TAX POLICY TOWARD RESEARCH AND DEVELOPMENT

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ABSTRACT

This paper assesses the need for research and development (R&D) tax incentives in light of the post-1960's decline in the U.S economic growth rate. Although total U.S. R&D spending relative to gross national product (GNP) has fallen since the mid-1960's, it still compares favorably with other industrial countries. Like the United States, other industrialized countries have also suffered from a growth slowdown. In the United States, perhaps 15 percent of the slowdown is related to reduced R&D spending. Many countries, including the United States, provide preferential taxation of R&D activity. A number of issues should be addressed in considering any additional R&D tax incentives for the United States.

TAX POLICY TOWARD RESEARCH AND DEVELOPMENT*

I. INTRODUCTION

Government policy makers are understandably concerned over the decline in the U.S. economic growth rate. Suppressed growth aggravates inflationary pressures, retards increases in the standard of living, and makes the United States less competitive in world markets. While real product per unit of labor increased at an average annual rate of 3.5 percent between 1948 and 1966, it increased by only 2.1 percent annually between 1966 and 1973, and fell further to 1.1 percent per year between 1973 and 1978, an overall drop of nearly 2.5 percentage points. 1/ Concurrently, research and development (R&D) spending peaked at nearly 3.0 percent of gross national product (GNP) in 1964 and then declined gradually until the late 1970's. Quite naturally, questions have arisen regarding the role which reduced levels of R&D spending has played in this growth slowdown

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1/ John W. Kendrick "Productivity and Economic Growth," *The AEI Economist*, November 1980, p. 3.

* I wish to to thank Emil Sunley and Harvey Galper for helpful comments and Carole Garland, Barbara Hall, and Elsa Vargas for their assistance in the preparation of the manuscript.

and a variety of tax incentives have been suggested to encourage technological innovation in general and R&D in particular. 1/ This paper assesses the need for such incentives.

Section II reviews recent trends in R&D spending, both in the United States and in other industrialized nations. Although U.S. R&D spending relative to GNP has fallen since the mid 1960's, it still compares favorably with other countries. More significantly, industry-supported R&D has actually risen since the mid-1960's.

Section III discusses the recent growth slowdown, both in the United States and other countries. It also reviews the available evidence on the impact of R&D on the U.S. economic growth rate. Although the U.S. growth rate fell sharply after 1966, reduced R&D spending is responsible for only about 15 percent of the overall decline. Weak capital formation is a more important source of the productivity

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1/ For example, see Aerospace Industries Association of America, Research and Development, A Foundation for Innovation and Economic Growth, 1980, Committee for Economic Development, Stimulating Technological Progress, 1980, and John W. Kendrick, "Productivity Trends and the Recent Slowdown: Historical Perspective, Causal Factors, and Policy Options," Contemporary Economic Problems, American Enterprise Institute, 1979, pp. 17-69.

decline. The United States is not alone in the productivity slowdown; it is a problem widely shared by other countries. In fact, some countries have experienced larger declines in their growth rates than has the United States.

Section IV discusses the impact of R&D on international competitiveness. R&D spending appears to be positively related to export performance in the United States. Since 1960, the United States, for example, has had a trade surplus in R&D-intensive manufactured products and a trade deficit in non-R&D-intensive products. The surplus, however, increased sharply between 1964 and 1975, the period in which R&D spending relative to GNP declined. Although some of the R&D-intensive industries also export their technology, this does not appear to have adversely affected the competitive position of those industries.

Many countries provide preferential taxation of R&D expenditures. Section V describes the R&D incentive provisions in the United States and four foreign countries, Belgium, Canada, France, and West Germany. Section VI concludes the paper with a discussion of the issues that should be addressed in considering any additional R&D tax incentives for the United States.

II. TRENDS IN R&D SPENDING

Total U.S. R&D spending, from both public and private sources, will reach $60 billion in 1980. 1/ As shown by Table 1, private R&D spending has increased relative to Federal government expenditures in the last fifteen years, with each now providing about one-half of total R&D funds. Although universities, colleges, and other nonprofit organizations perform significant amounts of R&D activity, they are only minimal sources of R&D funding. 2/

On a historical basis, total U.S. R&D expenditures have increased steadily over the past 25 years, but much of this reflects the impact of inflation. Table 1 also shows that real or price-adjusted R&D expenditures remained roughly constant from the mid-1960's to the mid-1970's, but have recently resumed their climb and will reach a new high of about $35 billion in 1980 (in 1972 dollars).

1/ National Science Foundation, "Highlights," May 23, 1980, p. 2.

2/ According to the National Science Foundation, universities and other nonprofits performed 17 percent of total R&D activity in 1980, but provided only 4 percent of total funding.

Table 1

United States Research and Development Expenditures, by Source of Funds, 1953-1980

	Current Dollars in Millions					Constant 1972 Dollars in Millions				
Year	Total	Federal Government	Industry	Universities and Colleges	Other Nonprofit Institutions	Total	Federal Government	Industry	Universities and Colleges	Other Nonprofit Institutions
1953	5,124	2,753	2,245	72	54	8,702	4,675	3,813	122	92
1954	5,644	3,132	2,373	80	59	9,456	5,247	3,976	134	99
1955	6,172	3,502	2,520	88	62	10,121	5,743	4,132	144	102
1956	8,363	4,852	3,343	96	72	13,296	7,714	5,315	153	114
1957	9,775	6,110	3,467	109	89	15,034	9,397	5,332	168	137
1958	10,711	6,779	3,707	121	104	16,214	10,262	5,612	183	157
1959	12,358	8,046	4,064	134	114	18,303	11,917	6,019	198	169
1960	13,523	8,738	4,516	149	120	19,693	12,725	6,576	217	175
1961	14,316	9,250	4,757	165	144	20,664	13,351	6,866	238	209
1962	15,394	9,911	5,123	185	175	21,820	14,048	7,262	262	248
1963	17,059	11,204	5,456	207	192	23,829	15,651	7,621	289	268
1964	18,854	12,536	5,888	235	195	25,930	17,241	8,098	323	268
1965	20,044	13,012	6,548	267	217	26,970	17,508	8,811	359	292
1966	21,846	13,969	7,328	303	246	28,460	18,198	9,547	395	320
1967	23,146	14,395	8,142	345	264	29,291	18,217	10,303	437	334
1968	24,604	14,926	9,005	391	282	29,798	18,077	10,906	474	341
1969	25,631	14,895	10,010	420	306	29,556	17,176	11,543	484	353
1970	25,905	14,668	10,439	461	337	28,355	16,055	11,426	505	369
1971	26,595	14,892	10,813	529	361	27,697	15,509	11,261	551	376
1972	28,413	15,755	11,698	575	385	28,413	15,755	11,698	575	385
1973	30,615	16,309	13,278	615	413	28,937	15,415	12,550	581	391
1974	32,734	16,754	14,854	677	449	28,214	14,440	12,803	584	387
1975	35,200	18,152	15,787	750	511	27,684	14,276	12,416	590	402
1976	38,816	19,628	17,804	821	563	29,019	14,674	13,310	614	421
1977	43,013	21,751	19,696	893	673	30,374	15,327	13,975	633	439
1978	48,286	24,058	22,433	1,029	766	31,787	16,006	14,638	672	471
1979	54,296	26,762	25,520	1,150	864	33,412	16,641	15,564	718	489
1980 1/	60,375	29,400	28,710	1,300	965	n.a.	n.a.	n.a.	n.a.	n.a.

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1/ Estimated expenditures.

Source: National Science Foundation, National Patterns of R&D Resources, 1953-1977 and 1953-1978-79, Science Indicators 1978, and Science Highlights, May 23, 1980.

The United States spends more on R&D than any other country in the world, and more than France, West Germany, Japan, and the United Kingdom combined. 1/ This is not surprising because the United States also has the world's largest output of goods and services. 2/ To adjust for the absolute size of a country's economy, Tables 2 and 3 relate R&D expenditures to GNP for the United States and some of its major trading partners. This method of comparison is popular, although E. F. Denison questions its rationale.

> Just because the size of the economy is, say, twice as big, does it take twice as much R&D to obtain the same annual productivity gain? Doubtless it would take twice as much R&D if an economy doubled its size by producing twice as many products, each with a unique technology, and no more of any one product. But why should more R&D be needed if growth occurs by expanding the average output of products rather than their number? An invention that cuts one percent from the production cost of 5 million automobiles should do as much for 10 million. 3/

1/ National Science Foundation, Science Indicators 1978, p. 6.

2/ U.S. Department of Commerce, Bureau of the Census, Statistical Abstract of the United States 1979, Washington, p. 895.

3/ Edward F. Denison, "Explanations of Declining Productivity Growth," Survey of Current Business, August 1979, p. 6.

According to Table 2, R&D spending in the United States reached a peak of nearly 3.0 percent of GNP in 1964, declined steadily until the late 1970's when it reached a low of 2.26 percent, and has recently recovered. Table 2 also shows that the post-1964 decline in R&D spending is attributable solely to reduced Federal spending for defense and space related for R&D. During this period, industry R&D funding increased relative to GNP and Federal nondefense R&D spending remained constant.

Although U.S. spending for R&D relative to GNP has declined since the mid-1960's, it still compares favorably with other industrialized countries. As shown by Table 3, total R&D expenditures relative to GNP are about equal in the United States and West Germany. Expenditures are lower in the United Kingdom, Japan, France, and Canada. Between the mid-1960's and mid-1970's, R&D expenditures increased in West Germany and Japan and decreased in France and the United Kingdom, as well as the United States. But since the mid-1970's R&D expenditures in each of these countries has been a relatively constant fraction of GNP. The increases in West Germany and Japan have leveled off and the declines in France, the United Kingdom, and the United States have abated.

Table 2

United States Research and Development Expenditures by Source of Funds as a Percent of GNP, 1953-1980

Percent of GNP

Year	Total	Federal: Total	Federal: Defense 1/	Federal: Nondefense	Industry	Universities and other nonprofits
1953	1.40	0.75	0.68	0.07	0.61	0.04
1954	1.54	0.86	0.77	0.09	0.64	0.04
1955	1.55	0.88	0.76	0.12	0.63	0.03
1956	1.99	1.15	0.99	0.16	0.79	0.05
1957	2.20	1.38	1.20	0.18	0.78	0.04
1958	2.39	1.51	1.29	0.22	0.83	0.05
1959	2.54	1.65	1.45	0.20	0.84	0.05
1960	2.67	1.73	1.46	0.27	0.89	0.05
1961	2.74	1.77	1.52	0.25	0.91	0.06
1962	2.73	1.76	1.51	0.25	0.91	0.06
1963	2.87	1.88	1.57	0.31	0.92	0.07
1964	2.97	1.97	1.67	0.30	0.93	0.07
1965	2.91	1.89	1.57	0.32	0.95	0.07
1966	2.90	1.86	1.48	0.38	0.97	0.07
1967	2.91	1.81	1.43	0.38	1.02	0.07
1968	2.83	1.72	1.33	0.39	1.04	0.07
1969	2.74	1.59	1.23	0.36	1.07	0.08
1970	2.64	1.49	1.12	0.37	1.06	0.09
1971	2.50	1.40	1.02	0.38	1.02	0.08
1972	2.43	1.35	0.99	0.36	1.00	0.08
1973	2.34	1.25	0.90	0.35	1.02	0.07
1974	2.32	1.19	0.82	0.37	1.05	0.08
1975	2.30	1.19	0.80	0.39	1.03	0.08
1976	2.28	1.15	0.77	0.38	1.05	0.08
1977	2.26	1.15	0.76	0.39	1.04	0.07
1978	2.27	1.13	0.75	0.38	1.05	0.09
1979	2.29	1.13	0.75	0.38	1.08	0.08
1980	2.34	1.14	n.a.	n.a.	1.11	0.09

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1/ Includes spending for defense and space purposes.

Source: National Science Foundation, National Patterns of R&D Resources, 1953-1977 and 1953-1978-79, Science Indicators 1978, and "Science Highlights," May 23, 1980.

Table 3

Total and Civilian 1/ Research and Development Expenditures as a Percent of GNP, 1961-1978, Selected Countries

Year	Total R&D Percent						Civilian R&D Percent				
	United States	Canada	France	West Germany	Japan	United Kingdom	United States	France	West Germany	Japan	United Kingdom
1961	2.74	n.a.	1.38	n.a.	1.39	2.39	1.22	0.97	n.a.	1.37	1.48
1962	2.73	n.a.	1.46	1.25	1.47	n.a.	1.22	1.03	1.14	1.46	n.a.
1963	2.87	0.9	1.55	1.41	1.44	n.a.	1.30	1.10	1.26	1.43	n.a.
1964	2.97	1.0	1.81	1.57	1.48	2.30	1.30	1.34	1.38	1.47	1.46
1965	2.91	n.a.	2.01	1.73	1.54	n.a.	1.34	1.37	1.53	1.53	n.a.
1966	2.90	n.a.	2.03	1.81	1.48	2.32	1.42	1.40	1.62	1.47	1.58
1967	2.91	1.3	2.13	1.97	1.53	2.33	1.48	1.50	1.70	1.51	1.68
1968	2.83	n.a.	2.08	1.97	1.61	2.29	1.50	1.54	1.72	1.60	1.70
1969	2.74	1.3	1.94	2.05	1.65	2.23	1.51	1.49	1.81	1.64	1.69
1970	2.64	1.3	1.91	2.18	1.79	n.a.	1.52	1.47	1.96	n.a.	n.a.
1971	2.50	1.3	1.90	2.38	1.84	n.a.	1.48	1.37	2.16	n.a.	n.a.
1972	2.43	1.2	1.86	2.33	1.85	2.06	1.44	1.39	2.13	n.a.	1.49
1973	2.34	1.1	1.77	2.32	1.89	n.a.	1.44	1.30	2.01	n.a.	n.a.
1974	2.32	1.1	1.81	2.26	1.95	n.a.	1.50	1.34	2.27	1.91	n.a.
1975	2.30	1.5	1.82	2.39	1.94	2.05	1.50	1.41	2.20	1.91	n.a.
1976	2.28	1.0	1.78	2.28	1.94	n.a.	1.51	1.42	2.09	n.a.	1.50
1977	2.26	n.a.	1.79	2.26	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1978	2.27	n.a.	n.a.	2.28	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.

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1/ Civilian expenditures equal total R&D expenditures less government funds for defense and space R&D.

Source: National Science Foundation, Science Indicators 1978.

The relative position of the United States with respect to civilian R&D expenditures, defined as total R&D expenditures less government funds for defense and space R&D, is less favorable. According to Table 3, civilian R&D expenditures in the United States relative to GNP are equal to those in the United Kingdom, higher than in France, but lower than those in West Germany and Japan.

One explanation is that West Germany and Japan have modest defense budgets; most of the R&D expenditures in these countries are for civilian purposes. A recent National Science Foundation publication observes that "the concentration of R&D in civilian areas may have assisted the Japanese and the West Germans to increase productivity rates and be more competitive in world trade." 1/ Still, defense and space related R&D may have spinoff effects that improve productivity and the quality of output in the civilian economy. Moreover, recent international developments stress the need for the United States to make more, rather than less, defense related R&D.

1/ National Science Foundation, Science Indicators 1978, p. 9.

III. IMPACT OF R&D ON ECONOMIC GROWTH

Since the mid-1960's, the United States has suffered from a depressed growth rate. The average annual increase in real product per unit of labor, for example, declined from 3.5 percent in the 1948-1966 period, to 2.1 percent between 1966 and 1973, and 1.1 percent between 1973 and 1978. 1/ Since R&D spending as a proportion of GNP reached its peak in 1964, attention has understandably focused on the possible role of reduced R&D spending in the growth slowdown. R&D, of course, is only one of many ingredients of economic growth.

Output may be increased by using more resources, such as capital or labor, or by increasing the efficiency or productivity of existing resources. Growth or productivity analysis frequently concentrates on labor productivity or output per unit of labor. But these measures do not necessarily reflect changes in the efficiency of labor. Labor productivity may increase for a variety of reasons: an increase in the amount of capital per worker, an improvement in the quality or education of labor, or a more efficient

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1/ Kendrick, "Productivity and Economic Growth," op. cit., p. 3.

combination of labor with capital and other resources. Thus, "increases in output per hour may best be viewed as reflecting the saving of labor per unit of output as the result of the joint effect of all inputs and the way they are combined." 1/

E. F. Denison's landmark studies on the sources of productivity growth illuminate the reasons for the productivity decline and the possible role of R&D. Denison finds that the growth rate in national income per person employed in the nonresidential business sector declined from 2.7 percent per year in the 1948 to 1969 period, to 2.1 percent annually between 1969 and 1973, and to -0.6 percent per year between 1973 and 1976. 2/ Thus, between the 1948-1969 and 1973-1976 periods, productivity growth actually fell by 3.3 percent per year. Denison has divided this productivity decline into two periods, 1969-1973 and 1973-1976.

1/ Steven P. Zell, "Productivity in the U.S. Economy: Trends and Implications," Economic Review, Federal Reserve Bank of Kansas City, November 1979, p. 13.

2/ Ibid., p. 19.

In the earlier period, the sources of the productivity decline are about evenly divided between factors affecting input quantity or quality, such as hours worked, education, and capital per worker and factors affecting output per unit of input, such as improved allocation of resources, economies of scale, and a residual described as "advances in knowledge and not elsewhere classified." In contrast, in the 1973-1976 period, all of the productivity decline of 2.7 percent per year is attributable to factors affecting output per unit of input. The "advances in knowledge and not elsewhere classified" factor acounts for 2.3 percentage points of the 2.7 percent decline in measure output. 1/

Denison's "advances in knowledge and not elsewhere classified" category has two components.

> The contribution of advances in knowledge is, conceptually, a comprehensive measure of the gains in measured output that result from the incorporation into production of new knowledge of any type-managerial and organizational as well as technological-regardless of the source of that knowledge, the way it is transmitted to those who can make use of it, or the way it is incorporated into production. 2/

1/ Ibid.

2/ Denison, op. cit., pp. 3-4.

The "not elsewhere classified" component refers to a number of miscellaneous determinants which are not separately specified, but whose effects are "believed small." 1/

Although the contribution of advances in knowledge to the growth in output declined dramatically between the 1969-1973 and 1973-1976 periods, Denison doubts that reduced R&D spending was much of a factor. Based on an earlier estimate, he concludes that only one-sixth of the total contribution of advances in knowledge is related to R&D spending. 2/ If correct, this estimate would assign less than 0.40 percentage points of the 2.7 percent per year decline in output growth to R&D, i.e., about 15 percent of the total decline. Denison also refers to Z. Griliches' estimate that the maximum contribution of R&D to the growth rate as of 1966 was 0.3 percentage points. Noting the approximately one-fourth drop in total R&D expenditures as a percent of GNP between 1964 and 1976, Denison observes that "if the 0.3 percentage point contribution of R&D to the growth rate of output were reduced

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1/ Ibid., p. 4.

2/ Edward F. Denison, The Sources of Economic Growth in the United States, Committee for Economic Development, 1962, p. 245.

proportionately, it would decline by less than 0.1 percentage points." 1/ But, he cautions, since industry-supported R&D did not decline at all, "there is no assurance that R&D spending contributed anything to the decline in productivity growth." 2/

In contrast to Denison and Griliches, J. W. Kendrick, using a modified version of Denison's growth accounting framework, estimates a much higher contribution of R&D to productivity growth. But because the decline in the R&D-related source of growth is less drastic than in Denison's analysis, his estimate of the role of R&D in the productivity slowdown is similar to Denison's. According to Kendrick, R&D contributed 0.9 percentage points annually to the growth rate between 1948 and 1966, 0.7 percentage points between 1966 and 1973, and 0.6 percentage points between 1973 and 1978. 3/ Thus, R&D was responsible for 0.3 percentage points of the 2.4 percent annual decline in the growth rate of real product per unit of labor estimated by

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1/ Denison, "Explanation of Declining Productivity Growth," op. cit., p. 6.

2/ Ibid.

3/ Kendrick, "Productivity Trends and the Recent Slowdown," op. cit., p. 33.

Kendrick between 1948-1966 and 1973-1978. This is 12.5 percent of the total decline and similar to Denison's estimate of 15 percent.

Other investigators have stressed the importance of reduced investment spending in explaining the growth slow-down since the mid-1960's. Citing the decline in the growth rate of the capital stock and the increase in the growth rate in labor hours, M. D. McCarthy concludes that "the slowdown in productivity growth, in the 1970's in particular, can be traced to a very slow growth in the capital/labor ratio in the years 1970-1975." 1/ Along with reduced R&D spending, S. P. Zell believes that the decline in the capital/labor ratio is an important cause of the "apparent slowdown" in the rate of technological progress in the United States. 2/ Likewise, J. A. Tatom concludes that "the relatively slow pace of capital formation, including research and development capital, has quietly played an important role in productivity's decline. 3/

1/ Michael D. McCarthy, "The U.S. Productivity Growth Recession: History and Prospects for the Future," The Journal of Finance, June 1978, p. 977.

2/ Zell, op. cit., p. 20.

3/ John A. Tatom, "The Productivity Problem," Review, Federal Reserve Bank of St. Louis, September 1979, p. 15.

Like others, J. R. Norsworthy, M. J. Harper, and K. Kunze have divided the productivity slowdown into two periods: 1965-1973 and 1973-1978, with 1948-1965 as the base period. Their method of analysis measures the effect of changes in capital, labor, and a residual described as "other factors." They find that the "other factors" category is important in explaining the earlier slowdown, but that reduced capital formation explains most of the more recent slowdown.

> One conclusion is immediate--two slowdowns occurred with two different patterns of contributing causes: the 1965-1973 slowdown is largely unexplained by factors quantified in this analysis, the 1973-1978 slowdown is largely accounted for by the relative weakness in capital formation. 1/

One of the reasons advanced for the weakness of capital formation in the 1973-1978 period is that, compared to the earlier period, the price of capital services increased by nearly four times whereas the price of labor increased by only one-third. 2/

1/ J. R. Norsworthy, Michael J. Harper, and Kent Kunze, "The Slowdown in Productivity Growth: Analysis of Some Contributing Factors," Brookings Papers on Economic Activity, 2: 1979, p. 415.

2/ Ibid., p. 420.

Since the effect of R&D is one of the elements in the "other factors" category, the authors concede it may have been partially responsible for the productivity slowdown in the earlier period. "Although R&D expenditures slowed during this period and may well have contributed to the productivity slowdown, we devised no satisfactory means to take this factor into account." 1/

Even Kendrick, who reports relatively high estimates of the impact of R&D on productivity growth, also stresses the importance of capital formation.

> Policies to promote tangible investment ... would obviously accelerate the growth of real product per unit of labor input.... In addition, the acceleration in tangible capital formation would have a positive effect on R&D spending and other tangible investments that are part and parcel of the inventive-innovative process. 2/

The productivity slowdown is not confined to the United States. Although the United States has a relatively high level of productivity, it has a relatively low level of productivity change, but compares favorably with other

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1/ *Ibid*., p. 421.

2/ Kendrick, "Productivity Trends and the Recent Slowdown," *op*. *cit*., p. 51.

industrialized countries in the degree to which productivity has decelerated. Tables 4 and 5 highlight the elements of the international productivity comparison.

Table 4 compares the productivity level, or real gross domestic product per employed civilian, for the United States and five other major industrialized nations. As of 1977, the United States has the highest productivity level for the countries under comparison, although each of the five countries improved its position relative to the United States since 1960. Japan, for example, has a very high productivity growth rate, but its productivity level is less than two-thirds that of the United States.

The deterioration in the relative position of the United States is shown by Table 5 which compares annual growth rates in real gross domestic product per employed civilian for the same countries, plus Italy. For the period 1960-1973 the United States has the smallest growth rate and for the 1973-1977 period only Italy has a smaller growth rate. But the United States compares reasonably well with respect to how much productivity has fallen between the two periods. According to column 3 of Table 5, only West Germany experienced a significantly smaller productivity slowdown.

Table 4

Real Gross Domestic Product Per Employed Civilian, for
Selected Countries Compared with the United States: 1960-77 1/

[Index, United States = 100]

Year	United States	Canada	France	West Germany	Japan	United Kingdom
1960	100	86.6	55.4	52.4	24.7	51.1
1961	100	85.8	57.0	53.1	27.2	49.8
1962	100	85.6	58.0	53.1	27.6	47.9
1963	100	86.2	59.0	53.2	29.6	48.5
1964	100	86.0	60.0	55.2	32.1	49.1
1965	100	85.6	60.8	56.2	32.2	48.2
1966	100	83.5	61.2	58.1	33.4	47.4
1967	100	83.4	63.4	57.3	36.8	49.0
1968	100	84.6	64.2	59.5	40.0	49.7
1969	100	86.2	67.6	63.2	43.9	50.4
1970	100	88.6	71.4	67.0	48.7	52.6
1971	100	90.6	72.9	67.5	50.8	53.9
1972	100	90.7	74.8	68.5	53.9	53.6
1973	100	90.8	76.4	70.2	56.5	54.8
1974	100	93.0	80.0	74.3	58.0	56.0
1975	100	91.9	81.2	74.7	59.5	55.4
1976	100	92.2	83.1	77.7	60.8	55.6
1977 (prel.)	100	91.6	84.7	79.1	62.2	55.1

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1/ Output based on international price weights to enable comparable cross-country comparisons.

Source: National Science Foundation, Science Indicators 1978, p. 157.

Table 5

Annual Growth Rates in Real Gross Domestic Product Per Employed Civilian, for Selected Countries, 1960-1973 and 1973-1977

Country	Growth Rates (Percent)		
	(1) 1960-73	(2) 1973-77	(3) Change (2-1)
United States	2.1	0.3	-1.8
Canada	2.4	0.5	-1.9
France	4.6	2.9	-1.7
West Germany	4.4	3.3	-1.1
Italy	5.8	-0.2	-6.0
Japan	8.8	2.7	-6.1
United Kingdom	2.6	0.4	-2.2

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Source: Edward F. Denison, "Explanations of Declining Productivity Growth," Survey of Current Business, August 1979, Part 2, p. 20.

Thus, although other countries continue to gain on the United States in the productivity race, they are gaining somewhat less quickly.

IV. R&D AND TRADE

Considerable evidence exists that U.S. R&D spending improves the country's competitive position in world markets. For the United States, D. B. Keesing, for example, compared the percent of an industry's work force involved in R&D activity with that industry's exports as a share of world exports. Keesing finds a linear correlation coefficient of .88 for the 18 manufacturing industries studied; that is, 88 percent of the variation in export shares is "explained by" variations in R&D activity. 1/ Keesing also allows for the influence of other factors on U.S. trade performance, but concludes that

> there turns out to be a powerful correlation between the intensity of R&D activity in American industries and their export performance. The association is probably heightened by a tendency for industries that conduct intensive R&D activity to exhibit at the same time economies of scale and high requirements for skills in production. Capital requirements, however, are inversely associated with R&D. 2/

1/ Donald B. Keesing, "The Impact of Research and Development on United States Trade," *Journal of Political Economy*, February 1967, p. 39.

2/ *Ibid.*, p. 45.

Similarly, W. Gruber, D. Mehta, and R. Vernon's cross-industry study of research effort and export performance finds "a strong export position for research-oriented industries and a weak export position for industries without large research inputs." 1/

A review of the trade balance performance of R&D-intensive and non-R&D-intensive product groups also indicates the importance of R&D to international competitiveness. Although the U.S. merchandise trade balance has a large deficit ($30 billion in 1979), R&D-intensive manufactured goods have a substantial trade surplus. According to Table 6, the United States has had a trade surplus in R&D-intensive manufactured products since 1960 and a trade deficit in non-R&D-intensive products. R&D-intensive industries are defined as: (1) having at least 2.5 percent of their work force employed as scientists or engineers engaged in R&D and (2) making R&D expenditures

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1/ William Gruber, Dileep Mehta, and Raymond Vernon, "The R&D Factor in International Trade and International Investment of United States Industries," Journal of Political Economy, February 1967, p. 23.

Table 6

U.S. Trade Balance 1/ in R&D-Intensive and non-R&D-Intensive
Manufactured Product Groups: 1960-77

[Dollars in millions]

Year	R&D-Intensive			Non-R&D-Intensive			Overall Balance 2/
	Balance	Exports	Imports	Balance	Exports	Imports	
1960	$ 5,891	$ 7,597	$ 1,706	$ -179	$ 4,962	$ 5,141	$ 5,712
1961	6,237	8,018	1,781	-12	4,730	4,742	6,225
1962	6,720	8,715	1,995	-691	4,940	5,631	6,029
1963	6,958	8,975	2,017	-765	5,284	6,049	6,193
1964	7,970	10,267	2,297	-678	6,121	6,799	7,292
1965	8,148	11,078	2,930	-2,027	6,281	8,308	6,121
1966	7,996	12,174	4,178	-3,325	6,913	10,238	4,671
1967	8,817	13,407	4,590	-3,729	7,437	11,166	5,088
1968	9,775	15,312	5,537	-6,581	8,506	15,087	3,194
1969	10,471	16,955	6,484	-6,698	9,830	16,528	3,773
1970	11,722	19,274	7,552	-8,285	10,069	18,354	3,437
1971	11,727	20,228	8,501	-11,698	10,215	21,913	29
1972	11,012	22,003	10,991	-15,039	11,737	26,776	-4,027
1973	15,101	29,088	13,987	-15,370	15,643	31,013	-269
1974	23,873	41,111	17,238	-15,573	22,412	37,985	8,300
1975	29,344	46,439	17,095	-9,474	24,511	33,985	19,870
1976	28,964	50,830	21,866	-16,499	26,411	42,910	12,465
1977	27,627	53,169	25,542	-24,378	27,284	51,662	3,249

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1/ Exports less imports.

2/ R&D-intensive balance less non-R&D-intensive balance.

Source: National Science Foundation, Science Indicators 1978, p. 161

equal to at least 3.5 percent of net sales. 1/ On this basis, only 5 groups of manufactured products qualify as R&D-intensive: aircraft and parts, chemicals, electrical machinery, nonelectrical machinery, and professional and scientific instruments. 2/ All other manufactured products are classified as non-R&D-intensive.

While U.S. R&D spending relative to GNP peaked in the mid-1960's, the U.S trade surplus in R&D-intensive products increased sharply between 1964 and 1975, nearly tripling between 1972 and 1975. The surplus has fallen slightly since 1975, coinciding with a substantial increase in the trade deficit in non-R&D-intensive goods. The total trade surplus in manufactured products, both R&D-intensive and non-R&D-intensive, fell from a peak of nearly $20 billion in 1975 to about $3 billion in 1977.

In recent years, nearly 90 percent of the trade surplus in R&D-intensive products has been generated by three product groups: nonelectrical machinery, (including

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1/ National Science Foundation, Science Indicators 1978, p. 30.

2/ Ibid.

computers), chemicals, and aircraft. 1/ There is some evidence that these industries also are active in the export of technology. U.S. direct investment abroad, for example, will reach nearly $200 billion in 1980. 2/ The largest portion of this investment is in manufacturing, with machinery (electrical and nonelectrical) and chemicals being the most important industries. 3/ Net receipts (receipts minus payments) of U.S. companies of royalties and fees from foreign affiliates will approach $3 billion in 1980. 4/ Again, manufacturing activity generates the largest portion of these receipts, with machinery and chemicals being the most important individual industries. 5/ Machinery and transportation equipment, along with chemicals, also are the leading industries in the volume of R&D performed abroad by foreign affiliates of U.S. firms. 6/

1/ Ibid., p. 162.

2/ Obie G. Whicard, "U.S. Direct Investment Abroad in 1979," Survey of Current Business, August 1980, pp. 16-36 and author's estimate for 1980.

3/ Ibid., p. 27.

4/ Ibid., p. 23 and author's estimate for 1980.

5/ Ibid., p. 23, 33-36.

6/ Sumiye Okubo, "The Impact of Technology Transfer on the Competitiveness of U.S. Producers," paper presented to Trade Policy Staff Committee, July 18, 1980, p. 15.

Although the machinery and chemical industries are important exporters of technology, S. Okubo doubts that the trade competitiveness of these industries has been adversely affected. Foreign direct investment, she notes, may have encouraged exports. "In general, American exports tend to be enhanced by foreign direct investment, but possibly up to some threshold level after which exports are no longer complementary and the relation between exports and foreign investment appears to be haphazard." 1/

1/ *Ibid.*, p. 39.

V. TAXATION OF R&D

Business firms undertake R&D activity in order to enhance their future profits. Successful R&D projects produce "properties" that frequently generate income over a number of years. In this respect, R&D is like other types of business investment; the expense is associated with a future stream of income. The intangible properties produced by R&D may be cost-saving processes, innovative marketing techniques, product variations, previously unexploited scientific principles, or patents. Aside from the form of the income-earning property that is acquired, R&D expenditures are conceptually like other kinds of business investment. Net income from the use of either an idea or a machine is measured by the annual difference between the additional gross income stream that results and the depreciation of the property due to deterioration and obsolescence.

An income tax system that favored neither R&D nor tangible investment would require the capitalization of all expenses. In the case of R&D, this would require that wages, materials, and depreciation of equipment and structures allocable to R&D would be charged to capital account and depreciated over the earning lifetime of the R&D "property." Whether or not this treatment would be administratively practical, it is the proper standard for neutrality among R&D and tangible investments under an income tax.

Whether dictated by administrative or incentive considerations, many countries provide for preferential taxation of R&D. These provisions are outlined below for the United States and four other countries.

A. United States

1. Section 174(a) of the Internal Revenue Code permits business taxpayers to deduct research or experimental expenses in the year they are incurred. Alternatively, a taxpayer may elect under section 174(b) to capitalize deductible R&D expenses and amortize them over at least 60 months. This election may be appealing to new or small firms with insufficient income to absorb a current year R&D deduction.

Section 174 does not apply to expenditures for the acquisition or improvement of land or depreciable property used for research or experimental activity. Depreciation allowances themselves, however, are covered by the provision "to the extent that the property to which the allowances relate is used in connection with research or experimentation." 1/ R&D expenditures for labor and materials are therefore deducted under section 174 and expenditures for buildings and equipment are depreciated as if employed in current production. A patent acquired from another, rather than resulting from one's own R&D activity, and having a determinable useful life, is depreciated, not expensed. 2/

Congress enacted section 174 into the Code in 1954 "to eliminate uncertainty and to encourage taxpayers to carry on research and experimentation." 3/ Prior to 1954, no special statutory provision existed for the treatment of R&D. In some cases, the capital nature of research expense and the difficulty of specifying a useful life combined to deny the deductibility of R&D expenses.

> Where they could not be clearly classified as current operating expenses, the courts required their capitalization for tax purposes. Because of

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1/ IRC §1.174-2(b)(1).

2/ IRC §1.167(a)-3.

3/ House Report 1337, 83d Cong. 2d Sess., 1954, p. 28.

> the indefinite nature of their useful life, amortization was generally not allowed. Difficulties of proving abandonment of a research project or termination of its utility usually precluded a loss deduction. The end result was disallowance of any deduction for these purposes. 1/

Pre-1954 administrative practice, however, was more liberal than judicial interpretations and sought to allow current expensing of R&D expenditures. A 1924 Treasury Department regulation allowed current expensing, but this option was withdrawn in 1926 in response to a Board of Tax Appeals decision that it contravened the statute. 2/ Nonetheless, the Bureau of Internal Revenue continued to permit the current deduction of R&D expenses "where this practice had been consistently followed by a taxpayer." 3/ Commissioner Dunlap explained the administrative rationale for this policy in a 1952 appearance before the Joint Committee on Internal Revenue Taxation.

1/ William M. Horne, Jr., "Research and Development Expenditures," Tax Revision Compendium, Vol. 2, Committee on Ways and Means, November 16, 1959, p. 1116.

2/ Charles R. Orem, Jr., "Research and Development Costs," Tax Revision Compendium, op. cit., p. 1111.

3/ Ibid., p. 1112.

> On account of the difficulty of determining the specific costs applicable to various projects and processes, as well as determining in advance, or at any time prior to patenting or successful operations, the actual cost of a successful research and development project, the Bureau has allowed all such costs to be deducted annually, except costs of obtaining patents. Many projects take as much as 10 years or more to develop; many are unsuccessful; some unpatentable.... The problem of allocating such expenditures to individual projects...is most difficult and would require elaborate accounting techniques. 1/

Section 174 thus codified existing practices for taxpayers with a history of deducting R&D expenditures. For new or small businesses, with no established pattern of R&D activity, it meant that such expenditures were clearly deductible. The Treasury Department, in endorsing the 1954 legislation, described its purpose: "Encourage research and experimental activity. Help small, pioneering businesses." 2/

Section 174 contains an additional incentive feature in that expenses need only be paid or incurred "in connection with" a trade or business. 3/ In Snow v. Commissioner, the

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1/ Ibid.

2/ Hearings on H.R. 8300, Senate Finance Committee, 83d Cong., 2d Sess., April 1954, p. 105.

3/ IRC Sec. 174(a)(1).

Supreme Court opined that the "in connection with" language of section 174 is intended "to dilute some of the conception of 'ordinary and necessary' business expenses under §162(a)." 1/ Observing that section 174 was legislated "to encourage expenditure for research and experimentation," 2/ the Court reversed a Court of Appeals decision denying a limited partner his share of a partnership's research and experimental expenses for 1966, even though the partnership made no sales before 1967.

2. To encourage scientific pursuits, individuals and corporations may deduct contributions to educational and scientific organizations operated in the public interest. 3/ Individual deductions are limited to 50 percent of adjusted gross income, corporate deductions to 5 percent of taxable income. 4/

1/ Snow v. Commissioner, 416 U.S. 502.

2/ 416 U.S. 504.

3/ IRC Sec. 170(a).

4/ IRC Sec. 170(b)(1); Sec. 170(b)(2).

3. The income of scientific and educational organizations operated in the public interest is exempt from Federal income tax. 1/ An organization conducting scientific research will qualify for the exemption if, the research "is directed toward benefiting the public." 2/ This condition is fulfilled if the research "is published in a treatise, thesis, trade publication, or in any other form that is available to the interested public." 3/ To meet this test, the Service has ruled that publication must be "timely." 4/ Provided it meets these tests, and even if performed under "a contract or agreement under which the sponsor or sponsors of the research have the right to obtain ownership or control of any patents, copyrights, processes, or formulae resulting from such research," 5/ research may still be regarded as performed in the public interest.

1/ IRC Sec. 501(a) and 501(c)(3).

2/ IRC §1.501(c)(3)-1(d)(5)(iii)(c).

3/ IRC §1.501(c)(3)-1(d)(5)(iii)(c)(2).

4/ Rev. Rul. 76-296; 1976-2 C.B. 141.

5/ IRC §1.501(c)(3)-1(d)(5)(iii)(c)(4).

Tax exempt organizations, however, are taxable on income derived from "unrelated" business activities. 1/ This is income from a business enterprise which is "not substantially related" to the organization's exempt purpose. 2/ A business activity is not "substantially related" to an organization's exempt function if it does not "contribute importantly" to the accomplishment of the organization's exempt purpose. 3/

Thus, the Service has held that commercially sponsored research which is published in timely fashion is scientific research carried on in the public interest and related to the organization's exempt purpose. Accordingly, income from that research will not be tainted as unrelated business income. 4/ But research, the publication of which is withheld or delayed significantly beyond the time reasonably necessary to establish ownership rights, is not in the public interest and constitutes the conduct of an unrelated trade or business under the statute. 5/

1/ IRC Sec. 511(a)(1).

2/ IRC Sec. 513(a).

3/ IRC §1.513-1(d)(2).

4/ Rev. Rul. 76-296; 1976-2 C.B. 141.

5/ Ibid.

There are other exceptions to the tax on unrelated business income. The following types of research related income are specifically excluded from the scope of unrelated business income:

(1) research income of a college, university, or hospital, 1/ and

(2) income from any research performed for the United States, a state, or political subdivision. 2/

Finally, dividends, interest, and royalties are not unrelated business income, unless received from debt-finance property. 3/ This exclusion provides scientific and educational organizations an opportunity to earn passive income without running afoul of the unrelated business income provisions of the Code.

4. Individual inventors who transfer "all substantial rights" to their patents are permitted to treat such revenue as capital gains. 4/ In determining whether "all

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1/ IRC Sec. 512(b)(8).

2/ IRC Sec. 512(b)(7).

3/ IRC Sec. 512(b)(1,2).

4/ IRC Sec. 1235.

substantial rights" have been transferred, the law distinguishes between the sale of patent rights or the granting of an exclusive license and the nonexclusive licensing of a patent. If a patent is sold, or exclusively licensed, the income is characterized as a capital gain, even though the payment is partly conditioned on future production or profits. If, however, the patent is licensed on a nonexclusive basis, the income is characterized and taxed as ordinary income. The capital gains treatment is an incentive provision since one might consider the sale of patents as ordinary income of an inventor, and it would be so treated without the special exemption provided in the law. Corporations that sell patents or license inventions do not automatically qualify for capital gains treatment, but such transactions may qualify for capital gains treatment as a sale of a capital asset. 1/

B. Belgium

1. Current research costs are deductible in the year incurred, provided they are related to the business activity of the taxpayer. 2/

1/ IRC Sec. 1231.

2/ C. Sibille, "Belgium: Tax Measures and Direct Incentives Applicable to Research and Development," European Taxation, 1977, p. 256.

2. Capital expenditures, including buildings, by a Belgian enterprise are generally depreciated under either the straight-line or declining-balance method. Scientific research equipment, however, is eligible for accelerated, three-year depreciation. 1/

3. Belgian law provides incentives for investments for specified purposes in economically distressed areas of the country. R&D is one of the purposes entitled to preferential treatment. Accordingly, investment in a development area for a new research laboratory is entitled to exemption from the immovable prepayment tax. The exemption applies to the building, as well as the land and equipment related to it. 2/

4. The sale of patent rights is taxed as ordinary income, provided the patent is used in the normal operation of the taxpayer's business or is the result of a continuous, rather than incidental, inventing program. Alternatively, incidential inventions of a private inventor are taxed at a reduced rate. 3/

1/ *Ibid.*, p. 258.

2/ *Ibid.*, p. 259.

3/ *Ibid.*, p. 262.

5. Contributions to non-commercial, non-profit organizations operated for the promotion of scientific research are tax deductible. 1/

C. Canada

1. Taxpayers are allowed to deduct both current and capital expenditures (including buildings, but not land) for scientific research in the year incurred, provided that the research is related to the taxpayer's business. To be deductible, current scientific expenditures may be incurred either inside or outside Canada, but capital expenditures must be incurred in Canada. No deduction is allowed for expenditures made to acquire another's patents or other rights arising out of scientific research. The allowable R&D deduction is reduced by any amounts received by the taxpayer pursuant to an Appropriations Act and used for scientific research aimed at improving the technological capability of Canadian manufacturing industry. Repayments of such grants are treated as deductible expenses. The

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1/ Ibid.

deduction of eligible current scientific expenditure also can be deferred at the taxpayer's option and claimed in future years. 1/

2. Payments to an approved Canadian educational or research institute are deductible, provided they are used for scientific research related to the taxpayer's line of business activity. Payments to a Canadian non-profit organization to be used for scientific research also are deductible. 2/

3. Canadian law provides a general investment tax credit for qualifying capital expenditures. The credit is equal to 7 percent of eligible expenditures and is limited to the first $15,000 of Federal tax liability plus 50 percent of any tax liability in excess of $15,000. Unused credits can be carried forward 5 years. 3/ This credit may

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1/ Commerce Clearing House, Canadian Master Tax Guide, 1980, par. 2810.

2/ Ibid.

3/ Ibid., par. 9077.

also be applied to current and capital scientific research expenditures. The deduction for expenditures for scientific research is reduced by the amount of the credit claimed for current scientific expenditures. 1/ The effect of this is to make the credit taxable.

4. Business enterprises are allowed an additional deduction equal to 50 percent of qualifying scientific expenditures in excess of a three-year base period amount. The expenditures must be incurred in Canada for scientific activities related to the taxpayer's line of business. Both current and capital expenditures are eligible for the special allowance and the investment tax credit may also be claimed with respect to such expenditures. 2/

D. France

1. Current research costs must be deducted in the year they are incurred. No option exists to capitalize and amortize these expenses. 3/

1/ Ibid., par. 2810.

2/ Ibid., par. 2852.

3/ C. Sibille, "France: Tax Treatment of Research and Development and the Result of Research," European Taxation, 1978, p. 78.

2. Capital equipment and buildings used for scientific purposes must be depreciated. While straight-line depreciation is usually mandatory in France for depreciable assets, declining-balance depreciation may be taken on certain types of assets, including scientific and technical research equipment, provided the assets are new when purchased and have a useful life of at least three years. 1/

3. Buildings generally may not be depreciated on the declining-balance basis. A special first-year allowance permits companies to write off 50 percent of the cost of acquiring or constructing buildings dedicated to scientific research. The remaining 50 percent of the cost is depreciated on a straight-line basis over the life of the structure. 2/

4. Enterprises may deduct 50 percent of their investment in the shares of approved research companies. When sold, such shares are taxed as a capital gain. 3/

1/ Ibid.

2/ Ibid., pp. 78-79.

3/ Ibid., p. 80.

5. Contributions to organizations operating in the public interest and carrying on scientific research are deductible. Corporate contributions are limited to 0.3 percent of gross sales, individual contributions to 1.5 percent of net income. 1/

6. Profits resulting from the sale or licensing of patent rights are taxed at the long-term capital gains rate. Transactions involving a sale, exclusive license, or non-exclusive license of patent rights are all eligible for the capital gains rate. To qualify for this preferential taxation, the patent must have been held by the transferor for at least two years, unless it was self-developed. 2/

E. West Germany

1. Current R&D expenditures are deductible in the year incurred. Capital expenditures, such as for laboratories, buildings, and equipment are depreciated as if employed in current production. 3/

1/ *Ibid.*, p. 82.

2/ *Ibid.*, pp. 84-85.

3/ E. Jehle, "German Federal Republic: The Tax Treatment of Research and Development," *European Taxation*, 1978, p. 345.

2. The costs of acquiring another party's research results, such a patent, must be depreciated over the useful life of the asset acquired. 1/

3. Taxpayers may claim an investment tax credit equal to 7.5 percent of the acquisition or construction costs of capital assets used for R&D purposes. The assets must be used for a least three years in the taxpayer's trade or business. To qualify for the credit, movable fixed assets must be used exclusively for R&D and at least two-thirds of a building must be devoted to R&D. The credit does not reduce the depreciable basis of the assets on which it is claimed. 2/

4. Inventors, both independent and employed, are eligible for preferential tax treatment. An independent inventor is taxed at one-half the normal rate on income earned on the development of a patentable invention,

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1/ Ibid., p. 348.

2/ Ibid., p. 349.

provided it is not exploited in the taxpayer's own trade or business. Similarly, a 50 percent reduction in the wage tax imposed on payments made by an employer to an employee is available for qualifying inventions. 1/

5. Organization's engaged in R&D activity for the public or common good are entitled to exemption from the income and net wealth taxes. Within limits, contributions to these institutions are tax deductible. 2/

1/ *Ibid.*, p. 351.

2/ *Ibid.*, p. 355.

VI. CONDISIDERATION OF ADDITIONAL R&D TAX INCENTIVES

In considering any additional R&D tax incentives for the United States, the following issues should be addressed.

1. Are additional incentives necessary? Although total R&D spending relative to GNP has fallen along with the growth rate since the mid-1960's, industry-supported R&D has increased steadily. The continued strong performance of private R&D is significant because this is the sector that would be most affected by additional tax incentives. Industry spokesmen have noted that the capacity of business to properly absorb the results of successful R&D is limited.

> Greater funding for R&D is not responsive to the problem.... The balance between creating new technology and applying it seems out of whack. The coming decade is a time when we as a nation must see that our R&D results and our accumulated knowledge and technique are applied to tangible engineering projects aimed at specific goals. 1/

Twenty years earlier, when private R&D spending was much lower, another executive echoed similar sentiments.

1/ E. E. David, Jr., President, Exxon Research and Engineering Company, "Engineering and Its Impact on the 1980's." Speech before the Conference of the American Association of Engineering Societies, Houston, Texas, October 16, 1980.

> There is...the question of the rate at which a company or industry can effectively absorb and commercialize the good results coming from its research and development program. Generally the scaling up of new processes costs a great deal more in money and manpower than laboratory research and development and leads to even larger requirements for new production and distribution facilities. 1/

2. Are additional R&D tax incentives the best way to improve productivity or the trade balance? Available studies indicate that reduced R&D spending may have been associated with about 15 percent of the post-1960's productivity decline. The United States already has a large trade surplus in R&D-intensive goods. Although not dismissing the importance of R&D incentives, recent studies stress capital formation incentives as the preferred way of improving economic performance. The Committee for Economic Development concluded that "a more rapid capital recovery allowance is the first-priority action among all the alternative tax measures." 2/ Similiarly, the Advisory Subcommittee on Economic and Trade Policy, a group of business community representatives, stated that "the removal

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1/ Robert W. Cairns, "Income Tax Provisions Regarding Research and Development Expenditures," Tax Revision Compendium, op. cit., p. 1106.

2/ Committee for Economic Development, op. cit., p. 31.

of disincentives to savings and investment should be the primary purpose of tax policy designed to encourage innovation." 1/

3. Do international comparisons suggest a need for more R&D incentives? The United States spends more on R&D than France, Germany, Japan, and the United Kingdom combined. Relative to GNP, its total R&D expenditures compare favorably with other countries, but its civilian R&D expenditures lag somewhat. Most industrial nations, not just the United States, have experienced a post-1960 growth slowdown. Other countries tend to have more generous R&D tax incentives than the United States, but this may simply reflect a different form of support for R&D. Although the percentage has declined in recent years, over 50 percent of total U.S. R&D funding is from government sources. Industry provides a larger share of the R&D budget in West Germany and Japan. 2/ Whether the United States should tilt its

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1/ Advisory Subcommittee on Economic and Trade Policy, "Final Report on Economic and Trade Policy," Advisory Committee on Industrial Innovation, February 1979, p. 13.

2/ National Science Foundation, Science Indicators 1978, p. 7.

support of R&D away from direct expenditure and toward tax incentives is a separate question.

4. Are additional tax incentives preferable to direct expenditures? Additional R&D tax incentives would require new definitions and guidelines to identify the eligible expenditures. It may be difficult, for example, to determine how much of the salaries paid to workers in "white coats" is for product research or development compared to quality control or market analysis. This generally is not necessary under current law since R&D may be expensed whether it generates current or future income. Accordingly, R&D is not even reported separately on the tax return, but is included as part of wages and salaries and other expense items. The Financial Accounting Standards Board set forth broad guidelines identifying R&D activities in its statement requiring the expensing of R&D, but decided against more precise definitions.

> Differences among enterprises and among industries are so great that a detailed prescription of the activities and related costs includable in research and development, either for all companies or on an industry-by-industry basis, is not a realistic undertaking for the FASB. 1/

1/ Financial Accounting Standards Board, "Accounting for Research and Development Costs," October 1974, par. 24.

It may not be a "realistic undertaking" either for the Internal Revenue Service, but a "detailed prescription of... activities and...costs" would be necessary if significant new tax benefits depended on the definition.

In addition to the definitional problem, tax incentives raise other issues. Like expenditures, they absorb government funds. But unlike expenditures, they are a form of Federal financing outside the scrutiny and rigor of the normal budget appropriation process. A tax incentive aimed at a particular segment of the R&D community, such as "technology-based" firms or universities, may redistribute rather than increase total R&D activity. No matter how precisely the intended beneficiary of the incentive is defined, it is difficult to avoid rewarding expenditures that would have been made without the incentive. Making an incentive incremental compounds the administrative problems.

5. If a new R&D tax incentive is necessary, the most sensible would be a R&D tax credit for privately-funded R&D expenditures on wages and equipment. The credit should be taxable and non-refundable. Such a credit would be relatively neutral among R&D projects. It would reduce the cost of all R&D spending, except for structures, by the same

proportion regardless of the economic life of the projects, the mix of current and capital expenditures, or the tax circumstances of most taxpayers. Unlike an incentive aimed at particular R&D expenditures, there would be no incentive for a taxpayer to redistribute, but not increase, its R&D expenditures to qualify for the credit. The credit would work within the market mechanism as firms would be free to pursue the most profitable innovations and technologies. Government officials would not have to make difficult subjective judgments concerning the relative merits of various innovations and technologies. Still, the problem of determining the particular outlays eligible for the credit, as discussed in point 4 above, would remain.