higher inflation may have added to uncertainty and caused businesses to curtail their R&D plans, especially for basic research which has a more delayed and uncertain payoff than many alternative investments. Second, in a number of areas, increased government regulation added substantially to the costs and uncertainty of innovation. Third, the 1970s were characterized by considerable economic slack.

The existence of economic slack and the outlook for sluggish growth in sales tended to discourage innovation in much the same way as they discouraged business fixed investment. They also discouraged the diffusion of innovation to the extent that this

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14/ See footnotes 5 and 6 of this chapter.

depends on the installation of new plant and equipment. Industry-financed R&D spending continued at about 1.0 percent of GNP, as it had since the early 1960s, but as the growth in real GNP slowed so did innovations.

Another negative influence--related to those already mentioned--was the depressed state of the capital markets during much of the 1970s. This was especially discouraging to the development of small, high-technology businesses. As shown in Table 28, the value of stock issued by companies with net worth of less than $5 million fell dramatically during the recession of 1973-1975, and the recovery has been slow and incomplete. This part of the capital market tends to mirror developments in equity markets as a whole, but it is more volatile. The pessimism of the capital markets was unusually deep and prolonged during much of the 1970s.

TABLE 28. STOCK ISSUED BY COMPANIES WITH NET WORTH OF LESS THAN $5 MILLION, 1969-1980

Period	Number of Issues	Share Value (millions of dollars)
1969	698	1367
1970	198	375
1971	248	551
1972	409	896
1973	69	160
1974	9	16
1975	4	16
1976	29	145
1977	13	43
1978	21	129
1979	46	183
1979 1st half	16	56
1980 1st half	30	149

SOURCES: Venture Capital, Inc., cited in The Washington Post (November 18, 1979), p. G-1; 1979 and 1980 first half from Capital Publishing Corporation.

Management Attitudes. Innovation may also have been dampened by changes in the way managers work. Some analysts feel that U.S. managers today focus more on short-term earnings performance than they did in the past, or than their counterparts do in other industrialized countries. Some observers also believe that modern managers have less technical knowledge of, or commitment to, their industry. 15/

POLICIES TO STIMULATE INNOVATION

The preceding survey of factors affecting innovation suggests that policies to stimulate it might focus on three aspects of innovation: research and development, diffusion of technologies, and small high-technology business firms. The deterioration of the economic climate has probably been a contributing factor behind the slowdown in R&D spending--particularly that for basic R&D--and behind the near-collapse in the public capital market for new high-technology firms. The best tonic for these ills probably would be an end to inflation and recession. But short of that, the following policy options might tend to offset some of the negative factors.

Policies to Stimulate R&D

The social returns from R&D seem to have exceeded considerably the private returns, and may also have been high compared with the social returns from alternative investments. Social benefits seem likely to exceed private benefits to a greater extent in basic research than in development and commercial application, because the results of basic research have broader applicability and may not be patentable. The case for public support of research and development may also be stronger in industries characterized by

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15/ See, for example, the statement of Robert B. Reich, Director, Office of Policy Planning, Federal Trade Commission, Hearings on Economic Growth, Senate Select Committee on Small Business, 96:2 (June 24, 1980); and R.H. Hayes and W.J. Abernathy, "Managing Our Way to Economic Decline," Harvard Business Review (July-August 1980), pp. 67-77. If true, some of the basic reasons may include the structure of capital markets in the United States that reward stable earnings growth and increased government regulation of the private sector.

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many small producers than in industries with a few large firms. Single producers in small-producer industries (for example, agriculture) are often not large enough to justify research. 16/

Accelerated Depreciation. Capital used in R&D might be made subject to accelerated depreciation for tax purposes. Accelerated depreciation is used in several countries as a way of stimulating R&D. Canada and Great Britain permit full depreciation in the first year of some types of capital, including that used for R&D. A number of other countries, including France and Germany, allow more rapid depreciation for R&D-related capital than for other types of capital. In the United States, rapid depreciation is permitted for some types of investments in which social benefits may exceed private returns, as in pollution abatement and low-income housing.

Tax Credits. Another frequently mentioned incentive would be a tax credit for R&D expenses. Under current laws, R&D operating costs can be expensed, rather than treated as an investment to be amortized over a period of years. A tax credit for R&D expenses would be similar to the tax credit for equipment.

Critics of the tax-incentive approach raise two basic objections. For one thing, they believe that tax measures might not stimulate much additional R&D spending. If it did not, the revenue loss might be large in relation to the net addition to R&D spending. They also argue that a tax credit for R&D expenses would be difficult to administer, since it would be hard to distinguish R&D expenses from ordinary business expenses. (The same persons may be involved in research and in more routine production; or an expensive computer may be used both for research and for ordinary accounting.)

16/ Other recent discussions of policy options to stimulate innovation include: Joseph J. Cordes, The Impact of Tax and Financial Regulatory Policies on Industrial Innovation (National Academy of Sciences, 1980); Eileen L. Collins, "Sorting Out the Arguments Underlying Proposed Tax Incentives to Encourage Innovation" (paper prepared for the annual meeting of the American Economic Association, September 5-7, 1980); Committee for Economic Development, Stimulating Technological Progress; and National Academy of Engineering, Industrial Innovation and Public Policy Options: Report of a Colloquium (National Academy Press, 1980).

Critics of R&D tax credits also raise several other points: The option to expense a large part of an R&D investment already constitutes a significant tax advantage. 17/ In addition, the benefits of a tax credit for research and development would be very unequally distributed, since a relatively few large firms account for a large proportion of total research and development in the private sector. Many firms--particularly young, small firms--might not have enough taxable income to use the tax credit.

Modifications could be made in response to these criticisms, such as limiting an R&D tax credit to increases in R&D spending from some base level. 18/ But this would make the credit more cumbersome and difficult to administer. Or the credit might be limited to firms below a certain size, or to particular industries. Alternatively, it could be targeted on research and development in capital goods industries, where innovations help to increase productivity in other industries. The tax credit could also be made refundable--which would help small businesses. 19/

17/ Economists believe that the option to deduct a capital investment in one year for tax purposes--to expense the investment--tends to be roughly equivalent to a zero tax on the return from that capital.

18/ H.R. 5829, as reported by the Senate Finance Committee, would provide for an income tax credit of 25 percent of the increase in qualifying research and experimental expenditures from the base period. See Tax Reduction Act of 1980, Report of the Senate Committee on Finance, 96:2 (1980), pp. 92-100.

19/ Another tax issue in the area of R&D is presented by Treasury Regulation 1.861-8, which prescribes the allocation of overhead expenses of multinational companies. An international company is required to apportion its overhead costs, including those for research and development, between domestic and foreign sources, even if they are not directly traceable to its foreign operations. Previously, a research and development expense was deductible for U.S. tax purposes unless it was directly related to foreign operations. The impact of this change on R&D activities is unclear. Some spokesmen for multinational firms hold that this will discourage a significant amount of research, but some other observers believe that this kind of R&D is not sensitive to tax policies.

The impact of special tax incentives is difficult to evaluate, for lack of U.S. experience with them. Some countries--including Canada--have tax credits for increases in R&D spending, as well as accelerated depreciation for capital used in R&D, but the quantitative impact of such tax measures on R&D spending is unknown. 20/ The problem of defining R&D spending would probably be easier in the case of accelerated depreciation than it would for a tax credit on current expenditures for R&D.

Options on the Outlay Side of the Federal Budget. One possibility would be to reorder existing priorities for federally sponsored R&D so as to place a relatively greater emphasis on projects related to productivity. Another would be to extend the use of government contracts and grants for specific kinds of R&D. Loans or loan guarantees might be used for particular projects. Price guarantees might provide incentives for the private sector in cases where large long-term investments are needed for projects in the national interest. 21/

The Carter Administration proposed the establishment of "generic technology centers" that would develop technologies in particular industrial sectors and make them generally available. The proposal called for the establishment of four such centers in 1981, to be sponsored by the National Science Foundation and the Department of Commerce at a cost of $6-8 million.

The Carter Administration also proposed an increase in the Small Business Innovation Program administered by the National Science Foundation, which provides funding to small companies for

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20/ For discussions of foreign measures to stimulate R&D, see Organization for Economic Cooperation and Development Policies for the Stimulation of Industrial Innovation (OECD, 1978), Robert S. Kaplan and others, "Tax Policies for R&D and Technological Innovation" (Graduate School of Industrial Administration, Carnegie-Mellon University, 1976; processed), chap. 1; and Gilles Paquet, "Taxation and Science Policy," Canadian Tax Journal, vol. 19, no. 5 (1971), pp. 429-37.

21/ For a more detailed discussion, see National Science Foundation, Division of Policy Research and Analysis, "Direct Federal R&D Support and Industrial Innovation: A Review of Recent Literature" (prepared for President's Domestic Policy Review on Industrial Innovation, December 1978; processed).

projects involving new technology. The proposal would increase the funding level for this program from about $2.5 million to $10 million in fiscal year 1981. 22/

A "development bank" could combine elements of the public- and private-sector approaches. Such a bank could employ a variety of instruments, including loans, loan guarantees, or price guarantees, and it could use them to target resources on the development of specific technologies. This is the general approach now being used to encourage the development of the synfuels industry.

Proponents of tax measures to stimulate R&D argue that this approach would be easier to administer, and would involve less interference with markets, than an approach involving government contracts and grants. They argue, too, that the government is not "good at picking winners" and therefore should avoid choosing among R&D projects that have potential commercial application. On the other hand, proponents of the government expenditure approach argue that tax measures are inefficient because they tend to subsidize businesses for doing what they would do anyway.

To a large extent, the choice of an appropriate instrument for stimulating R&D would depend on the particular purpose. If the purpose was to provide a general stimulus, a tax-incentive approach might be more advantageous. On the other hand, the government-spending approach would lend itself better to targeting on specific kinds of projects. 23/ Tax measures can be targeted to

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22/ The President's Message on Industrial Innovation of October 31, 1979, contained proposals in nine areas: enhancing the transfer of technical information, increasing technical information, improving the patent system, clarifying antitrust policy, fostering the development of smaller innovative firms, improving federal procurement, improving the regulatory system, facilitating labor/management adjustment to innovation, and maintaining a supportive attitude toward innovations.

23/ One reason that a tax approach tends to be easier to administer than a grant or contract approach is that the tax approach establishes a broad category of eligibility. If a grant program involved an entitlement, however, it might be about as easy to administer as a tax incentive with similar eligibility criteria. Both would tend to have similar "budget costs."

some extent, but they may serve better to provide a general stimulus.

Government regulations--including antitrust policy--may in certain cases bear heavily on the amount and effectiveness of private-sector R&D. In the drug industry, for example, the increased testing required in developing a new product might justify extending the period of protection under patent laws beyond the current 17 years. Uncertainty as to future changes in government regulations may itself be a drag on R&D, and reducing this uncertainty might help to stimulate some kinds of R&D.

Policies to Stimulate Diffusion of New Technologies

Investment. A basic approach to stimulating the diffusion of technology would be to increase the rate of business investment in plant and equipment. New technologies tend to be "embodied" in new capital. Measures to stimulate business investment are discussed in Chapter III.

Information. The flow of information also plays an important role in the diffusion process. In the postwar period, several countries--Japan and Germany in particular--have been very skillful in copying and adapting new U.S. technology. More recently, some countries have caught up and moved ahead of the United States in certain kinds of technology. This country might now benefit from an increased attention to technologies developed in other countries.

Patent Rights. A more specific approach would be to liberalize patenting rights for new technologies developed under government contracts. Currently, these generally belong to the government, and there is not much incentive for contracting firms to develop the resulting new technologies. One proposal would allow small businesses and universities substantial patent rights on projects developed under government contracts. 24/

24/ S. 414, the University and Small Business Patent Procedures Act.

Policies to Stimulate Small, High-Technology Businesses

Small business firms may suffer more than larger firms from the negative effects of government regulation. Similarly, the depressed state of capital markets during much of the 1970s could be expected to have a more pronounced effect on small and new firms than on large, established firms.

A number of proposals have been made to encourage small, high-technology businesses. 25/ One proposal would be to extend the period over which losses can be carried in determining income tax liability from five years under current law to a longer period such as ten years. This would particularly benefit small innovative businesses if they incurred heavy and prolonged expenses in developing new or improved products.

Small, high-technology businesses have particular difficulty in obtaining access to capital markets and in coping with government regulations. Many of the other proposals for stimulating small business relate to these problems. One approach would give further tax incentives to investors in small, high-technology enterprises. 26/ For example, the capital gains tax might be differentially lowered on this kind of investment. A related proposal would permit investors to roll over funds without capital gains tax if the proceeds were reinvested in the same type of investment. Another would give a tax credit to persons investing in small, high-technology businesses. Still another proposal would raise the limit on the size of net capital losses that can be deducted in any one year from ordinary income (currently $3,000). Economists do not know much about the quantitative effects of such tax measures on small, technology-based firms or on innovation.

25/ See SBA Advisory Task Force, Small Business and Innovation, Report to the Office of the Chief Counsel for Advocacy, U.S. Small Business Administration (May 1979).

26/ Currently, some provisions of the tax code provide special incentives for investors in small businesses. These include lower corporate income tax rates in the first $100,000 of income and special tax treatment of venture capital companies, Subchapter S corporations, and loss on small business capital stock. See Collins, "Sorting Out the Economic Arguments Underlying Proposed Tax Incentives to Encourage Innovation."

One drawback is that they would create new tax shelters and thereby reduce the horizontal equity of the tax system.

It has been suggested that federal financial regulations are a major impediment to small businesses in gaining access to capital markets. Under Regulation A of the Securities and Exchange Commission, new issues of stock involving less than $1.5 million can avoid full SEC requirements for information. Some have proposed that the limit should be raised. A cost of doing so would be the reduction in information available to prospective investors. 27/

Easier credit terms might offer another way of increasing access to financing for small, high-technology firms. For example, the Small Business Administration (SBA) could be encouraged to make loans to this kind of venture. At present, only a small number of SBA loans are of this kind. 28/ Many such ventures are too speculative to meet current SBA guidelines. Alternatively, another financial institution could be established to encourage lending to this segment of small business.

Government purchasing could also place more emphasis on small business. Currently, small business firms obtain a relatively small share of government contracts and of government R&D, despite official policies intended to increase it. One option would be to require agencies to allocate specific percentages of their contracts to small businesses. 29/ But this approach could result in less efficient purchasing.

27/ SEC Rules 144 and 146, which govern "private" or "non-public" offerings of securities are also relevant. For an explanation of Rules 144 and 146 and Regulation A and a discussion of their economic impact, see James R. Barth and Joseph J. Cordes, Evaluating the Impact of Securities Regulation on Venture Capital Markets, U.S. Department of Commerce, National Bureau of Standards, Monograph 166 (June 1980).

28/ The Small Business Investment Act, as amended, authorizes the SBA to purchase or to guarantee debt issued by small business investment companies. The program level is estimated at roughly $200 million for fiscal year 1981.

29/ See S. 2749, the Small Business Innovation Act of 1980.

CONCLUSIONS

Policies to reverse the slowdown in innovation that seems to have occurred during the 1970s might employ a variety of instruments: tax, budgetary, regulatory, and patent measures. Policies should aim at the diffusion as well as the development of new technologies, because a new discovery does not help productivity unless it is commercially implemented. Different tools may be needed for different objectives. Tax incentives might be considered as a general measure to stimulate R&D, but a more direct government involvement might be needed to stimulate R&D in some situations--for example, in industries made up of small producers. Basic research may require special public support because its potential benefits frequently cannot be adequately captured by those undertaking the research. There is generally a lack of information about the likely quantitative effects of various proposals for stimulating innovation.

CHAPTER VI. GOVERNMENT REGULATION AND PRODUCTIVITY

Government regulation of the economy has become an important influence on productivity growth. During the last 15 years, the scope of regulation has grown to include protection of the environment, occupational health and safety standards, product safety, equal employment opportunity, pension standards, and energy, to mention only some of the most important areas. This chapter discusses the ways in which government regulations affect productivity growth, and some approaches to regulation that might lessen its impact.

The implications are complex. Some kinds of regulation are clearly desirable and produce benefits to society. These benefits are not measured in statistics of productivity, although the hours of labor used in producing them are, and consequently they have a negative effect on indexes of output per hour worked.

Some forms of government regulation also tend to retard innovation and investment, which are essential to the growth of productivity. The current reliance on "command and control" regulation is costly in its effects on productivity growth. Proposals for improving the regulatory process include the use of incentives that would enlist market forces in the attainment of public objectives--for example, an effluent tax on activities polluting the environment.

IMPACT OF GOVERNMENT REGULATIONS ON PRODUCTIVITY GROWTH

Two kinds of government regulations are particularly important from the standpoint of productivity: economic regulations and social regulations. Economic regulations are those applied to certain industries in which monopoly elements are judged to be prominent, such as utilities and railroads. This type of regulation--covering matters such as price-setting and entry into an industry--has been in existence for quite a long time, in most cases decades. More recently, regulations have been used increasingly to meet social objectives.

TABLE 29. GOVERNMENT SOCIAL REGULATION--A PARTIAL LIST OF MAJOR LEGISLATION

Category/Legislation	Date
Protection of Environment	
Air Quality Act	1967
Clean Air Amendments	1970
Clean Air Act Amendments	1977
Water Quality Act	1965
Water Pollution Control Act Amendments	1972
Clean Water Act	1977
Safe Drinking Water Act	1974
Motor Vehicle Air Pollution Control Act	1965
National Environmental Policy Act (NEPA)	1970
Endangered Species Act	1973
Federal Environmental Pesticide Control Act	1972
Toxic Substance Control Act	1976
Resource Conservation and Recovery Act	1976
Surface Mining Control and Reclamation Act	1977
Noise Control Act	1972
Quiet Communities Act	1978
Occupational Health and Safety	
Occupational Safety and Health Act	1970
Federal Metal and Nonmetal Mine Safety Act	1966
Federal Coal Mine Health and Safety Act	1969
Mine Safety and Health Act	1977

(Continued)

Growth of Social Regulations

The growth in social regulation of the private economy bears heavily on productivity. Some of the most important pieces of federal legislation in the area of social regulation are listed in Table 29.

An important feature of these major pieces of federal legislation is that they involve a high degree of centralization in

TABLE 29. (Continued)

Category/Legislation	Date
Consumer Protection	
Consumer Product Safety Act	1972
Food, Drug and Cosmetic Act	1938
Food, Drug and Cosmetic Act Amendments	1962
Civil Rights and Equal Pay	
The Civil Rights Act (Title VII deals with equal employment opportunity and became effective on July 2, 1965)	1964
Equal Pay Law (Equal pay for women)	1963
Age Discrimination in Employment Act	1967
Fair Housing Act, Title 8	1968
Equal Credit Opportunity Act	1974
Financial Protection	
Employment Retirement Income Security Act (ERISA)	1974
Consumer Credit Protection Act	1972
Home Mortgage Disclosure Act	1975

administration and concern with detail. For example, as a result of the 1970 Clean Air Amendments, the Environmental Protection Agency (EPA) established permissible standards for certain kinds of air pollutants. In addition, the Federal Water Pollution Control Act of 1972 required EPA to develop specific water quality standards for each type of industrial process and to issue permits for every industrial source. By 1977, the effluent limits were to be consistent with the "best practicable control technology currently available," and by 1983, with the "best available technology

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economically available." Among other factors, EPA was to consider economic feasibility in setting effluent standards. (The Clean Water Act of 1977 introduced some modifications--particularly, some of the compliance deadlines were postponed--but the basic approach remained unchanged.)

Implications for Productivity

Both the economic regulations and the more recent social regulations tend to retard productivity growth in the private sector, but the latter have probably had a much stronger impact since the mid-1960s. Most of the economic regulations, such as those for railroads, have been in effect for many years. The social regulations may also impose more severe costs on the economy than the older, industry-related regulations. For one thing, the new kind have broad objectives that cut across industry boundaries. They also tend to be focused on a single goal, such as raising environmental standards or improving occupational safety and health. As a result, the administering agency may have difficulty in taking a balanced view of the industry, including broader economic considerations. By contrast, the "older" form of regulation was likely to have an industry orientation, requiring the regulating agency to consider the welfare of the particular industry. 1/

Government regulations have two kinds of costs that relate to productivity growth. One is the cost of the resources used in implementing the government regulation. Resources devoted to meeting government regulations are not available for producing ordinary goods and services.

Another kind of cost involved in government regulation is that it may slow innovation and diminish business incentive to invest in new projects. Some analysts believe that such dynamic costs are substantial, including longer delays and additional uncertainty. For example, current regulatory procedures that impose more stringent requirements on new, as compared with existing, facilities create incentives to delay new investment and new innovations. The drug industry has argued that regulations have

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1/ See, for example, Murray T. Weidenbaum, The Costs of Government Regulation of Business, Subcommittee on Economic Growth of the Joint Economic Committee, 95:2 (1978).

become so strict that the introduction of new products takes much longer and costs much more than formerly. Finally, government regulations may divert managerial attention from activities that contribute to productivity improvement. 2/

All of the costs, but only a part of the benefits, of government regulation get reflected in the conventional measure of labor productivity. 3/ The Commerce Department estimates that the private business cost of implementing the pollution abatement regulations was approximately $22 billion in 1977. Spending for pollution abatement capital accounted for roughly 5 percent of total capital outlays in 1977, but the percentage varied considerably in different industries and sectors of the economy (see Table 30). Growth in the capital stock is notably reduced by adjusting for pollution abatement, particularly in manufacturing (see Table 31).

The increase in government regulation is believed to present a special burden for small businesses, and this could adversely affect innovation. 4/ Compliance with regulations may require quite specialized and highly skilled manpower. Small firms also may lack the financial resources needed to comply with regulations and, in some cases, this may prevent new firms from entering an industry.

2/ For discussion of the impact of regulation on innovation, see George C. Eads, "Regulation and Technological Change: Some Largely Unexplored Influences," American Economic Review, Papers and Proceedings (May 1980), pp. 50-54; Henry G. Grabowski and John M. Vernon, The Impact of Regulation on Industrial Innovation (National Academy of Science, 1979); and U.S. Department of Commerce, Advisory Committee on Industrial Innovation: Final Report (September 1979), pp. 37-114.

3/ To the extent that the regulation results in an "improved product" purchased by consumers it also gets reflected as an increase in output, but the increased costs of business in cutting down on pollution associated with production do not get reflected at all in output measures.

4/ The role of small business in innovation, and policies to stimulate this source of innovation, are discussed in Chapter V of this report.

TABLE 30. EXPENDITURES FOR POLLUTION ABATEMENT CAPITAL BY INDUSTRY, 1977 (In percent of total capital outlays)

Industry	1977
All Industries	5.1
Manufacturing	7.0
Durable goods	5.9
Primary metals	15.7
Electrical machinery	3.4
Machinery, except electrical	1.8
Transportation equipment	3.1
Stone, clay, and glass	7.3
Other durables	3.6
Nondurable goods	8.0
Food, including beverage	4.2
Textiles	3.8
Paper	13.8
Chemicals	10.2
Petroleum	8.2
Rubber	3.3
Other nondurables	1.2
Nonmanufacturing	3.5
Mining	2.2
Railroad	1.0
Air transportation	0.8
Other transportation	1.0
Public utilities	8.8
Communication, commercial, and other a/	0.5

SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis, as presented in Economic Report of the President 1979, p. 127.

a/ "Other" consists of trade, service, construction, finance, and insurance.

TABLE 31. RATES OF GROWTH OF THE CAPITAL STOCK, INCLUDING AND EXCLUDING POLLUTION ABATEMENT CAPITAL, BY SECTOR, SELECTED PERIODS, 1948-1978 (Annual averages, in percent)

	1948-1965		1965-1973		1973-1978	
Sector	Total	Excluding pollution abatement capital	Total	Excluding pollution abatement capital	Total	Excluding pollution abatement capital
Private Business	3.14	3.11	4.48	4.37	2.31	2.05
Private Nonfarm Business	3.24	3.21	4.59	4.47	2.37	2.09
Manufacturing	2.93	2.86	3.93	3.64	2.16	1.47

SOURCE: J.R. Norsworthy and others, "The Slowdown in Productivity Growth: Analysis of Some Contributing Factors," Brookings Papers on Economic Activity (1979:2), p. 405.

Some partial estimates of the impact of government regulation on productivity growth are available. According to one study, two of the major kinds of government regulation--pollution abatement and occupational health and safety--reduced productivity growth by 0.24 percentage points a year from 1973 to 1976. 5/ Another

5/ Edward F. Denison, Accounting for Slower Economic Growth (Brookings Institution, 1979), p. 114; for a more detailed analysis, see Edward F. Denison, "Effects of Selected Changes in the Institutional and Human Environment upon Ouput per Unit of Input," Survey of Current Business (January 1978), pp. 21-44.

study surveyed available estimates, including the foregoing one, and concluded that environmental regulations had accounted for 5 to 15 percent of the slowdown in productivity since the mid-1960s. 6/

Such estimates tend to be limited to the static impact of government regulation and do not include all of the dynamic aspects discussed above. Moreover, the available estimates deal with only certain kinds of regulations, not including the most recent developments. Hence, they probably understate the full impact of the increased scope and extent of government regulations.

Will the impact of government regulations on productivity decrease in the future? Some analysts believe that most of the impact has already been felt. According to this view, increasing the safety standards in the mining industry, for example, can be expected to produce a "once-over" decline in the level of productivity. This should have only a temporary impact on productivity growth unless the standards are continually raised. Similarly, it is argued that once the capital stock has been replaced or retrofitted to reduce pollution, the effects on productivity should diminish. In the aggregate, however, it is not at all clear whether the impact of regulation on productivity growth will become less or greater. For one thing, policymakers have continued to tighten regulations and broaden them to include new areas such as controlling toxic wastes. For another, as mentioned earlier, the standards being applied to new facilities tend to be more stringent than those for existing facilities; thus, it could take years to adjust the capital stock fully to the more stringent standards. Finally, the dynamic impact of regulation--the retardation of investment and innovation--would tend to lower the rate of productivity growth indefinitely. This effect could even intensify over time rather than diminish.

6/ Gregory Christiansen, Frank Gollop, and Robert Haveman, Environmental and Health/Safety Regulations, Productivity Growth, and Economic Performance: An Assessment, Joint Economic Committee, 96:2 (1980), p. 71.

POLICY OPTIONS

The Current Approach: Command and Control

The current approach to government regulation of the private economy relies on what might be called "command and control" techniques. Authority is vested in a centralized agency, which establishes many detailed rules to carry out its mandate. The authorizing legislation generally focuses on one objective, without giving explicit recognition to possible consequences in other areas--such as the market costs of achieving nonmarket objectives.

One cost of the command and control approach is slower productivity growth. In requiring that certain engineering standards or particular technologies be used, it prevents businesses from choosing less costly alternatives. 7/ Moreover, with the regulatory approach there is no incentive to do more than just meet the standard. Another criticism is that current procedures do not give firms an incentive to find new ways of reducing pollution or industrial accidents and in some cases actually discourage such innovations. 8/

Alternative Approaches

Most of the ideas for reducing the negative effects of government regulation on productivity focus either on regulating less or

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7/ An example is the regulation of sulfur dioxide (SO_2) emitted from electric generating plants. Current regulations require that a new plant must install expensive "scrubbers" to reduce the emission of SO_2, since that is the "best available" technology as required by law. But some grades of coal give off less SO_2 than others, and the use of some types of coal could enable the utilities to meet the standard more cheaply. See the discussions in Charles L. Schultze, The Public Use of Private Interest (Brookings Institution, 1977), pp. 46-64; and Advisory Committee on Industrial Innovation, pp. 96-7.

8/ For instance, by calling for "best available technology" current legislation discourages firms from developing better technology because they would then have to meet more stringent standards. See Schultze, The Public Use of Private Interest, p. 53.

on improving the regulatory process. Proposals for improving the process include:

- o Adopting flexible, market-type incentives such as an effluent tax on pollution as a partial substitute for detailed regulations;
- o Applying management tools to government regulation, such as benefit-cost analysis, cost-effectiveness analysis, or a "regulatory budget";
- o Reforming administration so as to reduce duplication and improve the monitoring of regulations;
- o Modifying regulatory legislation to recognize tradeoffs between market and nonmarket objectives.

Market Incentives. Economists have written extensively about the advantages of relying on market incentives to control "externalities" such as pollution. In brief, this approach would increase the cost of producing pollution-intensive goods relative to the costs of producing other goods and services; and it would give businesses a financial incentive to find ways to remove pollution. It would involve such techniques as taxing firms according to the degree of their pollution, or permitting firms to buy and sell limited rights to pollute. 9/

There are, however, some practical difficulties in relying on market incentives to control the unwanted side effects of production. One is that the information requirements may be quite extensive: For example, to tax pollution it would be necessary to measure it by source and to monitor the amount of it by source.

9/ For a discussion of the advantages and disadvantages of alternative approaches to the control of pollution, see, for example, W.J. Baumol and W.E. Oates, Economics, Environmental Policy and the Quality of Life (Prentice-Hall, 1979), chap. 16; and Allen V. Kneese and Charles L. Schultze, Pollution, Prices and Public Policy (Brookings Institution, 1975). The Environmental Protection Agency has been experimenting with market-type incentives. For a discussion, see Environmental Quality, Tenth Annual Report of the Council on Environmental Quality (1979), chap. 12.

This would become less practical where there are many sources of pollution.

A second criticism is that it might be difficult to know how high to set the tax in order to achieve environmental objectives. If it were too high, it might drive away too much industry; if it were too low, it might not be effective. (To meet the latter objection, some have advocated the use of marketable permits that would limit total emissions.)

Third, the tax approach could add to the uncertainty faced by businesses, since they might not know the level of the tax in the future.

Fourth, some critics believe that taxing pollution would do little to discourage it, and might even appear to condone it. Some firms might just "pay the tax" and go on polluting as before.

Management Tools. This approach includes a range of proposals such as the "regulatory budget," cost-effectiveness analysis, and benefit-cost analysis. A regulatory budget would include estimates of the private costs of compliance as well as the federal budget costs of administration. It would set limits to the growth in the estimated cost of federal government regulation. Proponents of the regulatory budget also believe that it would force policymakers to weigh alternative regulatory objectives--in short, to apply budgeting techniques and budget discipline to regulations.

A criticism of the regulatory budget is that policymakers might find it inherently difficult or infeasible to measure the private-sector costs of regulation. For one thing, firms would have an incentive to exaggerate the costs, and there might be no good way of checking accuracy. 10/

Cost-effectiveness analysis involves estimating the costs of alternative ways of reaching the same goal and choosing the least costly approach. The principles of a cost-effectiveness approach to regulation are perhaps best illustrated by an example from the

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10/ For discussions of the regulatory budget, see U.S. Department of Commerce, Regulatory Reform Seminar: Proceedings and Background Papers (1978); and John H. Young, "Mechanisms for Linking Regulatory and Economic Policy" (Office of Technology Assessment 1980; processed).

area of occupational health and safety. OSHA (the Labor Department agency responsible for administering the Occupational Safety and Health Act of 1970) proposed specific engineering standards for meeting noise standards. According to one study, the same goal might have been achieved at much less cost if OSHA had permitted personal protective devices (such as ear plugs) instead of requiring engineering standards. Moreover, cost-effectiveness might have been greater if different noise standards had been applied to different industries, because the cost of reducing noise levels varies greatly among industries. 11/

Benefit-cost analysis, applied to government regulation, weighs the present (discounted) value of the estimated economic benefits and costs of a regulation. If the benefit-cost ratio for a particular regulation is less than one, the economic benefits alone do not justify its costs (although there may be other, non-economic justifications). One criticism of benefit-cost analysis is that some of the benefits, such as health or saving lives, cannot or should not be costed out in this way.

Administrative Reform. Currently, no government agency coordinates the manifold activities of different regulatory agencies. Some people believe that a mechanism is needed for considering the combined impact of numerous regulations of different agencies on a particular industry. 12/ The Carter Administration took several steps to monitor the regulatory process and to reduce the burden of government regulations on the private sector. These include Executive Order No. 1274 to reduce paperwork and the establishment of a Regulatory Analysis Review Group (RARG), chaired by the Council of Economic Advisers. 13/

11/ John F. Morrall III, "Exposure to Occupational Noise," in James C. Miller III and Bruce Yandle, eds., Benefit-Cost Analyses of Social Regulation (American Enterprise Institute, 1979), pp. 33-58.

12/ This could involve an "industrial policy" approach to regulation and other aspects of government influence on private industry. The industrial-policy approach is discussed in Chapter VIII of this report.

13/ For a discussion of the effectiveness of RARG, see Christopher C. DeMuth, "Constraining Regulatory Costs," Parts I and II, Regulation (January-February and March-April 1980).

An attempt to introduce more flexibility into the regulatory process is EPA's use of the "bubble concept." Under this policy, a firm is allowed to balance an increase in pollution from one source against a decline from another source within the same plant. This approach, however, may have heavier information requirements than the more detailed approach. 14/

Modifying Legislation. To alter the current procedures of regulation substantially would require modifying the underlying legislation. This might include a more explicit recognition of important economic tradeoffs. Such tradeoffs between market and nonmarket objectives are already being made implicitly by regulatory agencies. An explicit recognition of the need for them in the underlying legislation might lead to regulatory decisions more in accord with the intentions of the Congress.

14/ For a discussion of the "bubble concept," see Environmental Quality, pp. 678-79.

CHAPTER VII. ENERGY AND PRODUCTIVITY GROWTH

The availability and price of energy are other important factors affecting productivity growth. The dramatic increases in energy prices during the 1970s played a significant role in the productivity slowdown, although their exact or quantitative importance is hotly disputed by economists. The implications for policy are not clear. No policy can fundamentally change the likelihood of long-run increases in the real cost of energy. The relationships among energy, the environment, and productivity involve difficult tradeoffs. Policies that reduce the use of energy are likely to have negative effects on productivity, while policies that increase the supply of energy may be destructive of the environment. Other policies might be considered as well: a clearly delineated energy policy to hold uncertainty to a minimum, and effective stabilization policies to offset the depressing effect of energy price shocks.

THE IMPACT OF HIGHER ENERGY COSTS ON LABOR PRODUCTIVITY

Throughout much of the post-World War II period, the price of energy relative to other goods in the U.S. economy was stable or slightly falling; this contributed to the rapid growth of productivity. But the era of cheap energy came to a sudden end in the early 1970s. After declining an average of 1.4 percent a year from 1960 to 1970, the relative price of energy increased approximately 9 percent annually during the 1970s (see Table 32). Of course, the price of imported crude oil rose much more rapidly than energy prices in general. In addition, the U.S. economy was now dependent on unstable sources of foreign oil.

An increase in the cost of energy adversely affects labor productivity through several channels:

- Depresses the demand for goods and services generally;
- Causes businesses to substitute labor for more expensive energy;

TABLE 32. ENERGY TRENDS IN THE UNITED STATES, 1960 TO 1970 AND 1970 TO 1979 (Percent change per year)

	1960-1970	1970-1979
Relative Price of Energy a/	-1.4	8.9
Relative Price of Imported Crude Oil b/	-2.3	16.8
Oil Consumption	4.0	2.5
Oil Imports	6.5	9.3
Cost of Oil Imports	6.6	37.5

SOURCES: U.S. Department of Labor, Bureau of Labor Statistics; U.S. Department of Energy, Energy Information Administration; U.S. Department of Commerce, Bureau of Economic Analysis; Data Resources, Incorporated; Central Intelligence Agency, National Foreign Assessment Center.

a/ Producers Price Index for fuels and related products and power, deflated by the implicit price deflator for domestic business output.

b/ Price of imported oil, deflated by the implicit price deflator for business output.

- Shifts the pattern of demands toward services, which have more limited potential for productivity growth, and away from goods, transportation, and power generation;
- Outmodes part of the capital stock because it is not energy efficient;
- Adds to uncertainty about future economic conditions;
- Produces chronic inflationary pressures that call for restrictive monetary and fiscal policies;

- Reduces growth in real incomes, stimulating labor force growth; and

- Shifts the focus of investment and innovation toward energy efficiency rather than labor efficiency. 1/

Much of the impact on the productivity growth rate is believed to be temporary, associated with the structural changes in the economy brought about by higher energy costs, and productivity growth can be expected to recover partially after these adjustments are completed. But some of the effects on productivity may be gradual and require an extended period to work themselves out. The obsolescence of capital due to higher energy prices, and the channeling of relatively more investment and innovation into achieving energy efficiency rather than labor efficiency, might have such longer-run effects. These adjustments are necessary because of changes in the relative prices of labor, capital, and energy.

Analysts agree that an increase in energy prices tends to retard labor productivity growth, but they disagree as to the size of the effect or the precise channels of causation. At one end of the spectrum, some analysts believe that the increase in energy prices may have reduced productivity growth as little as 0.1 or 0.2 percentage point between 1972 and 1976. 2/ At the other end, some believe that it accounted for at least 0.7 percentage point of the

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1/ For a more detailed discussion of the relationship between energy costs and productivity, see J.M. Griffin and P.R. Gregory, "An Intercountry Translog Model of Energy Substitution Responses," American Economic Review, vol. 66 (December 1976), pp. 845-57; and Edward A. Hudson and Dale W. Jorgenson, "Energy Prices and the U.S. Economy, 1972-1976," DRI Review (September 1978), pp. 1.24-1.37.

2/ See, for example, George Perry, "Potential Output: Recent Issues and Present Trends," in Center for the Study of American Business, U.S. Productive Capacity: Estimating the Utilization Gap, Working Paper 23 (1977), pp. 6-13; and Edward F. Denison, Accounting for Slower Economic Growth (Brookings Institution, 1979), p. 142.

slowdown in productivity growth. 3/ The larger estimates tend to include both direct and indirect effects such as the depressing effect on aggregate demand and investment, and the shift in the composition of demand toward services.

Circumstantial evidence suggests that higher energy prices may have played quite an important role in the productivity slowdown during the 1970s. Productivity growth slowed substantially in practically every industrialized country after 1973 (see Table 33). This suggests that if energy was not a direct cause of the slowdown, it may have contributed to a set of conditions that, taken together, had a severe impact on productivity.

TABLE 33. ANNUAL GROWTH IN GROSS DOMESTIC PRODUCT PER EMPLOYED WORKER IN LEADING INDUSTRIAL COUNTRIES, 1965-1979 (Percent change per year)

Country	1965-1973	1973-1979 a/
United States	1.6	0.3
Belgium	4.3	2.7
Canada	2.4	0.4
France	4.5	2.9
Germany	4.3	3.1
Italy	5.8	1.7
Japan	9.1	3.4
Netherlands	4.6	2.6
United Kingdom	3.4	1.1

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, unpublished data.

a/ 1979 data are preliminary.

3/ See, for example, Hudson and Jorgenson, "Energy Prices and the U.S. Economy, 1972-1976;" and John A. Tatom, "The Productivity Problem," Federal Reserve Bank of St. Louis Review, vol. 61, no. 9 (September 1979), pp. 3-16.

Some have suggested that, if higher energy prices were the major factor responsible for slower productivity growth, the slowdown in the United States would have been less than in most other industrial countries that import a larger share of their energy. But this overlooks two facts: First, energy consumption per unit of gross domestic product is higher in the United States than in most other countries (see Table 34). Second, most industrialized countries other than the United States and Canada had already adjusted their economies to a regime of expensive energy--through such means as high excise taxes on gasoline. The United States, on the other hand, had maintained a policy of cheap energy in the post-World War II period. For those reasons, the adjustments to higher energy prices may have been even more severe in the United States than in other countries. 4/

ENERGY POLICIES AND PRODUCTIVITY GROWTH

Government policies cannot fundamentally change the likelihood of long-run increases in the real cost of energy, and these rising costs can be expected to slow down future productivity growth. Policymakers will be faced with some very difficult and uncertain choices: between conserving energy at the expense of higher productivity, or increasing the supply of energy at some cost to the environment.

Tradeoffs Between Energy Use and Other Objectives

Policies to conserve energy may be directed at two main classes of energy users: consumers and businesses. In general, policies that reduce the use of energy by businesses tend to retard productivity growth. Policies that reduce energy used by consumers

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4/ The impact of higher energy prices on per capita real income in a country would, however, be importantly affected by the share of energy that was domestically produced. Moreover, some argue that the adverse impact on living standards might be greater in a country that already had high energy prices because "all the easy adjustments had been made."

TABLE 34. COMPARISON OF ENERGY USED PER UNIT OF GROSS DOMESTIC PRODUCT IN LEADING INDUSTRIAL COUNTRIES, 1972

Country	Index (U.S. = 100)
United States	100
Canada	120
France	54
Germany	70
Italy	62
Japan	57
Netherlands	86
Sweden	72
United Kingdom	76

SOURCE: Sam H. Schurr and others, Energy in America's Future: The Choices Before Us (Johns Hopkins University Press, 1979), p. 102.

do not have such a direct, adverse effect on productivity. 5/ If energy conservation policies were applied to both businesses and consumers, they would tend to lower labor productivity. But they might in the long run increase real income in the United States. The reason for this seeming paradox is that the United States buys so much oil on world markets that a reduction in its oil purchases might have a substantial effect in lowering the world price of oil. Also, by purchasing less oil, the exchange value of the

5/ There may, of course, be indirect or transitional effects. A higher gasoline tax, for example, would tend to reduce the demand for automobiles, which are produced by a high-productivity industry.

dollar might increase, thus improving the terms of international trade. 6/

Policies designed to increase the production of energy tend to conflict at many points with goals of maintaining or improving the environment. Notable examples are the expanded use of atomic energy and coal as alternatives to petroleum. 7/ The United States has an abundant supply of coal, but burning coal releases more sulfur dioxide, a pollutant, into the air. Similarly, nuclear energy could be rapidly expanded, but the accident at Three Mile Island has forcefully raised questions in the public mind as to the safety of nuclear power plants. Moreover, government regulations in some situations add to construction costs or prevent utilities from choosing the most economical fuel (see Chapter VI).

Reducing Uncertainty About Energy Policies

Some believe that uncertainty over the future course of energy policy served to retard investment and innovation during much of the 1970s. Before deciding what kind of plant to build and where to build it, a firm frequently needs to estimate the future energy situation and, therefore, future energy policies. For example, price controls on oil may have reduced the near-term uncertainty about the energy situation, but added to uncertainty about the more distant future.

6/ See William D. Nordhaus, "Policy Responses to the Productivity Slowdown," in The Decline in Productivity Growth, Conference Series No. 22 (Federal Reserve Bank of Boston, June 1980), pp. 166-69.

7/ For recent discussions of alternative energy policies see, for example, Energy: The Next Twenty Years (Ballinger, 1979); Sam H. Schurr and others, Energy in America's Future: The Choices Before Us (Johns Hopkins University Press, 1979); Robert Stobaugh and Daniel Yergin, eds., Energy Future (Random House, 1979); and Nuclear Power Issues and Choices, Report of the Nuclear Energy Policy Study Group sponsored by the Ford Foundation (Ballinger, 1977).

Effective Stabilization Policies

A stable economy encourages productivity growth. Rapid escalations in energy prices, such as those occurring in 1973-1974 and 1979, tend to cause recessions. They also cause worldwide imbalances that can impair the flow of international trade.

An effective stabilization policy is difficult to define in a broad context, but the implications for productivity are clear. A recession or severe economic slack tends to slow productivity growth through numerous channels. On the other hand, if an initial inflationary shock is permitted full play, it may lead to even higher rates of inflation, and inflation itself tends to undermine some of the sources of productivity growth, especially in conjunction with the federal income tax system. 8/

8/ The effects of energy-related price shocks on the U.S. economy and the world economy have been discussed in several reports by the Congressional Budget Office. See, for example, Recovery: How Fast and How Far? (1975), chap. V; President Carter's Energy Proposals: A Perspective (1977), chap. IX; and The World Oil Market in the 1980s: Implications for the United States (1980), chap. VI.

CHAPTER VIII. INDUSTRIAL POLICIES TO INCREASE PRODUCTIVITY

The search for ways to stimulate productivity growth in the United States has fostered a growing interest in an "industrial policy" approach. Although a precise and agreed-upon definition of this term has not emerged, it frequently is used to mean measures that would spur the movement of resources into industries where productivity is high, as well as measures designed to improve the international competitiveness of specific industries. Industrial policies thus differ from policies that attempt to raise productivity throughout the economy by increasing the quantity and quality of productive resources.

Industrial policies have been employed in other countries such as Japan, France, West Germany, and the United Kingdom. In the United States, decisions regarding the allocation of resources among industries have traditionally been left to private enterprise, and a plan for restructuring industry would represent a major change in approach.

This chapter examines the differences in productivity among U.S. industries. It also contains a brief survey of experience with industrial policies in other countries, and a discussion of some issues related to the selection of an industrial policy strategy.

PRODUCTIVITY AND EMPLOYMENT IN DIFFERENT INDUSTRIES

Industries vary considerably in levels of productivity and rates of productivity growth. Movements of labor among industries can affect the growth of aggregate productivity because of these differences. When labor moves from low-productivity to high-productivity industries, aggregate productivity rises, even if everything else remains the same. On the other hand, when employment shifts from slow-productivity-growth to fast-productivity-growth industries, aggregate productivity can fall if the level of productivity is below average in the fast-productivity-growth industries. It is important, therefore, to distinguish between productivity level and productivity growth. Industries characterized by high rates of productivity growth are not necessarily those with above-average levels of productivity.

Interindustry Differences in the Growth of Productivity

Aggregate productivity growth in the private business sector (excluding government enterprises) declined from an average 3.3 percent in the 1949-1965 period to 1.2 percent in the 1974-1978 period (see Table 35). Productivity growth slowed in all major industries except communications. The slowdown was especially pronounced in mining, construction, utilities, and wholesale trade. During the 1974-1978 period, mining, construction, and wholesale trade experienced negative average rates of productivity growth.

A number of special factors have been cited as partial explanations for the recent productivity slowdown in various industries. 1/ In agriculture, the decline may largely reflect the impact of the corn blight and the removal of acreage controls. Higher energy costs and oil and gas shortages undoubtedly are responsible for some of the slowdown in mining, transportation, and utilities. Various health, safety, and environmental regulations also are thought to have reduced productivity growth in mining and utilities.

In construction, however, there is no discernible cause for most of the productivity decline. 2/ Nor is there any apparent reason why productivity in wholesale trade has fallen. In the case

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1/ Reasons for slower productivity growth in particular industries are discussed by Lester C. Thurow, "The U.S. Productivity Problem," The DRI U.S. Review (August 1979), Section 1, pp. 14-19; J.R. Norsworthy, Michael J. Harper, and Kent Kunze, "The Slowdown in Productivity Growth: An Analysis of Some Contributing Factors," in Brookings Papers on Economic Activity (1979:2), pp. 387-421; Council on Wage and Price Stability, Productivity: A Report Submitted to the Congress (July 23, 1979); and H. Kemble Stokes, Jr., An Examination of the Productivity Decline in the Construction Industry, U.S. Department of Commerce (March 1979).

2/ Estimates of productivity in construction are relatively unreliable because, to a significant extent, output is measured as the deflated costs of labor and material inputs. The use of labor inputs to measure output in services and in finance, insurance, and real estate also results in questionable estimates of productivity in these sectors.

TABLE 35. RATES OF PRODUCTIVITY GROWTH AND STANDARDIZED LEVELS OF VALUE ADDED PER WORKER HOUR, BY INDUSTRIAL SECTOR

Industrial Sector	Average of Annual Productivity Growth Rates (percent)			Standardized Value Added Per Worker Hour a/ (average = 1.00)		
	1949-1965	1966-1973	1974-1978	1948-1965	1966-1973	1974-1978
Agriculture, Forestry, and Fisheries	5.0	3.7	2.1	0.46	0.58	0.60
Mining	4.3	1.9	-4.8	1.78	1.98	1.51
Construction	3.4	-2.1	-1.0	1.16	0.99	0.77
Nondurable Goods Manufacturing	3.3	3.3	2.4	0.91	0.94	1.02
Durable Goods Manufacturing	2.8	2.2	1.2	1.06	1.02	1.03
Transportation	3.1	2.9	0.8	1.06	1.09	1.11
Communications	5.4	4.6	7.2	1.32	1.73	2.29
Electric, Gas, and Sanitary Services	6.4	3.5	0.8	2.07	2.65	2.69
Wholesale Trade	3.1	3.4	-0.5	1.25	1.30	1.24
Retail Trade	2.7	2.1	1.1	0.66	0.63	0.63
Finance, Insurance, and Real Estate	2.0	0.2	1.8	3.68	3.02	2.90
Services	1.2	1.7	0.3	0.80	0.65	0.63
Total	3.3	2.2	1.2	1.00	1.00	1.00

SOURCE: Congressional Budget Office calculations based on data from the U.S. Department of Commerce and the U.S. Department of Labor, Bureau of Labor Statistics.

a/ Standardized value added per worker hour is the level of gross product per worker hour originating in a particular industry divided by the average level for all industries. A value greater (less) than 1.00 is above (below) average.

of finance-insurance-real estate, failure to take full account of factors such as quality changes in output resulting from the technological impact of electronic data processing may explain some of the deceleration. Within the service sector, interindustry shifts appear to be responsible for a major part of measured productivity change. It is likely that the extension of retail trade store hours for the convenience of customers has reduced productivity growth in that industry.

In the case of manufacturing, the productivity slowdown between 1966-1973 and 1974-1978 is dominated by the impact of the 1974-1975 recession. In 1974, productivity declined by 5.5 percent in durable goods manufacturing and by 3.7 percent in nondurable goods manufacturing. When the 1974 productivity declines are excluded from the 1974-1978 calculations, the rate of productivity growth in manufacturing shows practically no decline relative to the 1966-1973 period.

Interindustry Differences in the Level of Productivity

For comparison with productivity growth rates, standardized levels of productivity also are presented in Table 35. Each entry is the level of productivity in an industry divided by the average level for all industries. A value greater (less) than one indicates that the level of productivity in that industry is above (below) average.

In general, industries that were below (above) average in the 1948-1965 period were also below (above) average in the 1974-1978 period. The industries with the highest productivity levels during the 1974-1978 period were finance-insurance-real estate, utilities, and communications. Except for utilities, these industries had an above-average productivity growth rate for the 1974-1978 period. The four industries with below-average productivity levels in the 1974-1978 period were agriculture, construction, retail trade, and services. Productivity growth was above average in agriculture, but below average in retail trade, construction, and services.

Although the level of productivity in manufacturing was roughly equal to the average for all industries during the 1974-1978 period, productivity varied considerably within manufacturing (see Table 36). For example, value added per hour worked was especially low in the textile, apparel, furniture, and leather industries, but high in the tobacco, petroleum and coal, and motor

TABLE 36. RATES OF PRODUCTIVITY GROWTH AND STANDARDIZED LEVELS OF VALUE ADDED PER WORKER HOUR IN MANUFACTURING INDUSTRIES

Industry	Average of Annual Productivity Growth Rates (percent)			Standardized Value Added Per Worker Hour a/ (average = 1.00)		
	1949-1965	1966-1973	1974-1978	1948-1965	1966-1973	1974-1978
Food and Kindred Products	3.0	3.1	3.8	1.00	1.03	1.09
Tobacco	3.2	4.3	5.4	3.30	3.65	4.42
Textile Mill Products	5.1	2.5	4.6	0.45	0.58	0.62
Apparel and Other Textile Products	1.9	4.4	3.0	0.55	0.51	0.58
Lumber and Wood Products	4.3	2.0	1.9	0.68	0.86	0.88
Furniture and Fixtures	2.0	1.6	1.2	0.74	0.63	0.62
Paper and Allied Products	2.6	4.9	0.5	1.03	0.98	1.04
Printing and Publishing	1.9	1.3	0.6	1.11	0.97	0.89
Chemicals and Allied Products	4.8	4.6	0.6	1.09	1.34	1.37
Petroleum and Coal Products	5.3	3.1	1.6	2.15	2.77	2.71
Rubber Products	2.6	2.5	1.0	0.97	0.94	0.91
Leather and Leather Products	1.2	1.9	2.0	0.61	0.53	0.56
Stone, Glass, and Clay Products	2.6	1.5	1.5	1.10	0.97	0.92
Primary Metals	1.7	1.1	-2.6	1.57	1.26	1.08
Fabricated Metals	2.3	1.7	0.9	1.00	0.92	0.85
Machinery, Except Electrical	1.9	2.1	0.2	1.20	1.05	0.98
Electrical Equipment and Supplies	4.7	4.2	2.1	0.74	0.94	0.99
Motor Vehicles	5.0	3.2	6.0	1.43	1.64	1.85
Transportation Equipment, Except Motor Vehicles	3.0	1.6	-2.2	1.07	1.05	0.87
Instruments and Related Products	3.4	2.5	0.4	0.96	0.99	0.94
Miscellaneous Manufacturing Industries	2.6	4.0	4.3	0.72	0.73	0.78
Total	3.0	2.6	1.7	1.00	1.00	1.00

SOURCE: Congressional Budget Office calculations based on data from the Department of Commerce and the Bureau of Labor Statistics.

a/ Standardized value added per worker hour is the level of gross product per worker hour originating in a particular industry divided by the average level for all industries. A value greater (less) than 1.00 is above (below) average.

vehicles industries. In terms of productivity growth, six manufacturing industries experienced average annual gains in excess of 3 percent, and eight industries had average productivity gains of less than 1 percent during the 1974-1978 period.

Changes in the Industrial Distribution of Hours Worked

Since 1948, the major shifts in hours worked have occurred primarily in low-productivity industries (see Table 37). The share of hours worked has decreased substantially in agriculture and risen substantially in services. Except for finance, insurance, and real estate, there has been relatively little increase in the share of hours worked in the high-productivity industries.

The proportion of hours worked in manufacturing declined from 29.0 percent in 1948-1965 to 27.0 percent in 1974-1978. Within manufacturing, the largest changes in the share of hours worked have been declines in the food, textile, apparel, lumber, leather, primary metals, and transportation equipment industries; and increases in the chemicals, rubber and plastics, fabricated metals, machinery, electrical equipment, and instruments industries (see Table 38).

The contributions to aggregate productivity growth from interindustry shifts of labor are shown in Tables 39 and 40. For the private business sector, the net effect of these shifts has been positive, but has declined over time as the positive gains from movements of labor out of agriculture as well as into finance-insurance-real estate have diminished, and as the negative impacts of a growing service sector have increased. Overall, industrial shifting of employment accounted for 0.474 percentage point of the average productivity growth realized in the 1949-1965 period, 0.301 percentage point in the 1966-1973 period, and 0.151 percentage point in the 1974-1978 period.

Within manufacturing, the shifting of labor among industries produced small net impacts on productivity growth during the 1948-1965 and 1966-1973 periods, as the positive impact of declining shares of labor in the textile, apparel, lumber, and leather industries were offset by less than average growth in hours worked in above-average productivity industries such as tobacco, petroleum and coal, and primary metals. In the 1974-1978 period, the significant positive contribution of 0.203 percentage points per year primarily reflected movement of labor out of textiles and

TABLE 37. AVERAGES OF ANNUAL RATES OF GROWTH IN HOURS WORKED AND DISTRIBUTION OF HOURS WORKED, BY INDUSTRIAL SECTOR

Industry	Average of Annual Growth Rates (percent)			Percentage Distribution		
	1949-1965	1966-1973	1974-1978	1948-1965	1966-1973	1974-1978
Agriculture, Forestry, and Fisheries	-3.8	-2.4	-0.4	12.2	6.3	5.6
Mining	-2.2	0.1	6.8	1.4	1.0	1.2
Construction	1.2	2.5	1.7	6.0	6.5	6.5
Nondurable Goods Manufacturing	0.4	0.6	-0.1	12.6	12.2	11.0
Durable Goods Manufacturing	1.6	1.4	0.7	16.4	17.4	16.0
Transportation	-1.0	0.8	0.9	5.0	4.4	4.1
Communications	1.2	3.6	1.0	1.3	1.5	1.6
Electric, Gas, and Sanitary Services	0.9	2.0	0.9	1.0	1.0	1.0
Wholesale Trade	1.5	2.4	3.1	5.3	6.0	6.7
Retail Trade	0.8	1.6	1.3	18.2	18.1	18.1
Finance, Insurance, and Real Estate	2.8	3.6	3.0	4.2	5.4	6.1
Services	2.3	2.7	3.1	16.3	20.2	22.1
Total	0.5	1.6	1.6	100.0	100.0	100.0

SOURCE: Congressional Budget Office calculations based on data from the Bureau of Labor Statistics.

TABLE 38. AVERAGE OF ANNUAL RATES OF GROWTH IN HOURS WORKED AND DISTRIBUTION OF HOURS WORKED IN MANUFACTURING INDUSTRIES

Industry	Average of Annual Growth Rates (percent)			Percentage Distribution		
	1949-1965	1966-1973	1974-1978	1948-1965	1966-1973	1974-1978
Food and Kindred Products	-0.2	-0.6	-0.3	11.0	9.2	8.8
Tobacco	-0.7	-1.4	-3.3	0.6	0.4	0.3
Textile Mill Products	-1.5	1.0	-2.7	6.4	5.3	4.8
Apparel and Other Textile Products	0.9	0.2	-0.9	6.9	6.6	6.3
Lumber and Wood Products	-1.1	1.4	-0.1	4.5	3.8	3.7
Furniture and Fixtures	1.6	2.0	0.0	2.2	2.4	2.4
Paper and Allied Products	1.8	0.9	-0.2	3.5	3.7	3.6
Printing and Publishing	1.8	1.3	1.1	5.0	5.3	5.6
Chemicals and Allied Products	2.0	1.4	1.9	4.6	5.1	5.4
Petroleum and Coal Products	-1.1	0.4	3.0	1.3	0.9	1.0
Rubber Products	3.2	4.4	1.2	2.3	3.2	3.6
Leather and Leather Products	-0.6	-2.4	-2.9	2.1	1.6	1.3
Stone, Glass, and Clay Products	1.0	1.1	-0.1	3.6	3.5	3.5
Primary Metals	0.8	0.1	-0.9	7.1	6.4	6.2
Fabricated Metals	1.9	2.0	-0.1	7.5	8.2	8.1
Machinery, Except Electrical	2.0	2.3	2.0	9.1	10.3	11.4
Electrical Equipment and Supplies	3.4	2.4	0.6	7.6	9.3	9.4
Motor Vehicles	1.9	1.7	1.0	4.7	4.5	4.7
Transportation Equipment, Except Motor Vehicles	6.0	-0.9	1.1	5.5	5.5	4.7
Instruments and Related Products	3.3	2.9	3.0	2.2	2.7	3.0
Miscellaneous Manufacturing Industries	0.1	0.3	0.2	2.4	2.2	2.2
Total	1.1	1.1	0.3	100.0	100.0	100.0

SOURCE: Congressional Budget Office calculations based on Bureau of Labor Statistics data.

TABLE 39. IMPACT OF INTERINDUSTRY SHIFTS IN HOURS WORKED ON PRODUCTIVITY GROWTH

	1949-1965	1966-1973	1974-1978
Average Annual Increase in Productivity (percent)	3.308	2.198	1.214
Percentage Points due to Interindustry Shifts	0.474	0.301	0.151
Agriculture, Forestry, and Fisheries	0.287	0.124	0.044
Mining	-0.029	-0.015	0.040
Construction	0.006	-0.003	-0.001
Nondurable Goods Manufacturing	0.002	0.006	-0.002
Durable Goods Manufacturing	0.014	0.008	0.003
Transportation	-0.005	-0.002	-0.004
Communications	0.001	0.019	-0.011
Electric, Gas, and Sanitary Services	0.002	0.009	-0.012
Wholesale Trade	0.013	0.014	0.033
Retail Trade	-0.013	0.002	0.014
Finance, Insurance, and Real Estate	0.255	0.220	0.160
Services	-0.059	-0.077	-0.113

SOURCE: Congressional Budget Office calculations based on data from the Commerce Department and the Bureau of Labor Statistics.

NOTES: All values are expressed as average annual rates. Columns may not add to totals because of rounding.

The change in average productivity in period t can be expressed as:

$$\Delta P_t^A = \sum_i (P_{t-1}^i - P_{t-1}^A)(w_t^i - w_{t-1}^i) + \sum_i (P_t^i - P_{t-1}^i)w_{t-1}^i + \sum_i (P_t^i - P_{t-1}^i)(w_t^i - w_{t-1}^i)$$

where

P^A = average value added per hour,
P^i = value added per hour in the i^{th} industry, and
w^i = the share of total hours worked in the i^{th} industry.

The overall percentage point change in productivity growth due to interindustry movements of labor was calculated by dividing the first term by P_{t-1}^A, or

$$\sum_i (P_{t-1}^i / P_{t-1}^A)(w_t^i - w_{t-1}^i) \quad .$$

For each subperiod, the net effect of changes in the share of hours worked in the i^{th} industry was calculated as:

$$\sum_t (P_{t-1}^i - P_{t-1}^A)(w_t^i - w_{t-1}^i)/P_{t-1}^A) \quad .$$

TABLE 40. IMPACT OF INTERINDUSTRY SHIFTS IN HOURS WORKED WITHIN MANUFACTURING ON PRODUCTIVITY GROWTH

	1949-1965	1966-1973	1974-1978
Average Annual Increase in Productivity (percent)	2.952	2.628	1.700
Percentage Points due to Interindustry Shifts	0.017	-0.025	0.203
Food and kindred products	0.005	-0.002	-0.019
Tobacco	-0.022	-0.025	-0.043
Textile mill products	0.111	0.003	0.064
Apparel and other textile products	0.005	0.028	0.035
Lumber and wood products	0.038	0.001	0.009
Furniture and fixtures	-0.002	-0.008	0.006
Paper and allied products	-0.001	-0.001	0.000
Printing and publishing	0.004	0.002	-0.002
Chemicals and allied products	0.000	0.001	0.041
Petroleum and coal products	-0.034	-0.009	0.048
Rubber products	-0.001	-0.006	0.000
Leather and leather products	0.015	0.027	0.020
Stone, glass, and clay products	0.000	-0.001	0.001
Primary metals	-0.046	-0.025	0.014
Fabricated metals	0.001	-0.005	0.006
Machinery, except electrical	0.000	0.003	0.000
Electrical equipment and supplies	-0.040	-0.010	-0.001
Motor vehicles	-0.018	0.004	0.028
Transportation equipment, except motor vehicles	-0.003	-0.006	-0.001
Instruments and related products	-0.003	-0.001	-0.003
Miscellaneous manufacturing industries	0.008	0.005	0.000

SOURCE: Congressional Budget Office calculations based on data from the Commerce Department and the Bureau of Labor Statistics.

NOTES: See notes from Table 39.

apparel, and a rise in the share of hours worked in the chemical and petroleum industries.

The estimates in Tables 39 and 40 indicate that the productivity impact of interindustry shifts of labor can be significant, and that policies to encourage the growth of high-productivity industries may be worth considering by U.S. policymakers. 3/ This source of productivity growth has been tapped by other nations.

AN INTERNATIONAL COMPARISON OF INDUSTRIAL POLICIES

Interest in the formulation of an industrial policy for the United States is largely attributable to the successful use of structural policies in countries such as Japan, France, and West Germany. An industrial policy is not always the solution to the problem of poor economic performance, however, as witnessed by the United Kingdom. In assessing the desirability and potential effectiveness of an industrial policy in the United States, a review of foreign experience seems relevant.

Japan

Japan is the prime example of the use of structural economic policies to stimulate productivity growth. 4/ In the early stages

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3/ The policy implications of past interindustry movements of labor are discussed in Thurow, "The U.S. Productivity Problem"; and Arnold H. Packer and Brian P. Brosnahan, "The Productivity Puzzle, or the Hounds That Didn't Bark," U.S. Department of Labor, Office of Macroeconomics and Economic Policy Review (November 15, 1979).

4/ Discussions of Japanese industrial policy are presented in Organization for Economic Cooperation and Development, The Industrial Policy of Japan (1972); Shinichi Ichimura "Japanese Industrial Restructuring Policies: 1945-1979" (paper presented at the Symposium on World Development and Restructuring of Industrial Economies, Varenna/Bellagio, Italy, September 10-16, 1979; processed); OECD, The Aims and Instruments of Industrial Policy: A Comparative Study (1975); and Ministry of International Trade and Industry, The Vision of MITI Policies in the 1980s (Tokyo, March 1980).

of postwar reconstruction, the Japanese recognized that major changes in their industrial mix would be needed to achieve a high level of prosperity and a satisfactory balance of trade. Because of its situation as a resource-poor, densely populated nation, Japan's comparative advantage in world production at that time was in labor-intensive, low-productivity industries. A decision was made to alter this comparative advantage by actively encouraging the growth of capital-intensive and high-technology industries highly responsive to rising consumer incomes, rapid technical progress, and fast-rising labor productivity. Over time, the list of favored industries has changed as Japan has progressed through its "product cycle." Initially, attention was focused on industries such as shipbuilding, steel, fertilizer, and power generation. As the economy grew and developed, resources were directed toward the production of chemicals, petrochemicals, autos, and computers. The agenda for the 1980s includes efforts to develop new technologies in areas such as energy, medicine, and large information systems.

Government and business have participated jointly in the formulation of Japanese industrial policy. The guiding force in this process has been the Ministry of International Trade and Industry (MITI). The role of MITI essentially is one of persuading, facilitating, and encouraging industry to move in the desired directions. Its success is said to owe much to a spirit of cooperation between business and government--viewed as "two wheels of a cart"--and to the willingness of Japanese workers to accept the necessary changes. The cooperation of labor may stem from the job security provided many workers by the lifetime employment tradition in Japan, which essentially guarantees that a worker who performs satisfactorily will be employed until retirement age.

Tax incentives such as accelerated depreciation have been used to encourage and facilitate industrial adjustments, but these seem to have played a relatively minor role compared with credit allocation by the government and the banks. Because of an underdeveloped financial market, Japanese firms have relied primarily on bank loans to meet their external financing needs, and the government has exercised considerable influence on the allocation of such loans. Finally, export and import policies have helped new industries to develop and some others to adjust to foreign competition and changes in world demands; antitrust policies have permitted large mergers that would produce economies of scale.

France

Since 1946, the French economy has operated under a series of five-year "indicative plans," developed by the General Planning Commission with the cooperation of all public and private organizations concerned. 5/ While agreement on explicit goals has not always been achieved, the sectoral group consultation process has served as a forum for communication among business, labor, and government representatives.

During the 1950s and 1960s, French industrial policy sought to rebuild and modernize industry, and to develop prestigious national firms that could compete successfully in world markets. The government used a varied and extensive set of tools to affect or make industrial decisions. These included the erection of protective trade barriers, encouragement of mergers, creation of public investment corporations, subsidies and tax concessions, credit market intervention, and price controls. It also nationalized a number of industries such as utilities, banking, coal mining, and motor-vehicle manufacturing. These various policy measures were consistent with the concept of dirigisme--the idea that substantial centralized direction of the economy is desirable.

Under the leadership of President Giscard D'Estaing, France has been relying more on market signals than on consensus-building among government, business, and labor to indicate the direction in which capital and labor resources should go. In recent years, the government has dismantled price controls and has tightened competitive measures within sectors. Also, many more troubled firms have been allowed to go bankrupt in a display of the new policy of giving management responsibility back to enterprise.

Notwithstanding, France continues selectively to promote some industries. One difference from the past, however, is that the criterion for support is no longer the prestige of the industry but

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5/ For a description of French industrial policies, see OECD, The Industrial Policy of France (1974); Lawrence G. Franko, European Industrial Policy: Past, Present, and Future (The Conference Board in Europe, February 1980); John Pinder, Takashi Hosomi, and William Diebold, Industrial Policy and the International Economy (Trilateral Commission, 1979); and James O. Goldsborough, "Giscard's New French Revolution: Capitalism," Fortune (April 9, 1979), pp. 67-74.

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the likelihood that it will soon become viable in international competition. Also, in contrast to the Gaullist insistence on purely French solutions, selected foreign companies have been invited to participate in government ventures as a way of achieving competitiveness and technological excellence. A third difference is that French policy is now less oriented toward particular industrial projects or direct involvement in particular firms, and more toward providing risk capital, support through government purchases, and stimulus to growing enterprises in the context of sectoral programs and objectives.

The success of French industrial policy may be due to the fact that the French have been willing to cut their losses when particular approaches were shown to be uneconomic. They have learned from their mistakes. French industrial policy has pragmatically tended to support, strengthen, salvage, and promote industry on a selective basis.

The Federal Republic of Germany

Germany was the first Western European country to follow the efforts of France and Japan to formulate industrial strategies consistent with macroeconomic goals, and to devise institutional means of obtaining a consensus among business, labor, and government about how to achieve them. 6/ It sought to develop a system that would allow an overall consideration of economic problems within a context of economic freedom and with an international outlook. The Stability and Growth Act of 1966 established a process that closely resembled the French sectoral interest group consultation process.

On the other hand, in contrast to the detailed administrative guidance provided to industry in Japan and until recently in France, the West German government has been less predisposed to intervene in the investment decisions of industries and firms. The main contribution of the public authorities has been to provide a stable economic environment. In the view of the West German

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6/ The industrial policies of the Federal Republic of Germany are reviewed in Franko, European Industrial Policy: Past, Present, and Future. See also OECD, The Industrial Policies of 14 Member Countries (1971), pp. 9-48; and "The Reindustrialization of America," Business Week (June 30, 1980), pp. 139-40.

government, "industrial policy" is only a special aspect of its general economic policy aimed at maintaining full employment, economic growth, stable prices, and balanced foreign trade. In line with this view, Germany has pursued a strong anti-inflation macroeconomic policy that creates a climate of investor confidence, but leaves it to corporate management to decide where to invest.

For the most part, German subsidies have been targeted on the creation of new job opportunities rather than on maintaining existing firms. Guidelines established in the late 1960s required that subsidies be limited in time, involve private risk capital, and be as general as possible--that is, sector-focused rather than firm-focused.

At the beginning of the 1970s, a social consensus emerged that, if high wage rates and real incomes were to be maintained or further increased, there would have to be an increase in high-skill, knowledge-intensive production; low-skill, low-value-added production in which low-wage countries were developing a comparative advantage would have to be phased out.

The German government has intervened substantially in the creation and/or reorganization of advanced technology sectors, but care has been taken to leave the practical implementation of these programs to private industry. Germany is at the non-interventionist end of the industrial policy spectrum in Western Europe, with France at the other end.

The cooperative relationship between labor and management in Germany is an important institutional factor. Under the "codetermination" system, union representatives sit on corporate boards. More important, however, is the law that makes it illegal for worker representatives to operate against the company's best interests. German unions are notably more inclined than those of some other countries to support the adaptive aspects of industrial policy.

Another important factor is the network of close stable links between industrial companies and banks that encourage German companies to invest with an eye toward long-term growth. Bankers typically sit on company boards. The large private banks assume a risk-taking role that elsewhere is assumed by the government (for example, France) or not assumed at all (for example, the United States).

The United Kingdom

The British attempt to adopt an explicit set of industrial policies began in the mid-1960s, despite opposition by the Conservative Party, some segments of business, and many trade unions. 7/ Forty sectoral development committees (modeled on those in the French indicative planning process) were set up, as well as a government investment bank (the Industrial Reorganization Corporation). Equity capital and credit were provided to potential growth companies, and several mergers were arranged with the aim of achieving economies of scale and increased managerial efficiency.

But the British policies were limited in many ways. Sectoral targets were not set in the context of a plan or of general economic goals. British law, social policy, and macroeconomic policy did not mesh with the plans for strengthening industry, and were sometimes thoroughly inconsistent with them. Unions, managers, and civil servants seemed to share a job-protection mentality resistant to change.

British industrial policy measures in the 1970s were scattered across the whole spectrum of manufacturing. Insofar as the policy was targeted at all, it was on providing defensive assistance not only to declining sectors (such as clothing, steel, and shipbuilding), but to a broad range of middle-technology sectors. At least 40 industrial sectors were declared to be of critical importance by the National Economic Council. In effect, it attempted to salvage and protect nearly every ailing branch of industry, thus reinforcing the existing industrial structure rather than reshaping it along the lines of national comparative advantage.

The National Economic Council functioned through tripartite business-government-labor working parties, which seemed unwilling or unable to set sectoral priorities. The idea of a government role in picking the winners was not accepted, and the notion of letting

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7/ Discussions of British industrial policy can be found in Lawrence G. Franko, European Industrial Policy: Past, Present, and Future; John Pinder, Takashi Hosomi, and William Diebold, Industrial Policy and the International Economy, pp. 33-35; OECD, The Aims and Instruments of Industrial Policy: A Comparative Study (1975); and "The Reindustrialization of America," Business Week (June 30, 1980), pp. 140-42.

the losers go seemed anathema. When the 40 working parties finally agreed on a set of goals, they called for increasing or stabilizing import protection in all 40 industries. Their concept of industrial strategy did not seem to require that certain activities be left to other nations, and the resources used in these activities shifted to more efficient British sectors.

Since the Conservative Party took power in 1979, the government has appeared to be backing away from industrial policies in favor of monetary stringency and free-market economics. It is putting more reliance on general measures such as a reduction in personal tax rates, removal of price and exchange rate controls, and cuts in public expenditures in its effort to stimulate the economy and help ailing industries. But it is only reducing, not eliminating, subsidies to shipbuilding and other hard-pressed industries.

The United States

In the United States, policies to alter the industrial structure have generally been deemed inappropriate. 8/ Private business has been relied upon to play the major role in charting the course of industrial development. The federal government's part has basically been to provide a sound and stable economic environment, mainly through steering the economy with fiscal and monetary policies.

Although the United States has not pursued policies explicitly intended to alter the industrial structure, many government actions have done so implicitly. Military contracts, for example, have fostered the development of defense-related industries such as aerospace, shipbuilding, metals, electronics, and computers. Agriculture has received federal assistance in such forms as price

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8/ For reviews of U.S. industrial policy, see OECD, United States Industrial Policies (1970); and OECD, The Aims and Instruments of Industrial Policy: A Comparative Study (1975); "The Reindustrialization of America," Business Week (June 30, 1980), pp. 55-142; and "A Report on U.S. Industrial Policies" (speech by Jerry J. Jasinowski, Assistant Secretary for Policy, U.S. Department of Commerce, May 9, 1980; processed).

supports, crop insurance, disaster relief, and subsidized loans. The housing industry--both owner-occupied homes and rental dwellings--receives substantial federal aid, primarily in the form of tax benefits and interest subsidies to owners of housing. The health-care industry benefits from the income tax deduction for medical expenses and from programs to provide health care to the needy.

The government has also intervened in private markets to produce desired social or economic results. It takes antitrust actions aimed at maintaining competition. It regulates natural monopolies. It enforces social regulations in such areas as consumer protection, affirmative action, environmental quality, and health and safety. Finally, in the area of international trade, it has taken restrictive measures to protect employment in endangered domestic industries.

The United States has no agency that is the equivalent of Japan's MITI, or even France's General Planning Commission. The Department of Commerce--largely a research and information agency--is only one of many agencies engaged in activities that have major impacts on business. The diverse missions of these agencies, and the lack of a unifying framework, have made it difficult to coordinate government actions. This lack of coordination may at times have resulted in counterproductive policies.

In addition, some argue that there is relatively little cooperation among American business, labor, and government in the formulation of policy. In large part, this may be due to an atmosphere of distrust. The relationship between business and government is often adversarial in nature, as is the character of labor-management relations in the private sector.

INDUSTRIAL POLICY CONSIDERATIONS FOR THE UNITED STATES

A decision to raise productivity by fostering the growth of high-productivity industries would represent a major change in policy for the United States. An alternative policy would be to attempt to raise productivity by correcting or offsetting market distortions that result in resource misallocation.

The Economic Rationale for Government Intervention

In a competitive market economy with no market distortions, the price mechanism generally can be relied upon to allocate resources efficiently (that is, most productively) in a manner consistent with consumer preferences. Under those circumstances, government intervention to restructure industry would violate consumer preferences, and could be counterproductive. But when market forces fail to operate freely--when there are distortions in the product, labor, or financial markets--the price mechanism may not produce an efficient allocation of resources; then gains can be realized by government actions that restructure industry in a manner consistent with "undistorted" resource and product prices. This rationale for government action is applicable no matter what the cause of the market distortions--whether they reflect domestic market imperfections, whether they result from the industrial policies pursued by foreign nations, or whether they are the by-products of domestic government policies.

Thus, market distortions provide an economic rationale for corrective government intervention in private markets. But it is not always easy to determine whether economic difficulties are the result of market distortions or of the normal working of market forces. Failure to distinguish between the effects of market forces and the effects of market distortions can result in inappropriate policy actions. For example, providing aid to an ailing industry may be appropriate if the industry is the victim of market distortions, but not appropriate if the industry is declining simply because foreign production is more efficient. Moreover, it is important to identify the cause of market distortions in order to design effective policy responses. If the rate of return to capital in an industry is depressed because strong unions have negotiated wage gains that exceed productivity growth, providing financial aid may simply result in higher wage settlements instead of increased investment.

Selecting an Industrial Policy Strategy

Should policy be designed primarily to promote the growth of selected high-productivity industries, or should it be directed at correcting or offsetting structural distortions in the

marketplace? 9/ More specifically, should regulatory, tax, trade, procurement, and other policies that affect the structure and performance of industry be designed to shift resources from low to high value-added production, or should these policies be concerned instead with correcting or offsetting market distortions that affect the allocation of resources among industries?

Advocates of the industry-specific ("pick-the-winners") approach argue that, in many cases, current knowledge and politically acceptable policy tools are inadequate to deal effectively with market distortions that retard productivity growth. Moreover, they note that, while a competitive-market determination of resource allocation may be efficient, it fails to recognize that differences in the comparative advantage among nations in the production of low and high value-added products are subject to policy manipulation. Thus, they contend that, without policies designed to direct resources into high-productivity industries, the United States may continue to experience declining market shares in these industries compared with countries that actively pursue industry-specific growth policies.

Opponents of an industry-specific policy approach believe that the market mechanism, despite its imperfections, is superior to industrial planning in allocating resources efficiently and satisfying consumer demands. They often point to the United Kingdom as an example of the failure of extensive government involvement with industry. Another argument frequently made is that the free-enterprise institutional framework in America may not readily accommodate efforts to foster the growth of specific industries.

These opposing viewpoints suggest some basic considerations for choosing an industrial policy strategy:

- As a general principle, government policies should be designed to improve social welfare. Productivity growth is not the only measure of social welfare, and policies that focus solely on productivity growth may be less desirable

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9/ Issues of this sort are discussed in Robert A. Leone and Stephen Bradley, "Toward an Effective Industrial Policy" (Harvard Business School, July 31, 1980).

than those that attempt to allocate resources efficiently across all industries in a manner consistent with social preferences.

- When government policies themselves are the cause of industrial distortions that retard productivity growth, it might be well to modify the policies. For example, the effort to achieve a cleaner environment might explore alternative ways of sharing the cost. Also in some cases, antitrust laws might be modified to allow businesses to cooperate in the development of new technologies. Tax policies that stimulate the demand for housing and health care could be reevaluated. Finally, trade policies that protect inefficient and low-productivity domestic industries could be reassessed, and other ways of assisting their workers could be explored.

- When imperfections in labor, product, or financial markets cause structural distortions, government could undertake to correct or offset these imperfections. Policies of this sort may not be effective, however, if policy actions do not reflect a clear understanding of the underlying problems.

- Industry-specific growth policies may be justifiable when other types of government policies cannot achieve the productivity objectives in a reasonable amount of time. In the United States, however, such policies would require more cooperation than now exists among business, labor, and government. Foreign experience shows the importance of developing a consensus among these groups for deciding upon the industries to be targeted for special treatment. Without it, the "planning" approach to industrial development is unlikely to succeed.

APPENDIX. INTERNATIONAL COMPARISON OF PRODUCTIVITY LEVELS AND GROWTH RATES

TABLE A.1 REAL GROSS DOMESTIC PRODUCT PER EMPLOYED PERSON IN LEADING INDUSTRIAL COUNTRIES BASED ON INTERNATIONAL PRICE WEIGHTS, 1950-1979 (United States = 100)

Country	1950	1960	1970	1979 a/
Belgium	55.6	59.7	73.7	90.7
Canada	84.5	89.5	92.6	94.8
France	42.4	53.7	71.0	88.8
Germany b/	37.3	56.0	71.3	87.9
Italy	25.5	34.9	53.4	59.5
Japan	15.5	23.8	48.7	66.4
Netherlands c/	55.4	62.7	76.1	93.0
United Kingdom	53.4	53.7	57.6	59.5

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, unpublished data.

a/ Data are based on preliminary estimates.

b/ Excluding the Saar and West Berlin in 1950.

c/ Employment figures for the Netherlands are Dutch estimates of work-years of employed persons.

TABLE A.2 AVERAGE ANNUAL GROWTH IN GROSS DOMESTIC PRODUCT PER EMPLOYED PERSON IN LEADING INDUSTRIAL COUNTRIES, 1960-1979 (Percent change per year)

Country	1960 to 1979 a/	1960 to 1970	1970 to 1979 a/
United States	1.5	2.0	1.1
Belgium	3.7	4.2	3.2
Canada	1.9	2.3	1.3
France	4.2	4.9	3.4
Germany	3.9	4.4	3.4
Italy	4.6	6.4	2.6
Japan	7.1	9.5	4.5
Netherlands b/	3.6	4.0	3.3
United Kingdom	2.4	2.7	2.0

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, unpublished data.

a/ Data for 1979 are preliminary.

b/ See Table A.1.

TABLE A.3 AVERAGE ANNUAL RATES OF CHANGE IN OUTPUT PER HOUR IN MANUFACTURING IN LEADING INDUSTRIAL COUNTRIES, 1960 TO 1979

Country	1960-1979 a/	1960-1970	1970-1979 a/
United States	2.6	2.8	2.4
Belgium	6.8	6.4	7.3 b/
Canada	3.9	4.3	3.5
Denmark	5.6	6.9	5.3
France	5.5	5.8	5.1
Germany	5.4	5.5	5.2
Italy	6.1	7.1	5.0
Japan	8.1	10.8	5.2
Netherlands	6.7	7.1	6.2 b/
Sweden	5.3	6.8	3.7
United Kingdom	2.9	3.6	2.1

NOTE: Data relate to all employed persons in the United States and Canada; to all employees in the other countries.

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

a/ Data for the latest year are preliminary.

b/ For Belgium and the Netherlands, data relate to period ending 1978.

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