S. HRG. 99-246, PT. IX

TAX REFORM PROPOSALS—IX

HEARING

BEFORE THE

COMMITTEE ON FINANCE
UNITED STATES SENATE

NINETY-NINTH CONGRESS

FIRST SESSION

JUNE 26, 1985

(R&D Tax Credits and Venture Capital Formation)

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TAX REFORM PROPOSALS—IX

WEDNESDAY, JUNE 26, 1985

U.S. SENATE,
COMMITTEE ON FINANCE,
Washington, DC.

The committee met, pursuant to notice, at 9:39 a.m., in room SD-215, Dirksen Senate Office Building, Hon. John C. Danforth presiding.

Present: Senators Danforth, Wallop, Symms, Grassley, Bentsen, Moynihan, and Baucus.

[The press release announcing the hearing follows:]

[Press Release No. 85-040, June 11, 1985]

CHAIRMAN PACKWOOD ANNOUNCES FINANCE TAX REFORM HEARINGS

Senator Bob Packwood (R-Oregon), Chairman of the Committee on Finance, today announced further Committee hearings in June on President Reagan's tax reform proposal.

Chairman Packwood announced the second five days of hearings, as follows:

On Wednesday, June 19, 1985, the Committee will receive testimony from witnesses representing taxpayer organization and public interest groups.

The Committee will hear from public witnesses on the impact of the tax reform proposal on capital formation on Thursday, June 20, 1985.

On Tuesday, June 25, 1985, invited witnesses will discuss the issue of whether the tax-exempt use of industrial development bonds ought to continue.

On Wednesday, June 26, 1985, public witnesses will testify on research and development tax credits, and venture capital formation.

The Committee will receive testimony from economists on the impact of the President's tax reform proposal on the economy on Thursday, June 27, 1985.

All hearings will begin at 9:30 a.m. and will be held in Room SD-215 of the Dirksen Senate Office Building.

Senator DANFORTH. The issue now is S. 58, and generally the question of the R&D credit. And we are delighted to have Secretary Baldrige as our first witness.

STATEMENT OF HON. MALCOLM BALDRIGE, SECRETARY, DEPARTMENT OF COMMERCE, WASHINGTON, DC

Secretary BALDRIGE. Mr. Chairman, thank you.

In the interest of time, I have a statement, but unless you wish, I would just as soon not read it.

Senator DANFORTH. Fine. It will be included in the record.

Secretary BALDRIGE. Because looking at the array of Senators, I know they have some questions. I'll be glad to answer as best I can.

I would just make our opening statement that I am very much in favor of the R&D tax credit and let it go at that.

Senator DANFORTH. Was that the statement?

Secretary BALDRIGE. Yes.

Senator DANFORTH. Oh. [Laughter.]
Well, the next panel——
[Laughter.]
Senator DANFORTH. Thank you. It's wonderful to see the administration so accommodating on every issue and so straightforward. It is appreciated.

Well, let me ask you a question, Mr. Secretary. One of the issues is whether the credit should be made permanent or whether it should be extended for only 3 years. S. 58 would have it made permanent. The version of it included in the administration's tax bill would have a 3-year extension. We have had testimony in the past that one of the most important thoughts in the mind of business people who are planning what to do with their businesses is what is going to be the tax law in the long term. We have given them a fairly jolting experience over the last few years of changing our tax laws seemingly every year. And the testimony in the past has been that planning for research and development is not done on a year by year basis or even a 2- or 3-year basis, but more like a 7- or 8-year basis. Thus, if we are going to have an R&D credit to maximize its effectiveness, we should have a degree of certainty as to its future.

Would the administration be amenable to a permanent R&D credit?

Secretary BALDRIGE. Well, as you know, Mr. Chairman, the administration's position, which I support, is that we already have enough experience to believe that the credit works. We've also had enough experience to know that there are some problems that still have to be worked out. And this provision, no matter however important, must be balanced against the President's overall objective of revenue neutrality. For these reasons, we decided to select a period of 3 years. It gives the credit a fair test, and provides assurances to corporate managers that it will be around for a while. That's why a 3-year extension was selected.

There is still some disagreement—although I must say it's slight—inside the administration about whether all the facts are in. There is a reporting lag since the first provision was enacted that leads some to think that maybe we need more figures.

I was the one back in 1981 who originally lobbied the hardest for and got the R&D credit included in the first tax bill, so, obviously, I am for it. And I think you all know that my personal position is that it is a good thing and ought to be extended and made permanent. But I can certainly support the administration's position that we ought to take enough time to make sure of all the facts.

I would say as a practical matter that I don't see many businessmen who are worried that at the end of the 3 years this will be changed, if, indeed, the Senate passed only a 3-year provision. There just doesn't seem to be that much opposition that makes any sense. Most businessmen will act, in my opinion, as if this was permanent, whether it's in for 3 years or not. This is the second renewal and the figures to date all seem to point toward the fact that it is a success. So as a practical matter it is not difficult for me to go along with the administration's position of another 3 years because I think it will work out.

Senator DANFORTH. The other sections in the bill, in S. 58, are designed to encourage business people to take greater interest in

basic research and in research and teaching in colleges and universities. You have spent most of your life in the business world. The objective here is to create a sense of participation by the business community in healthy research and in basic research in colleges and universities. Is that a worthwhile objection in your view?

Secretary BALDRIGE. Yes, Senator, it certainly is.

Senator DANFORTH. Is it served by the provisions in the bill?

Secretary BALDRIGE. Yes. As you know, the administration hasn't taken a position on that yet, except to say that—the bill should first be passed, some of those details should be cleared up later. So we don't have a position on that yet. But I would say that, personally, Commerce's position would coincide with what you have in your bill.

Senator DANFORTH. Thank you, sir.

Senator Bentsen.

Senator BENTSEN. Thank you, Mr. Chairman.

Mr. Secretary, I'm pleased to see you here. You are, I think, as much as anyone in the administration—you have fought to try to correct this imbalance of trade. And I wish you had won more because you have the kind of background and experience that I think is terribly important in this problem that we are now facing.

We run into a bit of a conflict, Senator Danforth and I, on the R&D credit. When we talk about neutrality in the tax system among companies, I think that we have to use that phrase with some caution because I do think there are reasons to use incentives within that tax system, and I sure think this is one of them.

I know that the testimony of one of the witnesses says that the results for R&D to an individual company are often less than they are for society as a whole. Therefore, there is a tendency for underinvestment in R&D. Would you go along with that?

Secretary BALDRIGE. Yes, sir. I think any sophisticated look at R&D would indicate that. Take the example of robotics or flexible manufacturing systems look at some of the newer kinds of manufacturing techniques that we need to make us competitive in a very competitive world market. Those were invented in the United States. They were not adopted by enough of our companies when they first came out. The Japanese took the lead in robotics by using our technology, and through a series of applied R&D incentives, particulary a mechanism for leasing that was very favorable to the Japanese manufacturers.

It took the United States too long to wake up to that. We are catching up now. We are making real progress in both those areas.

But that's an example of where there are rewards to all of American society in terms of jobs, and ability to compete rather than just to the two or three or four companies who began making robotics in this country. And I might say the same for flexible manufacturing systems.

So, frequently, the populace as a whole, through lowered costs and job creation, are the benefactors—the benefits are spread more broadly than they are just to the one or two companies that began the whole R&D process.

Senator BENTSEN. I see my time is about to expire.

Let me reiterate a question to you that I asked of Mr. Smart. I look at the limitation of current information available to U.S. com-

panies as compared to what the Japanese have been able to find out about our industry, its competition. And I know Senator Baucus has worked on legislation to try to get a translation into English of Japanese scientific reports. Can we get an additional emphasis on that by the Department of Commerce?

Secretary BALDRIGE. You mean on translation of——

Senator BENTSEN. Translations or getting more current input on foreign production and what we are facing from other countries, Japan in particular. I cited the example to Mr. Smart of our information being—the latest information being 1977 as compared to what the Japanes have in more current information.

Secretary BALDRIGE. The Japanese—and I might add the Soviets also—spend a lot more public money on keeping up to date on new developments, and new technologies in the manufacturing sector than the United States does. I'll be glad to look into that, Senator.

Senator BENTSEN. Let me give you a specific. You may not have been in the room when Mr. Smart was testifying.

But each quarter for the last 11 years, the International Trade Administration or its predecessor agencies published a book of charts and tables about international economic indicators which gives some good figures of the trade situation. The last quarterly report which was published March 1985—and this is a different one, an example of it. The staff has been instructed not to continue this valuable publication. Incidentally, I understand it is sold at $5 a copy. They are going to stop that one because of budget constraints. Then you have got another one on—where the Japanese collect the inputs and outputs of various industries of each country. Their current table is 1984. And our current table of that is the year 1977.

Secretary BALDRIGE. Well, I'm advised that our Bureau of Economic Analysis is about to come out with a new one, Senator. I'll look that up when I get back to the office. And I'll write you, if it's all right, or get in touch with you about our plans and whether we are having any financial problems on worthwhile reports.

We put out so many reports that I can't believe they are all worthwhile, but if there are some that we are cutting out that are worthwhile, I want to know about it.

Senator BENTSEN. I can recall one time I had a management consultant in. I was in business. And we were talking about all the reports we put out. And he said, I'll tell you what. He said, have all the reports sent to your office. And he said, after 6 months—he said, have them lined up around the wall. And he said, after 6 months those that are not missed or asked for, we do away with. Something like that might work.

Secretary BALDRIGE. I'd have to move to another office if I did that. [Laughter.]

Senator DANFORTH. Senator Baucus.

Senator BAUCUS. Thank you, Mr. Chairman.

Mr. Secretary, I have two basic questions. The first is whether you think the total amount spent on R&D in this country, is sufficient to get ahead or stay ahead of our major competitors, namely, Japan and the other industrialized countries? I ask the question because as recently as 1982, total U.S. R&D, including civilian and military, was about 2.6 percent of GNP. Civilian R&D in the seven-

ties in the United States was about 1.5; Germany was about 2; and Japan close to 2 percent as well. Japan has also announced a project that spends about 3½ percent of GNP in R&D over the next 10 years.

The second question is: Do you think this bill will provide enough incentive for sufficient R&D generally within the U.S., given the efforts that other countries have undertaken?

Secretary BALDRIGE. Well, I would hesitate to say it's enough. We just don't know. It will clearly be a help. We, at least in my opinion, do spend enough to keep ahead on R&D that I call basic research through one means or another. We are able to devote enough resources to the basic side of research.

I am concerned about applied use of that research. I'm not sure we spend enough in that area. We sometimes get beaten on costs and quality because of implied research to new manufacturing techniques. We have been slow, too slow, compared with our competitors to make use of in the sixties and seventies and perhaps the early eighties. I really see that changing now. I don't think it is changing fast enough yet. But we were clearly behind the curve in new applied research to manufacturing techniques for at least two decades, the sixties and the seventies.

INDUSTRIAL R&D FUNDING HISTORY AND PROJECTIONS

August 14, 1985

The following chart depicts annual funding and annual percentage increase in funding of civilian/corporate R&D since 1960 in current and constant dollars. Funding as a percent of gross national product (GNP) is also shown.

PAST COMPANY FUNDING OF INDUSTRIAL R&D PERFORMANCE 1960-1984

	Billions of Current Dollars		Billions of Constant 1972 Dollars		
Year	Funding	Annual Percent Increase in Funding	Funding	Annual Percent Increase in Funding	As a Percent of GNP
1960	$4.428		$6.445		0.874%
1961	4.668	5.42%	6.733	4.47%	0.890%
1962	5.029	7.73%	7.122	5.78%	0.890%
1963	5.360	6.58%	7.479	5.01%	0.898%
1964	5.792	6.88%	7.959	6.42%	0.908%
1965	6.445	12.50%	8.667	8.90%	0.933%
1966	7.216	11.96%	9.401	8.45%	0.955%
1967	8.020	11.14%	10.144	7.90%	1.003%
1968	8.869	10.59%	10.745	5.93%	1.015%
1969	9.857	11.14%	11.357	5.70%	1.044%
1970	10.288	4.37%	11.250	-0.94%	1.036%
1971	10.654	3.56%	11.097	-1.36%	0.989%
1972	11.535	8.27%	11.535	3.95%	0.973%
1973	13.104	13.60%	12.391	7.50%	0.988%
1974	14.667	11.93%	12.745	2.86%	1.023%
1975	15.582	6.24%	12.387	-2.81%	1.006%
1976	17.436	7.60%	13.175	6.36%	1.015%
1977	19.340	10.92%	13.809	4.81%	1.008%
1978	22.115	14.35%	14.702	6.07%	1.022%
1979	25.708	16.25%	15.731	6.54%	1.063%
1980	30.476	18.55%	17.081	8.58%	1.158%
1981	35.428	16.25%	18.112	6.04%	1.198%
1982	39.512	11.53%	19.053	5.20%	1.287%
1983	42.606	7.83%	19.785	3.84%	1.289%
1984	47.719[1]	12.00%	21.171	7.01%	1.291%

Sources: NSF and Department of Commerce, Bureau of Economic Analysis figures.

[1] NSF estimate.

As the chart shows, annual funding increases have been between 3.56 and 18.55 percent in current dollars and between -2.81 and 8.90 percent in constant 1972 dollars.

The following chart projects R&D company funding for industrial R&D performance for the years 1985-1988.

PROJECTIONS OF COMPANY FUNDING
FOR INDUSTRIAL R&D PERFORMANCE
1985 - 1988

	Billions of Current Dollars		Billions of Constant 1972 Dollars		
Year	Funding	Annual Percent Increase in Funding[1]	Funding	Annual Percent Increase in Funding	As a Percent of GNP[2]
1985	$52.228	9.45%	$22.325	5.45%	1.322%
1986	56.328	7.85%	23.185	3.85%	1.320%
1987	61.476	9.14%	24.377	5.14%	1.335%
1988	67.096	9.14%	25.629	5.14%	1.349%

Source: Department of Commerce, Office of Economic Affairs.

[1] A 4% annual inflation rate is assumed.

[2] A 3 percent annual GNP growth rate is assumed for 1985, 4% for 1986-1988.

We believe the realization of this R&D funding projection is much more likely if the incremental tax credit is extended beyond 1985. In addition, two related factors will continue to increase the effectiveness of industry R&D funding. First, low inflation has allowed firms to buy more R&D for the same amount of money. Second, increased cooperative R&D ventures among firms have not only allowed firms to attack projects too big for any one of them, but have also leveraged their money and manpower by avoiding redundancy of effort.

As to whether we spend enough on R&D the best judge is the marketplace. It is not only a matter of comparing what we spend vis-a-vis our competitors--but, equally important how effectively we make use of the R&D we perform. This latter step involves increasing private sector access to Federally-funded R&D results and increasing the rate at which we actually implement the new technology we or others have invented. I have faith that our private sector can read the marketplace better in the aggregate than the combined government/industry organizations of other countries.

Senator BAUCUS. Actually, this discussion is a little haunting. I sense that Japan is even now one step ahead of us. Japan is moving toward basic R&D research. In my last visit to Japan, I was left with a very strong impression that Japan is more worried about its historical practice of improving upon other countries' technologies. Japan now wants to be more creative. They are investing much more in basic R&D than in the past. They are also seeking—in the Japanese school systems—ways to teach creativity. Their concern is that perhaps the Japanese will be too regimented and technical.

I think you are probably right about the emphasis on applied R&D. But I hope we don't end up neglecting basic R&D. Japan—I don't know the exact figures—will give up to something like 50-percent additional R&D credit for basic research. That's the direction Japan is going.

Do you have any projections as to what American civilian R&D will be if the R&D credit is continued for 3 or 4 years?

Secretary BALDRIGE. We have some estimates. I didn't happen to bring them with me today—but I would say to your previous statement that we have been increasing basic R&D. I don't think we are in danger of being outstripped in that area. We always have to watch out and make sure we are not. But I don't think the trends show that way.

I think we ought to keep our basic R&D growth the same as it has been, but increase the applied research with respect to manufacturing techniques. I would like to see that increase.

Senator BAUCUS. Mr. Chairman, I have one other question.

There are some who argue that our approach in this country of giving R&D credits to individual firms, as helpful as it is, isn't as efficient as it could be. That is, since individual firms are engaged in R&D, they do not enjoy the advantage of cooperation and sharing results as much as they otherwise might. The suggestion has been made that—perhaps in addition to an R&D tax credit—we should have some kind of national science foundation for industry or a panel of industry-Government peers to give grants much in the way the NFS does. The U.S. Government might also give grants and help with pooling. What is your reaction to that?

Secretary BALDRIGE. Well, you could probably answer the question for me, Senator. You know what my reaction would be.

The French tried that in the past. The Japanese have tried it. We hear about—we haven't seen too many successes with it in France. We have seen some successes with that method in Japan, but we tend to overlook the failures that have come about too.

I think for our system that there isn't a better way than the discipline of the marketplace. People will develop what they think will work and will be used, and what will be profitable.

The problem in trying to have any kind of a panel to direct R&D funds, other than for basic research as we do in some of our national labs, is that no group is wise enough to be able to spend that money better than it is spent by individual companies now.

We've had a very good record of developing from research the items I mentioned earlier—flexible manufacturing systems, robotics, computer advances and so forth. Where we have fallen behind is simply by not making use of them or, by watching other coun-

tries almost force-feed their manufacturing systems by leasing various kinds of grants and subsidies. But as for the development of the techniques that come from R&D—I haven't seen anybody come close to the United States. And that certainly applies to Japan. Their success has been by and large from taking our inventions and not even necessarily developing them anymore, but just having people use them over through various kinds of incentives.

Senator BAUCUS. I agree with you. Could you for the record provide the Department's projection on what American R&D will be?

Secretary BALDRIGE. Sure.

Senator BAUCUS. You have probably heard of one joint Government—industry project in Japan to develop a roboticized garment industry.

Secretary BALDRIGE. To develop a what?

Senator BAUCUS. Roboticized garment industry. That is, the computerized systems—the retail outlets will be set up so that you go into a retail outlet and you are sized up for your clothes. That is, you are measured for suit, jacket, trousers and so forth. That's all put into a computer and the computer sends the measurements to the factory, and the factory then tailor makes your own specific suit, the idea being that, of course, they can cut down on costs and have tailor-made clothes .

So my question is whether that is going to work or not. It may not work. But it would be interesting if it does.

Secretary BALDRIGE. I could be wrong, Senator, but that sounds like a sure loser to me. [Laughter.]

Senator BAUCUS. It could be, but it's interesting. Thank you.

Senator DANFORTH. Senator Grassley.

Senator GRASSLEY. I suppose if I don't explain, my question might appear to be unfriendly and it is not, because I have been a supporter of R&D tax credits. And as far as I can tell from the President's proposal and what I have co-sponsored I would be supportive of both.

But isn't it a fact that the foreign tax credit is needed to some extent due to the inadequancy of our policy? We are finding ourselves noncompetitive in many areas of in foreign trade, and so we have the R&D tax credit to help us develop new markets, and to be more competitive in the international market. However, if we had been more hard-nosed and would become more hard-nosed in our international trade policies, particularly dealing with the European Community and the Japanese, we would be more competitive in the technical markets and then less in need of an R&D. So isn't it kind of like locking the barn door after the horse is stolen? If we are really going to be truly successful in this area, the R&D research credit is not—it may be an answer, but it's surely not the best answer.

Secretary BALDRIGE. Well, I understand your point, Senator, and it isn't an answer to lack of a trade policy. It won't fill in for or substitute for trade policy. There is no way it can do that. But let's assume that everyone's trade stayed at the same level for some time. And the R&D efforts among our competitors grew and the R&D in the United States did not grow. We would soon be in real trouble if we were to decide not to give R&D incentives because

that decision doesn't mean that the rest of the world would decide to go along.

There are very strong incentives for research and development among all our major industrial competitors. It would simply mean that they would get ahead of us.

But I would have to agree that you can't call on R&D policy to substitute for trade policy.

Senator GRASSLEY. Well, I assume that we find ourselves slipping behind not because of the tax policies in the other countries in this area, but because of their governments' subsidies in these areas. That's what I thought our trade policies should address. And if they had, then we wouldn't be in the trade deficit position as we are now in. Am I right on the issue of subsidies as opposed to the tax policies of the other countries?

Secretary BALDRIGE. Yes. We've tried to tackle all subsidies that we can especially where we've had a legal case to move against them. We've had some hundreds of cases since I've been Secretary of Commerce in which we have decided that there is a subsidy and have put a countervailing duty on it.

But I think our greatest trade problem, even larger than our fight against subsidies abroad, is the strength of the dollar. That's gone up 50 percent since the 1979-80 period. And it recently has gone down about 10 percent. So now it's about 40 percent higher than it was at the turn of the decade. That's almost exactly like a 40-percent tax on our exports, and a 40-percent incentive on imports. The largest reason by far for our trade deficit is the strength of the dollar.

And we could have another hearing on what it takes to bring that down, but that's what is eating our lunch today. It's the strength of the dollar.

Senator DANFORTH. Mr. Secretary, thank you very much for being here. It is a very important subject. The fact the R&D credit is included in the administration's tax bill, which does away with tax credits, I think indicates the significance that is placed on it by the administration, and by your appearance here today also.

Secretary BALDRIGE. Thank you, Mr. Chairman, and members.

[The prepared written statement of Secretary Baldrige follows:]

STATEMENT OF

SECRETARY OF COMMERCE MALCOLM BALDRIGE

BEFORE THE

SENATE FINANCE COMMITTEE

EXTENSION OF THE RESEARCH AND EXPERIMENTATION CREDIT

AS PROPOSED IN "THE PRESIDENT'S TAX PROPOSALS TO

THE CONGRESS FOR FAIRNESS, GROWTH, AND SIMPLICITY"

JUNE 26, 1985

MR. CHAIRMAN AND MEMBERS OF THE COMMITTEE, I AM VERY PLEASED TO BE HERE THIS MORNING TO TESTIFY ON ONE OF THE MORE IMPORTANT FEATURES OF THE PRESIDENT'S TAX PROPOSALS: EXTENDING THE RESEARCH AND EXPERIMENTATION CREDIT THAT IS DUE TO EXPIRE AT THE END OF THIS YEAR. THE PRESIDENT WANTS - AS WE ALL DO - FAIRNESS, SIMPLICITY AND GROWTH. THE CREDIT IS FAIR AND, AT LEAST BY THE STANDARDS OF THE TAX CODE, SIMPLE. BUT IN A LARGER SENSE, ANY DISCUSSION ABOUT R&E IS A DISCUSSION ABOUT THE THIRD GOAL - GROWTH.

TO EXTEND THE 25% INCREMENTAL RESEARCH CREDIT, WE NEED A "YES" ANSWER TO AT LEAST TWO FUNDAMENTAL QUESTIONS. FIRST, IF CORPORATE MANAGERS AREN'T SPENDING ENOUGH MONEY ON R&E, IS IT FAIR TO ASK THE AMERICAN TAXPAYERS TO PROVIDE THEM WITH AN INCENTIVE THROUGH THE TAX SYSTEM? SECOND, IF WE DO AGREE THAT A TAXPAYER-SUPPORTED INCENTIVE IS APPROPRIATE, CAN THE CREDIT WE ARE NOW USING BE IMPROVED?

THE ANSWER TO BOTH IS UNQUESTIONABLY YES.

TURNING TO THE FIRST, THE REASONS THAT DICTATE WHETHER A COMPANY WILL INVEST IN R&E ARE COMPLEX. MANY PEOPLE WHO TRY TO ANALYZE CORPORATE BEHAVIOR INSTINCTIVELY UNDERSTAND THE IMPORTANCE OF R&E TO INNOVATION. THEY ALSO UNDERSTAND THAT INNOVATION, IN TURN, IS THE PRINCIPAL SOURCE OF PRODUCTIVITY, COMPETITIVENESS, AND ECONOMIC GROWTH. YET EVEN THESE NORMALLY CLEAR-HEADED OBSERVERS CAN FALL INTO SOME DANGEROUS TRAPS.

ONE TRAP IS THE ARGUMENT THAT MANAGERS ARE UNWILLING TO MAKE THESE IMPORTANT EXPENDITURES BECAUSE THEY HAVE SOMETHING CALLED A "SHORT-TERM HORIZON." THIS THEORY IS POPULAR AMONG THOSE WHO BELIEVE THAT STOCK MARKETS ARE DOMINATED BY LARGE INSTITUTIONAL INVESTORS WHO DO NOT PARTICULARLY VALUE LONG-TERM PROJECTS SUCH AS R&E. ACCORDING TO THE THEORY, UNLESS CORPORATE MANAGERS FOCUS ON SHORT-TERM PROFITS, THEIR COMPANIES WILL BE SUBJECT TO A HOSTILE TAKEOVER AND THEY MAY BE OUT OF THEIR JOBS.

THAT'S A NICE THEORY IF YOU WANT TO BELIEVE THAT MANAGERS ARE SHORT-SIGHTED AND SELFISH AND THAT INVESTORS ARE NOT TOO BRIGHT. I DON'T HAPPEN TO SHARE THAT VIEW. FOR THAT REASON, I WAS PLEASED TO LEARN OF THE RECENT SEC STAFF STUDY THAT DEMONSTRATED THAT INVESTORS ARE NOT FOOLED BY FIRMS THAT CUT BACK ON SOUND LONG-TERM INVESTMENT TO INFLATE PRESENT EARNINGS. IN OTHER WORDS, WE ARE NOT SUPPORTING EXTENSION OF THE CREDIT BECAUSE MANAGERS AND INVESTORS SUFFER FROM MYOPIA WHERE R&E IS CONCERNED.

THE SECOND TRAP IS THE ARGUMENT THAT IF R&E IS SO IMPORTANT, AND WE ALL AGREE THAT IT IS, MARKET FORCES WILL COMPEL CORPORATE MANAGERS TO UNDERTAKE THESE INVESTMENTS. WHY USE SCARCE TAX REVENUES? AFTER ALL, DOESN'T THE REAGAN ADMINISTRATION HAVE ENORMOUS FAITH IN THE MARKETPLACE?

OF COURSE WE DO, BUT IT'S A FAITH THAT SPRINGS FROM AN UNDERSTANDING OF WHAT MARKETS CAN AND CANNOT DO RATHER THAN A

BLIND FAITH. THE CENTRAL POINT TO UNDERSTAND ABOUT THE MARKET IN THIS CONTEXT IS SIMPLY THIS: THE RATE OF RETURN ON R&E TO THE ECONOMY AS A WHOLE IS GREATER THAN THE RETURN TO INDIVIDUAL INVESTORS. IN OTHER WORDS, EVEN IF A PRIVATE FIRM REASONABLY EXPECTS SOME PROFIT, WHICH IS NOT ALWAYS THE CASE, IT CAN RARELY HOPE TO CAPTURE ALL OF THE ECONOMIC BENEFIT FROM THE INVESTMENT IT IS UNDERTAKING.

AUTOMATED MANUFACTURING IS A GOOD EXAMPLE OF HOW A TECHNOLOGY DEVELOPED BY A FEW COMPANIES SPREAD TO MANY FIRMS IN MANY INDUSTRIES. WE ALL BENEFITED, BUT ONLY SOME TOOK THE RISK. FOR THAT REASON, I THINK THE PRESIDENT'S PROPOSAL WAS RIGHT ON THE MARK WHEN IT SAID "THERE ARE REASONABLE GROUNDS FOR BELIEVING THAT MARKET REWARDS TO THOSE WHO TAKE THE RISK OF RESEARCH AND EXPERIMENTATION ARE NOT SUFFICIENT TO SUPPORT AN OPTIMAL LEVEL OF SUCH ACTIVITY." ONE CAN RESPECT MARKET FORCES WHILE APPRECIATING THEIR LIMITATIONS.

IN SUM, GIVEN THAT THE TAXPAYERS AS A WHOLE BENEFIT I DON'T THINK IT IS UNFAIR TO ASK THEM TO PROVIDE SOME ASSISTANCE - ASSUMING WE CAN SHOW THEM SUFFICIENT EVIDENCE THAT THE CREDIT HAS BEEN DOING THE JOB IT WAS INTENDED TO DO.

IT IS TEMPTING TO LOOK AT SOME RECENT INCREASES IN AGGREGATE R&E SPENDING SINCE 1980 AND ATTRIBUTE THEM TO THE INCREMENTAL CREDIT, BUT I DOUBT THAT WOULD BE VERY FAIR. ONE, THE ECONOMY SUFFERED A

SEVERE RECESSION IN 1981-1982 WHICH MAY HAVE MADE OTHER INVESTMENT ALTERNATIVES LESS ATTRACTIVE. TWO, THE RESEARCH PROCESS IS INHERENTLY LONG-TERM IN NATURE AND THE SOON-TO-EXPIRE CREDIT WASN'T FULLY PHASED IN UNTIL 1983. THREE, I HAVE TO WONDER AS TO HOW SUCCESSFUL THE LAWYERS AND ACCOUNTANTS HAVE BEEN IN RECHARACTERIZING EXPENSES AS R&E THAT MIGHT HAVE BEEN TREATED OTHERWISE BUT FOR THE CREDIT'S AVAILABILITY - A PROBLEM THAT SHOULD DIMINISH IN TIME AS WE REFINE THE STATUTE.

STILL, THERE IS EVIDENCE THAT THE CREDIT HAS IN FACT CONTRIBUTED TO INCREASED R&E EXPENDITURES SINCE 1980. AS NOTED, R&E SPENDING REMAINED STRONG DURING THE RECESSION. MOREOVER, TOTAL R&E SPENDING, IN CURRENT DOLLARS, INCREASED STEADILY FROM ABOUT $30 BILLION IN 1980 TO MORE THAN $42 BILLION IN 1983. THE NATIONAL SCIENCE FOUNDATION CURRENTLY ESTIMATES THAT THE FIGURE FOR 1984 WILL BE $47.7 BILLION. I UNDERSTAND THAT BUSINESS WEEK'S NEXT ISSUE WILL REVEAL THE RESULTS OF ITS OWN STUDY OF 826 FIRMS WITH ANNUAL R&E EXPENDITURES OF MORE THAN $1 MILLION. IT WILL SHOW TOTAL R&E EXPENDITURES FOR 1984 OF A SIMILAR ORDER AS WELL AS A DRAMATIC INCREASE IN R&E AS A PERCENTAGE OF SALES.

I CANNOT ILLUSTRATE THE CREDIT'S VALUE BY TELLING YOU "WERE IT NOT FOR THE CREDIT, COMPANY A WOULD NOT HAVE UNDERTAKEN PROJECT X." WHAT IS IMPORTANT IS REVEALED IN THE STATEMENTS AND TESTIMONY OF EXECUTIVES FROM SUCH FIRMS AND ORGANIZATIONS AS MOTOROLA, BELL LABS, IBM, THE AMERICAN ELECTRONICS ASSOCIATION, THE SEMICONDUCTOR

INDUSTRY ASSOCIATION AND A NUMBER OF VITAL, VIBRANT SMALLER COMPANIES THAT SO OFTEN HOLD THE KEY TO THE FUTURE: BY REFLECTING A NATIONAL COMMITMENT TO R&E AND BY INCREASING THE POOL OF FUNDS AVAILABLE TO A GIVEN COMPANY FOR DESIRABLE PROJECTS, THE CREDIT HAS BECOME AN INTEGRAL PART OF CORPORATE THINKING. THIS, IN TURN, HAS CONTRIBUTED TO AN INCREASED SENSITIVITY TO THE IMPORTANCE OF RESEARCH.

MOVING FROM THE GENERAL TO THE SPECIFIC, THE CREDIT HAS BEEN CITED AS ONE OF THE PRINCIPAL FACTORS THAT INFLUENCED SUCH MAJOR CORPORATIONS AS BURROUGHS, DU PONT, GE, HEWLETT-PACKARD, HONEYWELL, IBM, RCA AND ABOUT TWENTY OTHERS OF SIMILAR SIZE TO SUPPORT THE SEMICONDUCTOR RESEARCH CORPORATION. SRC WAS FORMED TO PROMOTE BASIC RESEARCH AND SCIENTIFIC STUDY BY UNIVERSITIES IN ENGINEERING, MATH, AND SEMICONDUCTOR TECHNOLOGY. IT IS NOW ACTIVELY ENGAGED IN SUCH AREAS AS COMPUTER-AIDED DESIGN OF INTEGRATED CIRCUITS, PROPERTIES OF SILICON MATERIAL, LITHOGRAPHY, FAULT TOLERANCE, MICRO-PACKAGING AND MANUFACTURING SYSTEMS RESEARCH.

IN SUM, THE R&E CREDIT MAKES SENSE AND EVEN THOUGH THE FEW YEARS IT HAS BEEN ON THE BOOKS HAVE NOT ENABLED US TO OBTAIN AS MUCH INFORMATION AS WE WOULD HAVE LIKED, IT APPEARS TO BE DOING ITS JOB. IF WE CONTINUE IT, THEN WE WILL BE MAKING IT EASIER FOR R&E MANAGERS TO COMPETE MORE EVENLY AGAINST OTHER CLAIMANTS FOR LIMITED CORPORATE FUNDS. WE WILL BE ENCOURAGING TECHNOLOGICAL

INNOVATION WITHOUT PUTTING GOVERNMENT IN THE BUSINESS OF TRYING TO "PREDICT WINNERS" - THE INITIATION, DESIGN AND SCOPE OF THE PROJECTS WILL REMAIN THE SOLE RESPONSIBILITY OF INDIVIDUAL COMPANIES AND THE FREE MARKET. FINALLY, WE WILL REAFFIRM OUR COMMITMENT TO INCREASING THE ABILITY OF AMERICAN FIRMS TO COMPETE IN WORLD MARKETS.

THAT BRINGS ME TO THE SECOND QUESTION I RAISED EARLIER - UNDER WHAT CONDITIONS SHOULD THE CREDIT BE EXTENDED? HOW, IF AT ALL, CAN IT BE IMPROVED? THE THREE BASIC PROBLEMS ARE:

- WHAT KINDS OF R&E SHOULD QUALIFY?
- IS THE CREDIT IMPROPERLY DENIED TO FIRMS THAT CAN PUT IT TO GOOD USE AND DESERVE TO HAVE A CHANCE TO DO SO?
- FOR HOW LONG SHOULD IT BE EXTENDED?

AS TO THE FIRST, I AGREED WITH THE APPROACH THIS COMMITTEE TOOK LAST YEAR OF DEFINING "QUALIFYING RESEARCH" TO TIE THE CREDIT MORE CLOSELY TO EXPERIMENTS RELATING TO INNOVATION RATHER THAN TO MATTERS OF STYLE, TASTE, COSMETICS, OR SEASONAL VARIATIONS. THE DEFINITION SHOULD BE TIGHTENED SENSIBLY BUT WE NEED TO MAKE SURE WE AVOID ONE PITFALL. HOWEVER MUCH WE MAY WANT TO TIE THE CREDIT TO INNOVATIVE ACTIVITIES, WE MUST TAKE CARE NOT TO ADOPT A

DEFINITION THAT MAKES THE CREDIT UNAVAILABLE TO FIRMS THAT ARE TRYING TO CATCH UP WHEN A FOREIGN COMPETITOR WAS FIRST TO DEVELOP A NEW PRODUCT OR PROCESS.

THE SECOND ISSUE INVOLVES THE STATUTORY REQUIREMENT THAT THE CREDIT BE AVAILABLE ONLY FOR R&E CARRIED ON IN CONNECTION WITH THE TAXPAYER'S TRADE OR BUSINESS. THIS OPERATES TO DENY IT TO NEW FIRMS, EXISTING FIRMS TRYING TO ENTER NEW TRADES OR BUSINESSES, AND CERTAIN PARTNERSHIPS. THESE ARE THE FIRMS IN WHICH SOME OF THE MOST INNOVATIVE ENTREPRENEURIAL ACTIVITY TAKES PLACE. IT WOULD BE A MISTAKE TO DENY THEM ITS BENEFITS. LAST YEAR THE COMMITTEE TOOK GREAT PAINS TO RESOLVE THIS PROBLEM AND IT AGAIN DESERVES YOUR ATTENTION.

AFTER THE PRESIDENT'S PACKAGE HAS BEEN ENACTED AND THE CREDIT HAS BEEN MADE AVAILABLE TO FIRMS YOU BELIEVE ARE UNFAIRLY DENIED IT, THE COMMITTEE SHOULD EXPLORE WAYS OF PROVIDING AN INCENTIVE FOR CASH-POOR FIRMS JUST STARTING OUT THAT HAVE NO TAX LIABILITIES. THEY WILL BE UNABLE TO TAKE ADVANTAGE OF THE CREDIT EVEN IF THE "TRADE OR BUSINESS" LIMITATION IS MODIFIED. A REFUNDABLE CREDIT IS NOT THE ANSWER. THAT WOULD BE EXPENSIVE AND WOULD SET A BAD PRECEDENT. WE AT COMMERCE ARE EXPLORING THE QUESTION OF WHETHER THE CREDIT SHOULD BE MADE AVAILABLE TO R&D LIMITED PARTNERSHIPS. THEIR INVESTMENT IS PRIMARILY TARGETED TO START-UPS.

FINALLY, WE COME TO THE QUESTION OF DURATION - FOR HOW LONG SHOULD THE CREDIT BE EXTENDED? THE BASIC DILEMMA IS THAT BECAUSE R&E

EXPENDITURES REPRESENT A LONG-TERM COMMITMENT, CORPORATE MANAGERS MUST HAVE REASONABLE ASSURANCE THAT THEY WILL BE ABLE TO TAKE ADVANTAGE OF IT IN THE OUT-YEARS. THAT IS, THE PERIOD OF EXTENSION WILL HAVE A VERY REAL EFFECT ON THE LEVEL OF INVESTMENT. LAST YEAR THIS COMMITTEE, IN ITS REPORT ON THE DEFICIT REDUCTION ACT, RECOGNIZED THAT THE ABSENCE OF ASSURANCE THAT THE CREDIT WOULD BE AVAILABLE AFTER 1985 WOULD ADVERSELY AFFECT THE START OF NEW PROJECTS IN 1984 OR 1985.

WE HAVE ENOUGH EXPERIENCE TO BELIEVE THE CREDIT WORKS BUT WE ALSO HAVE ENOUGH TO KNOW THERE ARE SOME PROBLEMS THAT HAVE TO BE WORKED OUT. GIVEN THAT THIS PROVISION, HOWEVER IMPORTANT, MUST BE BALANCED AGAINST THE PRESIDENT'S OVERALL OBJECTIVE OF REVENUE NEUTRALITY, WE MUST SELECT A PERIOD THAT (A) GIVES THE CREDIT A FAIR TEST, AND (B) PROVIDES ASSURANCES TO CORPORATE MANAGERS THAT IT WILL BE AROUND FOR A WHILE. THE PRESIDENT'S TAX PACKAGE BALANCES THESE FACTORS AND RECOMMENDS A THREE-YEAR EXTENSION.

I WILLL BE PLEASED TO ANSWER ANY QUESTIONS.

Senator DANFORTH. Next we have a panel consisting of Dr. Joseph Rowe, vice chairman and chief technical officer, Gould, Inc., and chairman of the Coalition for the Advancement of Industrial Technology; Dr. Joseph A. Saloom, senior vice president, M/A-Components, on behalf of New England Council, Burlington, MA; Dr. Robert Lawrence, Senior Fellow, The Brookings Institution; Dr. Robert Barker, university provost, Cornell University, Ithaca, NY.

I just want to say as the panel is taking its place that Senator Packwood asked me to extend his apologies to all witnesses for not being here this morning. It happens that at the time we are having this hearing, on the floor of the Senate is the imputed interest bill, and he is the manager of that bill. Therefore, he cannot attend.

Also, there is a meeting at the White House a little later this morning so I'm going to have to be leaving for that. But my departure in no way indicates lack of interest. I think that the R&D credit is very important in maintaining our research and technological edge.

Gentlemen, unless there is some objection, let's proceed in the order in which your names appear on the witness list.

Dr. Rowe, would you like to go first?

STATEMENT OF DR. JOSEPH ROWE, VICE CHAIRMAN AND CHIEF TECHNICAL OFFICER, GOULD, INC.; AND CHAIRMAN, COALITION FOR THE ADVANCEMENT OF INDUSTRIAL TECHNOLOGY

Dr. ROWE. Thank you, Mr. Chairman.

I'd like to open by commending you, Mr. Chairman, and the members of your committee for setting aside time to look at the research and development aspect of tax reform.

We certainly agree that as we overhaul the Tax Code we need to be ever mindful of the impact of the tax policy on our industrial and international competitiveness.

As vice chairman and chief technical officer of Gould and as chairman of the Coalition for the Advancement of Industrial Technology, I'm therefore very pleased to appear before you. My comments represent the views of the coalition, which consists of some 57 research oriented corporations, 16 research universities, and 9 trade associations.

In our opinion, there is no issue of greater importance to our country than to channel our entrepreneurial energy in order to survive the fierce international competition that we find ourselves in. And in the face of this competition, economic arguments in favor of the R&D tax credit take on an added urgency.

We believe that public policy should recognize the strong and very positive correlation that exists between R&D spending and international and industrial competitiveness. And although the relationship between high levels of R&D spending and success in world markets is generally accepted, the United States ranks behind Japan and West Germany with regard to the percentage of gross national product devoted to civilian R&D. That position is untenable from industry's point of view.

I was very pleased to hear Secretary Baldrige make a strong statement in support of permanency of the R&D tax credit. Our coalition would certainly support that.

When we formed the coalition last fall, we felt that pursuit of the tax credit in 1985 would, obviously, have to be based on solid, favorable evidence, and the case would have to go beyond the interest of any single industrial firm or any single university, for that matter. And so to obtain an independent assessment of the need for the tax credit, the coalition commissioned Martin Bailey and Robert Lawrence, senior fellows at The Brookings Institution and Data Resources, Inc., to conduct an indepth review.

I would like to just summarize a few points from their findings.

No. 1, there is chronic structural under-investment in industrial research and development simply because the firms can't capture fully the returns for inherently long-term risky R&D investments. The second point: there has been a dramatic increase in R&D spending since the credit was adopted in 1981. From a level of some $30 billion in 1980, industrial R&D is expected to reach a level of approximately $55 billion this year. And for the first time in 1981–82, company R&D spending actually increased during a recessionary period.

And the final point there—a permanent tax credit, we believe, will yield substantial gains for the economy as a whole. The research indicates that their gains could be as much as $17 billion in increased gross national product annually beginning in 1991.

I'd like to give two brief examples from Gould's experience. First, is the investment in a new field of semiconductor research, that of gallium arsenide compound research and device development. That field is still in its infancy. It was certainly in its infancy in the 1980–81 timeframe. And Gould has made major investments into that field to stimulate new research.

Another example is the area of fiberoptics and the experience is somewhat similar.

May I go on?

Senator DANFORTH. Yes, sir, but if you could summarize.

Dr. ROWE. I would like also to address the need to strengthen ties between industries and universities. And that speaks to the point of additional support for basic research. The basic research conducted in universities is important to American industry and it's achievement of competitive status worldwide. And an additional tax credit which would further strengthen the ties between industry and the universities, we strongly believe, will work to the benefit of the Nation.

Finally, I would just like to mention, as you probably already know, the Congressional Research Service has supported R&D tax credit in the context of a major tax overhaul. And CRS also indicated that they believe it should be made permanent.

Thank you.

Senator DANFORTH. Thank you.

[The prepared written statement of Dr. Rowe follows:]

TESTIMONY OF DR. JOSEPH E. ROWE
VICE PRESIDENT AND CHIEF TECHNICAL OFFICER -- GOULD, INC.
CHAIRMAN, C.A.I.T.
BEFORE THE SENATE FINANCE COMMITTEE

June 26, 1985

I want to begin by commending you, Mr. Chairman, for setting aside the time to look at the research and development aspects of tax reform. These hearings indicate that the Senate Finance Committee recognizes that as we review the tax code, we need to be ever mindful of the impact of tax policy on our industrial and international competitiveness.

Technological leadership is one of our nation's most important resources. It has meant the development of new, cutting-edge products and also the application of technology to manufacturing processes of other products.

President Reagan's tax reform message indicated that we are in the Age of the Entrepreneur and that, as we head into the 1990s, there is no issue of greater importance than how to channel our entrepreneurial energy to survive fierce international competition. In recognition of this challenge, the Administration's tax plan extends the research and development tax credit.

As Vice Chairman and Chief Technical Officer of Gould, Inc., and also as Chairman of the Coalition for the Advancement of

Industrial Technology, I am therefore extremely pleased to appear before you. My comments on the research and development tax credit represent the views of 57 research-intensive corporations, 16 research universities, and nine associations.

The R&D Tax Credit and Industrial and International Competitiveness

We will discuss in greater detail the economic arguments for the research and development tax credit. At the onset, however, I want to emphasize that these arguments for the credit take on added urgency in the face of massive and record-setting trade deficits. These trade deficits -- $123 billion last year -- raise fundamental questions that rival deficit reduction and tax reform in national importance: How do we craft public policies that encourage competitive advantage?

Public policy should acknowledge the strong, positive correlation between R&D spending and international competitiveness. As a study by the Congressional Budget Office recently found, "a strong R&D effort is characteristic of American industries that are effective international competitors."

Yet, although the relationship between high levels of R&D spending and success on world markets is widely accepted, the United States ranks fifth among Japan, West Germany, France and

the United Kingdom with regard to percentage of gross national product devoted to civilian R&D. And, although this gap has begun to be closed since the credit was adopted, our major international competitors also have adopted aggressive policies to stimulate industrial research, particularly in high technology fields. Japan, for example, has had a tax credit in effect since 1966; according to the Japanese Science and Technology Agency, their R&D tax credit raised the level of industry-funded R&D 45% higher than it would have been in the absence of the credit.

A key component of our nation's ability to compete abroad and enjoy healthy growth at home is productivity growth. Here, most economists agree, the most important determinant of productivity growth is innovation which, in turn, depends largely on research and development. Hence, R&D spending is a vital part of the process by which productivity growth and improvements in living standards are achieved in our economy.

Finally, R&D spending has assumed a unique direction in the decade of the eighties. For the past twenty years, the high technology sector has experienced rapid and often dramatic growth and technological breakthroughs. While this growth will undoubtedly continue, it is increasingly accompanied by a relatively new phenomenon -- that is, the spread of new process and control technologies to mature industries. The adoption of advanced technology has already occurred in many industries but knowledgeable observers feel it will become even more of a driving force in the R&D field in coming years.

The Case for the R&D Tax Credit

When the Coalition was formed last fall, we felt that pursuit of a tax credit in 1985 would have to be based on a very solid body of favorable evidence. This case would have to go beyond the interests of any single firm or university.

As a group we were convinced that the R&D tax credit was working to substantially increase industrial R&D spending and that it benefitted society as a whole. But we decided that we also needed an independent assessment of those conclusions.

We therefore commissioned a study on the research and development tax credit. The study was conducted by Martin Baily and Robert Lawrence, both senior fellows with the Brookings Institution, and Data Resources, Inc. Dr. Robert Lawrence, who is also the author of the recent book Can American Compete?, is here with us today to explain in greater detail the results of their study.

The central point of the Baily/Lawrence study, a point I add that is widely accepted by economists, is that there is chronic, structural underinvestment in industrial research and development. Because firms cannot capture fully returns from their R&D investments, they will spend less on these highly risky

activities than is in society's best interests. In the high-tech sector, in which I work, the risks are multiplied because it is not uncommon for technological obsolescence to occur within just a few years or for competitors to gain access to new technology through "reverse engineering."

In this highly competitive environment, therefore, it is a fundamental characteristic of high technology electronics firms that they must continually develop and apply new technologies and products. Any firm which fails to do this will soon find that its products have been rendered obsolete by foreign competitors.

The R&D tax credit stimulates investments in company research by lowering the after-tax cost of such work. Since the credit was first adopted in 1981, dramatic increases have occurred in industrial R&D. From about $30.9 billion in 1980, company R&D spending is expected to reach $55 billion this year.

I think it is important to note that, for the first time, R&D spending by companies actually increased during a recession. Even though the R&D tax credit was not fully phased in until 1983, over the 1981-82 recession we feel the credit was already having a beneficial effect on R&D budgets. By contrast, total corporate expenditures for investment in plant and equipment fell from $216 billion in 1981 to $207 billion in 1982.

In short, structural underinvestment in R&D can be at least partially offset by a tax credit. In their study, Baily, Lawrence and DRI project for the first time the anticipated effect of a permanent R&D tax credit and found that such a policy could add as much as $17 billion a year to gross national product by 1991. This new taxable wealth would more than offset any Treasury loss due to the credit by that time.

Drs. Baily and Lawrence found that extending the credit was in the country's best interests. Study after study by a broad spectrum of other authorities and organizations agree that one of the most important steps Congress can take to keep our firms competitive is to keep the R&D tax credit. These studies include recently released reports by:

- The President's Commission on Industrial Productivity;
- The Business-Higher Education Forum;
- The National Association of Manufacturers;
- The White House Conference on Productivity;
- The U.S. Chamber of Commerce;
- Georgetown University's Center for Strategic and International Studies;
- The Joint Economic Committee; and
- The Congressional Research Service

The R&D Tax Credit: An Example of How it Works

From my own company's vantage point, the credit has become a key factor enabling us to compete more effectively. A good example of how the credit helps expand research efforts is Gould's work in fiber optics. Several years ago, we realized that any research into single mode fiber optic devices was extremely risky and expensive. The role of the R&D tax credit in the decisionmaking process on the fiber optics projects was clear -- by reducing the after-tax cost of the research, the credit was an important factor persuading us to accelerate our research in this area.

As a result, we are now nearing completion of a project to develop a new type of coupler that will be used to merge two or more optical fibers with minimal light loss from one fiber to the next.

Gould's experience illustrates that the credit is doing what it was designed to do -- expand and accelerate industrial R&D.

The Role of Universities and Independent Research Institutes

As Dr. Robert Barker, University Provost of Cornell University will explain to you shortly in greater detail, the Coalition strongly supports the provisions contained in S. 58 which are designed to encourage closer corporate ties with

research universities and independent, tax-exempt research institutes.

As many of you know, the existing R&D tax credit has not only stimulated in-house industrial research but has also helped increase corporate grants to universities and tax-exempt research institutes for basic research. This has occurred because companies can apply 65% of the cost of our contract research -- including that which is contracted out to universities and institutes -- toward the incremental R&D credit.

There is no doubt but that industry is a more important source of university research funds than it has been for many years. Because of the unique nature of university research which provides the underlying knowledge for most technological advances, we believe the time has arrived to adopt a new, separate credit to further company ties to basic research institutions. Accordingly, we strongly support the provision in the proposed Senate legislation that would provide for a separate, 20% flat rate credit for that portion of a company's basic research expenditures that exceeds a substantial threshold level. The remainder of a company's basic research payments to universities and non-profit institutes would remain eligible for the R&D tax credit as under present law.

We also support improved incentives to encourage corporate donations of advanced scientific equipment. According to a recent survey by the American Society for Engineering Education, most engineering equipment in university laboratories is 20-30 years old and equipment to teach new technologies is almost non-existent. Current law adopted in the 1981 tax legislation does not allow the enhanced deduction for donations of scientific equipment for educational purposes as would pending legislation, but rather restricts these donations to research applications. Also, the pending bill would make donations of computer software eligible for the deduction as well as donations of state-of-the-art equipment used in the taxpayer's trade or business.

These changes, we feel, would make the enhanced donation provisions more useful to colleges and universities in need of advanced scientific equipment for training and research purposes. Without help, many of these institutions will not be able to afford this often extremely expensive equipment.

Improving the R&D Tax Credit

Over the past year, the Coalition and others have reviewed the R&D tax credit's effectiveness and looked at ways it could be improved. There are three basic improvements that I want to underscore this morning.

The first is to make the credit permanent. Research and development is a long-term process. Many research projects take from five to ten years to complete.

The problem is that a temporary credit, especially one that is about to lapse, distorts R&D investment decisions. If the tax incentive embodied in the credit seems problematic, then a company's ability to overcome the financial risks associated with R&D is reduced and could lead to termination of some projects.

Many researchers who have examined the credit agree that it should be made permanent to have its full incentive effect. The Baily/Lawrence/DRI study showed that the credit was an effective public policy tool and that a permanent credit could reasonably be expected to make a substantial contribution to the economy. Also in 1985, the Congressional Research Service issued an indepth study on the credit and recommended that it be made permanent.

I predict that if the R&D tax credit is made permanent, strategic planners in corporations, who are required to look well into the future, will continue to take a harder look at more speculative R&D work. The permanence of the tax credit will tip the scales in favor of going ahead, sometimes on very sizable projects, thereby permitting company researchers to seize opportunities that otherwise would be foregone.

When a company such as mine is determining where to invest its resources, there always arises the question of balancing the short term and the long term. The short term always seems to have a greater sense of urgency associated with it, and therefore there is a bias towards cutting into long-term programs in favor of the short-term programs. The R&D tax incentive addresses this issue directly. The R&D credit can, and does, encourage investment in the longer-term areas of R&D.

The second improvement that we strongly support is the provision in the Senate legislation that makes the credit available to start-up corporations, which by definition have no tax liability, but would be able to carry the credit forward to years in which profits were generated from product sales. The credit would thereby encourage budding research efforts at the small business level.

Thirdly, we support the revised definition of qualified activity included in S. 58. We recognize that the credit can be improved by modifying the definition of qualified research to better target the credit to the purposes for which it originally was enacted. By allowing the credit only for those advances which are technological, rather than stylistic, we believe the revised definition achieves the goal of a more focused approach.

There are other changes to the credit that have been suggested. Many of them, including altering the incremental feature of the credit, would be costly. While we might agree that such provisions would enhance research and development efforts, we felt it would be irresponsible for us as a Coalition to be recommending costly changes in the current fiscal climate.

The R&D Tax Credit in the Context of Tax Reform

As I mentioned in my introductory remarks, we especially appreciate the opportunity to comment on the R&D tax credit in the context of the tax reform hearings the Senate Finance Committee is holding. We feel strongly that the evidence overwhelmingly shows that, even if a neutral tax system is created, the strong arguments in favor of continuing the R&D tax credit persist. Unlike most other areas of tax preferences, market forces alone cause underinvestment in R&D because market returns will not fully compensate firms for the costs and risks of their R&D spending.

The Congressional Research Service study cited earlier looked at the credit in the context of major tax overhaul and found that, "tax rate reductions may actually have a negative impact on R&D investments and justify a retention or an increase" in the R&D tax credit.

To foster entrepreneurship and innovation in this age of the entrepreneur, President Reagan personally endorsed incentives for research and experimentation and said they would be preserved in the Administration's comprehensive tax reform proposal, as they were in Treasury's report of last fall.

Specifically, the plan most recently released by Treasury recommended that Congress extend the research and development (R&D) tax credit because:

> [t]he benefit to the country from... innovation is unquestioned, and there are reasonable grounds to believe that market rewards to those who take the risks of research and experimentation are not sufficient to support an optimal level of such activity.

In addition, the plan released by the Administration also references a separate credit for companies that contract with universities and independent research institutes for basic research and states that these proposals would be considered within the context of efforts to extend the existing R&D tax credit.

CONCLUSION

We strongly urge your favorable consideration of S. 58. The R&D tax credit is a good investment in keeping American workers productive and our firms competitive. The R&D tax credit has stood up well under close scrutiny and should be made permanent.

The separate provisions for encouraging corporate support of university basic research and scientific education efforts are also important to our future and deserve your approval.

The issue for us in 1985 is whether we are willing to make these investments in our country's economic future. These decisions will determine whether jobs in the 1990s will be here or abroad. They will determine whether our children and our grandchildren will be beneficiaries of America's technological superiority over foreign competitors. Frankly, we did not make those decisions in the 1970s and we are paying the price today.

I applaud your efforts in holding hearings specifically to address these issues and I urge you to take swift action on S. 58 to ensure our continued technological and scientific excellence.

Senator DANFORTH. Dr. Saloom.

STATEMENT OF DR. JOSEPH A. SALOOM, SENIOR VICE PRESIDENT, M/A-COM COMPONENTS, ON BEHALF OF THE NEW ENGLAND COUNCIL, INC., BURLINGTON, MA

Dr. SALOOM. My name is Joe Saloom. I am a senior vice president of Corporate Components Technology Development Center, the company called M/A-Com, located in Burlington, MA.

Our company is also a member of the New England Council, on whose behalf I am testifying today. The New England Council is a group of businesses of about 1,300 businesses, with a small portion of the businesses in the high technology area. The rest are from old manufacturing to recently new to high technology companies.

A top priority of this council is the continuation of the R&D tax credit.

One of the questions that I am sure is being asked is does the R&D tax credit work; has it worked. I am a field commander in R&D. I'm a research director. I'm not the CEO of our company. And I can tell you my life has changed. It has been much more pleasant during the last few years. When I went before the CEO with my budget, he always asked, what do you do, Joe, with $400,000 less; you know, this is a hard year. Last year, when our sales were up 20 percent, our profits were down 1 percent, our R&D in my section went up 50 percent. And he said, what would you do if you had $400,000 more. They may have cut advertising but they didn't cut me in the last few years. A real benefit. It's changed his mentality. And, in fact, the question of permanency comes up—how long should it be?

I think one of the criteria might be that it should be twice as long as the average tenure of CEO's because what he really does with this R&D tax credit, is, in fact, during his tenure—and his time is somewhat like a ball player's lifetime—he wants to see that benefit within his time. The R&D tax credit has lengthened his range of thinking.

Now I will give you one example and then be quiet. It was sometime back that we in the laboratories were doing work in the compound semiconductor that Dr. Rowe mentioned, called gallium arsenide. This particular material is the basis for the Japanese fifth generation computer. Now we have been in this business for 20 years, and I guess our sales got up to maybe $10 million. And the field began to advance. And so as member of a small group in our company, an advocate of this particular new material, we proposed an extension. And I can tell you that today we have the largest gallium arsenide facility in the United States located in Lowell, MA. We bought a $25 million building, put in 15 million dollars' worth of equipment, and the last 12 months we have added over 100 new scientists and technicians this year in that facility. And I can tell you the Japanese are still ahead. I don't think we would have built such a big building, I'm sure we wouldn't put such modern equipment in and hired that rate without the credit—we wouldn't have dropped out of gallium arsenide. Certainly not. This is real international competition.

The Japanese today supply over 70 percent of all the base material on which all our GaAs R&D is done. And to take that risk of the base material, the base substrate wafer that you see in these factories, is unwise.

Today, we are the U.S. largest supplier of gallium arsenide substrates, with plants in New Jersey are doing it and plants in New England. The Japanese are still ahead.

Please make this tax credit permanent. Do it in a hurry, because the planning cycle is long. It's going to take us 5 to 10 years to really develop that base technology that is not visible under the water line of this iceberg.

Thank you very much for what you have done. And, please, do not send a signal back to my chairman that you are not interested in R&D.

Thank you.

[The prepared written statement of Dr. Saloom follows:]

The New England Council, Inc.

Suite 510 • 1800 Massachusetts Avenue, N.W. • Washington, D.C. 20036 • (202) 659-8860

June 26, 1985

Testimony of Dr. Joseph A. Saloom, Senior Vice President of M/A-COM Components, on Behalf of The New England Council, Inc., Before the Senate Committee on Finance.

Good day. My name is Joseph A. Saloom. I am Senior Vice President, Corporate Components Technology Development Center, of M/A-COM Components, Incorporated, located in Burlington, Massachusetts.

I am also a member of The New England Council, on whose behalf I am testifying today.

The New England Council is a regional business association of over 1300 firms representing the full spectrum of business activities--from basic manufacturing to new age high technology service industries like my own. Founded 60 years ago, The Council has dedicated itself to working with government officials for the betterment of our six-state region and the nation.

A top priority for The Council this Congress is the continuation of the R&D tax credit.

U. S. technological leadership is one of our most important resources and the basis for our high

standard of living. However, the U. S. is being challenged in the international marketplace by countries enacting tax and other incentives to encourage research and development activities. Japan and West Germany are examples of foreign countries competing directly with the U. S. Japan targets its high growth potential industries with developmental subsidies, accelerated depreciation rules, and loans for research and development. West Germany grants low interest loans for research and development, cash grants for investment in research and development facilities, and special depreciation for research and development plant and equipment. The U. S. has devoted the lowest share of the GNP to civilian R&D when compared with France, Germany, Japan and the United Kingdom.

The economic benefits of a permanent R&D tax credit are significant. Benefits from increased R&D include productivity gains, increased standards of living and "high tech transfers" to non-high tech industries. A study by Martin N. Baily and Robert Z. Lawrence, two economists at the Brookings Institution and Data Resources, Inc., has shown that the social return from private R&D spending is twice the rate of return received by the private sector. They have also demonstrated that at least half the gains from innovation are received by non-manufacturing industries.

Many of our basic or non-high tech industries perform considerable amounts of R&D. R&D spending by these industries has increased significantly since enactment of the R&D tax credit in 1981. The automobile industry is using computers to aid in their design and manufacturing processes. Specialty steel firms are developing new techniques and new products. All firms can benefit from the credit, regardless of their R&D levels relative to other companies or industries. These new innovations improve the cost competitiveness of non-high tech or traditional industries. Improved and more efficient manufacturing processes keep costs down and improve productivity.

R&D is also essential to reduce the U. S. trade deficit. The U. S. has become increasingly dependent on high tech products to maintain its competitive position in world markets. High tech products made up 44 percent of total exports of manufactured products in 1983. In 1970, this figure was 35 percent. A report by Data Resources, Inc., states that the U. S. has lost two million jobs because of the high value of the dollar since 1980. High technology products have performed relatively well in comparison with other manufactured products in the international marketplace. Between 1980 and 1983, the trade balance decline in other manufactured goods was about

$42.1 billion compared with $8 billion in high technology products. Narrowing the trade deficit in the future will depend to a greater extent on increased exports of high technology products. This will depend on innovation which in turn depends on increased amounts of R&D spending.

Economists at the Brookings Institution and Data Resources, Inc., have quantified the effect on the GNP of a permanent R&D tax credit. They determined under very conservative assumptions that the R&D tax credit would add $1.2 billion annually to real GNP by 1986 and $2.9 billion in 1991. Under "best case" but reasonable assumptions, the R&D tax credit would add $7.5 billion to the GNP by 1986 and $17.7 billion by 1991. These productivity gains would be difficult to attain without increased levels of research and development. R&D spending increased from $30.5 billion in 1980 (one year prior to enactment), to $39.2 billion in 1983. This was the first R&D spending increase to occur during recessions--1980 and 1982.

R&D tax credit legislation is also designed to promote private support of basic research. University basic research provides the basis for technological innovations and new scientific discoveries. However, basic research funding by the private sector has declined considerably. New equipment is needed to

train scientists and engineers. These individuals play a prominent role in developing new technologies to enhance our competitive position. Many of these scientists and engineers establish their own business and maintain their ties with the university sector. This infrastructure is conducive to further economic development. Silicon Valley in California and Route 128 outside of Boston are good examples of regions which benefit from such collaboration.

New England is a good example of how R&D can affect the economic vitality of a certain region. Industries with high research and development content tend to locate in research and development centers. New England has been such a center for the computer and analytical instrumentation industries, and will be a center for genetic engineering and computer software as well. As New England is serious about holding on to the high tech/knowledge-intensive industries in the future, it must create a climate where a broad range of industrial and institutional research and development can flourish.

New England is the oldest and second (to California) largest high technology market in the U. S. New England's healthy economic performance during the past recession was largely due to its high technology industry. This sector provides

22 percent of all manufacturing jobs in new England. The high technology industry is the largest employer among New England's manufacturing industries. It also accounted for 60 percent of New England's industrial exports in 1983. In that same year it provided 51 percent of New England's capital spending, up from 27 percent in 1976. The high tech industry is New England's largest capital investor.

R&D is typically a risky venture for the private sector. Returns are uncertain and social benefits are greater than commercial gains. Therefore, government support is needed to enhance private returns in order that society receives desired benefits. The tax credit helps to lessen this risk by reducing research cost. Since R&D is risky and projects require long-term commitments, the tax credit should be made permanent. A company needs to know if the tax credit will be available prior to making project commitments.

Our technological leadership is being threatened by our competitors. Innovation is essential to maintain our leadership role. We need the R&D tax credit. It is not a tax credit to benefit a specific U. S. industry. It will strengthen our competitive position and improve not only our standard of living, but the quality of life for future generations.

New England industries are increasingly vulnerable for two reasons. First, they are knowledge-intensive, fast-growing industries, and therefore dependent on research and development. Second, the fastest growing segment and staple of New England's economy is small business.

This region provides research and development for corporations nationwide. It lends itself to research and development and the seeding of new industries because of 1) its pool of experts in the high-tech and associated areas surrounding scientific and university facilities; 2) its pool of well-educated, highly entrepreneurial managers and technical people; and 3) its ample supply of venture capital.

Increased investment in both basic and applied research and development would directly and immediately stimulate New England's economy. Accelerated development of commercial products and processes and the seeding of new industry would further stimulate New England's economy as well as that of the entire nation.

STATEMENT OF DR. ROBERT LAWRENCE, SENIOR FELLOW, THE BROOKINGS INSTITUTION, WASHINGTON, DC

Senator DANFORTH. Dr. Lawrence.

Dr. LAWRENCE. Thank you very much, Mr. Chairman.

I come to this problem as an economist who is generally skeptical about the role of Government and Government intervention in the economy; who believes the market by and large should be left to allocate resources. And, therefore, I believe that in order to make the case for Government intervention, first, one has to make a credible argument that there are strong reasons to believe that the market fails in a particular area. That's the basis on which I think we should have Government intervention. And, second, once we have strong reason to believe that the market fails, we should then choose the instrument that is most appropriate to correct that particular deficiency and has a reasonable chance of improving the situation.

I believe that an R&D tax credit meets these criteria. And that's why I support it. First, in principle, it is well recognized by economists that the promotion of knowledge involves significant spillovers or externalities, as we call it. That individual inventors cannot appropriate all of the benefits of their invention. Once the Wright brothers had flown an airplane, you had to take one look at that structure, and if you were planning a similar activity, you would know more or less what it had to look like. You, therefore, derived a benefit from that that was just not available and which was not something that they could essentially charge for.

And that's the simple case as to why a private market will under invest in R&D. Now there are some who say that this is only confined to basic research. And I would agree that in the area of basic research, these spillovers are the greatest. And, indeed, that's why we as a society ought not to provide property rights to basic research. We want the knowledge to be spread around. But the evidence suggests that this spillover exists also in other areas, and it extends to the commercial field. And one of the most enlightening studies is one by Professor Mansfield from the University of Pennsylvania who demonstrates quite clearly the massive difference between the rate of return that accrues to individuals and firms and entrepreneurs who undertake commercial R&D activity, and the returns that accrue to society. That's the basic rationale for a stimulus to R&D.

Second, I believe that in principle many strategies are required in order to stimulate basic research and R&D in companies. I think a tax credit is an appropriate mechanism in principle. In fact, if you are talking about a small credit, I think that at the margin a tax credit will increase more spending than an equivalent grant. If we set up a Government agency that was giving out an amount of money that's equal to 1 or 2 percent of the total value of commercial R&D spending, what's going to happen? Firms are going to submit to that agency their best projects. They are going to compete on the basis of what they have best, and, therefore, my belief is that you will not get a large incremental effect.

A tax credit, does—because it affect that decision at the margin will not have this deficiency. It's that last dollar of R&D spending

which the firm is thinking about which is going to be affected by a tax credit. A grant program of a small size will not necessarily do that. If you told me you wanted to give $60 billion as a program, I think you would get an incremental effect. Firms are only spending $50 billion today. But I think that with respect to this particular credit, and given its magnitude, you will get more incremental effect using a tax mechanism. That's not to mention the advantages that the companies themselves have in knowing where the potential for technological and, indeed, for commercial breakthroughs are.

Finally, just let me say that we have conducted a study which has tried to stress the fact that it's not simply that this R&D tax credit has stimulated spending on R&D. We believe it has. But more importantly, because of these spillovers, because the social returns are higher than the private returns. We have provided estimates of what R&D spending does to raise GNP. Even under conservative estimates, I think that this particular policy is a good bet.

Thank you, Mr. Chairman.

[The prepared written statement of Dr. Lawrence follows:]

Statement of Robert Z. Lawrence
Senior Fellow
The Brookings Institution
before the
Committee on Finance
U.S. Senate
June 26, 1985

SUMMARY

The case for supporting the R&D tax credit rests on three basic propositions: (a) Government support is required to offset the tendency of the private sector to systematically underinvest in R&D. (b) In principle, tax credits are an appropriate tool for promoting commercial R&D. (c) In practice, the existing tax credit has worked successfully, providing society with benefits that, even under conservative assumptions, far outweigh their costs.

After analyzing each of these propositions in turn, the statement concludes by commenting on the vital role of R&D in economic growth and international competitiveness.

Statement of Robert Z. Lawrence*
Senior Fellow
The Brookings Institution
before the
Committee on Finance
U.S. Senate
June 26, 1985

I am pleased to appear before you today to testify on the need to extend the tax credit for R&D and make it permanent. My testimony draws on a study of the current R&D tax credit undertaken by me together with my colleague, Martin N. Baily, and Data Resources, Inc. I would request that the study, which was commissioned by the Coalition for the Advancement of Industrial Technology, be made part of the record. My statement will highlight its major findings. I will argue that the case for supporting the R&D tax credit rests on three basic propositions:

(a) Government support is required to offset the tendency of the private sector to systematically underinvest in R&D.

(b) In principle, tax credits are an appropriate tool for promoting commercial R&D.

(c) In practice, the existing tax credit has worked successfully, providing society with benefits that, even under conservative assumptions, far outweigh their costs.

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*The views expressed in this statement are the sole responsibility of the author and do not represent those of the Brookings Institution, its officers, trustees, or other staff members.

After analyzing each of these propositions in turn, the statement concludes by commenting on the vital role of R&D in economic growth and international competitiveness.

The Case for Government Intervention

> ...[W]e expect a free enterprise economy to underinvest in invention and research (as compared with an ideal) because it is risky, because the product can be appropriated only to a limited extent, and because of increasing returns in use.[1]
>
> Kenneth J. Arrow, Nobel Prize in Economics, 1972.

> It is an elementary principle of economics that a society's basic research and development cannot be left entirely to private industry, because then there will always be under-investment in R & D. Many of the economic benefits of R & D cannot be captured fully by the developer, and he will not take account of these valuable public goods that flow from his efforts in his investment decisions. It is good economics, as well as good public policy, to provide substantial public subsidy for research and development.[2]
>
> Herbert A. Simon, Nobel Prize in Economics, 1978.

> ...[T]ake the case of government provision of research on corn farming. No one competitive farm is large enough to do it; and each also knows it cannot retain the monetary advantage of the research financed by it. Nevertheless, there is great benefit to the group and to society from learning about and adopting any improvements that might be uncovered by research on farming. As a result of these considerations, because of a clear externality in the use of knowledge, no prudent private firm can be expected to invest its scarce dollars in research up to the point of best advantage to the group as a whole.

> Therefore governmental activity in this area of research, whether in its own laboratories or by comissioning of private or university research, may well be a desirable act of representative democracy.[3]
>
> Paul A. Samuelson, Nobel Prize in Economics, 1970.

At a time when the Congress is actively seeking to reduce the budget deficit and to remove distortions in the tax system, it is appropriate that proposals for revenue expenditures in the form of tax benefits be subject to particular scrutiny. The case for stimulating R&D with a tax credit is particularly strong. Proponents of tax proposals point to benefits such as job creation or the encouragement of investment in a particular industry. But they often assume that labor or capital are unemployed and ignore their alternative uses. Over the long run, however, most of the people drawn into one activity are drawn away from another; most of the capital invested in one activity will be drawn away from capital invested in others. To justify reallocating resources towards a particular activity, its social benefits should exceed those obtained elsewhere in the economy. We should assume that a given quantity of resources is being fully utilized by the private market and then demonstrate that government intervention could increase the efficiency with which those resources are being used.

Government support for R&D meets this more severe and appropriate test. As the quotations at the begining of this section indicate, there is a virtual consensus among economists that, if we move resources from some other profitable activity into expanded R&D spending, society as whole will be better off. While for most activities in the economy, the returns to labor and capital reflect the value of their social benefits; in the case of R&D, the social returns exceed those which accrue to the performers.

In a well-functioning economy the marketplace should determine the vast majority of private economic decisions. Businesses decide what to produce, how to produce it, and what to sell it for. Consumers decide how much to spend and save and how to allocate their purchases. Many mistakes get made, but in general the people making the decisions know the most about them and have the most to gain or lose from making the right decision. Overall this results in a system which generally ensures that the productive capacity of the economy is best used to meet the needs of consumers.

In some cases, however, firms and consumers responding to purely private incentives do not produce the best outcome from a social viewpoint. One of these is the decision to engage in R&D. When a company develops a new product or process, the benefits will spill over outside the company in ways for which the company itself will not receive payment. Competitors will copy the new technology. Research and engineering staff will leave to join other companies or set up

their own, taking the knowledge with them. For these reasons the innovating company cannot "appropriate" all of the returns to its own R&D. The "appropriability" problem can be described with the simple example of a recent industrial innovation. About 15 years ago, a small Massachusetts company called Modicon developed a programmable controller -- a type of industrial computer. This product now has annual sales in excess of $700 milion and is a staple of assembly-line and materials-handling technology. The automobile industry is a primary user of the technology as are several other industries. And the pulp and paper, steel, chemical, oil and gas and electric utility industries also use it. Basically, the controller acts to monitor and control the status of individual manufacturing operations to make sure they are done in the right sequence, at the right time and in the right environment. This monitoring could be done before the controller was developed, but it makes the task simpler and much more flexible.

Certainly the Modicon Company reaped benefits from its innovation. Modicon was acquired by Gould, Inc. and now has about one-third of the $700 million market. But the benefits to the innovator are dwarfed by the benefits accruing to others. Modicon's competitors have about two-thirds of the market and they are earning substantial returns. The users of the new technology have been able to reduce their costs and raise their profits. And, most importantly, competitive market pressures kept the prices of the final products of the using industries below what they would have been without the innovation. Automobiles,

paper, chemical products, gasoline and electricity are all a little cheaper, and American consumers are the beneficiaries. This process is replicated for numerous innovations in products and processes throughout the economy each year.

In short, there is a substantial gap between the social and private rates of return for R&D and innovation. As a result, without additional incentives businesses will spend less on R&D than would be desirable from the perspective of society as a whole. This means, in turn, that if the U.S. economy is to be efficient and fully productive, it must use one or more measures to stimulate R&D and the development of new products and technologies.

Some economists agree that there is a gap between private and social returns in basic research but suggest that in commercial activities the gap is too small to justify government intervention. But this view is not supported by the evidence.

The most straightforward and compelling study of social and private returns from industrial innovation has been carried out by Professor Edwin Mansfield and his associates at the University of Pennsylvania. This group obtained detailed information on a sample of seventeen typical innovations. They found that the median project in their sample had rates of returns to the firm undertaking it of 25 percent. However, once they took into account the benefits accruing to other firms and consumers, they estimated the median return to society to be 56 percent. Numerous other researchers (cited in the attached

study) have obtained similar results.

In sum therefore there is a compelling case for government programs to stimulate R&D. While economists may be famous for their disagreement, the three nobel laureates (and most members of the profession) agree on this point.

The Role of Tax Incentives

As discussed in our study, a variety of approaches are required to stimulate research and development including direct grants, tax credits and patents. However, to address the specific problem of underinvestment in industrial R&D, a tax incentive program is likely to be more effective than a program of similar magnitude which directly provides funding for the development of new commercial technologies.

First, market-driven choices are more likely than government decisions to fund projects attuned to concrete economic needs. Government administrators may be able to decide that certain research will further scientific knowledge. But they have neither the knowledge nor the incentive to know what projects are most likely to pay off with innovations for which there will be substantial demand, on terms sufficient to cover the costs of producing them. Second, if as is very likely, private companies would respond to such a program by seeking financing for their best projects, then the general result is that firms will simply substitute government funds for the projects they would have been most likely to undertake on their own, in the absence of the government program. In short it is a mistake to assume that an

R&D grant program would add dollar-for-dollar to the amount of R&D actually carried out across the economy. Indeed, since an R&D tax incentive would affect decisions made on the margin by creating incentives to increase additional spending a relatively small tax program is likely to induce more spending than a program of grants which is likely to select those projects which would be undertaken in any case.

The Impact of the Credit

The R&D tax credit adopted in the Economic Recovery Tax Act of 1981 has been in effect during a period of impressive increases in R&D spending. Investment in private R&D began to pick up in the late 1970s as oil prices increased and energy-related research was encouraged. Private spending remained unusually high into the 1980s and even climbed further despite the subsequent drop in oil prices and the deep recession of 1982.

Our study suggests that the credit has played a role in the dramatic rise in R&D spending over the past few years. But the study also goes further than previous work in estimating the impact of the credit on the national economy as a whole, rather than just its impact on private R&D spending. To evaluate the effect of the R&D tax credit, the study presents both a very conservative and a best-case scenario. Under the most conservative assumptions, a permanent R&D tax credit would generate an extra $1.4 billion (in constant 1984 dollars) per year by 1986 and $3.3 billion by 1991.[4] Under the best-case scenario,

an R&D tax credit would yield $7.2 billion dollars per year in 1986 and $17.0 billion in 1991. GNP increases of these magnitudes would produce taxable revenues that should more than offset Treasury revenue losses due to the R&D tax credit.

In sum, even if the responses by the private sector were extremely modest, the R&D tax credit would raise GNP.

The Role of R&D in Productivity Growth and International Competitiveness

Over the past 15 years, our economy has experienced a dramatic slowdown in its rate of productivity growth. The private business sector of the economy would now be producing about 30 percent more output than it is now producing had the pre-1965 growth trend continued. This extra output would have been enough to solve the budget deficit problem several times over and have still left resources over to meet other pressing social needs. Increasing R&D spending is one avenue to reverse this decline, and the resurgence in U.S. R&D spending over the last few years offers hope that this slowdown will eventually be reversed.

Continued innovation is also essential if the United States is to remain internationally competitive. Since U.S. labor costs are high, American firms must compensate for their higher costs with higher productivity and superior products. These in turn depend on technological innovation. Indeed, technology-intensive products have made a disproportionately large contribution to U.S. trade performance

that has been rising over time. In 1983 high-technology products, as defined by the Commerce Department, accounted for 29.6 percent of all U.S. merchandise exports and 43.7 percent of U.S. exports of manufactured products. These shares have increased from 24.2 and 35.2 percent in 1970, respectively. In contrast to the long-run decline in the U.S. trade balance in non-high technology products, the U.S. trade balance in high-technology products increased from a $6.1-billion surplus in 1970 to a $25.5-billion surplus in 1980. The U.S. has also performed relatively better in international competition in high-technology goods than in other manufactured products since the dollar's rapid appreciation in 1980. Between 1980 and 1983, the decline in the trade balance in high-technology products was only a fifth of the slump in the rest of manufacturing trade.

At the same time as the U.S. has become increasingly dependent on high-tech exports, however, American global dominance in high-tech has been eroding. The U.S. shares of world trade of many high-tech products have diminished. U.S. technological leadership is no longer unquestioned. To remain competitive our commercial innovative efforts must be sustained and strengthened. Measured as a share of GNP, U.S. total spending on R&D is quite similar to that of Germany and Japan. But, since a high proportion of the U.S. R&D effort is spent on noncivilian technologies (i.e., defense and space), the United States share spent on civilian R&D is lower than that of Germany or Japan. In addition, because of stepped up efforts by foreign governments and

firms, the growth in U.S. spending has lagged behind that of spending abroad. Despite the rapid increase in U.S. R&D efforts since 1978, the recent data indicate an erosion in the relative U.S. R&D position. Between 1978 and 1984, the share of R&D in U.S. GNP increased by 0.4 percent of GNP; by comparison German R&D spending increased by 0.63 percent of GNP. Moreover, foreign government programs call for a continued and stepped up challenge to U.S. civilian technological leadership.

Since continued innovation will be essential in the U.S. effort to stay internationally competitive, R&D efforts in the U.S. need to be enhanced. The R&D tax credit represents a rather modest contribution towards that goal. At a minimum, it should be renewed.

FOOTNOTES

1. Kenneth J. Arrow, "Economic Welfare and the Allocation of Resources for Invention," in National Bureau of Economic Research, The Rate and Direction of Incentive Activity (Princeton: Princeton University Press, 1962) p. 619.

2. Herbert A. Simon, Models of Bounded Rationality: Economic Analysis and Public Policy (Cambridge: MIT Press, 1982), p. 396.

3. Paul A. Samuelson, Economics (New York: McGraw-Hill, Inc., 1980), pp. 151-52.

4. These figures reflect minor revisions in our estimates. They are virtually identical to those in the original study.

Senator DANFORTH. Dr. Barker.

STATEMENT OF DR. ROBERT BARKER, UNIVERSITY PROVOST, CORNELL UNIVERSITY, ITHACA, NY

Dr. BARKER. My testimony is endorsed also by the Association of American Universities, which is an organization of 50 research-oriented universities, and, of course, by Cornell University.

I would like to make several points. The first is that economic development in the high technologies area is going to depend to a very significant degree on areas in which university basic research is very strong—material science and engineering, chemistry, physics, applied mathematics, computer science, software development, cell and molecular biology. All of those are areas in which a great deal of the U.S. strength lies in universities.

Senator DANFORTH. Dr. Barker, I wonder if I could interrupt for a minute.

Dr. BARKER. Surely.

Senator DANFORTH. I'm going to have to leave. Senator Wallop is here and is good enough to chair the hearing.

I would like to ask some questions now, and if you could just note down the questions, and then in my absence answer them, if that would be all right.

One, is there any doubt in your mind that making the tax credit permanent as opposed to a 3-year extension is important?

And, two, would you comment on the other portions of the bill, in addition to the tax credit itself, namely, the increased credit for corporate support of basic research at universities; corporate contributions to the universities; the deduction for the donation of scientific and technological property to universities; and the provision in the bill relating to scholarship and student loans and their exclusion from the income of graduate students in the scientific field.

In other words, some of you might not want to comment on any of them, but to the extent that you have comments on them, I think the record should be beefed up in those areas.

Thank you very much.

And, Dr. Barker, I'm particularly apologetic to you for leaving in the middle of your testimony.

Dr. BARKER. I understand.

Senator DANFORTH. Thank you for being here.

If my brother found out that I left during the testimony of somebody representing the American Association of Universities, I would be persona non grata in my own family. [Laughter.]

Dr. BARKER. I understand that.

Senator WALLOP. Please continue, Dr. Barker.

Dr. BARKER. Yes.

The second point is that university-industry collaborations in basic research both increase the rate at which we accomplish basic research and perhaps more importantly from the point of view of this committee stimulate technology transfers. Without a doubt, some of the basic information that is developed in universities takes several years to enter the public domain because of the great care taken in making sure that it is correct before it is published.

The situation that can develop if universities and industries collaborate is that the preliminary knowledge of those basic areas can

be transferred to industry, which may have a very different use for it and be able to use it very quickly.

The next point is that, to be effective, university-industry collaborations have to have at least three characteristics. The first is the industry must perceive a benefit. The second is that the industry must sponsor the research. And, third, ideally, the industry should participate in the research.

We've had recent experience with this at Cornell University, and have two major new research activities going on which involve not just industry sponsorship, but the participation of industry—on the campus in the research effort. And that, I think, is when the real interaction can occur and the transfer of information occur, in both directions.

I point out also that the traditions of this country were to have relatively strong industry support of university research 25 years ago. Up to about the late 70's, that had fallen from a level of 8 percent to about 4 percent. It has now gone back up a bit, to 5 percent. And in the last 2 or 3 years, Cornell University, for example, has doubled—there has doubled on the campus the percentage of the research sponsored by industry. It now stands at approximately 12 percent.

The next point I would make is that I fully support the provisions of S. 58, and I think you understand that that's why I'm here. I would point out finally that this is a critical time in the evolution of research universities. University-industry collaborations can have a lot of positive things to do with that evolution. If there is collaboration, it has beneficial effects on training and education. It does that in a variety of ways. There's a difference in the way in which a research organization on a campus behaves, if it has industry collaboration and if it does not. It ensures technology transfer, which I pointed to before. The time can be greatly reduced for that transfer to occur. It tends to target basic research. And I don't mean by that that it becomes applied, but it gets targeted somewhat differently than it might otherwise.

There are complementary efforts developed between the universities and the industries that collaborate. The university directs its basic research in a given way, and the industry tends to direct its applied research in a different way because of the collaboration.

Finally, in areas of instrumentation, we have a great need to modernize. I think everyone understands that. Instrumentation is rapidly evolving. And, interestingly, universities are increasingly becoming the site of major instruments which industry needs to have access to. And the collaborations I am being supportive of here lead to the effective use of those large instruments which are and should be centered on the campuses.

Thank you, sir.

Senator WALLOP. Thank you, sir.

[The prepared written statement of Dr. Barker follows:]

TESTIMONY OF DR. ROBERT BARKER, UNIVERSITY PROVOST
CORNELL UNIVERSITY -- ITHACA, NEW YORK
BEFORE THE SENATE FINANCE COMMITTEE

June 26, 1985

My name is Robert Barker, and I am University Provost of Cornell University. Cornell is a member of the Coalition for the Advancement of Industrial Technology and also the Association of American Universities' Higher-Education Coalition for the R&D Tax Credit.

I am pleased to appear before you today to provide you with the views on the R&D tax credit and on the related provisions affecting universities. We strongly support S. 58, the High Technology Research and Scientific Education Act of 1985. We also strongly support Senate efforts to enhance university basic research and stimulate additional university and corporate cooperation.

I believe that the development of effective university/ corporate partnerships offers us one of the nation's best opportunities to compete successfully in a global economy. To a great extent, our ability to compete in the future depends upon the quality and the quantity of trained personnel who are ready to take their places in both the corporate and academic worlds of science and technology.

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The rise of the high technology sector, and the need to apply new technology to mature industries, depend on high quality, highly trained engineers and scientists. Without close industry/ university collaborative efforts, the threat of critical shortages in these areas becomes very real.

Over the past several years, a dramatic turn around has occurred in corporate/university relations. Recognition that universities can, and should, play major roles in creating a national environment for entrepreneurship and innovation has led to collaborations that greatly benefit both industry and the academic community.

America's future industrial competitiveness will depend to a great degree on how fast we can advance our basic knowledge in state-of-the-art fields. Since university basic research provides much of this underlying knowledge, strong industry/university cooperative research efforts can greatly enhance industrial competitiveness.

The financial resources coming to the universities from these basic research contracts and grants permit them to upgrade their scientific education programs by attracting high caliber faculty who wish to work on state-of-the-art research projects. These funds also allow universities to modernize antiquated laboratory facilities and equipment that are essential to scientific education and research.

The Cornell Experience

Cornell University has been a direct beneficiary of this trend toward close corporate/university research ties. As you may know, the Cornell University Center for Theory and Simulation in Science and Engineering is one of four new advanced scientific computing centers financed by a $200 million initiative by the National Science Foundation.

The Center is receiving over $30 million in corporate support and is seeking additional industrial partners. Uses of the Cornell Supercomputer facility include studies of improved aircraft wings and helicopter blades; pesticide application strategy; economic and air quality effects of controlling emissions from electric power plants; movement and cycling of disease epidemics; location of mineral deposits; and, the occurrence of earthquakes.

Two years ago, Cornell established a Biotechnology Center in collaboration with Kodak, General Foods, Union Carbide and the State of New York. That Center involves industry scientists as residents of the Cornell campuses, directly working in the basic research programs of the faculty. The value of this Center as a source of training, ideas and discovery is already apparent. We are quite proud of these centers at Cornell. They are representative of a great many similar projects cropping up all over the country.

The R&D Credit and Basic Research

Over half of all basic research conducted in this country takes place in university facilities. Despite the central role of universities in basic research, industry support of university research was in a long decline for many years and fell from about 8% of company R&D spending in 1960 to 4% by the late 1970s.

Since the enactment of the R&D tax credit in 1981 -- which extends to corporate funding of university and non-profit institute research -- industry sponsorship of university research is now increasing and comprises 5% of total university research budgets. It represents an even larger share of the research budgets on many major campuses and is the fastest growing source of university research funds. At Cornell it now stands at 12% of a sponsored research budget whose overall growth has averaged 10% for the last few years.

The R&D tax credit was an important first step in bolstering university-based research programs. Moreover, we believe that universities and independent, non-profit research institutes occupy a special place in the long chain between an idea and a commercially-viable process or product. Because the R&D tax credit is slated to expire at the end of 1985, it is a good year for a comprehensive review of how the university-company relationship can be strengthened.

The R&D tax credit permits companies to apply part of their contract research to university research. This has resulted in a substantial increase in corporate support for university research. It is therefore a high university priority that Congress extend the R&D tax credit and make it permanent. The credit has proven to have had a beneficial effect just at a time when advances in basic research and the availability of scientifically-skilled manpower are necessary for the next round of major technological advances.

The Need for a Separate Basic Research Credit

Company response to the university basic research provisions of the existing R&D tax credit has been quite positive. However, university officials feel strongly that there is potential for even greater cooperation. It is for this reason that we support separate tax incentives for corporate support of basic research at universities.

Specifically, we support the separate basic research credit included in S. 58. The present tax credit under I.R.C. § 44F provides no particular incentive for a corporation to shift research projects from in-house operations oriented toward applied research and product development to university basic research. This is because the credit treats corporate payments to universities for basic research in the same manner as a contract payment for product development.

The current R&D credit is calculated on an incremental basis using a rolling base period which includes university basic research payments as well as the company's in-house product development R&D expenditures. Thus, dollars paid by the company to a university for basic research increase a company's threshold for obtaining the credit over the next three years by increasing the base period amounts applicable in those years, and thereby reduces the amount of available R&D credit in those years.

University basic research has less direct immediate commercial value to any company than does in-house applied research and product development. It is for this reason that there is a need for a separate incentive if corporate taxpayers are to be persuaded to apply a more significant part of their R&D budgets to fund university basic research.

We believe that the non-incremental credit included in S. 58 is an appropriate approach to encourage corporate support of university basic research. The flat, non-incremental credit for a corporation's payments to universities for basic research applies to only those which are in excess of a substantial threshold.

This threshold, termed the "maintenance-of-effort" level, is linked to the company's average annual R&D spending levels over the 1981-83 period. The percentage-of-research budget floor also prevents a windfall to companies that thus far have been inactive in supporting university basic research. The pending legislation also contains protections so that companies cannot merely shift their present charitable contributions to universities to the support of R&D in order to qualify for the enhanced credit.

One important advantage of making the university research credit non-incremental, either on a general basis or when a company's university payments exceed a substantial threshold, is that the credit continues to provide an incentive for the company to make such payments in bad years as well as good years. In a volatile industry like the high technology electronics industry, many companies must endure severe swings in earnings.

In times of adverse circumstances there is a temptation for a company to cut support of university research; cutting university research funding is often simpler and less painful than laying off employees or reducing company R&D or manufacturing facilities. In these circumstances a very substantial effort may be required just for the company to maintain its university research support at previous years' levels or to achieve a modest increase in such funding. A flat rate credit clearly would encourage the company to make such a substantial effort.

Support for a separate credit for university research comes from a broad spectrum of organizations. The following groups have recently issued studies recommending a basic research tax credit:

- The Business-Higher Education Forum
- The Committee for Economic Development
- The Heritage Foundation
- The National Association of Manufacturers
- The President's Commission on Industrial Competitiveness

Upgrading Scientific Equipment in University Facilities

Also included in S. 58 are provisions to expand the present enhanced tax deduction available to companies for donations of scientific equipment. The proposed legislation would accomplish the following:

- eligible uses of the property are expanded to include direct education as well as research and research training;

- donations of computer software are made eligible for the deduction;

- donations of state-of-the-art equipment used in the taxpayer's trade or business are made eligible for the deduction.

As I am sure you know, rapid advances in scientific and technical equipment have left many universities with antiquated equipment. According to an American Society for Engineering Education assessment, the engineering equipment found in most college labs is 20-30 years old, and equipment to teach new "growth technologies" is almost non-existent.

A brief look at the record of the deduction provisions that were adopted as part of the 1981 Economic Recovery Tax Act reveals that they have been effective in stimulating company donations of scientific equipment to colleges and universities for research purposes. The Council for Financial Aid to Higher Education reports that corporate gifts of scientific equipment climbed dramatically, and almost doubled in the last two years surveyed.

The following organizations have recommended enhanced deductions to corporations that contribute state-of-the-art scientific equipment and related support services for educational and research purpoes:

- The Business-Higher Education Forum
- The Committee for Economic Development
- The Heritage Foundation
- The Joint Economic Committee
- The National Association of Manufacturers
- The President's Commission on Industrial Competitiveness
- The White House Conference on Productivity

I would like to note at this point that the Coalition supports a provision contained in the House companion to S. 58, H.R. 1188, that would allow non-profit, tax-exempt independent research institutions to be eligible recipients under the enhanced deduction provisions. The Coalition hopes that the Senate will consider including these non-profit institutes as eligible recipients.

The International Challenge

Over the past decade and a half, we have witnessed rapid changes in technology, particularly in electronics and related industries. Future growth will be able to continue only if corresponding advances are made in the foundations of knowledge in the fields of engineering and physical science which underly these technologies.

Our international competitors are well aware of this link. Earlier this year, for example, the Japanese recognized the fundamental role of basic research in industrial advance when their national government passed the "Basic Technology Research Coordination Bill" which emphasizes and funds basic research activities that are within the jurisdiction of the ministries of International Trade and Industry and Posts and Telecommunications.

Not only is there industry and university benefit from the expansion of knowledge through expanded university basic research efforts, but, just as importantly, the universities receive substantial resources to improve their scientific education and training programs. At our colleges and universities, education in mathematics, engineering, and the physical, biological and computer sciences has suffered from a chronic shortage of faculty and a lack of up-to-date scientific equipment upon which the students and faculty can learn and perform research.

Universities face great difficulty in stretching tight budgets to compete with private firms for graduate-level engineers for faculty employment. They also face difficulty in attracting high caliber faculty because of teaching overload and the antiquated laboratory facilities available for teaching and research.

The result of these chronic shortages of university science faculties and antiquated facilities is an inadequate supply of scientifically-skilled manpower, especially in critical areas such as computer science, electrical engineering, and mechanical engineering. Japan, with a fraction of the U.S. population, is currently producing more electrical engineers from its colleges and universities than is the United States.

A fundamental characteristic of high technology electronics companies is that their competitiveness, in both national and international markets, is a function of the competence and

creativity of their employees. The heart of the electronics industry is research and development. This is a labor-intensive human activity impossible without skilled and imaginative scientists, engineers, and technicians. For many companies, manufacturing is also an activity that requires highly-trained and skilled employees.

Thus, it is not surprising that high technology electronics companies view skilled and highly-motivated employees as their single most important asset. For this reason, industry is very concerned about the current critical shortage of engineers and scientists graduating from our nation's institutions of higher education.

Increased corporate funding of university basic research will provide the universities with resources to attract scientific faculty and to modernize laboratory facilities. In addition, the development of close working relationships immediately enhances the flow of information and technology, often leading to industry scientists and engineers working in the university setting. The effect is to greatly enhance the expertise that industries can draw from in developing new technologies.

Conclusion

American universities have a stake in keeping our firms technologically superior and in keeping our nation strong. We have long been partners with federal and state governments in basic research and now we are eager to expand our cooperative ties with industry. Public policies can be crafted to foster these relationships. We believe that this cooperation in no way detracts from the time-proven principles of academic freedom.

On behalf of Cornell University and research institutions in general, I urge favorable consideration of S. 58 by the Senate Finance Committee, by the Senate as a whole and by Congress. It surely embodies public policy of benefit to the university research community, industrial R&D efforts, and hence to the country.

Senator WALLOP. Dr. Barker, just quickly for starters, when you are speaking of technology transfer, you are not speaking in the perjorative terms that we sometimes use for national security, but you are talking about the transfer between——

Dr. BARKER. No, I am not. Correct. I am really talking of basic discovery transfer. Shortening the time between discovery and application, technology transfer is probably the wrong word for that.

Senator WALLOP. You know the kind of thing that sends chills into other people's mind. I wanted to just clear that up so that it wasn't part of this record in an obscure kind of way.

Dr. BARKER. Right.

Senator WALLOP. Did you have a response to Senator Danforth's question?

Dr. BARKER. On the first question, with respect to permanence, I would like to confirm what was said by Dr. Saloom. And that is that there is a mind set change which I perceive in our discussions with industry. And I think the people we were dealing with who were responding in part to the tax credit expected the current tax credit to continue. And, therefore, permanence is important. Very important on the campus. We cannot do things on a short time scale. We have to make commitments of people and facilities and for us it is extremely important that there be some sense of continuity in such a program.

Senator WALLOP. I assume that all of you gentlemen would agree that you cannot look at basic research in 3 year segments. Is that correct?

Dr. ROWE. I would make the point that the product development and maturation cycle in industry is frequently quite long, and re-

quires R&D investment many years before the products appear on the marketplace. And that, I think, argues in favor of the permanency of the R&D tax credit, to encourage industries to take the risk and invest in R&D for future benefits.

Senator WALLOP. Would it be your opinion that they would not do R&D without the tax credit?

Dr. ROWE. I don't believe it's a question of not doing R&D. R&D is a necessity for survival. I think it's the rate of investment. And the purpose of the tax credit would be to stimulate added investment in R&D and thereby continuing improvement in our ability to innovate.

Senator WALLOP. Dr. Lawrence.

Dr. LAWRENCE. Yes. Senator, we elaborate on this question in our study. And by the way, I would like to request that the full study be made part of the record.

Senator WALLOP. That's the Rowe-Barker study?

Dr. LAWRENCE. No. This is a study done by Martin Bailey and myself, and Data Resources, Inc., which examines the R&D tax credit. And I think it has some material bearing out——

Senator WALLOP. I'm a little late coming into this so pardon me while I get my feet on the ground.

Dr. LAWRENCE. Sure.

Senator WALLOP. Is that the one with the American Society for Engineering and Education?

Dr. LAWRENCE. This is——

Senator WALLOP. Still another one?

Dr. LAWRENCE. Yes. This is a study on the need for a permanent R&D tax credit, which was performed by Martin Bailey, myself and Data Resources, Inc.

Senator WALLOP. OK.

[The information from Dr. Lawrence follows:]

THE NEED FOR A PERMANENT TAX CREDIT FOR INDUSTRIAL RESEARCH AND DEVELOPMENT

An Economic Assessment

Prepared By

Martin Neil Baily, Robert Z. Lawrence
and
Data Resources, Inc.

February 1985

Commissioned By: The Coalition For The Advancement Of Industrial Technology

EXECUTIVE SUMMARY

The value of government efforts to stimulate private research and development (R&D) activities is demonstrated by considering the process of innovation in our society.[1] Benefits from commercial research quickly spread throughout the economy, improving the quality of life, worker productivity, and real Gross National Product.

Yet for individual firms, R&D activities are inherently risky and the rewards are normally impossible to capture fully. For these reasons, Congress enacted an R&D tax credit in 1981. This study analyses the efficacy of the credit but goes beyond prior analyses in that it assesses the impact of the credit on the national economy as a whole, not just its effect on individual private R&D spending.[2] For the first time, a dollar

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1 The study summarized below was conducted by Martin Neil Baily and Robert Z. Lawrence of the Brookings Institution and Data Resources Inc. It was commissioned by the Coalition for the Advancement of Industrial Technology, a broad-based group of private corporations, universities, industry associations, and independent research laboratories. The research and analysis were performed independently of Brookings and of the Coalition, and the results and conclusions are those of the authors alone.

2 Previous efforts to quantify the impact of the R&D credit have been limited to identifying the amount of additional R&D investment generated by the credit, as distinguished from the total benefits produced by the new investment. To reach these estimates of total benefits, the study draws on state-of-the-art academic analyses, to obtain estimates: of the social return to R&D investments; of the "average effective rate" or monetary value of the R&D

estimate is assigned to the additional GNP that the R&D tax credit is likely to generate.

To evaluate the effect of the R&D tax credit more completely, this study presents both a very conservative and a "best-case" scenario.

-Under the most conservative assumptions, a permanent R&D tax credit would generate an extra $1.2 billion a year by 1986 in real GNP and $2.9 billion in 1991.

-Under the "best case" scenario, but nevertheless reasonable given past gains from technological breakthroughs, an R&D tax credit would yield $7.5 billion in annual GNP increases in constant dollars by 1986 and $17.7 billion by 1991. GNP increases of these magnitudes would produce taxable revenues that should more than offset Treasury revenue losses due to the R&D tax credit.

The Need for Accelerating R&D. Private R&D activities are particularly vital to our economy at this time:

-Since the early 1970s (from 1973 to 1981), productivity gains dropped to an annual average rate of just 0.7%, compared to about 3% over the 1948-73 period. Also during the 1970s,

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Footnote continued

credit for individual companies; and, of the "price elasticity" or percentage increase in R&D spending attributable to the credit.

the growth rate of total industrial R&D spending was sharply lower than in the previous decade. Continued and increased R&D spending is necessary to ensure a prolonged recovery in U.S. productivity performance.

-High tech exports are increasingly important and accounted for almost 30% of U.S. merchandise exports in 1982, up from 24% in 1970. The U.S. trade balance in high tech products rose between 1970 and 1980 from $6.1 billion to $25.5 billion, although by 1982 it had fallen back to $17.5 billion.

-There is ample evidence that the American technological lead over competitors is not as great it once was. Japan and Germany, in particular, have increased their civilian R&D efforts at a faster pace than has the United States. Japan and the European Community nations have accelerated direct funding of commercial R&D projects. Japan has had an incremental R&D tax credit since 1966, as well as other incentives to encourage investment. Comparatively, the U.S. has devoted the lowest share of GNP to civilian R&D of France, Germany, Japan, the United States, and the United Kingdom.

Conclusion. The R&D tax credit adopted in the Economic Recovery Tax Act of 1981 has been in effect during a period of impressive increases in R&D spending. Investment in private R&D began to pick up in the late 1970s as oil prices were high and energy-related research was encouraged. Private R&D

remained high into the 1980s and even climbed further despite the subsequent drop in oil prices and the deep recession of 1982. (This performance is in sharp contrast to past recessionary periods, when R&D spending levels consistently fell.)

The findings and analysis presented in this report support a continuing government role in fostering private R&D activities. The R&D tax credit enacted in 1981 increased commercial R&D investment. Without Congressional action, the credit will expire at the end 1985. Without this added incentive, as the report confirms, private companies will spend less on their R&D than is in our country's best interests. A permanent R&D tax credit should therefore be enacted.

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INTRODUCTION

Congress enacted a tax credit for qualified private sector spending on research and development in 1981. Under its provisions, companies receive a 25 percent tax credit on the excess of current year spending on qualified R&D over the average spending level of the prior three years.[3] Without a statutory extension this credit will expire at the end of the year.

This study concludes that, for its size, the R&D tax credit has been as effective as could reasonably have been forecast, and that it should be made permanent, and perhaps strengthened. The estimates indicate that the credit is not simply rewarding activity that would otherwise occur. In fact, the credit is estimated to have stimulated increases in private R&D spending, which, in turn, have generated gains to society in the form of higher consumption and GNP. These gains will continue to accrue and compound if the credit is made permanent.

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3 The credit provisions, currently incorporated in Section 30 of the Internal Revenue Code, contain a number of qualifications and exceptions, the most important of which are discussed in Part IV below.

The study is structured in four parts. The initial section elaborates the widely held view that the benefits or returns to society from commercial R&D far exceed the returns earned by private businesses that undertake the R&D. As a result, without government support to increase the effective private rewards, private sector R&D spending will fall short of levels desired by society as a whole. The economic literature shows a consensus on this point among all serious students of the subject. As stated by Professor Robert Eisner:

> ". . . a strong argument can be made for government policies to encourage R&D spending. . . . To the extent that benefits of R&D inevitably flow outside of firms undertaking it, each individual company will attempt to underspend on R&D . . ."[4]

In the second section, the study concludes that continued strong government support for commercial R&D is necessary at this point in this country's history for a number of reasons. Since the early 1970's, the nation's rate of productivity growth has slowed markedly. This should concern all Americans, because it has meant slower growth of the national standard of

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4 Robert Eisner, "The Research and Experimentation Tax Credit," Interim Supplementary Report to the National Science Foundation, August 9, 1984, pp. 1-2. Professor Eisner would prefer that governmental support for R&D primarily take the form of an affirmative grant program, rather than a tax incentive program -- an issue discussed below in Part III -- but, as indicated here -- he does not depart from the consensus judgment that governmental aid for R&D is necessary and sound.

living. The resurgence in R&D spending in the last few years offers hope that this slowdown will eventually be reversed. But continued growth in R&D is important if there is to be a prolonged recovery in U.S. productivity performance.

America's productivity slowdown highlights a fundamental change in the U.S. position in the world economy. Throughout much of the post-War period, the U.S. was the unquestioned technological leader of the industrialized economies. While this continues to be true, that lead is no longer comfortable. Other countries have major programs to foster R&D and they are catching up or moving ahead in many areas.

Continued innovation will be essential in the U.S. effort to stay internationally competitive. It will also be vital to the performance of the domestic economy, and to improving productivity not only for high-technology industries, but for the entire economy, including basic industries that are now under such strong international competitive pressure.

The third section of the study concludes that the tax code was, and remains, an appropriate vehicle for stimulating commercial R&D. Although alternative policies -- notably direct government grants and patents -- are important components of a national policy toward R&D, they do not detract from the need to provide generalized incentives to commercial R&D through the tax code.

In its final section, the study presents estimates of the gains that society can expect if the basic elements of the current 1981 credit were made permanent. The estimates suggest that, given its size, the credit would produce significant increases in consumption and taxable income to society as a whole.

I. THE ECONOMIC RATIONALE FOR GOVERNMENT SUPPORT OF COMMERCIAL R&D

A. Commercial R&D Yields Rewards To Society In Excess Of Rewards To Private Investors

In a well-functioning economy the marketplace should determine the vast majority of private economic decisions. Businesses decide what to produce, how to produce it and what to sell it for. Consumers decide how much to spend and save and how to allocate their purchases. Many wrong decisions get made, but in general the people making the decisions know the most about them, and have the most to gain or lose by making the right decision. This system benefits all, because the marketplace ensures that the productive capacity of the economy is best used to meet the needs of consumers.

In several respects the decisions by businesses to perform R&D are made in a way that satisfies these desirable characteristics of a market. The businessman, guided by his staff, is the person best able to weigh the potential for technical advance together with the potential market demand for a new product. He can best judge the potential gains from a new cost-saving production process. Moreover, the businessman stands accountable to his shareholders or superiors. His own career and income reflect the soundness of his judgments. But

in one crucial respect the R&D decision does not meet the criteria required for a desirable market outcome. When a company develops a new product or process after an expensive and risky R&D project, the benefits will spill over outside the company in several ways. Competitors will copy the new technology. Research and engineering staff will leave to join other companies or set up their own, taking their knowledge with them. And other firms may be stimulated to innovate in other areas. For all these reasons, the innovating company cannot "appropriate" all of the returns to its own R&D.

The "appropriability" problem can be described with the simple example of a recent industrial innovation. About 15 years ago a small Massachusetts company called Modicon developed a programmable controller, a type of industrial computer. This product now has annual sales in excess of $700 million and is a staple of assembly-line and materials-handling technology. The automobile industry is a primary user of the technology and the pulp and paper, steel, chemical, oil and gas and electric utility industries also use it. Basically the controller acts to monitor and control the status of individual manufacturing operations to make sure they are done in the right sequence, at the right time and in the right environment. This monitoring could be done before the controller was developed, but it makes the task simpler and much more flexible.

Certainly the Modicon Company reaped benefits from its innovation. Modicon was acquired by Gould, Inc. and now has about one-third of the $700 million market. But the benefits to the innovator are dwarfed by the benefits accruing to others. Modicon's competitors have about two thirds of the market and they are earning substantial returns. The users of the new technology have been able to reduce their costs and raise their profits. And, most importantly, competitive market pressures kept the prices of the final products of the using industries below what they would have been without the innovation. Automobiles, paper, chemical products, gasoline and electricity are all a little cheaper, and American consumers are the beneficiaries. This process is replicated for numerous innovations in products and processes throughout the economy each year.

In short, there is a substantial gap between the social and private rates of return for R&D and innovation. As a result, without additional incentives businesses will spend less on R&D than would be desirable from the perspective of society as a whole. This means, in turn, that if the U.S. economy is to be efficient and fully productive it must use one or more measures to stimulate R&D and the development of new products and technologies.

B. The Gap Between Social And Private Returns For Commercial R&D Is Significant

The most straightforward and compelling study of social and private returns to innovation has been carried out by Professor Edwin Mansfield of the University of Pennsylvania and his associates.[5] This group contacted businesses in the Northeast and obtained detailed cost and return information for a sample of seventeen specific innovations. These innovations were a mixture of new products and new processes. Table 1 is drawn from the study and shows the rates of return that were estimated for the sample of innovations.[6]

Two conclusions emerge clearly from the table. First, the social rate of return to innovation is very high; the median rate for the group was 56 percent. The median private rate is much lower -- 25 percent. In short, the median social rate of return is over twice the private rate.

Second, there is tremendous variability in the rates of return. Six of the innovations earned a private return of less than 10 percent. One earned over 200 percent.

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5 Edwin Mansfield, John Rapoport, Anthony Romeo, Samuel Wagner and George Beardsley "Social and Private Rates of Return From Industrial Innovation," Quarterly Journal of Economics, 1977 pp. 221-40.

6 For a further discussion of the Mansfield study, see Part V below.

TABLE 1

SOCIAL AND PRIVATE RATES OF RETURN FROM INVESTMENT IN SEVENTEEN INNOVATIONS

Innovation	Rate of return (percent)	
	Social	Private
Primary metals innovation	17	18
Machine tool innovation	83	35
Component for control system	29	7
Construction material	96	9
Drilling material	54	16
Drafting innovation	92	47
Paper innovation	82	42
Thread innovation	307	27
Door control innovation	27	37
New electronic innovation	Negative	Negative
Chemical product innovation	71	9
Chemical process innovation	32	25
Chemical process innovation	13	4
Major chemical process innovation	56[a]	31
Household cleaning device	209	214
Stain remover	116	4
Dishwashing liquid	45	46
Median	56	25

a. Based on investment of entire industry.

Source: Edwin Mansfield et al. op. cit. page 233.

Even though these calculations show a social rate of return that is twice the private rate, Mansfield's group argues that their estimates of the social rate of return are probably too low. To compute the private returns, the innovating companies made available to the research group their own profitability computations. Tracking down the social returns was more difficult and some returns may well have been missed. This is likely, since returns over the whole future lifetime of an innovation cannot be known with precision. It appears, therefore, that Mansfield's estimate of the gap between social and private returns is conservative. The social rate may well be more-than twice the private rate.

The study by Mansfield and his associates is far from the only one to have found a high social rate of return to R&D. The Congressional Budget Office lists seven studies of the return to R&D.[7] The CBO list includes another Mansfield study, together with studies by Jora Minasian of USC, William Fellner of Yale, Zvi Griliches of Harvard, Nestor Terleckyj of the National Planning Association, F.M. Scherer of Swarthmore, M.I. Nadiri of NYU and A.N. Link of North Carolina. The CBO Study concludes:

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7 Congressional Budget Office, Federal Support for R&D and Innovation, Washington, April 1984, pp. 28-31.

"Despite the simplified assumptions needed to execute these studies their results strengthen the case for federal R&D support. If the measured rate of return to R&D exceeds the average return to other investments, this suggests that the private sector underinvests in R&D because of barriers such as nonappropriability."

C. The Riskiness Of R&D Contributes To Private Underinvestment In Commercial R&D

A second reason why businesses may undertake less R&D than the society would wish for is that R&D projects are very risky. The-wide variation in returns shown in Table 1 illustrates this.

Suppose there are a thousand different R&D projects that could be undertaken at some point in time. Suppose each project had only a 1 in 4 chance of success. From the perspective of the society as a whole, it might well be that all were worth doing. There would be about 250 successful projects and the overall rate of return could be high, even after allowing for the cost of the failures. For individual innovating companies, however, these projects are problematic. Each one might cost several million dollars, so that a single company could do only one or two. For a company with two such projects there is a greater than 1 in 2 chance that both will fail. These are tough odds to take on. Mansfield has reported in another study[8] that businesses try to stick to projects that have at least a 1 in 2 chance of success.

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8 Edwin Mansfield "Industrial Research and Development: Characteristics, Costs and Diffusion of Results," American Economic Review, May 1969, pp. 65-71.

The riskiness of R&D provides an additional reason why the private market may not provide an adequate incentive. For the society as a whole, the riskiness of a single project is not important. The overall risk is low because there are many projects. For the individual firm, this is not true. This problem applies particularly, of course, to expensive or large-scale R&D projects, where a single firm can afford to pursue only one or two.

D. High Private Returns To Commercial R&D Do Not Vitiate The Need For Government Support

Even though the studies of returns to R&D do find a substantial gap between the private and social rates of return, they often find that the private rate of return is still fairly high. This fact has been used to oppose further government support. After all, it is argued, if the private return is so high, why do businesses need a further incentive?

There are two answers to this objection. First, as already noted, R&D is very risky. In order to stimulate R&D spending, the expected return from R&D must be well above the return for safe investments. More significant, however, the estimates exaggerate private rates of return to R&D by either neglecting depreciation, or assuming it is small. A recent study by Ariel Parkes of the Hebrew University and Mark Schankerman of NYU[9] shows that the returns to an innovation

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9 Ariel Parkes and Mark Schankerman "The Rate of Obsolescence of Patents, Research Gestation Lags, and the

often decline quite rapidly over time. The effective rate of depreciation for the "knowledge capital" that R&D produces is quite high. This in no way changes the estimate of the gap between private and social rates of return, but it does show that the private return is not as high as it may have been estimated in most studies.

Footnote continued

Private Rate of Return to Research Resources." in Zvi Griliches ed. R&D, Patents and Productivity, Chicago, 1984

II. CONTINUED STRONG GOVERNMENT SUPPORT OF INNOVATION IS ESSENTIAL TO OUR ECONOMY

As noted at the outset, the U.S. economy is at a critical point in its history. Productivity growth has been sluggish. Our technological lead, once taken-for-granted, has narrowed considerably and is under vigorous assault from our competitors. Continued strong support of innovation is essential in this environment, for all of the reasons elaborated below.

A. Innovation And R&D Are Essential If The U.S. Is To Enjoy Significant Productivity Growth

1. Innovation, Productivity, And Economic Growth

Taken as a whole, the period from 1948 to 1983 was one of impressive growth in the private business sector of the U.S. economy. Output almost tripled, even after adjusting for the effect of inflation.[10] This increase in output was associated with a very large increase in productivity. Output per hour more than doubled over the period (it increased by a factor of 2.23).

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10 Data on output and productivity were obtained from the Bureau of Labor Statistics, U.S. Department of Labor.

This increase in productivity was the principal force driving improvements in living standards for all Americans. The average hourly compensation of employees in the business sector also more than doubled over the 1948 to 1983 period (it rose by a factor of 2.1), advancing more-or-less in line with productivity growth.

Some of the rise in productivity was due to an increase in the amount of capital equipment available to each employed worker. But this was not the most significant source of productivity growth. According to the Bureau of Labor Statistics (BLS), almost three-quarters (73 percent) of the growth in productivity has been the result of improvements in what is called "multifactor productivity." This productivity concept measures the effectiveness with which both capital and labor are used. To a considerable extent, increases in multifactor productivity are the result of new and improved technologies and production methods. These BLS data, therefore, suggest that innovation has been a key factor leading to increases in both productivity and in living standards in the post-War period.

Edward Denison of the Brookings Institution, who is perhaps the world's leading authority on economic growth, supports this finding. In his recently presented calculations for the lengthy historical period 1929-82,[11] Denison found

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11 Edward F. Denison, Trends in American Economic Growth, 1929-1982, draft manuscript, The Brookings Institution December 1984, see esp. p. 95

that 54 percent of the increase in labor productivity (output per person) in the non-residential business sector of the U.S. economy was a result of a residual factor that he identifies principally with "advances in knowledge." Moreover, he estimated that an additional 20 percent is the result of efficiency gains achieved through operating at a larger scale. Much of this additional 20 percent is also related to new technology. As Richard Levin of Yale has pointed out,[12] the benefits of large scale operation can often be achieved only in combination with improved technology. Larger plants can only be built as new materials, designs and production methods are developed. Denison's work suggests, therefore, that two-thirds and possibly as much as 80 percent of the productivity growth achieved during the 1929-82 period was directly or indirectly attributable to technological advance.

There is no serious dispute among economists or policymakers about the fact that innovation is a vital ingredient in the process of economic growth. But there is, perhaps, some misunderstanding of just how important innovation is in comparison to increased investment in plant and equipment. Certainly a growing economy needs to invest in new

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12 Richard C. Levin "Technical Change and Optimal Scale: Some Evidence and Conclusions," Southern Economic Journal, October 1977, pp. 208-221.

capital equipment, but as just discussed, innovation rather than capital investment has been shown to be the main force behind improvements in productivity and living standards. Indeed, innovation is crucial to investment. Old plant and equipment is replaced when it becomes obsolete, not when it wears out. Just adding more capital would not add much to profits or productivity if the new capital did not embody new technology or production methods. If the flow of new technology is inadequate, the rate of return on investment will be driven down and the flow of new investment itself will be discouraged.

2.- R&D, Productivity And Economic Growth

R&D carried out in U.S. businesses is today the primary means by which innovation is generated. Developments in pure science are transformed into new products and processes that meet the needs of the marketplace. Existing science and engineering are applied in new ways, and new materials are incorporated into products for consumers and producers.

In 1971 the National Science Foundation convened a Colloquium to which the leading experts on R&D and economic growth contributed papers. The proceedings of this Colloquium, published in 1972,[13] stand as a clear statement of the

13 National Science Foundation, Research and Development and Economic Growth/Productivity, Washington, 1972.

importance of R&D to the process of innovation and growth. For example Leonard Lederman of the NSF summarizes the findings as follows:

> "...all available evidence indicates that R&D is an important contributor to economic growth and productivity. Research to date seeking to measure this relationship (at the level of the firm, the industry, and the whole economy) points in a single direction -- the contribution of R&D to economic growth, productivity is positive, significant and high."[14]

The individual papers by Edwin Mansfield of Pennsylvania, William Fellner of Yale and Zvi Griliches of Harvard provide the basis for this conclusion.

Since 1971 both the same authors and others have continued to find R&D to be a very significant determinant of economic growth[15] Thus, both links in the chain are complete: innovation is the most important determinant of productivity growth and R&D spending is crucial for innovation. R&D spending by businesses is a vital part of the process by which productivity growth and improvements in living standards are achieved in our economy.

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14 National Science Foundation, Op. cit. p.3.

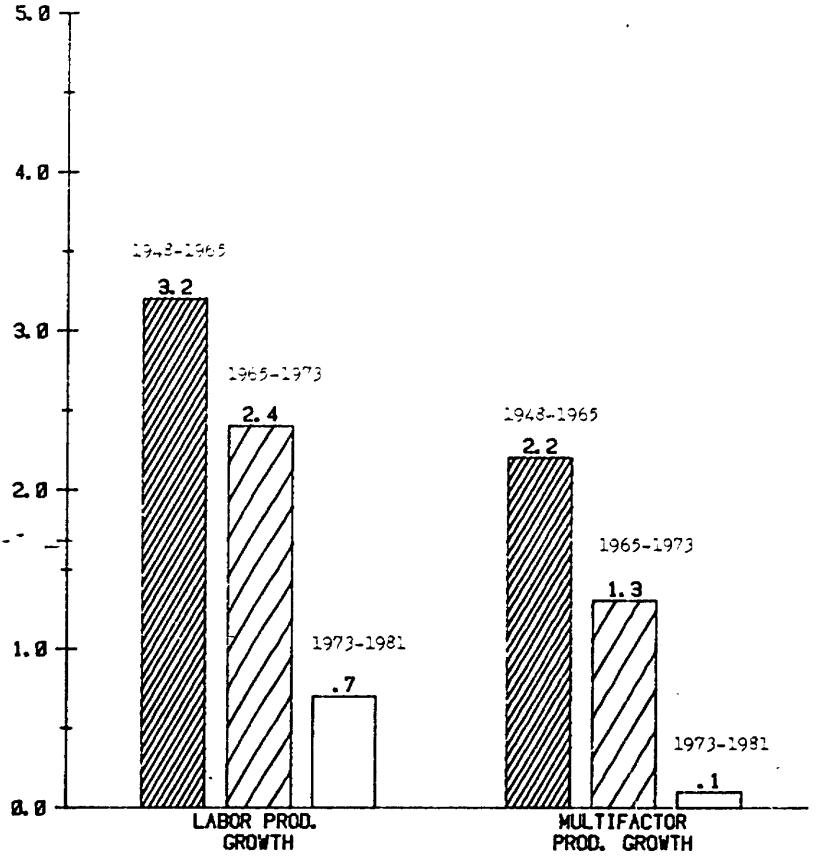
15 See for example, Nestor E. Terlecky, Effect of R&D on the Productivity Growth of Industries: An Exploratory Study, Washington, 1974 and M.I. Nadiri and G. Bitros "Research and Development Expenditures and Labor productivity at the Firm Level," in John W. Kendrick and Beatrice Vaccara eds., New Developments in Productivity Measurement and Analysis (New York, 1980).

3. Innovation, R&D And The Recent Slowdown In Productivity Growth

Although the post-war period as a whole was one of impressive advance, the U.S. experienced a dramatic slowdown in its rate of productivity growth beginning in the latter part of the 1960's and intensifying after 1973. Figure 1 shows the growth rate of labor and multifactor productivity over various periods. The private business sector of the economy would now be producing about 30 percent more output than it is now producing had the pre-1965 growth trend continued. This much extra output would have been enough to solve the budget deficit problem several times over and still have left more resources available for investment and consumption.

The economic difficulties of the past 15 years have been greatly exacerbated by the slowdown in productivity growth. Wage increases were geared to expected improvements in productivity, and when these gains did not materialize, the wage increases became inflationary. Increases in Social Security and other social programs were made in the expectation of a growing economy and rising incomes for taxpayers. When incomes failed to rise as expected, the results were increased tax burdens and budget deficits.

FIGURE 1. U.S PRODUCTIVITY GROWTH HAS BEEN DECLINING.



Note: Labor productivity is average output of the private business sector per hour worked. Multifactor productivity is average output per unit of combined capital and labor. Both are percent per year.

Sources: Computed by the authors from data supplied by the Bureau of Labor Statistics, release USDL 84-431.

The same logic that found that innovation was the main source of the productivity growth also suggests that the slowdown in productivity growth has been caused partly by a reduction in the pace of innovation. And there is some direct evidence to support this view, particularly the idea that innovation slowed after 1973. For example, the number of patents issued to U.S. inventors fell from a high of over 50,000 a year 1971-73 to around 35,000 a year in the early 1980's.[16]

The decline in innovation that is indicated by both the deterioration in productivity growth and the reduction in the rate of patenting has been linked to a decline in the growth of R&D spending that took place somewhat earlier. Figure 2 shows the extent of this growth decline. The growth rate of both total industrial R&D and company funded R&D was sharply lower in the period 1969-78 than it was in the prior period. Although it is not possible at this stage to identify precisely the impact of R&D on productivity growth, there is a virtual consensus that rapidly growing R&D is a prerequisite of rapid productivity growth. John W. Kendrick of the American

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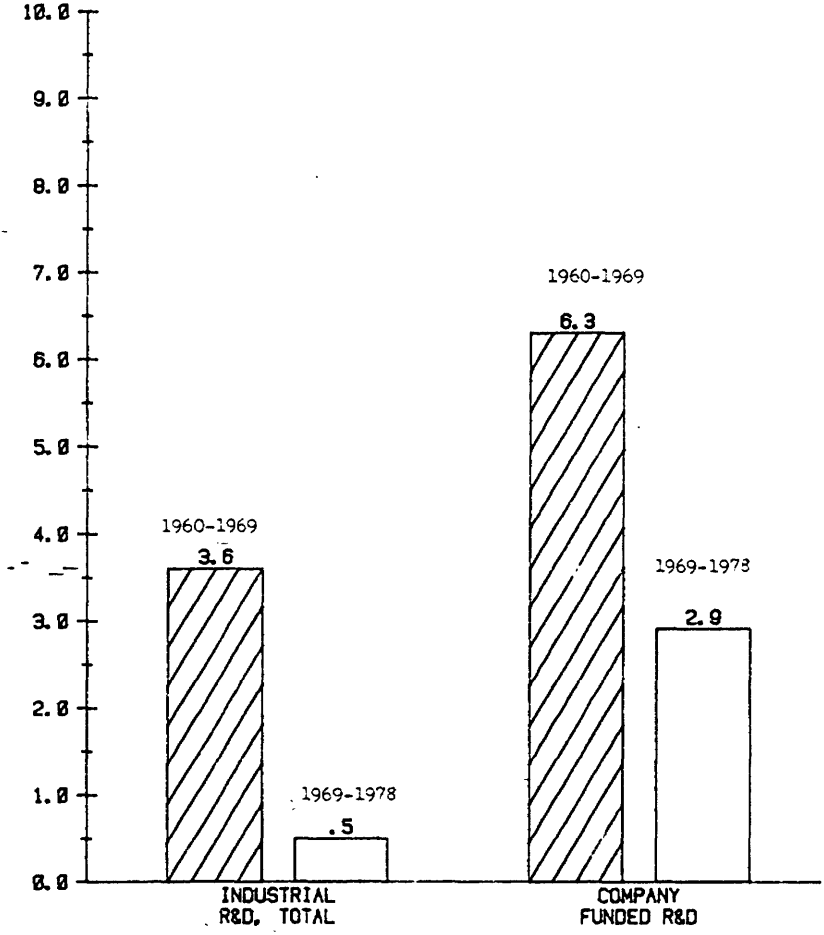
16 Data on patents and R&D from National Science Board Science Indicators 1982, Washington 1983. Recent patent data were obtained from the U.S. Patent Office by the authors.

FIGURE 2: THE GROWTH OF INDUSTRIAL R&D SPENDING WAS LOW IN THE 1970'S



Note: Percent annual growth rates of expenditures on Industrial R&D in constant dollars.

Source: National Science Board Science Indicators 1982, Washington 1983, p281

Enterprise Institute, a recognized expert on productivity, has emphasized that the slowdown in R&D was a major contributor to the decline of productivity growth.[17]

4. Recent Productivity Performance And R&D Spending Growth

Beginning after 1978 and continuing to the present there has been a resurgence in industrial R&D spending. Company-funded industrial R&D grew at an annual rate of 5.6 percent 1978-84.[18] Since 1978, R&D spending by U.S. companies has grown as rapidly as R&D spending by the U.S. government on defense.[19] Between 1978 and 1983, private companies accounted for over three quarters of the total increases in U.S. R&D spending[20]

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17 John W. Kendrick "The Implications of Growth Accounting Models" in Charles R. Hulten and Isabel V. Sawhill eds. The Legacy of Reagonomics, Washington, 1984.

18 This figure is adjusted for inflation. Data for recent years were obtained directly from the National Science Foundation.

19 Defense spending on R&D increased from $12.9 billion in 1978 to $24.9 billion in 1983; R&D financed by private industry grew from $22.5 billion in 1978 to $44.3 billion in 1983.

20 Private companies accounted for 52 percent of the total increase in U.S. R&D spending on basic research: for 83 percent of the rise in applied total U.S. R&D spending for research; and for 69 percent of the rise in total U.S. development spending.

The rise in private R&D spending took place despite both the mild 1980 recession and deep recession in 1982 (the worst the U.S. has experienced since the 1930's). In part, the R&D resurgence resulted from the realization by U.S. businesses that innovation and improved productivity were vital to their survival and that the opportunities for technical advance were out there to be exploited.

The 1981 R&D tax credit also played an important role. First, it demonstrated that even in a time of budget-cutting there was a new commitment in government to improving innovation and productivity. Second, it provided a modest but important financial incentive to encourage continued growth in spending. The strength of R&D spending in 1982, a deep recession year in which R&D budgets would normally be cut back, is significant evidence by itself that the R&D tax credit had a stimulative effect on private R&D efforts.[21]

Some have pointed to the surge in R&D spending in the two years before the credit as evidence that R&D thereafter would have increased in any event if the credit had not been in place. This line of argument ignores the fact that in 1979, a

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21 The concern has been voiced that, due to the structure of the credit in its current form, it would make R&D spending more cyclically sensitive. The experience of 1982 is exactly the opposite. For estimates of the social gains produced by the credit, see Part IV below.

year in which total R&D spending rose, oil prices jumped dramatically due to the decline in Iranian oil production. The sharp oil price rise induced energy-related companies to step up their R&D activities. For example, after adjusting for inflation, the chemical industry increased its R&D by 15 percent. The equivalent figures are 52 percent for the fuel industry and 58 percent for the oil service and supply industry.[22] In the absence of some additional incentive, such as the tax credit, R&D spending might well have fallen back again in 1981-83, once the price of oil stabilized or began to fall. The R&D tax credit helped to maintain the growth in spending -- unprecedented for a recessionary period, especially one so severe as 1982.

There are increasingly strong indications that the recent R&D surge is about to result in a surge in productivity growth. The delayed impact of R&D growth on productivity is normal and logical. First, it takes time before a new idea can be developed into a commercially successful innovation. Second, almost all private R&D is done in the manufacturing sector. The innovations that are generated do improve productivity within manufacturing, but just as importantly, the materials and equipment produced are then used by rest of the economy and

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22 Data are from Business Week, July 9, 1984 and the Economic Report of the President February 1984 (for the price deflator).

productivity is increased outside of manufacturing. This process takes time, as old machinery and methods are gradually replaced by the new.

It is to be expected, therefore, that the resurgence in R&D spending growth would begin to show up in productivity only after a few years. This is especially true since the 1982 recession cut capital spending and delayed the modernization efforts of many U.S. businesses. At present there are signs of an improvement of productivity growth within manufacturing -- the place where one would expect it first. Average labor productivity grew at an average annual rate of 3.1 percent from the third quarter of 1981 to the fourth quarter of 1984.

This recent performance compares to a productivity growth rate of 1.5 percent a year over the previous eight years. Outside the manufacturing sector, trend productivity growth remains weak.[23] But capital spending is now strong and there is a widespread judgment in the business community that the fruits of the recent surge in R&D spending will also show up in productivity growth outside the manufacturing sector over the next few years.[24]

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23 Productivity fell in the 1982 recession and then recovered after that. So far the trend of productivity growth -- after adjusting for the cyclical pattern -- does not look very strong.

24 See Business Week "The Revival of Productivity," February 13, 1983 and Fortune "Good News Ahead for Productivity," December 10, 1984.

B. Technology Is Important To Our Modern Economy

U.S. policies towards R&D are particularly important because of the role technology plays in U.S. growth. Technology contributes disproportionately to the growth in output, productivity, exports and to the provision of good manufacturing jobs.

One method of demonstrating the importance of technology is to examine the industries where technology is primarily developed -- the so-called "high-tech" sector. The following sections pursue this examination along several dimensions.

The high-tech industries are important because they make vital contributions not only to the workers and shareholders in their own industries, but also to the performance of other industries outside the high-tech sector as well. The new products and processes developed and produced by high-tech companies are subsequently embodied in the machines purchased by firms in other sectors. The new knowledge generated by high-tech is diffused to employees and management throughout the economy. The competitiveness of many basic industries in particular, will depend in the future on technological advances in automation and computer-aided design. In short, just as innovation itself produces social gains in excess of private returns, the high-tech sector disperses benefits to the entire economy that exceed the output of high-tech firms.

It also bears emphasis that certain of the so-called basic industries are major performers of R&D and are themselves becoming high-tech. The ceramics industry has been revolutionized with the growing importance of fiber optics. Specialty steel firms are increasingly engaged in new techniques and active in developing new products to meet changing demands. The automobile industry is pioneering innovations in robotics, computer-aided-design, and computer-aided-manufacturing. A recent news reports described a microelectronic monitor weighing 35 pounds capable of performing all functions heretofore performed by railroad freight-train crew members riding in the caboose, which has the potential of saving American railroads $400 million annually in fuel and maintenance costs.[25] As demonstrated below in Part IV, R&D spending by certain basic industries in the years following the enactment of the R&D credit has jumped significantly higher than would have been forecast based on historical trends and cyclical factors alone.

The advantage of the R&D credit is that it does not discriminate among particular industries. All firms, regardless of their present degree of R&D intensity, can benefit from the credit. The impact of R&D is most visible in

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25 Washington Post, Sunday, February 17, 1985, p. 1.

the so-called high tech industries, however. In 1979, for example, 75 percent of such R&D was performed in just six industries generally classified as high tech: Aerospace (21 percent), Electrical and Electronics (21) Chemicals (14), Computers (8), Instruments (7) and Machinery (4).[26] It is instructive, therefore, to examine their recent performance.

1. High Tech Industries And Employment.

About 96 percent of all R&D performed by private U.S. firms is undertaken in the manufacturing sector--primarily by a small number of industries. The standard, but conservative, estimate that we use here implies that high-tech accounted for about 7 percent of total U.S. employment in 1984 and about 33 percent of employment in U.S. manufacturing.[27]

As shown in Table 2, the employment share in manufacturing held by high-technology industries has accelerated in recent

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26 OECD Science and Technology Indicators: Resources Devoted to R&D, OECD Paris 1982.

27 The Bureau of Labor Statistics has identified high-technology industries using three definitions. "High Technology Today And Tomorrow: A Small Slice Of The Employment Pie", Monthly Labor Review, November 1983, pp. 50-58. By its broadest definition, high-tech accounted for 13.4 percent of U.S. employment in 1982. While the exact definition of the high-tech sector depends on the precise criteria used (such as the ratio of R&D to sales and/or the proportion of employment accounted for by scientists and engineers), the dominant role of a few industries means that similar conclusions are reached whatever reasonable definition is used.

Table 2. Shares of Value Added and Employment in U.S. Manufacturing, by Production Characteristics of Industries, Selected Years, 1960-80

Percent

Item and characteristic of industry	1960	1970	1972	1973	1980
Value added[a]					
High-technology	27	31	31	32	38
Capital-intensive	32	30	31	32	27
Labor-intensive	13	13	14	13	12
Resource-intensive	28	25	24	23	23
Employment[b]					
High-technology	27	30	28	29	33
Capital-intensive	29	30	30	30	28
Labor-intensive	21	20	21	21	19
Resource-intensive	23	21	21	20	20

Source: Lawrence, Robert Z., Can America Compete? (Brookings Institution, 1984)

a Computed for each input-output industry by multiplying gross output in 1972 dollars by the ratio of value added for output in the 1972 input-output table

b Derived from the Bureau of Labor Statistics series on employment and earnings.

years. After increasing from 27 percent in 1960 to 29 percent in 1973, it rose to 33 percent by 1980.[28] Moreover, employment in high-tech sectors fell less in the 1981 recession than in the rest of manufacturing and increased more rapidly in the subsequent expansion. The 9 percent rise in high-tech manufacturing employment between December 1982 and December 1984 compares with the 7.7 pace for manufacturing overall and the 8.0 rise in total establishment employment.

High-tech industries also pay good wages and afford proportionately more middle-class earnings opportunities than the rest of manufacturing. In 1980, for example, the annual average compensation in high-tech industries was 18.6 percent higher than in the rest of manufacturing.

2. The High-Tech Sector And Economic Growth.

Despite its relatively small share in the overall economy, the high-tech sector has an increasingly important and disproportionately large role in U.S. economic growth. Both output and employment growth in high-technology industries have been relatively rapid over the past decade. Indeed, nine of the ten fastest growing U.S. industries in recent years have been high-technology industries.[29]

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28 Lawrence, op. cit.

29 An Assessment of U.S. Competitiveness in High Technology Industries, U.S. Department of Commerce, February 1983.

Table 3. Growth of Fixed Capital, Hours Worked, and the Capital-Labor Ratio in U.S. Manufacturing, High Technology and Other Manufacturing Industries, Selected Period, 1950-80

Item	Average annual percentage change[a] 1950-60	1960-70	1970-80	1973-80
Fixed Capital				
High-technology[b]	4.6	4.4	4.4	5.1
Other Manufacturing[c]	2.8	2.8	3.0	3.3
Hours worked				
High-technology	2.8	2.7	1.7	1.6
Other Manufacturing	0.2	1.0	0.0	-0.9
Capital-labor ratio				
High-technology	1.8	1.7	2.6	3.4
Other Manufacturing	2.6	1.9	3.1	4.2

Source: Lawrence, Robert Z., Can America Compete? (Brookings Institution, 1984)

a Compounded annually

b High-technology: chemicals, machinery, instruments

c Low-technology: total manufacturing minus high technology

Being one of the few sectors of growing employment outside the services sector, high-tech industries have played a major role in preventing America's deindustrialization. Tables 2 and 3 highlight the increasing importance of these industries for U.S. manufacturing employment, output and capital formation over time. Together, they indicate the powerful long run shift toward high-technology industries -- a trend which accelerated between 1973 and 1980.

For example, Table 2 illustrates that in the thirteen years from 1960 to 1973, the share of high-technology products in output increased from 27 to 32 percent. In the next seven years it rose from 32 to 38 percent.

Table 3 reports growth in capital stock, separated at the two-digit SIC level into high technology and other manufacturing industries. Capital formation, like output and employment growth has been more rapid in the high-technology industries. When one compares 1973-80 with the 1950s and 1960s, fixed capital and the capital-labor ratio in high-technology showed a marked acceleration in the latter part of the 1970s.

3. The Importance Of High-Tech To Investment.

The high-technology sector plays a crucial role in the production of equipment. In 1980, for example, it accounted for over ninety percent of this end-use category.

Technological advances in the high-technology industries are embodied in new machines and products and diffused throughout the economy through equipment purchases. Indeed it has been estimated that half the benefits from R&D -- measured in terms of specific products and specific processes -- are gained by the non-manufacturing sectors of the economy.[30]

Since 1970, the high-technology sectors have assumed increasing importance in U.S. investment for two reasons: First, the mix of U.S. investment has shifted away from structures and towards equipment.[31] Second, innovations related to advances in electronics have made investment in information equipment the most rapid component of investment growth. Between 1973 and 1983, for example, the volume of U.S. investment in information technologies increased at an annual rate of 11.1 percent. Office equipment and computers rose at a 19.5 percent annual rate and the growth rate of investment in electronics and communications averaged 6.5 percent per year. In 1983, office equipment and computers accounted for 43.5

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30 Dept. of Commerce (op. cit) page 4. The estimate given in the text is based on F.M. Scherer, "Research and Development, Patenting and the Micro-Structure of Productivity Growth" Report to the NSF, June 1981.

31 In 1970, producer's durable equipment accounted for 61 percent of U.S. total fixed investment; in 1983, its share was 70 percent.

percent of total equipment expenditures as compared with just 21.4 percent a decade earlier.

4. High-Tech And Trade.

American policies promoting R&D are particularly important because the growing importance of high-technology products in U.S. trade has coincided with erosion of U.S. technological leadership.

The contribution of high-technology sectors to U.S. trade performance is disproportionately large and has been rising over time. In 1983, high-technology products, as defined by the Commerce Department, accounted for 29.6 percent of all U.S. merchandise exports and 43.7 percent of U.S. exports of manufactured products. These shares have increased from 24.2 and 35.2 percent in 1970, respectively. In contrast to the long run decline in the U.S. trade balance in non-high technology products, the U.S. trade balance in high-technology products increased from $6.1 billion in 1970 to $25.5 billion in 1980. The U.S. has also performed relatively better in international competition in high-technology goods than in other manufactured products since the dollar's rapid appreciation in 1980. Between 1980 and 1983, the decline in the trade balance in high technology products of $8.0 billion was only about a fifth of the slump of $42.1 billion in the rest of manufacturing trade.

Economists have advanced a variety of explanations for the growing U.S. specialization in high-technology products. Does it result from the relative abundance of engineers, scientists and other educated workers in the U.S. labor force, the relatively large amounts spent in the United States on R&D, or the market inducements to innovate in a rich economy? The strong association between these factors inhibits an exact quantification of the contribution of each.[32] Nonetheless, U.S. success in exporting depends on certain characteristics. Since U.S. labor costs are extremely high, U.S. firms must compensate for their higher costs with higher productivity and superior products. U.S. export industries are typically at the technological frontier. The products they sell are often novel, require specialized production methods, and as they are still being developed, they benefit from being made in close proximity to the market in which they are sold. Indeed, Raymond Vernon of Harvard University and others have observed a product cycle in which the U.S. continuously develops new export products to replace those whose production processes are diffused abroad.[33]

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32 See for example, Lowinger, Thomas C. "The Technology Factor and the Export Performance of U.S. Manufacturing Industries", Economic Inquiry June 1975, pp. 221-36.

33 Raymond Vernon, "International Investment and International Trade in the Product Cycle" Quarterly

Over time, however, international competition between the U.S. and other developed countries has changed in character.[34] Other nations have now moved much closer to the technological frontier. Their enhanced productivity has been reflected in higher wage rates, and thus they too must specialize in high-tech products. In addition, as foreign incomes have converged to U.S. levels and international markets have become more integrated, U.S. manufacturers have lost some of the advantages they enjoyed from producing in a high-income market and enjoying large economies of scale.

Footnote continued

Journal of Economics, Vol. 80, No. 2, (May 1966) pp 190-207. Gary C. Hufbauer, "The Impact of National Characteristics and Technology on the Commodity Composition of Trade in Manufactured Goods", in The Technology Factor in International Trade Raymond Vernon, ed. (New York: Columbia University Press, 1970) pp 145-231. Donald B. Keesing, "The Impact of Research and Development on United States Trade", Journal of Political Economy, Vol 75. No 1 (February 1967) pp. 38-48.

34 U.S. manufactured goods trade with developing countries continues to reflect traditional patterns of specialization. Imports, on the other hand, are by and large mature and standardized products that can be mass-produced using skills that can be quickly acquired. They may be manufactured relatively intensively using either unskilled labor (e.g., apparel, footwear) or capital (e.g. steel.)

Most of the major industrial nations are therefore now specializing in products that are knowledge intensive. This is confirmed in studies for Sweden, Germany, and Japan.[35] New products and processes are now moving across the Atlantic and the Pacific in both directions and the product cycle is no longer a phenomenon unique to U.S. manufactured goods trade.[36] In short, at the same time as the United States has become increasingly reliant upon high-tech exports, American global dominance in high-tech has been eroding. The U.S. shares of world trade of most high-tech products have diminished.[37] And the U.S. export surplus in high-tech products -- that is the extent to which the value of exports exceeds the value of

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35 See the study by Ohlsson quoted in Blackhurst, R., N. Marian and J. Tumlir, "Trade Liberalization Protectionism and Interdependence," GATT Studies in International Trade, No. 5 Geneva, Nov. 1977; Stern, Robert M. "Some Evidence on The Factor Content of West Germany's Foreign Trade" Journal of Political Economy, February 1976, Vol. 84, No. 1 pp. 131-145. and Heller, Peter S. "Factor Endowment Change and Comparative Advantage: The Case of Japan, 1956-1969", Review of Economics and Statistics, Vol 58, No. 3 (August 1976) pp. 283-291.

36 See Vernon, Raymond, "The Product Cycle Hypothesis in a New International Environment" Oxford Bulletin of Economics and Statistics, Vol. 41 (November 1979) pp. 255.

37 However, U.S. shares of world trade in high-technology products have declined relatively less than those of more routine goods. See for example, Balasa Bela, "U.S. Export Performance: A Trade Share Analysis", Johns Hopkins University Mimeo, 1978.

imports--has been declining as a share of high-tech exports over the past decade (falling from 56 percent to 45 percent).[38] The United States no longer has a comfortable technology lead. Staying ahead requires continuous innovation to offset the inevitable diffusion of technology overseas.

C. The U.S. R&D Effort In A Global Perspective

Global R&D activity is highly concentrated. Together the five biggest investors, the United States, Japan, Germany, The United Kingdom and France perform over 85 percent of R&D in the OECD area. We have stressed that social and private rates of return to R&D differ. Therefore it is interesting to compare the efforts by the U.S. to cover this gap with the efforts of the major R&D spenders.

The scale of the U.S. effort remains considerable. The United States still leads in terms of the absolute size of its expenditures, its labor force engaged in R&D, its overall productivity levels, contributions to technical and scientific literature, the share of world exports of high-technology products and international sales of technology.

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38 See Lester A. Davis "New Definition of High-Tech Reveals that U.S. Competitiveness in this Area Has Been Declining". Business America, U.S. Dept. of Commerce, October 18, 1982.

In 1979, for example, the U.S. spent as much on all R&D as France, Japan, Germany and the United Kingdom combined. We spent 1.5 times as much as these countries combined on industrial R&D, and employed about 1.3 times as many scientists and engineers in industry.[39]

Nonetheless, several considerations reveal the U.S. effort in a less favorable light. First, the U.S. R&D efforts looks large relative to that of other countries because the U.S. economy is itself so big. Measured as a share of total GNP, our total R&D spending is no greater than that of other nations (see Figure 3).

Second, a high proportion of the U.S. R&D effort is spent on nonciviltan technologies (i.e., defense and space). On the basis of its share of GNP devoted to civilian R&D, the United States has been among the lowest of the big five since the mid-1960's (See Figure 4).[40] Differences in government policies are important in explaining the differences in the

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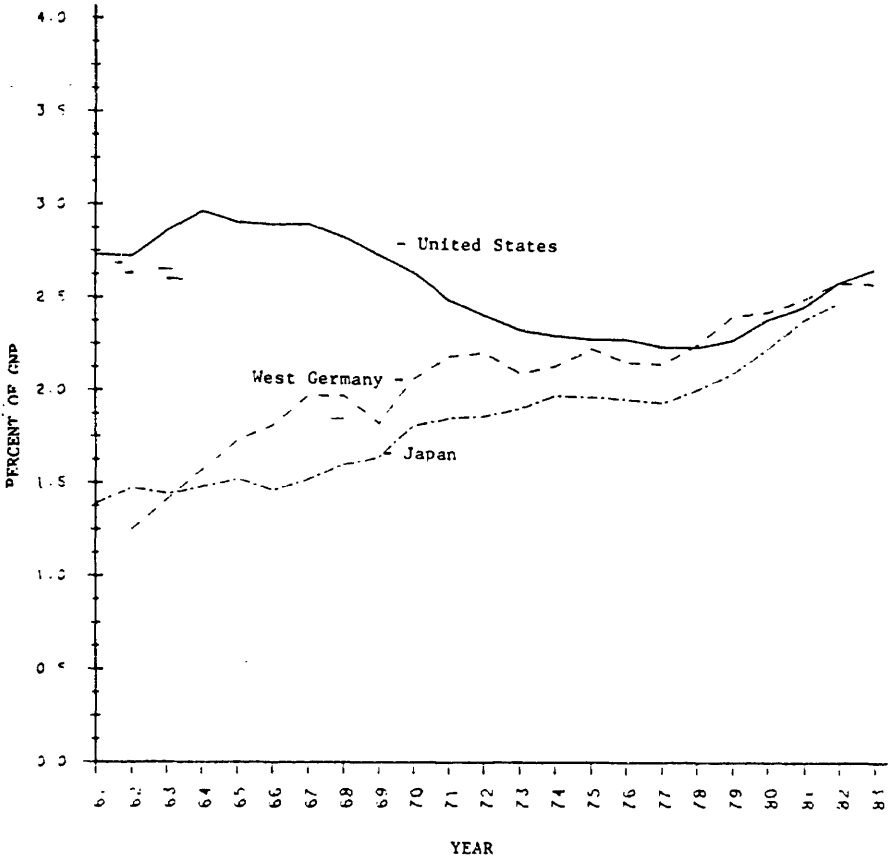
39 U.S. manufacturing firms continue to devote much higher proportions of value-added in manufacturing to R&D (6.5 percent in 1979). By comparison, the percentage of manufacturing product devoted to R&D was 5.0 in the United Kingdom, 4.0 in Germany, and 3.7 in Japan and France.

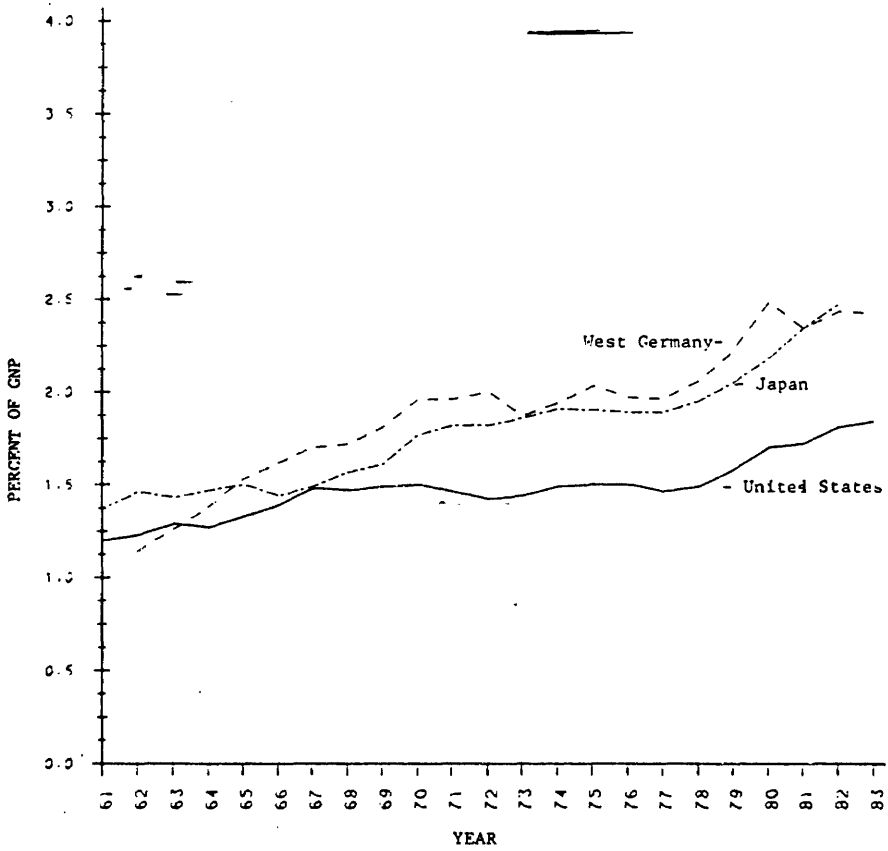
40 In 1965, for example, civilian R&D as a share of GNP was 1.39 percent in the United States, 1.40 in France, 1.62 in West Germany, 1.44 in Japan and 1.58 in the United Kingdom.

Figure 3. NATIONAL R&D EXPENDITURES AS A PERCENT OF GNP



Source: National Science Foundation

Figure 4. CIVILIAN R&D EXPENDITURES AS A PERCENT OF GNP



Source: National Science Foundation

proportion of R&D spent on defense in the United States and other nations. U.S. government support for R&D is distinguished by the large (and increasing) commitment to defense on the one hand and the small (and declining) aid provided directly for the development of commercial technologies. Indeed, according to OECD estimates, in 1979 the U.S. federal government spent $92 million to aid industrial development other than in aerospace; by comparison, the Japanese government spent $270 million, the French $332 million and the German $466 million.[41]

Third, U.S. technological leadership has been eroding. The growth rates of the R&D indicators for foreign countries have been higher than those for the United States. In part, this reflects the inevitable international diffusion of technology but it also reflects stepped up efforts by foreign national governments to improve technological capabilities.

Over the 1970's, the U.S. share in the total of R&D spending by the big five declined from two-thirds to one-half. Despite the rapid increase in U.S. R&D efforts since 1978, the recent data indicate a further erosion in the relative U.S. R&D position. Between 1978 and 1984, the share of R&D in U.S. GNP

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41 OECD Science and Technology Indicators: Resources Devoted to R&D, OECD 1984, p. 96.

increased by 0.4 percent of GNP; by comparison, German R&D spending increased by 0.63 percent of GNP.

The intensity of the U.S. civilian R&D effort has also continued to decline in comparison with Germany and Japan since 1978. Between 1978 and 1983, for example, U.S. civilian R&D as a share of GNP increased from 1.54 to 1.76 -- an increase of 13.6 percent. Yet, between only 1978 and 1981 (the latest data readily available), the share of GNP spent on civilian R&D in Germany and Japan increased by 21 and 18.8 percent, respectively.

Foreign governmental programs call for a continued and stepped up challenge to U.S. civilian technological leadership. They have specifically targeted high-technology industries for special support. Such industries receive the benefits of a broad range of measures, which include protected local markets, subsidized government loans, special tax credits and allowances, export subsidies, antitrust exemptions and government sponsorship of collaborative research efforts in key technological fields. In numerous respects, these efforts surpass those made on behalf of U.S. firms by the U.S. government.

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D. Foreign Government Support Of R&D

The greatest challenge to U.S. technological leadership comes from Japan, whose government is strongly subsidizing R&D. The current Socio-Economic Seven Year Plan (for 1979 to 1985) for Japan published by the Economic Planning Agency indicates that the Japanese government seeks to raise the share of GNP devoted to R&D to three percent, a level that would significantly exceed the current share in the U.S.

This goal demonstrates that Japan views the intensification of its R&D effort during the 1980's seriously in order to develop a strong national technological base. Indeed, the MITI vision for the 1980's proposes the concept of a "technology based nation."[42] To achieve this goal over the 1980's, MITI will spend in the materials field $217 million (and private firms 6-10 times that amount) in the development of new industrial materials (high performance ceramics; synthetic membranes for new osmotic techniques; advanced composites, i.e., plastics reinforced by carbon fiber); polmeric materials that are electrically conductive; advanced alloys of crystal and amorphous composition; and high performance engineering plastics). In biotechnology, a cooperative program with several large Japanese firms will

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42 OECD Science and Technology Indicators: Resources Devoted to R&D, OECD 1984, p. 135.

focus on recombinant DNA, bioreactor development and large-culture cell growth. And in information processing, MITI laboratories (Agency for Industrial Science and Technology) will work on the development of atomic grid electronic components, three-dimensional integrated circuits, and integrated circuits for use under extreme environmental conditions. In addition, MITI has major information processing projects devoted to the development of super-computers and fifth generation computers.

The Japanese tax system has been specially modified to encourage R&D spending. In Japan, capital R&D expenditures can be depreciated at more rapid rates than ordinary useful lives for other types of investment. In addition, Japan has had in place since 1966 an R&D tax credit for research work that currently is equal to 20 percent of the excess of current year R&D spending over the highest R&D spending level incurred in any accounting period since 1973.[43] According to the Report for the Cabinet Council on Commerce and Trade, prepared by the U.S. Department of Commerce, "Japan's tax policies have been particularly helpful to the development of their high-technology industries in general and for specifically

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43 Corporation Income Tax Treatment of Investment and Innovation Activities in Six Countries, National Science Foundation, PRA Research Report, 81-1.

designated industries such as microelectronics and computers." These policies encourage investment and savings; the special tax provisions encourage high-technology development through accelerated depreciation, write-offs for purchasing designated Japanese equipment such as computers, etc. The Commerce Department report notes: "The combined effect of these subsidies has been very important ... In 1981 alone, the tax revenues lost just under the category of promoting technology of over $600 million, was over one fourth of all Japanese national tax benefits granted."[44] In its comparison of the overall impact of government policies on high-tech capital costs in the United States with those abroad, the report concludes:

> "We believe that some specific high-technology industries may have faced effectively higher capital costs here than abroad. This has been due to the combined effects of preferential treatment afforded specific foreign firms in obtaining capital at favorable rates and foreign government policies which in effect act to reduce the risk of an industry project."[45]

The German government is also devoting increased attention to promoting industrial productivity and technology. Between 1979 and 1982, German government efforts intensified in

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44 U.S. Department of Commerce, op. cit. p. 19.

45 Ibid., p. 22.

projects to finance activities in processing metalliferrous wastes, the promotion of the development of new products and techniques with the aid of microelectronics, development of components in optical communications and promotion of R&D in small and medium sized firms.

The French government has instituted major new commercial R&D programs. In 1981, French R&D efforts were stepped up with a view to raising the share of R&D spending in GNP from 1.8 percent in 1981 to 2.5 percent in 1985.[46] Between 1981 and 1985, government funding for R&D is planned to increase at a real growth rate of 11.3 percent per year, while real civilian R&D will rise at 17.8 percent per year. Six priority sectors are to receive intensive efforts because of their strategic importance for the nation's independence and the competitiveness of its economy.[47]

The European Community has also increased its efforts to finance R&D at the European level. In 1984, the EC authorized a 10-year, $1 billion program -- ESPIRIT -- designed to improve European competitiveness in advanced information technology.

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46 By 1982, it was already up to 2.12 percent.

47 These sectors include biotechnology; electronics, energy, research to improve working conditions; scientific and technical cooperation with developing countries and robotics.

The community's executive commission has chosen 270 companies, universities and research institutes to collaborate on a wide range of high-technology research projects. These include long term research in microelectronics, advanced computer design, office automation and computerized manufacturing techniques.

In summary, therefore, partly because of government programs for civilian R&D and differences in tax policies, U.S. leadership in resources devoted to commercial R&D has declined over time. The growth of the technological capacities of our competitors has both benefits and costs. U.S. firms may now enjoy some of the benefits of employing foreign techniques. U.S. consumers may now enjoy new foreign products. On the other hand, U.S. firms will also experience increasing pressures from foreign competitors.

III. TAX INCENTIVES FOR FURTHER STIMULUS TO COMMERCIAL R&D ARE SUPERIOR TO OTHER ALTERNATIVE APPROACHES

As noted above, all serious students of the issue agree that innovation is vital to economic performance, and that government support for R&D is necessary. However, it has sometimes been suggested that a tax-based approach might be less desirable than other ways of channelling government support for R&D. Such views sometimes take the form of comparing the tax credit to some allegedly perfect alternative program. It is important when evaluating the desirability of the tax credit to recognize that all the policy options have some flaws. And doing nothing is the worst of all.

As demonstrated below, various non-tax measures for stimulating R&D each play an important role in our overall national effort to promote R&D. Nevertheless, with respect specifically to commercial R&D, there are persuasive reasons for preferring a tax approach for providing the added incentive that the foregoing discussion demonstrates is appropriate.

4. Direct Funding Of R&D

There is no question that direct government support for basic research is essential. Advances in basic science do not provide direct commercial benefits, and clearly there are inadequate incentives for private businesses to fund such

research on the scale that is needed. Basic research thrives best in a climate of openness. New results are quickly published. Scientists gain their reputations and rewards by revealing their discoveries to their professional colleagues.

There is also an appropriate role for government funding of what is called "generic" research. This is applied research with important industrial applications, but is so general that no single company or even group of companies could justify it. An example is research into the nature of friction.

The third area for government-funded R&D activity involves objectives distinctly public in nature, where the need for innovation is great, and the goals of research are comparatively clear, but where a general tax incentive could not be relied upon to get the job done. Defense is the obvious example of R&D activities within this category. The U.S. government is overwhelmingly the predominant purchaser of the output of the defense industry. It must work with the industry in developing new technologies. There is not and could not be a private market that could support the R&D needed to keep our defenses safe and effective.

Since direct funding of research into basic science, generic research and for clearly public purposes like defense is plainly desirable, why not forget about the tax credit and spend a billion dollars on direct funding of new commercial

technologies? The answer is that these are not mutually exclusive strategies. Both Government supported and private R&D are needed; neither is a substitute for the other. However, to address the specific problem of underinvestment in industrial R&D, a tax incentive program is the superior approach, for several reasons.

First, market-driven choices are more likely than governmental decisions to fund projects attuned to concrete economic needs. Government administrators may be able to decide that certain research will further scientific knowledge. But they have neither the knowledge nor the incentive to know what projects are most likely to pay off with innovations for which there will be substantial demand, on terms sufficient to cover the costs of producing them.

Second, governmental project selection will frequently involve uneconomic biases. Government funding of commercial activities of any sort inevitably invites, or becomes subject to, political pressures. A broad-scale industrial R&D grant program would risk having decisions turn not simply on the merits of candidate projects, but on such questions as what region, district, industry, or firm would benefit from the grant. A tax incentive program avoids this problem. Another type of bias often found in government grant programs is excessive caution. It is not unreasonable to expect that

administrators of an R&D grant program would tend to select the safest candidate projects, the ones where the outcomes are most predictable. (In academia, one often hears it observed, not wholly in jest, that the best way of getting government research support is to base a proposal on research that has already been done.)

This cautionary bias characteristic of government grant programs underscores a third disadvantage of that type of approach to providing government support for R&D. If, as is very likely, private companies would respond to such a program by seeking financing for their safest, most defensible proposals -- rather than comparatively marginal, risky concepts -- then the general result would be that firms would tend simply to use government funds for the projects they would have been most likely to undertake on their own, in the absence of the government program. This would free up the revenues that would otherwise have to have been invested in the R&D, of course. But there would be no requirement that these new-found revenues would have to be spent on R&D.

In short, it is a mistake to assume that an R&D grant program would add dollar for dollar to the amount of R&D actually carried on across the economy. Indeed, since an R&D tax incentive could generate benefits only in proportion to R&D activities actually undertaken, a tax could be more likely than

direct funding to stimulate investment in the marginal projects for which pure market incentives are insufficient.

There is evidence from abroad of the problems created when government gets too closely involved in the commercial R&D process. For example, Richard Nelson of Yale has argued convincingly that a major reason for the relative failure of the French R&D efforts has been the attempt to achieve both commercial and defense objectives in a single program.[48] The Anglo-French Concorde provides another example where government involvement resulted in an innovative product that nevertheless lacked commercial viability.

We do not wish to say that government research support in the U.S. is badly administered. On the contrary, we would encourage direct support both of research into basic science and into ways of using the sciences to meet social needs through generic research. But government sponsorship of R&D should not be at the expense of private R&D.

B. Private Support Of Basic Research

Technological and scientific expertise in the universities and research laboratories in the U.S. are important for

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48 Richard R. Nelson, "Policies in Support of High Technology Industries", Institution for Social and Policy Studies, Yale University, working Paper No. 1011, April 1984.

businesses located here. U.S. firms have access, as a result, to a pool of trained people who have learned their skills in a first-rate environment. And it is becoming increasingly the case that outstanding scientists and engineers divide their time between academically-oriented basic research and the commercial application of scientific advances. This means that cooperation between basic research institutions and commercial R&D labs is something to be fostered.

To be sure, the nation needs to maintain or increase its financial support for basic research, even for research that generates new knowledge without obvious applications. But the taxpayers have the right to expect that the bulk of the research the government is supporting will benefit U.S. workers and consumers. Not only is it important for those in business to learn of scientific progress in academia, it is also important for academics to learn what the business community needs. Academic scholarship can become arid and arcane if it is too cut off from social needs. After all, the great historical advances in astronomy by such as Galileo and Newton were spurred by the needs of merchant sailors. Tax incentives are an excellent mechanism for fostering the kind of industry-academic cooperation that can benefit both parties.

C. Patents

One of the ways in which the government has traditionally tried to overcome the problems created by the fact that the innovator does not receive the full benefit of his innovation is by granting patents to inventors. In addition, businesses use secrecy as a way of protecting their innovations. However, while the patent system works well in certain cases, it is not a full answer to the problem. We know that it isn't, because when Mansfield and others measure the social returns to innovation and find them to be very high and much higher than the private returns, they are observing an economy where patents are already in use.

The problem with the patent system is that it provides, at most, limited protection for the innovator. Many innovative ideas and designs cannot be patented. Patents are costly to obtain and very costly to defend. In areas where the technology is moving quickly, such as electronics, the patent is often obsolete by the time it is issued. Rival companies can copy an innovation and then come up with their own version of the new product or process. Patent holders who take their cases to court cannot be assured of victory. Judges often mistrust the patent system because it limits competition. Moreover, a patent has to be obtained well before the time of commercial introduction. This means that the true economic

life of a patent is much less than the statutory seventeen years.

Of course, one possible answer to these problems is to strengthen the patent system, and indeed there may be a case for doing this. But a stronger patent system is not a substitute for incentives for R&D. The patent system can limit competition and create its own inefficiencies. It is a compromise between two goals: providing an incentive to the innovator on the one hand, and making as wide as possible use of new ideas after they are developed, on the other. Moreover, patents can make the R&D process riskier, especially for small firms. A small firm may be reluctant to do research in some area if it knows that a bigger rival is likely to come up with a patent, blocking access to part of the technology.

The U.S. economy would do better if R&D could be encouraged outside the traditional industries and large firms. A universal tax credit provides an incentive to small firms or firms that have done little R&D to get started. By rewarding firms whose R&D spending is growing rapidly, it encourages those who have lagged behind.

IV. THE SOCIAL GAINS FROM A PERMANENT R&D TAX CREDIT

As discussed above, the tax credit for privately funded R&D is almost unique among the varied incentives that have become part of the federal tax code over the years. Unlike private expenditures that may be stimulated by most other tax incentives, R&D spending produces benefits to society as a whole that extend beyond the private rewards reaped by the firms and individuals who undertake R&D.

The excess social gains accrue both to consumers and to firms that compete with the companies that succeed in innovating. Consumers benefit from lower prices on products as a result of cost-saving innovations. Competing firms are able to earn greater profits as a result of copying or developing their own versions of innovations of other firms. Edwin Mansfield and his colleagues, in the study cited in Part I above, estimated the magnitudes of both these sources of excess social gains from data supplied by innovating firms in the Northeast. The Mansfield results indicated a median excess social return over private gains of 31 percentage points. For purposes of the present analysis, the Mansfield estimate (rounded to 30 percent) is conservatively taken as an upper limit in our best case scenario. Our worst case assumes that the excess social return to R&D is 15 percent.

This range of excess social returns from R&D is used below to calculate the absolute value of the total social gain due to the added R&D stimulated by the credit. The social gains are measured in terms of increased consumption and GNP. The higher levels of GNP, in turn, generate additional tax revenues for federal and state governments, which also cumulate over time and help offset the immediate reductions in federal tax revenue in the years when the credits are taken.

As demonstrated in detail below, the social benefits are analogous to an annuity, in which the investment of additional resources in R&D each year stimulated by the credit produce continuing returns to society indefinitely. Both the returns and the total stock of added R&D that generates them compound over time as the credit continues to stimulate new R&D each year. Any measurement of single year increases in private R&D spending due to the credit not only fail to capture the social returns, but like a single snapshot, they also fail to capture an ongoing process in which the social gains from a growing additional base of R&D investment are themselves compounding through time.

The estimation procedure reported below takes account of this compounding process. It shows that, if made permanent, the credit is estimated in a worst case to produce an increase in annual real GNP (in 1985 dollars) of $1.2 billion by 1986 (5

years following the original enactment of the credit), and of $2.9 billion by 1991 (the tenth anniversary year of the credit). Under best case assumptions, the higher levels of annual GNP produced by a permanent credit are estimated to be $7.5 billion in 1986, and $17.7 billion in 1991. The added federal tax revenues on those gains would almost offset the immediate tax loss from the credit under worst case assumptions, and would more than offset it in a best case scenario.

The ranges between the worst and best case scenarios reflect the degree of uncertainty about the precise impact of the credit on private R&D spending; and about the magnitude of social benefits generated by any increased level of private R&D activity (which depend on the size of the gap between social and private rates of return to R&D). The uncertainty about the stimulative impact of the credit is due to a number of factors. First, the existing credit has been in place for only three years. Second, as discussed below, the net effective rate reduction afforded by the credit is relatively modest -- and significantly below the 25 percent nominal amount of the credit applied to incremental R&D spending. This effect was intended by Congress, which made only incremental R&D spending eligible for the credit as a way of targeting the credit toward companies with rising R&D expenditures.

Third, many other things were changing around the time the credit was enacted. There were recessions. The price of oil rose sharply. The value of the dollar rose. And, perhaps most importantly, major changes were made in the corporate tax code. In particular, the ACRS program was introduced. This had the effect of sharply reducing the corporate tax on equipment.[49] Given this effect, the tax credit could have been justified in part simply to prevent a diversion of spending away from R&D.

A. Estimating Methodology

The stimulus to R&D depends on how businesses respond to a small drop (on balance) in the cost of conducting R&D. We have estimated their response alternatively by

- comparing 1982-83 R&D spending in R&D-intensive industries with the values predicted by trend and cycle factors;
- multiplying econometric estimates of the price elasticity by the estimated average value of the effective credit.

Both methods show that the credit has increased R&D spending. The first method indicates the largest increase--7 percent overall. The second method generally predicts a smaller increase -- a range of 1 to 4 percent. The two methods measure different concepts, however. The trend estimates

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49 Alan J. Auerbach, "Corporate Taxation in the United States," Brookings Papers on Economic Activity 2: 1983, Table 4, p. 467.

measures the spending response after the first two full years (1982-83), whereas the econometric estimates, in principle, measure the long-run response.

1. Comparisons With Trend-Cycle Extrapolations. These estimates compare 1982-83 R&D ratios to sales in industries funding about 80 percent of private R&D with trend-cycle extrapolations of those ratios. To be sure, this technique is limited by the fact that only two full years of R&D data, disaggregated by industry, are available since the credit was enacted. Nevertheless, the preliminary data indicate a significant response. As Table 4 shows, 1982-83 R&D spending in 9 of 12 industries exceeded that projected by trend and cycle factors.

In particular, the table indicates that several basic industries -- including chemicals, steel, and nonferrous metals -- recorded R&D spending in 1982-83 more than 10 percent higher than would have been forecast based on trend and cyclical patterns. This evidence suggests that the credit had an effect that reached significantly beyond the high-technology industries. The average excess for all industries stood at 7 percent.

2. Econometric Estimates. The procedure followed in the econometric approach is to determine the responsiveness of R&D to changes in the cost of conducting it (and other variables)

Table 4: Deviations Between Actual R&D Spending and Trend-Cycle Projections for 1982-83 in Selected R&D - Intensive Industries 1/

Industry	Average Deviation in Percent
Industrial chemicals	13.9
Other chemicals	12.0
Petroleum	-3.6
Steel	10.0
Nonferrous Metals	24.7
Fabricated Metals	0.0
Machinery	2.4
Electrical Equipment	19.8
Autos	-13.7
Aircraft	9.6
Scientific and Engineering Instruments	7.5
Surgical and Other Instruments	7.6
Weighted Average 2/ of above	7.3

1/ The trend-cycle projections were based on historical regressions of R&D as a percent of sales on time, time-squared, time cubed, and industry sales divided by 5-year average sales.

2/ Weighted by 1982-83 R&D spending.

based on data before the credit was enacted. In particular, the econometric estimates assume that business R&D spending can be predicted (in part) from past changes in output and in the real user cost of R&D spending. The estimated responsiveness of R&D spending to changes in the cost of capital can be used to project the impact of the credit -- which lowers the cost of capital -- on R&D spending, as follows.

The responsiveness to cost or price changes is typically expressed as a price elasticity -- measuring the percentage change in the amount of R&D for a given change in the price of conducting it. For example, if the credit reduces the price of conducting R&D by 4.0 percent, then a price elasticity of 1.0 would imply an increase in R&D of 4.0 percent. Similarly, a price elasticity of 0.5 would imply a net increase of 2.0 percent (4.0 x 0.5).

Appendix A displays 3 of the equations we have estimated. Taken as a whole, these results point to a price elasticity for R&D spending ranging as low as .2 or .3 and as high as 1.[50]

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50 The .3 estimate agrees closely with the value reported earlier by Nadiri (1978). The first equation reported in the Appendix uses the specification introduced by Bischoff (1971), and predicts gross investment from price and output variables, and also incorporates the constraints of cash-flow on R&D spending. The equation, which implies that levels (as well as changes) of price and output affect spending, yields an estimate for the long-run price elasticity--about 1.2. This relatively high estimate is, perhaps, due to the fact that the Bischoff specification

The range of elasticity estimates produce a range of worst and best case scenarios of the stimulative affect of the credit on R&D spending. These scenarios are generated by multiplying the average effective rate of the credit by the estimated percentage increase in R&D spending stimulated by the credit. Using data compiled by Eisner (1984) on the proportion of companies above and below the base in 1981-83 by varying tax status, we have estimated that the average effective credit ranges from 3 to 4 percent.[51] Given a price elasticity between

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Footnote continued

restricts the price and output elasticities to be essentially the same.

The second equation estimates distinct price and output effects using a specification resembling Bischoff's. The long-run price elasticity drops to .3 and statistical insignificance.

The third equation estimates separate effects of price and output changes on net investment in R&D. (The estimates of net investment assume that past R&D spending adds to business productive capacity with a 3-year average lag and then grows obsolete at an 11 percent annual rate.) The long-run price elasticity comes in just above .2 and has marginal significance.

51 The effective credit depends on current and past R&D spending and tax liabilities, expectations about future R&D spending and profits and anticipations about future legislation bearing on the credit. Hundreds of different combinations of these factors exist, each implying a particular effective credit ranging from -20 to 25 percent.

For the majority of companies with growing R&D and current tax liabilities, the effective rate on a discounted basis

.3 and 1 and an average effective credit of 3 to 4 percent, we compute an increase in R&D spending due to the credit of 1 to 4 percent.

B. Estimated Economic Gains From The Credit

By reducing the cost of R&D, the tax credit shifts resources to R&D from other activities. This resource shift raises the nation's real consumption and taxable income if, as most studies find, R&D yields social benefits exceeding its cost.[52]

Footnote continued

(at a 12 percent nominal after corporate tax rate) stands at about 5 percent on qualifying R&D costs (which are approximately 2/3 of total R&D expenditures), and therefore at 3.4 percent on total R&D (2/3 x 5 percent). In particular, although $1 dollar of incremental spending in the current year yields a credit of $.25 in the first year, it raises the base in the subsequent three years by $.33. The higher base period amounts, multiplied by .25 and then discounted at 12 percent, offset the initial $.25 gain. The net amount of the credit for the added $1 of R&D spending is approximately $.05.

Other companies face different effective credit rates depending on their circumstances. For those with falling R&D or with no tax liabilities over the period enlarged by the 15-year carryforward and carryback allowances, the credit has no value. For those with R&D currently below base levels, but expected to rise above the base in the future, the credit actually turns negative. For a taxable company with R&D below base only in the current year, the credit actually raises qualified R&D costs by 20 percent at the margin. For taxable companies with R&D above base levels only in the current year, the credit on qualifying costs reaches the statutory rate of 25 percent.

The 3 to 4 percent average results from weighting realistically the most common sets of circumstances.

52 See Part II of this Study.

We estimate the social gains under a range of assumptions. The worst case assumes the smallest price responsiveness of R&D spending to the credit (price elasticity of 0.3) and a gap between social and private returns from R&D of just 15 percent.[53] The best case assumes a responsiveness elasticity of 1.0 and a social/private return gap of 30 percent.

The use of the econometrically estimated price elasticities to calculate the stimulative effect of the credit is a conservative approach (compared to the estimates based on the trend/cycle approach) for a number of reasons. First, the price elasticities approach provides the best method for estimating the long-run responsiveness of R&D spending to the credit.[54] Second, since the estimated equations yielding the price elasticities are based on data predating the 1981 credit, they are not subject to question on the ground that the tax data reflect reclassification by companies of some expenditures as R&D.[54]

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53 As noted in Part II, a 15 percent gap is far below the 31 percent gap reported in the Mansfield study.

54 Some companies may have initially reclassified activities as R&D in preparing their tax returns, which in 1981 show much larger jumps in R&D than other data. Prior to 1981, there was no complusion to define R&D with particular care or, especially, with broadly uniform criteria; so a period of adjustment was inevitable. There is no reliable evidence, however indicating that reclassification has affected companies' financial records (reported by the Census Bureau and the National Science Foundation) which

Finally, the conservatism of the price elasticities approach is demonstrated by the fact that the first two years of evidence since the credit was taken (the trend/cycle estimates) suggest significantly higher responses of private R&D spending to the credit.[55]

Footnote continued

are the basis of the trend/cycle and price elasticity estimates reported above, since generally accepted accounting principles haven't endorsed any shift in conventions regarding R&D.

Moreover, there are a number of reasons to doubt that reclassification has been a significant problem, especially since the initial year of the credit.

First, the use of a moving average base should have mitigated any distortions, such as they may have been, owed to initial reclassification activity; since any additions in one year, detract from subsequent credits by raising the base. (It should also be noted that the credits for donations to non-profits are not subject to this objection since they are explicitly arms length transactions).

Second, since R&D spending is relatively concentrated, large users of the credit have to consider seriously that they will be audited annually.

Thirdly, the proposed legislation, S.58 will revise the rules to define qualified R&D as only that which represents serious scientific research or technologically-oriented development of new products, that are functional in nature, as distinguished from cosmetic or stylistic.

55 The trend-cycle technique shown above produces an estimated increase for R&D of 7 percent, which given an effective credit rate of 3-4 percent, implies a price elasticity in the neighborhood of 2.0.

The computation of the social gains can be understood as follows. The typical incremental dollar invested in business R&D not only pays back the initial investment with interest, but also yields further returns roughly equivalent to an annuity yielding 15 to 30 percent after inflation. Future benefits must be discounted, however, because they are not worth as much as benefits received immediately. An appropriate social discount rate is 5 percent, which is approximately the present real after-tax return available from private investment.[56] At this discount rate, an annuity yielding 15 percent would be worth $3 for every $1 invested (on a net basis, after accounting for a return of the original investment). This is analogous to putting a dollar in the bank and earning a return of 15 percent per year forever, and then calculating the present discounted value of the future sum. An annuity yielding 30 percent would be worth $5 for every $1 invested.[57]

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56 This rate also approximates the real after-tax return recently available from long-term Treasury bonds.

57 As noted in the note to Table 7 below, Appendix B reports the mathematical procedure used to estimate the long-run economic gains from the credit. The calculations there use gross multipliers (before accounting for return of original investment) of 4 and 6, for 15 and 30 percent excess returns, respectively.

Now, suppose that the credit raises U.S. private R&D spending in 1984 and thereafter by 4 percent and that this additional R&D yields excess returns of 15 percent. Given total national (private) R&D spending of approximately $40 billion, the 4 percent increase in 1984 R&D translates into about $1.6 billion, which (by reasoning illustrated above) provides a cumulative discounted net benefit conservatively worth $4.8 billion ($1.6 billion x 3) in 1984. Suppose further, that real R&D spending trends up after 1984 at a 3 percent annual rate. In 1985, therefore, the added R&D spending caused by the credit also rises 3 percent higher than in 1984, to $1.648 billion ($1.6 x 1.03). That extra R&D spending in 1985 yields future net gains worth $4.94 billion ($4.8 x 1.03) when discounted back to 1985. But these gains arrive one year later than those caused by the added 1984 R&D spending, so their value discounted back to 1984 is 5% less, or $4.71 billion (in 1984 dollars).

This process continues into the indefinite future, assuming permanent enactment of the credit. The sum of discounted gains calculated as first described underestimates total benefits from the credit because it excludes excess social returns to added capital formation and ignores a second round of R&D spending stimulated by higher GNP. Table B3 in Appendix B presents a range of estimates of discounted gains in

future consumption that include these secondary effects. Table 5 presents a range of estimates of increased real GNP generated by the credit that also includes these second-round effects.

Table 5

Annual GNP Gains Produced
by R&D Tax Credit
(Billions of 1985 $'s)[58]

Percentage Gain In Private R&D	Excess Social Return to R&D	
	15 Percent	30 Percent
	Fifth Anniversary Year (1986)	
1	1.2	4.9
4	1.9	7.5
*	*	*
	Tenth Anniversary Year (1991)	
1	2.9	11.5
4	4.4	17.7

The table illustrates that, under worst case assumptions, the credit is estimated to produce an increase in annual real GNP levels by 1986 of $1.2 billion, and by 1991 of $2.9 billion. Under the best case combination of assumptions, these estimates are $7.5 and $17.7 billion, respectively.

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58 These estimates assume that the economy realizes fully the long-run percentage gains in GNP from the credit after 10 years, but only half of these gains after 5. See model 1 in Appendix B for derivation of the long-run gains. Note that the long-run annual gains in annual real GNP after 1991 would exceed $2.9 billion, reflecting continuing growth in the economy.

C. Estimated Revenue Impacts

The Department of the Treasury originally estimated that the R&D tax credit would reduce federal receipts by less than $1 billion annually in 1983-85, but current data suggest a greater initial tax loss. After studying Office of Tax Analysis data on companies' 1981 tax returns and financial-statement data on companies' 1981-82 R&D spending and profits, Eisner (1984) concluded that the 1983-85 static tax loss would average about $1.5 billion annually.[59]

These tax losses, however, are only temporary. Table 6 reports the estimated net tax effects of the credit, taking into account increased tax revenues generated in future years by the gains in taxable income produced by the credit. The net tax position improves with the passage of time, as the GNP gains from the added R&D compound. Under worst case assumptions, there is a small tax loss that falls to an estimated $200 million by 1991. Under best case assumptions, the credit is a net revenue producer.

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59 As explained in the text, these estimates are static, meaning they exclude the added tax flows that would result as the economy moves to higher GNP associated with greater R&D spending.

Table 6

Annual Tax Impacts From The
R&D Credit (Billions of 1985 $'s)

Percentage Gain In Private R&D	Excess Social Return To R&D	
	15 Percent	30 Percent
	Fifth Anniversary Year (1986)	
1	-.5	-.6
4	-.3	1.3
	* * *	
	Tenth Anniversary Year (1991)	
1	-.2	2.4
4	.3	4.2

D. Possible Improvements To The Credit

The proposed extension of the credit reflected in S.58 would improve the effectiveness of the 1981 provisions by narrowing the definition of qualified R&D. However, the benefit estimates shown above, coupled with all of the foregoing arguments supporting government incentives, suggest that the credit may be further increased. The Congressional Budget Office and the Congressional Research Service have outlined several optional approaches to enhancing the stimulative effect of the credit. Any increase would, in turn, generate social gains above those estimated here.

CONCLUSION

There are compelling reasons for the Congress to make the 1981 R&D tax credit permanent. R&D and innovation play a crucial role in improving productivity, creating, new jobs, and facilitating the competitiveness of U.S. industry in international trade. The U.S. relies primarily on private companies to undertake R&D, yet there is strong evidence that, without additional government support, private companies will spend less on R&D than is socially optimal.

In principle, government efforts to supplement private R&D spending should meet three criteria. First, the approach should be efficient. Second, it should be designed to maximize additional R&D activities and not to support spending that would be undertaken in any case. And third, it should be consistent with U.S. political and social traditions and policy approaches.

While no policy instrument meets these criteria perfectly, the R&D tax-credit appears to come close in several respects. It provides an incentive which is available to all private firms. It does not involve government bureaucrats in having to pick winners, either in particular industries or technologies. Instead of allocating resources through a costly and elaborate

government bureaucracy, the credit stimulates spending through a market mechanism in which individuals with the best information -- the performers of R&D -- can select the projects. Since it is tied to additional spending by firms it is more likely to raise incremental spending than a process of direct funding, which is likely to result in the funding of projects that would be undertaken in any case.

U.S. government approaches to R&D must be consistent with U.S. traditions so that policies can be credibly continuous. The U.S. has long relied on system of achieving public goals (such as contributions to hospitals, universities and charities) by having the government supplement private contributions with tax deductions. A permanent R&D tax credit would be such an approach. It represents support for a widely held public goal by means that have the support of a clear majority of the population. Indeed, about ninety percent of the U.S. public believes that American industry should invest more heavily in scientific research and development and over seventy percent believe the federal government should provide larger tax incentives to increase industrial R&D.[60] Congress can give expression to this strong public support by making the R&D tax credit a permanent fixture of our tax code.

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60 Jon D. Miller, A National Survey of Public Attitudes Toward Science and Technology (DeKalb:III:Northern Illinois University, 1982) cited in Science Indicators:1982 National Science Board, 1983 page 326.

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Appendix A: Regression Equations Fitted to Company R&D Spending

(1)

Dependent Variable: R&DPrivate72

Independent Variables	Sum of Coefficients	T-ratios
$(P/C)_{t-i} * Q_{t-i}$	-.006	-1.8
$(P/C)_{t-i-1} * Q_{t-i}$	1.54	13.4
$(NFCINTEXP/NFCGIF)_{t-i}$	-6.02	-2.7

$\bar{R}^2$ = .99
DW = 1.53
s.e. = .30
c.v. = .027

Price elasticity	1.2

(2)

Dependent Variable: log (R&DPrivate72)

Independent Variables	Sum of Coefficients	T-ratios
$\log (P/C)_{t-i}$	.27	.8
$\log Q_{t-i}$	1.49	11.5
$\log (NFCINTEXP/NFCGIF)_{t-i}$	.17	-2.3

$\bar{R}^2$ = .99
DW = 1.74
s.e. = .018

Price elasticity	.27

(3)

Dependent Variable: NetR&DPrivate72

Independent Variables	Sum of Coefficients	T-ratios
$Q_{t-i}\ \Delta(P/C)_{t-i}$	0.0033	1.9
$(P/C)_{t-i}\ \Delta Q_{t-i}$	0.0066	3.1
$(NFCGIF72)_{t-i}$	0.0321	4.4
RHO1	1.69	10.0
RHO2	-.83	-9.1

$\bar{R}^2$ = .94
DW = 2.06
s.e. = 0.15
c.v. = 0.042

Price elasticity	.23

Definitions of variables:

R&DPrivate72 = company-funded R&D spending in 1972-dollars;

NetR&DPrivate72 = estimated 1972-dollar net investment in R&D by companies;

(P/C) = GNP deflator divided by the estimated user cost of R&D capital;

Q = 1972-dollar final sales less real personal consumption of housing services and real government compensation, all adjusted to account for mandated pollution-abatement spending;

NFCINTEXP = nonfinancial corporate interest expenditures;

NFCGIF = nonfinancial corporate gross internal funds;

NFCGIF72 = nonfinancial corporate gross internal funds in 1972 dollars.

APPENDIX B: Alternative Models of R&D and Production

This appendix reviews two growth models used in studying R&D and derives effects of the tax credit in each case. The first model assumes a constant elasticity of output with respect to R&D capital. The second model assumes a constant excess social return to R&D spending. In the first model, the tax credit raises the level of real GNP; in the second model, it raises the rate of growth. Both models show the credit becoming at least nearly self financing and yielding large gains in wealth.

Model 1: Constant Elasticity of R&D Capital

We summarize this model by the equations (1).

$$Q = A K^{\alpha} L^{\beta} R^{\gamma} e^{\lambda t} \tag{1}$$

$$L = L_0 e^{gt}$$

$$K = \alpha Q/c = 3Q/2$$

$$R = R_0 Q/p_R^{\epsilon}$$

Taking logs and substituting for K, L, and R, we get

$$\log Q = \text{const.} + \left(\frac{\beta g + \lambda}{1 - \alpha - \gamma}\right) t - \left(\frac{\gamma \epsilon}{1 - \alpha - \gamma}\right) \log p_R \tag{2}$$

which implies

$$\frac{\partial \log Q}{\partial \log p_R} = -\left(\frac{\gamma \epsilon}{1 - \alpha - \gamma}\right) \tag{3}$$

To assign a value to γ and thus to this derivative, we need other results obtained below. Assuming that R&D capital grows obsolete at the annual rate 100δ, that R&D spending has averaged about 1 percent of output, and that output has grown 100n percent annually, we obtain

$$R/Q = .01 \int_0^{\infty} e^{-nt} e^{-\delta t} \tag{4}$$

$$= .01/(\delta + n)$$

Further, if B/C denotes the social benefit-cost ratio of each added dollar of R&D and ρ denotes the marginal social product of R&D capital and r denotes the social discount rate, we have

$$B/C = \int_0^{\infty} \rho e^{-\delta t} e^{-rt} = \rho/(\delta + r) \tag{5}$$

From (1), we get

$$\frac{\partial Q}{\partial R} = \gamma(Q/R) = \rho \tag{6}$$

which combined with (4) and (5) gives

$$\gamma = \left(\frac{\delta + r}{\delta + n}\right) .01\ B/C \approx .01\ B/C \tag{7}$$

Now we can evaluate (3)

$$\frac{\partial \log Q}{\partial \log \rho_R} = -\left(\frac{.01\ B/C}{1 - \alpha - .01\ B/C}\right) \varepsilon \tag{8}$$

and estimate the credit's effect on real GNP as follows

$$d \log Q = -\left(\frac{.01\ B/C}{1 - \alpha - .01\ B/C}\right) \varepsilon\, d \log \rho_R \tag{9}$$

Assuming that $\alpha = .3$ and (as in the text) that $4 < B/C < 6$, $.3 < \varepsilon < 1.$ and $-.03 > d \log \rho_R \geq -.04$, we compute that the credit would raise real GNP permanently by .061 to .375 percentage point (see Table A-1).

TABLE A-1. Long-run Gains In Real GNP Caused By the Credit Under Varied Assumptions In Model 1 (in percent)

R&D Benefit Cost Ratio	Stimulus to R&D 1%	4%
4	.061	.242
6	.094	.375

Note that these percentages measure the long-run gains in GNP and thus aren't directly comparable to the after-five-year gain shown in Table 5 in the text. That estimate of the gain after 5 years assumed that the economy would be only half way to the higher GNP path ultimately implied by the reduced cost of R&D.

The long-run GNP gains imply that the tax credit eventually will have little effect on Treasury revenues and more than likely will increase them. Assuming that the credit boosts R&D spending to 1.2 percent of GNP and that nominal GNP grows 8 percent annually, we estimate the maximum possible static tax loss by

$$TXLS = .25\,(2/3)(.012\ GNP - .012\ GNP e^{-.12}) \tag{10}$$

This estimate will exaggerate actual losses, since it assumes all firms qualify for the credit. More important, it ignores revenue gains caused by higher GNP spawned by the credit. Assuming a 30 percent marginal tax rate on GNP, we estimate these revenue gain by

$$TXGN = .3 (GNP - GNP\ e^{-b}) \quad (11)$$

in which b denotes the stimulus to GNP caused by the credit. The net gain clearly equals the difference

$$NETTXGN = .3\ GNP(1 - e^{-b}) - .002\ GNP(1 - e^{-.12}) \quad (12)$$

Table A-2 shows the net gains under varying assumptions.

TABLE A-2: Long-run Tax Gains From the R&D Tax Credit (billions of 1985 dollars)

R&D Benefit Cost Ratio	Stimulus to R&D 1%	4%
4	- 0.2	1.9
6	0.2	4.1

These again are long-run effects. They have been calculated for 1986 even though one might argue that the full response to the credit would not occur within 5 years following the 1981 enactment. This explains why Table 6 in the text shows a tax loss of $.5 billion after 5 years, rather than the estimate of $.2 billion shown here for comparable long-run assumptions.

We compute the tax credit's social value by cumulating the associated discounted gains in consumption. Based on the model studied here, we estimate that the credit increases national wealth by 80 to 500 billion (1985) dollars (see Table A-3).

TABLE A-3: Gain In National Wealth Caused By the Credit Under Varying Assumptions In Model 1[1/]

R&D Benefit Cost Ratio	Stimulus to R&D 1%	4%
4	80	317
6	123	493

[1/]Calculated using the formula

$$(.75)\,GNP\,(e^{b}-1)\left(\int_0^{\infty} e^{-.03t}\,e^{-.05t}\,dt\right) = -\Delta K_0 - \Delta R_0$$

which assumes personal plus government consumption accounts for about 75 percent of GNP as estimated by Kotlikoff (1984); a social discount rate of .05; and instantaneous adjustment of physical and R&D capital. For the purpose of this calculation we also assume the full change in R&D capital equals the change in R&D spending. The latter half of the assumption implies $\delta = \infty$, thereby supporting the approximation introduced above in (7).

Model 2: Constant Excess Social Returns to R&D

This model assumes

$$\frac{\partial Q}{\partial R} = \rho\,(\text{constant}), \tag{13}$$

or

$$\frac{\partial Q/Q}{\partial R/R} = \rho\,(R/Q) \tag{14}$$

The complete model follows as equations (15)

$$\begin{aligned}
\dot{Q}/Q &= \alpha\,\dot{K}/K + \beta\,\dot{L}/L + \sigma\,(R/Q)\,\dot{R}/R + \lambda \\
\dot{L}/L &= g \\
\dot{K}/K &= \dot{Q}/Q \\
\dot{R}/R &= \dot{Q}/Q + \varepsilon\,(\dot{p}_R/p_R)
\end{aligned} \tag{15}$$

In the long run in which $p_R = 0$

$$\dot{Q}/Q = \frac{\lambda + \beta \quad \beta}{1 - \alpha - \rho(R/Q)} = n \tag{16}$$

which means

$$\frac{\partial \dot{Q}/Q}{\partial \log p_R} = -n \left(\frac{\rho (R/Q)}{1 - \alpha - \rho(R/Q)}\right) \varepsilon \tag{17}$$

In contrast to Model 1, the credit here affects the growth rather than the level of GNP. Using the results (4) and (5) above (which aren't model specific) we get

$$\rho(R/Q) = \left(\frac{\delta + r}{\delta + n}\right) .01 \text{ B/C} \approx .01 \text{ B/C} \tag{18}$$

which implies

$$\frac{\partial \dot{Q}/Q}{\partial \log p_R} = -n \left(\frac{.01 \text{ B/C}}{1 - \alpha - .01 \text{ B/C}}\right) \varepsilon \text{ .1/} \tag{19}$$

1/ Note that since $\dot{Q}/Q = n$, we can write this as follows:

$$\frac{\partial \dot{Q}/Q/Q/Q}{\partial \log p_R} = -\left(\frac{.01 \text{ B/C}}{1 - \alpha - .01 \text{ B/C}}\right)\varepsilon$$

which is analogous to (8) describing the logarithmic derivative of the level of output in Model 1.

Assuming again that $n = .03$, $\alpha = .3$, $4 < B/C < 6$, $.3 < \varepsilon < 1$, and $-.03 > d \log p_R > -.04$, we estimate that the credit would raise annual GNP growth by .0018 to .0112 percentage point (see Table A-4).

Table A-4 Long-Run Increases in Economic Growth Caused by the Credit Under Varying Assumptions in Model 2 (in percent, annual rates)

R&D Benefit Cost Ratio	Stimulus to R&D 1%	4%
4	.0018	.0073
6	.0028	.0112

These gains in growth imply that the credit eventually increases Treasury revenues. In this case, we estimate the maximum long-run static tax loss by

$$TXLS = .25\,(2/3)\,(.012GNP - .012\,GNP^{-.12-1.5b}) \tag{20}$$

in which b denotes the higher growth rate achieved under the credit. The tax gain depends on the gain in GNP, which in turn reflects the cumulative effect of faster growth, as shown in (21).

$$TXGN = .3\,GNP_0 \int_0^{\infty} (e^{(.03+b)t} - e^{.03t})\,dt \tag{21}$$

The net gain equals the difference between (21) and (20)

$$NETTXGEN = .3\,GNP_0 \left(\frac{e^{(.03+b)t} - 1}{.03+b} - \frac{(e^{.03t}-1)}{.03}\right)$$

$$- .002\,GNP_t\,(1 - e^{-.12-1.5b}) \tag{22}$$

which clearly changes with time. Assuming that the credit's favorable effect on growth begins in 1984, we estimate that 1987 tax losses would range from $406 million to $1 billion. But by 1995 these losses would turn to gains ranging from $193 million to $11.7 billion (see Table A-5). In each case, the credit produces cumulative tax gains.

Table A-5: Tax Gains in 1987 and 1995
Under Varying Assumptions in Model 2
(billions of $s)

R&D Benefit Cost Ratio	Stimulus to R&D 1%	4%
	(1987)	
4	-.95	-.63
6	-.89	-.41
	(1995)	
4	.19	6.90
6	2.41	11.66

Once again, the credit's value to society can be calculated by summing the associated discounted gains in consumption. This model predicts that the credit increases national wealth by 100 to 700 billion (1984) dollars (see Table A-6).

Table A-6: Gains in Wealth Caused by the Credit
Under Varying Assumptions in Model 2
(1985 $'s billions)[1/]

R&D Benefit Cost Ratio	Stimulus to R&D 1%	4%
4	106	32
6	177	708

1/Uses the formula

$$\Delta W = .75\, GNP_0 \left(\int_0^{\infty} (e^{(.03+b)t} - e^{.03t})\, e^{-.05t}\, dt \right)$$

$$- R\&D_0 (e^{s}-1) \int_0^{\infty} (e^{(.03+b)t} - e^{.03t})\, e^{-.05t}\, dt$$

where $\overline{R\&D}_0$ denotes spending at the time the credit starts to have an effect, and 100s measures the percentage stimulus to R&D.

Senator WALLOP. I would like also if we could get the Rowe-Barker study or I mean the study that was cited by Dr. Rowe and Dr. Barker from the American Society for Engineering and Education.

Dr. ROWE. Oh, I did not refer to that. The study I referred to, Mr. Wallop, was the one conducted by Messrs. Bailey and Lawrence, an economic study commissioned by CAIT.

Senator WALLOP. Actually in your written statement? Both of you cited a study by the American Society for Engineering and Education that said that most engineering equipment is 20 to 30 years old.

Dr. ROWE. Yes, sir. Now I'm with you.

Senator WALLOP. We would like to have that one as well as the one which was requested to be made a part of the record.

Dr. ROWE. We will get that study to you.

And at this point I would like to request that the record be left open so that the individual members of CAIT might file, particularly those not present today, their views on the subject with the committee.

Senator WALLOP. I believe that the record remains open for 2 weeks after the hearing, and we would welcome participation by those.

Dr. ROWE. Thank you.

Dr. LAWRENCE. Senator, your question relates to the incremental effect of R&D. Of course, research and development will always be performed. But the crucial finding in our study—and indeed it's an opinion shared by almost every economist, which is something rare.

Senator WALLOP. That could give you pause right there. [Laughter.]

Dr. LAWRENCE. Well, we have some quotations from three Nobel prize winners who agree on this particular point, and little else probably.

And that is that a private market system will have a chronic tendency to under invest in the development of knowledge because the inventors of that knowledge cannot obtain all of the social benefits. Therefore, in principle, appropriate social policy will try to stimulate additional spending until such time as that social rate of return is brought down to equal the private rate of the return. That's when we as a society will be as best off as we could be.

And so I think this credit is a reasonable effort at trying to get at that margin—at that marginal dollar. There will be spending done anyway. But with the tax credit, additional spending will be undertaken. Our estimates are that they will be significant, and that as a result of that discrepancy between the private and the social rate of return, society will be better off. Under reasonable assumptions, in fact, gross national product will rise sufficiently to provide the tax return to pay for that. That's a claim we hear a lot about nowadays. But I think this is clearly a case where you can make that statement.

Senator WALLOP. Dr. Saloom.

Dr. SALOOM. Oh, just back to the question of permanency that you stated. If there is one way to paralyze a risky investment is

add uncertainty already on top of the uncertainty already inherent in the research itself. So I think the permanency issue is quite important in the research planning and its execution.

Senator WALLOP. Well, if there were no uncertainty, one could hardly call it research.

Dr. SALOOM. No. But the uncertainty occurs in the mind. There is the uncertainty in research. That's there. We accept that. We accept those risks. But the uncertainty of the credit is hard to accept.

Senator WALLOP. Oh, that I understand.

Dr. SALOOM. The uncertainty is in the mind of the person that must make the investment decisions.

Senator WALLOP. Well, the critics of the credit—and I'm not one—but they point to abuses of it. I would just ask you as a panel, based on your experiences, if you are aware of any justification within the body of criticism of abuses. And, if so, if there is anything that might be done about that in the process of trying to hold onto the basic concept.

Dr. BARKER. Some of the abuses—and I'm speaking as a total nonexpert since it has to do with the industry side—lay in the definition of what is research and development. And it's my perception of the S. 58 bill that there is a significant tightening up of those definitions which will go a long way to dealing with those abuses.

Dr. ROWE. We very strongly support the proposed wording in S. 58 which we believe revises those definitions to focus on the R&D that really involves technological advances rather than stylistic or other such things.

Senator WALLOP. That would lead me to the other question. What is the difference between the basic research that is eligible for the new credit for university basic research and other types of R&D that the economy might engage?

Dr. ROWE. In terms of general categories of research, I think we tend to think principally of industrial research as being applied research and university research as being more basic relative to that. Basic in the sense of developing better understanding of materials, for example, without any particular application in mind.

Senator WALLOP. Can one, with ordinary use of the English language, draw that distinction clearly enough?

Dr. ROWE. Between basic and applied?

Senator WALLOP. Yes.

Dr. ROWE. Well, basic research, in my mind, deals with the generation of new knowledge without recourse to particular application. Applied research is the process of applying new knowledge wherever generated to solving a problem. And that's the focus of industrial activity.

Dr. BARKER. Could I comment from the university point of view?

Senator WALLOP. Yes.

Dr. BARKER. Most of the research which is done in American universities is basic. And I wouldn't want to use that as the perfect definition, but it would almost be a suitable definition. And I think there are good reasons for that, and most universities are very concerned about getting into applied research in a significant way because of the impact that that has on the freedom with which they can share the information that is developed. So I think there is an

element of a definition and some protection in the structure and function of the research university.

Senator WALLOP. Dr. Lawrence.

Dr. LAWRENCE. I think that at the margins, in the gray areas, it is very difficult to distinguish between those different notions. And it is extremely noteworthy that recently corporations have been performing more and more research by themselves which could be considered to be basic. They find that they just need some basic knowledge in order to push forward a certain product. And that's why the overall thrust of this credit, which does promote research and development spending, and clearly basic would qualify, is an appropriate one. Because to the degree that the corporations are performing this basic research—and, as I say, that's documented in National Science Foundation literature on this question—then the spillovers are going to be even greater. These social benefits are going to be even greater than they might be at the purely commercial end. They exist at both parts, but I think it's appropriate then to provide a credit on research and development spending for corporations as well. Not to mention the impact on the universities.

Senator WALLOP. Dr. Lawrence, Senator Bradley in other hearings relating to tax reform has asked witnesses whether if R&D were the only credit remaining in the code they would prefer to have that credit remain or lower tax rates, assuming again that that were the only benefit remaining in the code. How would you respond?

Dr. LAWRENCE. My answer would be that you ought to have research and development remaining in the code because it is an area in which we believe the private sector will not undertake the socially optimal amount of activity. And that argument is very different from many other kinds of preferences. Many other preferences can't meet that test. Let's say we took the money from the R&D tax credit, the $1.2 billion that we estimate that we are spending, and we simply use that to lower the corporate tax rate. What would happen? Well, we would get investment. We would hope we would. But let's even assume we do. What return would that investment get? It would get the private rate of return, the going rate of return throughout society. And let's assume that that's 10 or 15 percent. Now let's take that money and ask what we as a society will get if we devote it toward an R&D tax credit.

Well, the estimates are conservatively on the order of 50 percent return. So that's why I think that as a society trying to allocate our resources in an optimal way, we ought to have a credit like this. We ought to have credits where there's a credible case that the private market will fail. I do believe that there are equally credible cases for eliminating many other of the distortionary effects of the current tax system.

But, nonetheless, the case for retaining this particular credit in my mind remains and is even stronger——

Senator WALLOP. That would be in the study—I mean some level of—your view would be in that study.

Dr. LAWRENCE. Yes. The specific substantiation of the differences between the private and social rates of return are in the study. However, the study does not specifically address the question in the way you have dealt with it. It is, however, addressed in a study

done by the Congressional Research Service in which they argue that the case for an R&D credit remains even if you lower the corporate tax rate. Indeed, the effect of the credit is actually diluted when overall corporate tax rates are lowered. And, therefore, there is probably an even stronger case for the credit in that kind of a world. That is the opinion of the Congressional Research Service study.

Dr. ROWE. Senator, if I may, I would like to give a specific example illustrating the point that Dr. Lawrence is making.

In 1980, Gould pioneered the development of what is known as programmable controllers. These are small, special computers at the heart of factory automation systems. That was some 5 years ago. We have continued that development and we enjoy a substantial market position as a result of that investment.

But, also, those programmable controllers have for the past 2 or 3 years entered significantly into the automotive industry, the pharmaceutical industry, the foods industry, et cetera. And those industries are enjoying the benefits of that research conducted 5 and more years ago.

And we fully expect to see those controllers proliferate through American industry and contribute to our international competitiveness as a result. So the payoff can be very substantial, we think, as a result of the credit.

Senator WALLOP. In your testimony, you note that R&D spending has increased from nearly $31 billion in 1980 to $55 billion in 1985. Can you, with any sense of certainty, attribute any portion of that to the R&D credit? I mean some portion, but could you kind of characterize what portion?

Dr. ROWE. Of course, the specifics of the increase attributable to the R&D tax credit will vary across industries and across companies. I think typical of electronics companies such as Gould that I would feel comfortable in saying that we have increased our R&D spending by something like a factor of 2 as a result of the R&D tax credit.

I can't quantify it more closely than that.

Senator WALLOP. Dr. Barker, some have suggested that there may be some risk in S. 58 that would result in the diversion of corporate contributions to universities into the general basic research. Do you view this as a problem?

Dr. BARKER. It's my understanding of the wording of the bill that there is a protection there to make that less likely to happen. If that does happen, then there is a reduction of the corporation's gain from the investment in the basic research. And it's my sense from dealing with quite a few different corporations that the two decisions come out of different parts of the corporation. So that generally speaking there is a fairly clean separation there.

Senator WALLOP. Well, gentlemen, I think there may be some members of the committee that may wish to forward questions based on this record. I think it's been a very informative record. As you know, I am a rather strong supporter of this R&D concept. We have another bill, S.861, which is slightly different. But it's my hope that we find some means of making this credit permanent and add some level of predictability to the investments; that must be made on a long-term basis.

One last thing. Absent this, do we run a risk of running basic research abroad? Absent some kind of permanency to the R&D credit—and for all the good reasons that you have suggested that we should do that—but absent that, is there a risk that on the other side that we may find multinational corporations which may find other countries with more favorable tax treatments and they would be doing basic research abroad that would otherwise be conducted in universities in America?

Dr. ROWE. Yes. The failure to make permanent the R&D tax credit, we think, adds risk to an already risky business. And since the competition today is truly international and foreign countries have seen fit to award R&D tax credits to their companies, we will probably see changes in both the level of R&D funding on behalf of American companies and where the R&D investments are made.

Senator WALLOP. I have a feeling that this is already an unmeasurable part which makes the otherwise gloomy trade figures perhaps less gloomy. Somehow or another—I'm afraid of Dr. Lawrence's statement that the social goal as well as the economic goal of R&D and information that is developed from it becomes a national asset which we are franchising through a lot of other things makes the balance of trade figures perhaps a lot better in a world in which we don't know how to measure that. We measure barrels of oil and bushels of wheat and pairs of shoes, and I don't think we mention what this does for us in keeping us alive as a country in international economics.

Dr. LAWRENCE. Senator, on the question of the impact of research and development on our competitiveness, I think first there has been a very heartening rise in R&D spending. The private sector has done sufficiently well to match the growth that the Pentagon has sustained in its R&D spending over these years. That gives you a sense of the kind of growth that we have seen.

We have not yet seen it show up very powerfully in productivity growth in our economy, although it's a debatable question because we have difficulty in isolating productivity growth over shortrun periods of time. Scholars are divided about this. Some already have made quite strong statements about the recovery in productivity growth. But I agree with you that this all goes well for the future. R&D is obviously a channel that we could look to to reverse our productivity slowdown. And we have seen a great increase in that. And, therefore, I think we should expect some returns down the road.

On the question of competitiveness, what is striking as just as our spending in research over the last few years, so, too, has spending abroad. Indeed—and, again, we provide some evidence in the study. There has been a phenomenal increase in R&D spending in the other major industrial countries. Most notably in Germany and Japan. It is also true that a lot of knowledge defuses abroad rather rapidly. That just means we have to run faster in order to stay almost in the same place competitively.

So I do think that, in relative terms, despite our dramatic increase, we have not sustained our commitment to R&D relative to what other countries are doing. And that's a strong reason for the Government providing encouragement, and, indeed, for the private sector responding to that and undertaking this kind of business.

Senator WALLOP. Dr. Barker.

Dr. BARKER. Very quickly. I think the R&D tax credit can contribute quite significantly to bringing about an important structural change in the way in which we do science and link it to technological development in this country by fostering the creation of better relationships between the university and industry, and to the extent that this is an investment by the country in that structural change, it's important. It is the one thing that is needed to make a linkage between Federal spending for research in the universities and economic development. And we can do it without disturbing the basic mission of the university.

Senator WALLOP. I would say just one other thing. That it's applicable knowledge or technology is a merchantable product, which has a return to the country that may not be measurable in the same way that the sale of a barrel of oil is measurable or a bushel of wheat.

And I have a strong feeling that somewhere in those crazy figures that we talked about—there was only 7 trillion dollars' worth of trade. Only, which is rather extraordinary. That was last year, but 30 trillion dollars' worth of transaction.

I cannot believe that somehow or another that all $23 trillion that remains in that figure, whatever it is, was all speculation. I think that some of it lies in what you all are suggesting we make permanent.

I appreciate very much your testimony. Thank you all.

Dr. BARKER. Thank you.

Dr. SALOOM. Thank you, Senator.

Senator WALLOP. We now have a panel consisting of Mr. Don. E. Ackerman, member of the board, National Venture Capital Association, and general partner of J.H. Whitney & Co.; and Mr. William G. Moore, Jr., chairman, The American Electronics Association, and president and chief executive officer, Recognition Equipment, Inc.

Good morning, gentlemen. Mr. Ackerman.

STATEMENT OF DON E. ACKERMAN, MEMBER OF THE BOARD, NATIONAL VENTURE CAPITAL ASSOCIATION, AND GENERAL PARTNER, J.H. WHITNEY & CO., NEW YORK, NY

Mr. ACKERMAN. Thank you, Mr. Chairman.

I'm here representing the National Venture Capital Association, which is an organization with 202 member firms who manage approximately $13 billion in investment funds for the purpose of investing in small and new companies trying to develop major enterprises out of them.

In the area of tax policy, we are primarily interested in the differential between investment income on risk investments and ordinary income and a low capital gains rate to encourage investment in new enterprises. In addition, we are interested in supporting the incentive stock option changes proposed last fall by Senator Packwood and Senator Bentsen in the Senate and Congressman Jones and Frenzel in the House.

The administration's tax proposal of May 29 accomplishes the objectives we have with respect to capital gains, but does not address the incentive stock option issue. Now on balance, we support the plan, recognizing that the elimination of deductibility for State and local taxes will, in fact, result in an increase in capital gains taxes overall for many venture capital operations and for many investors in states that have income taxes.

Since the Stieger bill of 1978 and the further reduction in 1981, we have had a dramatic increase in entrepreneurial activity, risk investment, and infusion of capital in job creating growth companies. It's a fact that growth companies create jobs, improve productivity, and increase tax revenue through the corporate income taxes, personal income taxes and Social Security taxes that are paid by these new enterprises.

It is also a fact that equity capital is the lifeblood of growth companies, and that equity capital is highly sensitive to the capital gains rate and the differential between capital gains and that on other investment income. We believe the administration's proposal is progrowth, that it will increase the rate of job creation; will increase tax collections from payrolls, Social Security, and corporate income taxes from the class of company that we deal with; and it will help improve the deficit in the imbalance of payments and enhance the rate of innovation in the economy.

Past tax policy has seriously harmed the process of new company development. From the Tax Reform Act of 1969 through the act of 1976, Congress raised the minimum capital gains tax from 25 percent to 49 percent. This effectively dried up the flow of funds into venture capital firms and over-the-counter investments. New private capital committed to venture firms dropped from $171 million in 1969 to a low of $10 million in 1975. Price earnings ratios of over the counter growth companies were depressed during the period of high capital gains taxes, which both raised the cost of capital to growth companies, and lowered the return to risk investors on successful investments.

It was not until 1978 when the rate of tax on capital gains was reduced to 28 percent that the risk capital once again began to flow into young companies. Just a year before that act, only $39 million was committed to venture capital firms. After that act, the first year $570 million was committed. And by 1983, $4.5 billion was committed.

The revival of the over-the-counter market and the initial public offering market also took place concurrently with the change in tax rates. It's important to recognize the critical linkage between the public markets and the private markets. The funds used to start companies are only a small fraction of the total required, and that if there is not visibility on later capital requirements, that you can obtain those funds in the public market and that you can sell your original investment later in the public market at attractive prices, the process will not begin.

And much of the debate on the subject ignores the impact of capital gains rates on the equity markets in general. The level that you are investing declines significantly when there is no opportunity either for liquidity or follow-on growth capital in developing companies.

Low capital gains rates have had dramatic impact on the growth of innovative companies and the rate of new company formation. We offer the example of the electronics industry. From 1974 through 1977, the industry grew very slowly, and there were relatively few new companies started. After 1978, there was a dramatic increase in the growth rate. The industry more than doubled in a 5-year period, with a corresponding increase in personal taxes, Social Security taxes, and corporate taxes.

My final issue I would like to present for the committee is the change in the incentive stock option law. Presently, the law taxes the individual exercising an incentive stock option as a preference item at the time of exercise, and also on that same spread as a preference item at the time of sale, which is double taxation, which we think is unfair and seriously diminishes the effectiveness of this—a technique for rewarding entrepreneurism and for attracting managers out of major companies to help develop these growth companies.

There are a couple of other provisions. The sequential exercise rule, which we believe should be removed. And the limitation on grant of $100,000 that we believe should be changed to $100,000 of exercise per year. And so we strongly support the bill that was introduced last fall by Senators Packwood and Bentsen.

We believe that it is good public policy to encourage the development of young companies and growth companies because we believe that's where the job creation occurs in this economy, and where the rate of innovation is highest and the tax policy with respect to capital gains is a highly critical element of that process, and we strongly support the administration's bill.

Thank you.

Senator WALLOP. Thank you, Mr. Ackerman.

Without in any way trying to diminish the role that Congressman Steiger, whose sister is a constituent of mine—I would hope that it would not be forgotten that the Senate side of that bill was run by my former colleague, Cliff Hansen, a member of this committee. And at least on this side we called it the Hansen-Steiger bill. I would not want Cliff to go unmentioned in all of that because he performed a significant role over here. It was here that the Carter administration lost its final assault on trying to prohibit the passage of that legislation. And types of things which you have dramatically demonstrated did happen were the types of things that they were forecasting would happen. And to the total dismay of that era's Treasury. But I would have to say that Treasury Department, regardless of the administrations, have the same view. That anything that isn't taxed is thievery in their ordinary function in the world. So I appreciate your testimony this morning.

[The prepared written statement of Mr. Ackerman and a letter from Daniel T. Kingsley follow:]

STATEMENT OF DON. E. ACKERMAN, GENERAL PARTNER, J.H. WHITNEY & CO., NEW YORK, NY; MEMBER OF THE BOARD, NATIONAL VENTURE CAPITAL ASSOCIATION

I am Don E. Ackerman, general partner of J.H. Whitney & Co. of New York City and a member of the board of the National Venture Capital Association (NVCA), which represents 202 member firms, who have $12.8 billion under management. On behalf of the NVCA and the industry, I appreciate the opportunity to testify concerning the tax proposal and its effect on the entrepreneurial climate in the U.S. economy.

In the area of tax policy, the primary interest of the NVCA is to maintain a significant differential between the tax on capital gains and that on other income; and to lower the present rate of tax on capital gains.

The administration tax proposal of May 29 accomplishes both of those objectives and on balance we support the plan, recognizing that for some taxpayers the absence of a deduction for capital gains taxes paid in state and city returns will effectively cause an increase in aggregate capital gains percentage levels. We would also point out that the corporate gains rate remains at 28 percent. Nothwithstanding these two concerns and being aware that we cannot expect this proposal to necessarily satisfy our total requirements, we reiterate our support of the plan in its present form.

Since the Steiger bill of 1978 and the further reduction of capital gains rates in 1981, entrepreneurial activity, risk investment and the infusion of equity capital into job creating growth companies, has provided a healthy stimulus to our economy and the development of new technologies in our country.

It is a fact that:

- Growth companies create jobs, improve productivity and increase tax revenue.
- Equity capital is the lifeblood of growth companies.
- Equity capital is highly sensitive to the capital gains rate and the differential between the rate of tax on capital gains and that on other investment income.

Therefore, the Administration capital gains proposal will:

- Increase the rate of job creation.
- Increase the growth in tax collections from payroll, social security and corporate income.
- Improve the deficit in the balance of payments.
- Enhance the rate of innovation in the economy.

We are submitting data with this testimony that supports these statements. The availability of risk capital is dramatically affected by Federal tax policy. The facts show there is a direct relationship between investments by venture capital firms in portfolio companies and the maximum rates on long-term capital gains

There is significant historical evidence of this relationship. From the Tax Reform Act of 1969 through the Tax Reform Act of 1976, Congress raised the maximum capital gains tax from 25 to 49 percent. The effect on the venture capital industry was profound. Disbursements to entrepreneurial companies by venture capital firms dropped from $450 million in 1969, down to $250 million in 1975 -- a 45 percent decrease. Even more serious, new private capital committed to venture firms dropped from $171 million in 1969 to a mere $10 million six years later, in 1975. (see Table 1.)

The high capital gains tax rates beginning in 1970 disrupted the capital markets and dried up the flow of funds into both over the counter markets and venture capital firms. Price earnings ratios of OTC growth companies were depressed during the period of high capital gains taxes which both raised the cost of capital to growth companies and lowered the rate of return to risk investors on successful investments. (see Table 2)

It was not until 1978, when the rate of tax on capital gains was reduced to 28 percent, that risk capital once again began to flow into the marketplace. Just a year before the 1978 act, only $39 million in private capital had been committed to venture capital firms. In 1978, with the enactment of the lowered rate, $570 million was committed, and disbursements to portfolio companies rose over 30 percent. The continuation of this lower capital gains tax rate enabled the industry to flourish and fund thousands of entrepreneurs. By 1983, some $4.5 billion in private capital was committed to venture capital firms (see Table 3).

The revival of the over the counter market and initial public offerings also coincided with the capital gains reductions (see Table 4). It is important to recognize the critical linkage between healthy public capital markets and the availability of venture capital funds. The OTC market provides the larger amounts of capital required by growth companies after their venture capital funded start up period. The OTC market also provides the liquidity and pricing mechanism that permits investors to realize gains on venture investments. The level of venture investing declines significantly if there is no availability of public market growth capital or opportunity for liquidity and acceptable price levels.

The capital gains differential has raised the after tax rate of return for risk investing and has created healty equity markets. The result is that a wide range of investors have committed to both venture and OTC investments. Since on any given investment tax exempt entities receive a higher after tax rate of return than tax paying entities, significant investments have been made in venture capital funds by tax exempt sources.

It is clear that lower capital gains tax rates will result in stronger economic growth, more tax revenues, and an acceleration of the rate of innovation. Low capital gains rates have had a dramatic impact on the growth of innovative companies. We offer the example of the electronics industry. From 1974 through 1977, the industry grew slowly, laboring under effective maximum capital gains rate of 49 percent. In 1978, when that rate dropped to 28 percent, the annual payroll jumped from $19.7 billion to $24.1 billion. That added an estimated $600 million in personal taxes paid -- in just that year. The industry continued to expand, receiving another boost in 1981 when the effective rate was dropped again to 20 percent. By 1983, payroll was estimated at $49.8 billion -- an increase of over 100 percent from five years earlier. Personal taxes paid increased accordingly to $7.5 billion (see Table 5).

Before closing, Mr. Chairman, I would like to take this opportunity to urge the committee to consider incorporating the features of a capital gains related measure introduced last year by Senators Packwood and Bentsen which would have modified the incentive stock option (ISO) provision in three ways:

1. The spread between the exercise price and the fair market value would no longer be a preference item when computing the minimum tax.

2. The sequential exercising rule would be repealed.

3. The rule limiting the granting of no more than $100,00 in options per year would be changed so no more than $100,000 could be exercised in any one year.

The text of the bill and the introductory statements to S.3089 are attached as Appendix A to my statement.

ISOs are an important tool used by young, innovative firms to reward dedicated, but usually underpaid employees during the firm's formative years. ISOs are also a critical factor in attracting experienced, senior management needed to assure the continued high growth of these companies.

This proposal could be incorporated as part of the tax reform package at little or no cost, Mr. Chairman. In fact, experts tell us that Treasury would actually make money by its adoption.

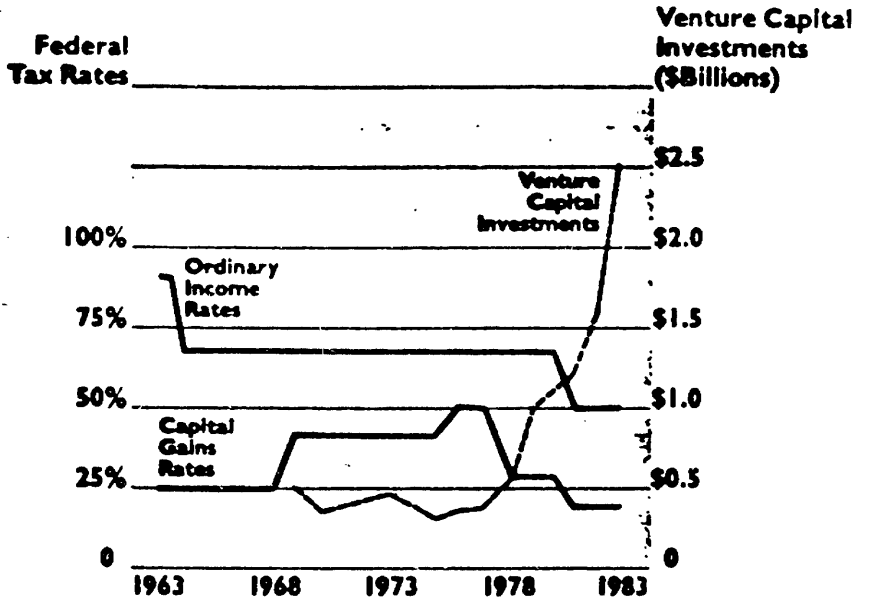
The hard data supports the case that the capital gains tax rate is critical to the flow of venture capital -- and to the success of innovative young companies. In the interest of encouraging the continuing development of growth companies with their job creating capability, we urge the Congress to support the Administration's tax proposal.

Thank you, Mr. Chairman, for the opportunity to appear before the committee.

TABLE 1

Influence of Tax Rates on Investments

Relationship between direct investments by venture capital firms in portfolio companies and the maximum rates on long-term capital gains and ordinary income



SOURCE Syntrex Incorporated and Capital Publishing Company, 1983

TABLE 2

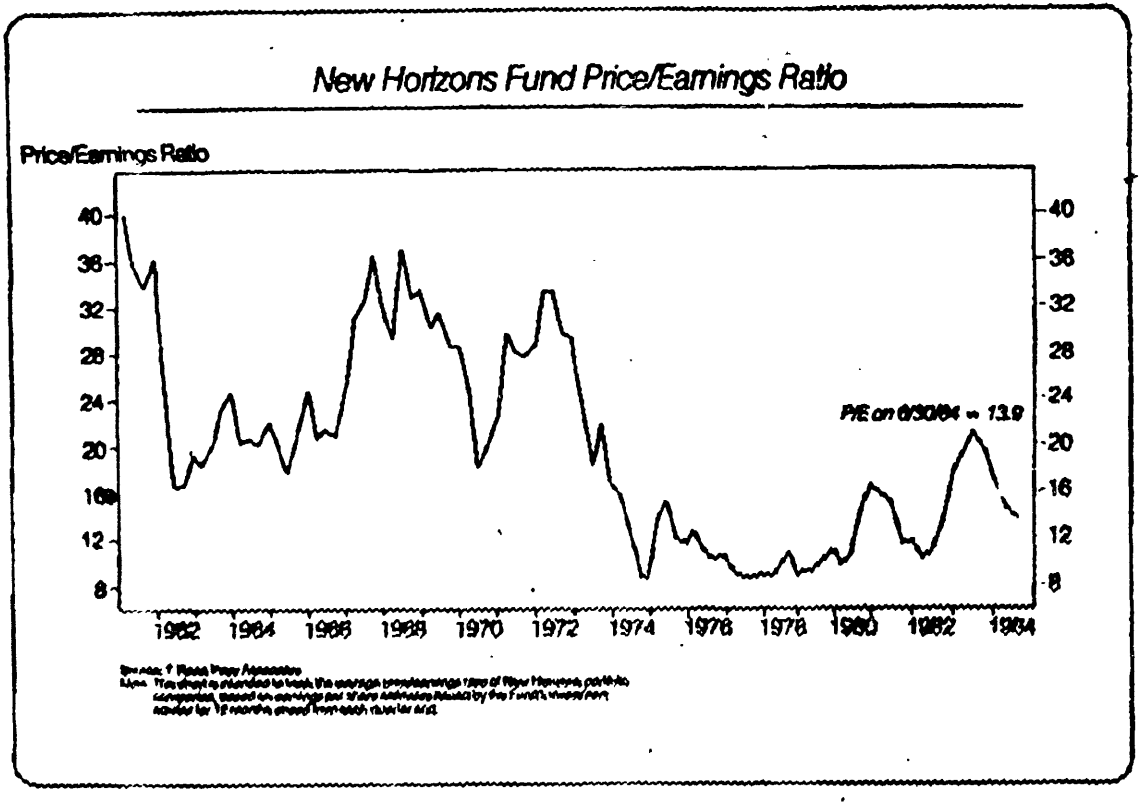

New Horizons Fund Price/Earnings Ratio
Price/Earnings Ratio
40
36
32
28
24
20
16
12
8
P/E on 6/30/84 = 13.9
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984

TABLE 3

Venture Capital Industry

Estimated Venture Capital

($ Millions)

Year	New Private Capital Committed to Venture Capital Firms	Estimated Disbursements to Portfolio Companies	Size of Total Pool
1983	$ 4,500	$ 2,800	$11,500
1982	1,700	1,800	7,600
1981	1,300	1,400	5,800
1980	900	1,100	4,500
1979	319	1,000	3,800
1978	570	550	3,500
Capital Gains Tax Decrease			
1977	39	400	2,500-3,000
1976	50	300	—
1975	10	250	—
1974	57	350	—
1973	56	450	—
1972	62	425	—
1971	95	410	—
1970	97	350	—
Capital Gains Tax Increase			
1969	171	450	2,500-3,000

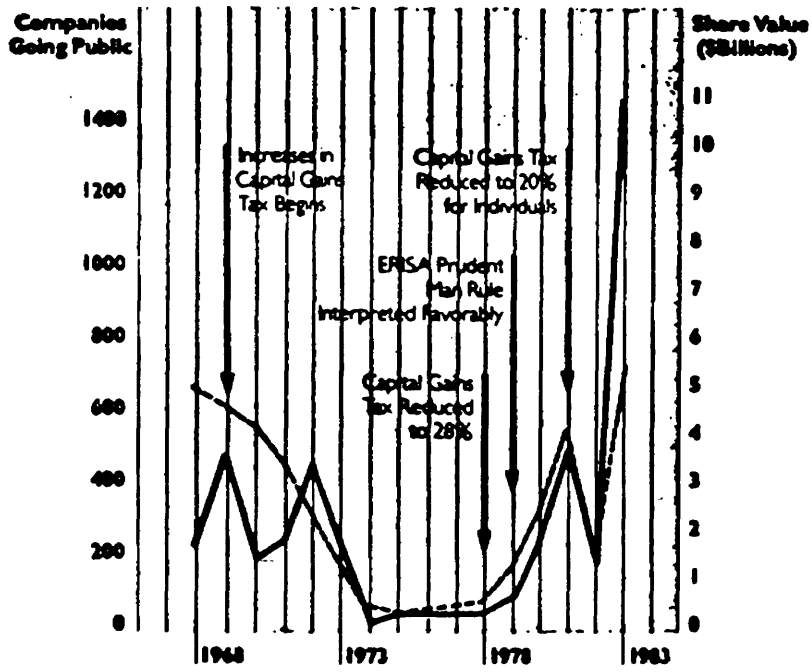
SOURCE *Venture Economics* August 1984

TABLE 4 ?

Policy and Rules Changes

Effect on Flow of Public Offerings

(Current Dollars)



SOURCE. (For Figures Only) *Investment Dealers' Digest* 1/17/84

TABLE 5

SIZE OF U.S. ELECTRONICS INDUSTRIES, 1974-1983

Years	Number Employees	Annual Payroll (billions)	Estimated Personal Taxes Paid** (billions)	Capital Gains Effective Maximum Tax Rate
1974	1,440,000	$ 15.8	$ 2.4	49%
1975	1,300,000	15.9	2.4	49
1976	1,300,000	17.5	2.6	49
1977	1,430,000	19.7	3.0	49
1978	1,570,000	24.1	3.6	28
1979	1,790,000	29.3	4.4	28
1980	1,960,000	35.1	5.3	28
1981	1,970,000	39.8	6.0	20
1982	2,070,000	43.5*	6.5	20
1983	2,280,000	49.8*	7.5	20

* Data for 1974-1981 are AEA estimates based on data published in County Business Patterns. Data for 1982 and 1983 are AEA estimates based on data supplied to AEA by the Bureau of Labor Statistics. Comparable data is not available for years prior to 1974. The 1983 employment total includes selected service categories not included in prior years.

** Assumes average effective personal tax rate of 15%.

NATIONAL VENTURE CAPITAL ASSOCIATION
1655 North Fort Myer Drive
Suite 700
Arlington, Virginia 22209
703/528-4370

June 24, 1985

The Honorable Bob Packwood
United States Senate
Washington, D.C. 20510

Dear Bob:

Attached you will find a letter from Stanley Pratt, chairman of Venture Economics, Inc. and publisher of the VENTURE CAPITAL JOURNAL, to Treasury Secretary James on the issue of the role of non-taxable investors in the funding of the organized venture capital industry. We would appreciate your attaching this as EXHIBIT A to the testimony of Don E. Ackerman, member of the NVCA board, on June 26, 1985.

Thank you

Sincerely,

NATIONAL VENTURE CAPITAL ASSOCIATION

Daniel T. Kingsley
Executive Director

DTK/mmm
attachment

VENTURE ECONOMICS

April 8, 1985

The Honorable James A. Baker III
Secretary of the Treasury
Department of Treasury
15th and Pennsylvania Avenue NW
Washington, D.C. 20220

Dear Mr. Baker:

There has recently been confusion in the national media as well as in data from the Treasury Department as to the role of non-taxable investors in the funding of the organized venture capital industry. Since Venture Economics, Inc. or our monthly publication, VENTURE CAPITAL JOURNAL, is credited as the information source, it is important that we inform you of the facts.

Tax-exempt (pension, foreign, endowment and foundation) investors are not the principal source of funding for venture capital funds. The confusion was most probably occasioned by analysis of only one of the segments of the venture capital industry, the independent private venture capital firms, but their $11.4 billion represents only 71% of the total industry capital. The other sectors, Small Business Investment Companies ($1.6 billion) and corporate subsidiaries ($3.0 billion) are almost exclusively taxable entities.

Analysis of the complete data shows that the increase in venture capital between 1978 and 1984 was slightly over $13 billion. Tax-exempt investors provided almost $5.4 billion of this total. The current capital committed to the organized venture capital industry is approximately $16 billion of which at least 62% is from taxable sources and only 38% from tax-exempt investors. If one considers informal venture investments from taxable individuals, which some analysts estimate to be greater than the organized activity, tax-exempt investors are even less significant.

Pension fund investors are important to the process since some portion of their more than $1 trillion of investment assets must be attracted to finance new business development. While they will not be directly influenced by tax considerations, they do in fact seek investment opportunities in favorable environments that have been stimulated by tax incentives. Even though many like to credit them with a leadership role, the fiduciary responsibilities of pension, endowment and foundation investors mandate a followers role in new investment trends, after others have served as pioneers.

Potential opportunity, not tax consideration, stimulates institutional investment. Innovators perceiving a favorable environment will create investment opportunities and institutional capital investment will flow towards the proven successes.

It is critical that we understand the real forces that drive new business development -- the perceptions of the entrepreneur. The

Venture Economics Inc
16 Lowell Ave P.O. Box 348 Wellesley Hills, MA 02181

belief that he or she will succeed in building a major new business and significant personal wealth despite the fact that most new businesses fail is a perception that often overcomes stark reality.

The favorable capital gains tax differential not only reinforces this perception, but it is critical in enabling the entrepreneur to attract the key employees who will leave large corporation comforts to work 80-hour weeks to make the vision a reality.

Incentives are relevant because entrepreneurs perceive them to be necessary. How can any of us ignore the sterility of new business development from 1969 through 1977, the period during which there was no differential between capital gains and ordinary income tax rates?

The rationale behind the current Treasury Department tax reform proposal overlooks two important factors. First, increasing the capital gains rate while decreasing the tax rate for dividends and interest income benefits the wealthy at the expense of those seeking to build wealth. In effect, we would hamper the most powerful instrument for social mobility in our economy -- not just for the Steve Jobs' (Apple Computer), but for the many hundreds of middle class employees who joined the effort and shared the success.

The capital gains tax differential can enable young businesses to compete with large corporations for both the capital and, by making Incentive Stock Option plans attractive, the management talent.

Second, our entrepreneurial climate and venture capital infrastructures are key competitive advantages internationally. The Europeans and Japanese recognize this and are attempting to develop a similar environment. Should we take an opposite course and signal entrepreneurial disfavor by eliminating the capital gains tax differential?

There has been discussion recently about providing special treatment for the venture capital industry. I strongly believe that narrowly targeted tax incentives are not feasible in the long term. Entrepreneurs, venture capitalists and investors should be rewarded for success, for achieving growth of jobs and economic benefits, for the creation of new wealth and value, not reimbursed for unsuccessful attempts. The capital gains tax differential rewards risk-taking and patience without undue targeting.

Very truly yours,

Stanley E. Pratt, Chairman
Publisher VENTURE CAPITAL JOURNAL

SEP/

cc: The Honorable Richard G. Darman
Deputy Secretary of the Treasury

The Honorable Ronald H. Pearlman
Assistant Secretary for Tax Policy

bcc: Mark Bloomfield

Senator WALLOP. Mr. Moore.

STATEMENT OF WILLIAM G. MOORE, JR., CHAIRMAN, AND PRESIDENT AND CHIEF EXECUTIVE OFFICER, RECOGNITION EQUIPMENT, INC., ON BEHALF OF THE AMERICAN ELECTRONICS ASSOCIATION, DALLAS, TX

Mr. MOORE. Yes. I would like to represent myself, frankly, as wearing two hats. One is the chairman of the American Electronics Association, which is the largest and broadest based assemblage of electronics companies in the country. We have about 2,600 member companies. That's largely an honorarium for me. That's a 1-year assignment. My real role in life is chief executive officer of a company by the name of Recognition Equipment, Dallas, TX. We are a $150 million, I think, very high-tech company. We are New York Stock Exchange listed. About a third of our business is offshore. We have a major operation in effect in Japan, for example, for the last 14 years.

In representing myself in two capacities—one as chairman of the American Electronics Association this year and as a high-tech CEO—I want to more or less offer myself and my testimony as a voice from the trenches as to what is going on in the high-tech community today vis-a-vis this potential fundamental restructuring of our Tax Code.

In that context, I want to tell you a little bit more about the proactivity that is occurring right now in our business. Of our 2,600 member companies, the majority are represented by their chief executive officer, not the organizational staff types doing staff work and so forth. We meet quarterly with 50 company presidents. I chair that directors meeting each quarter. And we discuss for more than half of our day and a half long meetings provisions of the Tax Code.

We have monthly meetings of all our members around the country. Upward of 1,500 company presidents are getting together on a monthly basis again with a high focus on this issue. And this past May we had 200 of our chief executives come here to Washington to talk to our various legislators about this legislation.

As a company CEO, 3½ years ago when I arrived at my company, we almost went bankrupt. We were going through one of these turnaround processes—the ups and downs that so often happen in our business. And I should tell you that last year the company reported record revenues and record profits. And that was largely because of its ability during the stock market run of 1982 and 1983 to raise over $40 million in equity capital in what was essentially a high-risk, high-technology company.

In my testimony we point out several things. There is a relatively consistent concensus among high technology executives today as to what is important to us to create the environment for our companies going forward. No. 1 is the preservation of the capital gains differential. I think we have got two charts—one that you see here in the easel to your left today, which shows you the job creation in our business since the Hansen-Steiger initiative, which shows that we have created over a million jobs in the high technology industry. We are now—and it is not generally recognized in the United

States—the highest manufacturing employer in our country, the high technology industry.

The second chart, which I will ask to be put up, shows what Don just mentioned relative to the way venture capital infusion into our industry's grow debt. This will give you some idea of the spike. These charts are in my testimony.

Again, our priorities in high technology is the availability of capital both to our venture startups and to our existing companies, like my own. The second is the R&D tax credit issue which you just talked about and which I felt on several occasions to raise my hand and help answer questions as to its importance to us. And, third is the viability of such things as 401(k) plans and stock options, which especially allow the small companies in our business to attract the talent they need. X high salaries, and high perquisites allow us to track those people to start these high-risk, you know, potentially very, very high reward ventures.

So, again, I might summarize and say that both as a high tech CEO and the chairman of a very large and broad based trade association we believe that the fundamental restructuring of our tax code which is about to take place will have significant impacts in our global competitive strategies as an industry and we very much appreciate the opportunity to be before you today.

Senator WALLOP. Thank you very much.

[The prepared written statment of Mr. Moore follows:]

Statement of William G. Moore, Jr.
Chairman, President and Chief Executive Officer,
Recognition Equipment, Inc.
for the American Electronics Association

Introduction

Mr. Chairman, members of this distinguished Committee; my name is Bill Moore. I am Chairman and Chief Executive Officer of Recognition Equipment, a 25 year old, $150 million New York Stock Exchange listed company. REI manufactures hardware and software systems employing optical character reading technology to perform such functions as credit card billing, bank check processing, mail sorting and currency handling. Today we employ 2,400 people and derive more than 1/3 of our revenues offshore.

Three and half years ago I took over the reins of REI when it was near bankruptcy. Largely through our ability to raise $40 million in the last 18 months in the public equity market, the company last year achieved its highest revenue and profit year in its 25 year history.

Description of AEA

I am appearing before you this morning in my capacity as Chairman of the Board of the American Electronics Association (AEA).

AEA is the largest trade association of this nation's largest manufacturing industry. AEA represents over 2,500 member companies nationwide, and over 450 financial, legal and accounting organizations which participate as associate members. AEA encompasses all segments of the electronics industries including manufacturers and suppliers of computers and peripherals, semiconductors and other components, defense systems and products, telecommunications equipment, instruments, software, research, and office systems. The AEA membership includes companies of all sizes from "start-ups" to the largest

companies in the industry, but the largest number (71%) are small companies employing fewer than 250 employees. Together our companies account for 63% of the worldwide sales of the U.S.-based electronics industries.

Summary of AEA's Position

On behalf of AEA, I thank you for this opportunity to appear early in these important hearings on fundamental tax reform. **The American Electronics Association generally supports the tax reform program proposed by President Reagan.**

Taking the plan as a whole, we support its elimination of a substantial number of existing tax preferences and application of that revenue to reducing corporate and personal tax rates. We believe this plan will aid the economy by reducing the amount of non-productive tax shelter activity that is damaging America's confidence in its tax system today.

We are particularly pleased to support retention of the vital capital gains tax differential which results in a 17.5% maximum rate; extension and focusing of the R&D tax credit; extension of the tax free status of employer-provided education benefits and retention of the tax deferred 401(k) savings plan for employees.

Concerns Summarized

We do however have some specific concerns that we wish to address. We are most concerned over:

- the arbitrary 12 year life proposed for computing the depreciation recapture provision;
- failure to recognize the short term life of high technology equipment for depreciation purposes.
- the proposed per-country limitation and foreign source income restrictions on the foreign tax credit; and

- abolition of the investment and tax credit;

AEA is also concerned about a provision of S.956 and S.973, minimum tax bills pending before this Committee, which would treat R&D business expense deductions as a tax expenditure that must be included in calculating the corporate minimum tax.

This statement will briefly examine each of these issues. But we first want to emphasize why the American high technology sector is vital to U.S. economic growth.

The Importance of High Technology to the U.S. Economy

A recent Commerce Department study concluded that:

> "High technology industries are vital to the U.S. economy. Their growth rate has been twice that of total industrial output, and they contribute the bulk of technological advances to all sectors of the economy.
>
> "National security depends upon the technology-intensive industries both for sophisticated items essential to modern weapons superiority, and for a strong and flexible industrial capacity for future contingencies.
>
> "The United States will have to depend heavily on its areas of greatest strengh -- principally advanced technology -- to meet increased competition in world markets." 1/

Vital as these electronics companies are for their contributions to innovations, productivity, national security and our quality of life, two important facts about them are not widely recognized.

1/ An Assessment of U.S. Competitiveness in High Technology Industries; International Trade Administration; U.S. Department of Commerce; February 1983; pg. iii.

First, as a direct result of the enlighted capital gains policies of the last seven years the U.S. electronics industry has created over a million new domestic jobs and become the nation's largest manufacturing industry, now employing over 2.6 million Americans. Policies which impact this industry therefore have an immediate and substantial impact on this nation's manufacturing sector and its overall economy.

Second, the future of this industry, and these jobs is now in jeopardy due to a decline in the international competitiveness of our technology industries. As noted in the recently released Report of the President's Commission on Industrial Competitiveness, U.S. companies have lost world market share in seven out of ten high technology sectors in the last 20 years. 2/

As a result of this loss of market share the surplus which these companies have traditionally contributed to the nation's trade balance became a serious trade deficit in 1984.

The United States world-wide trade in electronics products has fallen from a surplus of $7.4 billion in 1980 to a deficit of $6.2 billion in 1984.

2/ Global Competition, The New Reality; Report of the President's Commission On Industrial Competitiveness (Young Commission); January, 1985; pg. 16.

With that background, I would now like to turn to the specific issues before this Committee.

THE IMPORTANCE OF RETAINING THE CAPITAL GAINS DIFFERENTIAL

This nation's vital high technology sector is unusually vulnerable to increases in the tax on capital gains. To succeed in their intensively competitive markets, high technology companies need to grow at a faster rate than they can finance through retention of their own earnings. Even though they typically pay minimal or no dividends, they must frequently seek new infusions of outside risk capital investment.

The investors who provide this capital know they will receive no significant dividends. They can only hope for capital appreciation. This makes their investment decisions extremely sensitive to fluctuations in the tax on capital gains. History has shown when taxes on capital gains go up, these investors lose interest in risky, high technology ventures. When they go down, these investments flourish.

Lessons from History

In the last 15 years, our nation has experienced two dramatic demonstrations of the damage and benefits that changes in the taxation of capital can cause.

The Tax Reform Act of 1969, together with its subsequent revisions, raised the maximum effective tax on capital gains from 25% to 49%, and reduced the write-off to capital losses by 50%. The rewards for success were cut in half, and the penalties for failure were doubled. The effect on venture capital was devastating. The ability of small companies to raise equity capital by public stock issues declined drastically, and by 1973 small company issues had practically ceased. (see Appendix I)

A 1978 American Electronics Association survey documented that during 1971-75, companies in the electronics industry were able

to raise less capital in real terms than at any time in the prior fifteen-year period. 3/ This scarcity of investment funds caused many technology companies to stop growing, go deeply in debt, or sell their valuable technologies to foreign competitors in Europe or Japan just to meet their payrolls.

The Turning Point

Then in 1978, the late Congressman William Steiger in the House and several current members of this Committee in the Senate proposed reducing the effective tax on capital gains from 49% to 28%. They argued that allowing people to keep more of their capital gains would encourage investment and create jobs. Their proposal was ridiculed at the time as a "millionaires' relief act", which the Treasury estimated would cause a net revenue loss of $2.2 billion per year.

Rejecting that argument, Congress lowered the capital gains tax, and our nation's entrepreneurial revival began.

Results of the 1978 and 1981 Capital Gains Tax Reductions

Mr. Chairman the results of the 1978 and 1981 capital gains tax reductions have been spectacular:

1. The first and most immediate response was a boom in the amount of venture capital that became available for investment in "start-ups" and young company growth.

2. This capital led to a burst of entrepreneurship and new company creation which has caused dramatic growth in the electronics industry's employment.

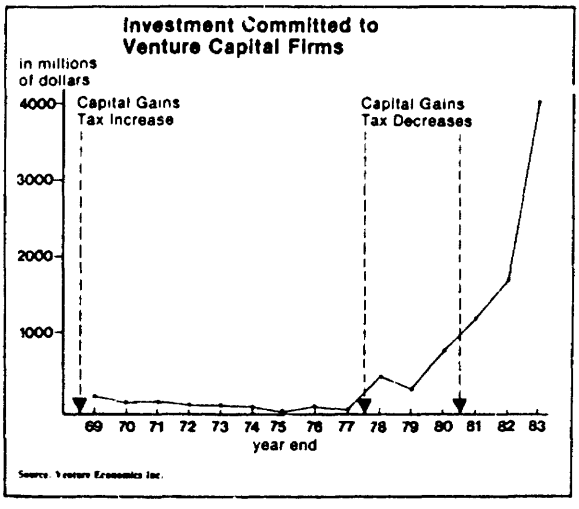
3/ Testimony before the House Ways and Means Committee by Edwin V.W. Zschau on behalf of the American Electronics Association, March 7, 1978.

3. At the same time, the Treasury's static predictions of revenue losses were contradicted by major increases in capital gains collections at the lower rates.

I will briefly describe each of these effects.

Effect on Venture Capital

As the following chart clearly demonstrates, the 1978 capital gains reduction triggered a major increase in the amount of money invested in organized venture capital funds. According to Venture Economics, Inc, of Wellesley Hills, Massachusetts, such investments increased from $39 million in 1977 to $4.2 billion in 1984. (See Appendix I). The total pool of venture capital in this country increased from approximately $3 billion in 1977 to $16.3 billion in 1984.

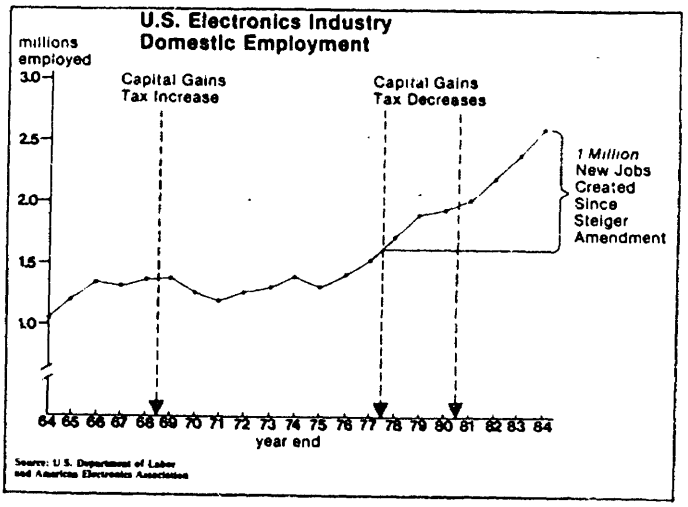


Effect on Electronics Industry Employment

Nearly all of the venture capital invested in this country is invested in "start-up" or emerging young companies. These are the same companies which generate the most new jobs for the economy.

It's important to realize however, that lower capital gains taxes have greatly improved the ability of companies of all sizes to raise the risk capital they must have to grow. For example public companies with a net worth of less than $5 million raised only $75 million in 1977. By 1983 these companies were raising $3.7 billion. Even in the relatively depressed market of 1984 they raised $1.2 billion. (see appendix 1). The total equity capital raised by all industries rose during this same period from $6.4 billion in 1977 to $40.2 billion in 1983.

As a direct result of this increased capital availability the U.S. electronics industry has created over a million new domestic manufacturing jobs since the captial gains tax reductions of 1978.



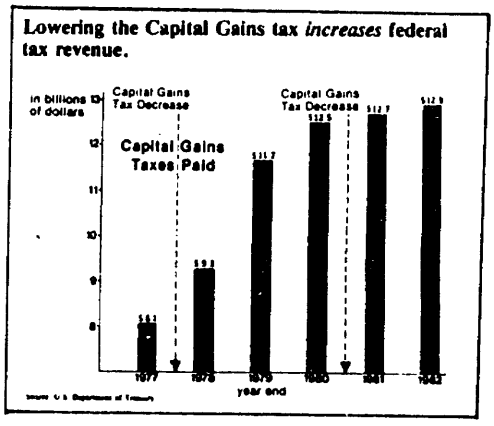
To put this million job statistic into perspective, it is useful to compare it with another important industry. According to the American Iron and Steel Institute, the total employment for that industry at the end of 1984 was 236 thousand jobs. **This means the U.S. electronics industry has added the employment equivalent of more than four entire steel industries just since 1978.**

During the period of high capital gains tax rates (from 1969 to mid-1978), the electronics industry added an average of 25,000 jobs per year. After the capital gains reduction, the industry averaged 150,000 new jobs per year. Thus lower capital gains taxes directly contributed to the creation of an additional 125,000 jobs per year in the electronics industry alone.

We do not contend the capital gains changes were the only factor which caused this increase in employment. But we are convinced that without the lower capital gains rates our industry could not have generated adequate risk capital to finance this level of growth.

Effect on Federal Revenue

A final, but crucial point to understand is that **reducing the capital gains tax does not cost the Treasury revenue--it actually increases capital gains tax collections.** Despite official predictions of a $2.2 billion revenue loss if the Steiger Amendment passed, Treasury's receipts increased 44%, from $8.1 billion in 1977 to $11.7 billion in 1979. As the following chart illustrates, the same effect was repeated in 1981. When the tax rate came down, Treasury's capital gains revenue went up.



The "Golden Egg" of Tax Policy

The point I want to emphasize is that **this is a tax provision that earns its keep. If there can be said to be a "golden egg" in tax policy, this is it. The capital gains tax differential is a powerful engine of job creation which also generates positive revenue for the Treasury.**

Rebutting the Critics

But since we are discussing tax policy, no matter what the benefits to the economy as a whole, there will always be controversy over provisions which benefit high income taxpayers.

You have already heard testimony that the capital gains reductions aren't really the reason that venture capital boomed and therefore the job creation we cite has to have been caused by other factors. For example, on June 7, 1985 Mr. Robert S. McIntyre, Director of Federal Tax Policy for an organization called "Citizens for Tax Justice" testified before the Ways & Means Committee that the vast majority of the funds invested in venture capital come from tax exempt or extremely low-taxed entities for whom the incentive has no importance. He said "Only 13 percent of the increase in venture money from 1978 to 1984 came from individual investors, the people affected by the capital gains tax cuts."

This statement is factually incorrect. It is based on a faulty understanding of the data compiled by Venture Economics, Inc. Mr. Stanley E. Pratt, Chairman of that firm recently wrote Treasury Secretary Baker to correct the record. Mr. Pratt's letter states in part: "Tax-exempt (pension, foreign, endowment and foundation) investors are <u>not</u> the principal source of funding for venture capital funds...The current capital committed to the organized venture capital industry is approximately $16 billion of which at least 62% is from taxable sources and only 38% from tax-exempt investors".

But this 38% still only relates to the organized, formal venture capital industry as such. It does not count the large amount of risk capital investments made by private individuals who are not considered professional venture capitalists. Essentially all of these investors are affected by changes in the capital gains tax.

Mr. Pratt explains that "potential opportunity, not tax consideration, stimulates institutional investment. Innovators perceiving a favorable environment will create investment opportunities and institutional capital investment will flow towards the proven successes." In other words, it is because of the efforts of tax-motivated entrepreneurs that these investment opportunities have attracted institutional support. (The complete text of Mr. Pratt's letter is attached to this statement as Appendix II.)

J.E.C. study confirms importance of the Capital Gains

A major study of the venture capital industry conducted by the Congressional Joint Economic Committee independently confirmed Mr. Pratt's finding that the vast majority of venture capital comes from tax paying sources. 4/ The J.E.C. conducted the largest survey of the venture capital industry ever performed, and they did it in 1983-84, before the first Treasury reform proposal was released. Two hundred seventy-seven venture firms of various sizes responded.

The Joint Economic Committee concluded that: "The capital gains tax differential was, and continues to be, a major factor behind the post 1978 surge in venture capital availability". 5/

4/ "Venture Capital and Innovation"; Joint Economic Committee; S. Prt.98-288; December 28, 1984; pages 20, 21.

5/ J.E.C. ibid. Pg. XI

The Last Comparative Advantage

Mr. Chairman, in concluding our comments on this subject, I want to return briefly to the vital question of America's competitiveness in international trade.

There is wide agreement that the economic future of this nation depends on the ability of U.S. companies to compete with foreign goods in world markets and at home. As you know U.S. exporters are fighting against severe handicaps. Our cost of capital is higher than our foreign competitors'. Our cost of labor is much higher. The cost of our materials is often higher. The overvalued dollar then amplifies the impact each of these other factors.

But the United States does have one remaining comparative advantage over our foreign trading partners. it is our nation's spirit of entrepreneurship and innovation. This spirit is the envy of our competitors. It is our nations best hope for the future. And, it is driven by a quest for capital gains.

Mr. Chairman, we simply cannot afford to quench that spirit by reducing the capital gains tax differential.

PROVISIONS TO ENCOURAGE RESEARCH AND DEVELOPMENT

The ability of companies to compete in the international marketplace depends first on their ability to raise capital but secondly on their willingness to invest their resources in the development and application of new technologies. Research and development is the key to innovation.

AEA strongly supports the Administration's recommendation to extend the R&D tax credit and to limit the definition of

qualifying R&D according to the principles proposed last year in the Senate amendments to H.R.4170. These principles again are contained in legislation in both the Senate and House (S.58, with 30 cosponsors and H.R.1188, with over 195 cosponsors).

In proposing an extension of the R&D tax credit, the Administration states:

> The benefit to the country from such innovation is unquestioned, and there are reasonable grounds for believing that market rewards to those who take the risks of research and experimentation are not sufficient to support an optimal level of such activity. The credit is intended to reward those engaged in research and experimentation of unproven technologies.

Studies by the Congressional Research Service, Data Resources, Inc., and a variety of nationally-known economists all point to the necessity of maintaining the credit even under a "pure" tax reform environment. In addition to providing incentives for conducting the optimum level of research and innovation in the economy, the credit is responsible for tangible increases in our nation's GNP, which in turn generates tax revenues in excess of those "lost" directly through the credit.

New technology equipment often is obsolete after only two to five years. Thus, companies need to invest large amounts of their capital in R&D and sell to the widest possible marketplace to recoup their investment as soon as possible. **Therefore, loss of competitiveness in foreign markets directly threatens the ability of U.S. high technology companies to survive in the U.S. market.**

Recognizing these facts, **foreign governments provide a variety of R&D incentives** to their native companies and to companies

locating in their territories. For example, Japan provides a permanent 20 percent tax credit for the difference between current R&D expenditures and the level of R&D expenditures in 1966. This provides an effective tax credit of approximately 18 percent for all R&D, while the U.S. credit applies only to incremental R&D expenditures.

While the Administration supports a three-year extention of the R&D credit, AEA believes it should be made permanent. Companies plan their R&D programs over three to five year periods. Thus, a temporary extention will not provide the kind of program stability needed to maximize the incentive effect of the credit.

University Research Provisions

Additionally the Administration plan states:

> Other legislative proposals, such as a separate credit for contributions to fund basic university research or an enhanced charitable deduction for contributions of scientific equipment to universities, are typically associated with the research credit.

AEA agrees that provisions to encourage university research and to modernize our nation's scientific research base go hand and hand with incentives to promote corporate innovative efforts. Provisions which encourage corporate funding of university basic research and donations of scientific research equipment to universities also are essential if the U.S. intends to be a leader in technological innovation for the indefinite future.

INDIVIDUAL INCENTIVES FOR PRODUCTIVITY AND INNOVATION

Our economy can grow only as fast as the people who drive it. We need to provide our nation's workers with the skills necessary to create and apply new technologies to growing world markets and we need to provide incentives for workers to maximize their potential.

AEA Strongly supports the Administration's recommendation to extend the tax free status of Section 127 employer-provided educational assistance which is widely used throughout the economy, mostly by employees below the executive level. It is a means by which employees can broaden their education to their personal and professional benefit. Such benefits directly enhance the growth potential of the employee, his or her employer, and the economy as a whole. This benefit is particularly important today as American workers seek retraining necessary for adjustment from declining to growth industries.

AEA also is encouraged by the Administration's recommendation to continue cash or deferred retirement accounts (CODAs) such as Section 401(k) retirement investment plans. These plans encourage employee savings for future retirement through pre-tax payroll deductions. Preliminary data indicate that more workers earning between $5,000 and $50,000 participate in such cash or deferred arrangements than in individual retirement accounts.

While the Administration proposes to limit both contributions and withdrawals associated with such CODAs, AEA strongly beleives that CODAs must be maintained for workers to plan independently for their own retirement. The security provided through such plans is reflected not only in future years but in current year productivity of covered workers.

AEA would prefer that current law treatment of Section 401(k) plans be maintained. This is particularly the case with regard to the Administration's proposed changes in the anti-discrimination rules applying to such plans. Under the Administration's recommendations, the contributions of employees earning over $50,000 would be significantly limited and in many cases these employees would not be able to contribute as much to 401(k) plans as employees earning less than $50,000. For example, an employee earning $49,000 would be able to contribute up to $8,000 into a 401(k) plan; while an employee earning $51,000 likely would be limited to a contribution of less than $3,000 (125 percent of the average contribution of those earning less than $50,000).

The initial intent of Section 401(k) plans was to promote private savings by American taxpayers. This objective is no less important today.

ELECTRONICS INDUSTRY CONCERNS

It is important to note that while the Administration's tax reform package represents a generally positive development in U.S. tax policy, no proposal which attempts to rewrite our nation's tax laws is perfect. The intent of tax reform is to create "fairness, growth and simplicity." There are several proposals currently being considered which threaten these objectives.

1. Excess Depreciation Recapture

The Administration proposes to recapture "excess depreciation" benefits which are derived when accelerated depreciation allowances have permitted taxpayers to defer tax liability into the later years of an asset's depreciable life. The Administration contends that a "windfall" will result when the lower tax rates proposed under its package are applied against those deferred tax liabilities. By "recapturing" these "excess" depreciation allowances, the Administration plan would raise $56 billion (in three years) of the plan's $118 billion (over five years) total increase in corporate tax revenue.

The Administration's proposal makes two related but incorrect assumptions regarding the effect of accelerated depreciation on U.S. industries. First, the recapture provisions assume that all industries benefited from the accelerated cost recovery system (ACRS) enacted in the 1981 tax act; and thus all industries will have reaped "excess" benefits when corporate tax rates are reduced on July 1, 1986, assuming rate reductions are enacted by that date.

In fact, however, high technology industries derived little or no benefit from the 1981 ACRS provisions. Since most high technology equipment is obsolete within two to five years after

it is purchased, "accelerating" the depreciable life of such assets to three or five years (as under the ACRS methodology) merely reflects the true economic life of such assets. Therefore, **there are no "excess" benefits from ACRS which need to be "recaptured."**

The second incorrect assumption made in the Administration's recapture provisions is that straight-line depreciation deductions used in calculating a corporation's earnings and profits (E&P) should form the basis of determining which accelerated depreciation benefits should be deemed "excessive." **A straight-line E&P depreciation schedule assumes a twelve year recovery period for assets which, as described above, are obsolete within two to five years for most high technology goods and services.** To tax 40 percent of those benefits in excess of an arbitrary E&P straight-line method simply imposes a penalty on the production of short-lived high technology equipment.

2. The Alternative Minimum Tax

Both the Administration's tax plan and a variety of bills in the House and Senate propose an alternative minimum tax (AMT) to be imposed on corporations. In the House, Congressmen Schumer and Russo introduced in early May H.R. 2424 with 56 cosponsors. The Senate versions are S.956 and S.973.

The intent of an AMT is to ensure that corporations and individuals pay a certain minimum amount of taxes when they report positive financial balances. These proposals require taxpayers to calculate their taxes using an alternative method which adds back into their taxable income certain "tax preferences" designed to stimulate certain activities of the taxpayer. If the alternative computation yields a higher tax liability, the taxpayer is required to pay the higher amount.

While AEA does not object to the intent of the AMT, **we strongly oppose the inclusion of deductions for research and development**

expenditures as a tax preference in calculating the minimum tax. (We agree that the R&D tax credit is a tax preference, and AEA does not oppose including it in AMT calculations.) The Administration's plan does not include R&D expense deductions as a tax preference, but S.956 and S.973 do.

The deductions taken by taxpayers for R&D expenditures (salaries of R&D personnel, their supplies and other related costs) clearly are business expenses and should not be considered tax preferences. In fact, R&D expenditures are **required** to be deducted for financial reporting purposes to shareholders and to the SEC. Thus, any R&D deduction reduces financial income and taxes in proportion. A corporation's effective tax rate therefore will not change. By disallowing R&D deductions, H.R. 2424 will cause a company's effective tax rate substantially to exceed any minimum tax rate.

Under the provisions of these bills, **high technology companies conducting large amounts of R&D would face tax increases whether or not they were profitable.** For example, in profitable years, companies would be faced with higher effective tax rates under the alternative minimum tax, as discussed above. However, in years in which companies report no profits on their financial statements. These bills would require them to add back into their taxable income their expenditures on R&D--**thereby imposing a tax of 25 percent of their R&D expenditures even though the company had no profit.**

The Internal Revenue Code provision permitting R&D to be deducted was enacted in 1954 to provide certainty and consistency of treatment to R&D expenditures, not to establish a tax incentive (preference) for R&D expenditures. In 1952, the Commissioner of the Bureau of Internal Revenue (the predecsssor of the IRS) cited several justifications for this position:

1. apportioning R&D costs to specific projects is very difficult;

2. such costs "usually are a necessary part of most businesses";

3. most taxpayers consistenty charge such costs to expense; and

4. over time, allowing expense deductions does not create a materially different tax result from requiring capitalization with later deductions for depreciation or abandonment losses.

In other major high technology countries of the world, R&D expenditures are deducted for tax or financial accounting purposes. Thus, disallowing R&D as a deduction under any minimum tax would be inconsistent with major worldwide accounting conventions. It would have a serious impact on U.S. high technology corporations' attempts to keep pace with foreign competitors.

High technology industries devote an inordinately high amount of their resources to research and development activites. They must do so to survive. Disallowing these legitimate business expenses under an AMT will cause a major tax increase for companies which already pay relatively high effective rates of tax.

The intent of an AMT is to discourage tax avoidance, not to increase taxes on companies already paying high effective taxes. However, the effect of disallowing R&D expenditures under an AMT would be to discourage such expenditures not because of economic considerations but because of tax consequences. This is neither the intent of an AMT nor of tax reform which is designed to minimize the number of economic decisions based on tax consequences.

3. Foreign Tax Provisions

Exports are an integral part of maintaining U.S. high technology competitiveness both here and abroad. Several provisions in the

Tax Code provide incentives for U.S. companies to export their goods and services. These provisions exist not only to augment opportunities for U.S. companies to export and thereby improve the U.S. balance of trade, but to offset foreign taxes and other foreign-imposed costs of conducting business overseas.

The Administration's tax proposal, however, recommends two substantial changes in current foreign tax provisions. The first is the repeal of the so-called "overall" foreign tax credit (FTC) limitation and its replacement by a "per-country" limitation. The second would allow income from the sale of property to be treated as foreign source income eligible for the FTC only when it is attributable to a fixed place of business. **These proposals cause a major tax increase with respect to the foreign income of electronics companies and consequently will reduce the competitiveness of conducting international business transactions by U.S. based technology companies.** Given that these provisions would increase the cost for U.S. companies to export and given the aggressive foreign-country incentives designed to attract U.S. manufacturing and R&D activities, these proposals could further erode U.S. technological competitiveness while augmenting the competitiveness of our trading partners.

4. Capital Cost Recovery and the Investment Tax Credit

Economic growth and job creation require investment in new technologies and capital equipment throughout the economy. Computers, instruments, automation equipment, robotics, etc. all are capital equipment. Indeed, high technology manufacturers merely are the "toolmakers" for the nation's economy. Incentives to use these tools are as important as incentives to make them.

Incentives for corporate investment in capital equipment, such as the investment tax credit (ITC) and the accelerated cost recovery system (ACRS) have enhanced our nation's productivity and job creation. Such provisions therefore are important not only to high technology companies themselves, some sectors of which are highly capital intensive, but to all of the industries which invest in new, productivity-enhancing technologies.

The Administration proposes the elimination of the ITC and the significant reduction in value of ACRS. In low profit years, the tax increase represented by the elimination of the ITC offsets the tax reduction represented by lowering corporate tax rates.

Furthermore, as noted above, most high technology equipment is extremely short-lived, obtaining obsolescence in two to five years. While the Administration's proposed CCRS depreciation methodology is intended more accurately to reflect the true economic life of assets, it fails in key areas such as manufacturing equipment, semiconductors, instruments and telecommunications equipment to recognize this fact. In fact, the CCRS proposal places much high technology equipment in a depreciation category with a recovery period of seven years--longer than the true economic life of such property. **Such equipment more appropriately should be placed in categories with recovery periods of between two and five years.**

CONCLUSION

In conclusion, Mr. Chairman, AEA supports the President's proposals to reform our nation's tax system. We are particularly pleased with his recommendations to reduce corporate tax rates and to encourage economic growth and productivity through such measures as a capital gains tax differential and a tax credit to stimulate increases in corporate and university research and development efforts.

While AEA does have concerns about various other provisions suggested in the President's proposals, **we must emphasize the importance of acting as quickly as possible to enact a tax reform package this year.** Important economic decisions are being postponed during this period while Congress deliberates tax reform. The business community needs an environment of stability and certainty to conduct its transactions. Thus, the longer we delay making final decisions regarding taxes and the environment affecting business decisions, the more we risk slowing down our economy.

AEA greatly appreciates this opportunity to present its views to you. We look forward to working with you in the coming months to improve our tax system in ways designed to promote economic growth and productivity for our future generations.

VENTURE ECONOMICS

Appendix I

VENTURE CAPITAL INDUSTRY
ESTIMATED
FUNDINGS AND DISBURSEMENTS
(Millions of Dollars)

Year	Net New Private Capital Committed to Venture Capital Firms*		Size of Total Pool	Estimated Disbursements to Portfolio Companies		Public Underwritings of Companies with a Net Worth of $5 Million or Less	
						Number	Amount
1984	$4,200		$16,300	$3,000		(224)	$1,186
1983	4,500		12,100	2,800		(477)	3,671
1982	1,800		7,600	1,800		(113)	619
1981	1,300	$13,400	5,800	1,400	$11,650	(306)	1,760
1980	700		4,500	1,100		(135)	822
1979	300		3,800	1,000		(46)	183
1978	600		3,500	550		(21)	129
		Capital Gains Tax Decrease					
1977	39		2,500-3,000	400		(22)	75
1976	50			300		(29)	145
1975	10			250		(4)	16
1974	57	$466		350	$2,935	(9)	16
1973	56			450		(69)	160
1972	62			425		(409)	696
1971	95			410		(248)	551
1970	97		2,500-3,000	350		(198)	375
		Capital Gains Tax Increase					
1969	171		2,500-3,000	450		(698)	1,367

Total Estimated Capital Committed to the Organized Venture Capital Industry
(Billions of Dollars)

	12/31/82	12/31/83	12/31/84
Independent Private Venture Capital Firms	$4.4	$ 8.2	$11.8
Small Business Investment Companies	1.3	1.4	1.6
Corporate Subsidiaries (Financial and Non-Financial)	1.9	2.5	2.9
Total	$7.6	$12.1	$16.3

This pool remained static from 1969 through 1977 at some $2.5 to $3.0 billion (with new fundings more or less equal to withdrawals).

*Total new private capital less capital withdrawals.

SOURCE: Venture Economics, Inc.

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VENTURE ECONOMICS

Appendix II

April 5, 1985

The Honorable James A. Baker III
Secretary of the Treasury
Department of Treasury
15th and Pennsylvania Avenue NW
Washington, D.C. 20220

Dear Mr. Baker:

There has recently been confusion in the national media as well as in data from the Treasury Department as to the role of non-taxable investors in the funding of the organized venture capital industry. Since Venture Economics, Inc. or our monthly publication, VENTURE CAPITAL JOURNAL, is credited as the information source, it is important that we inform you of the facts.

Tax-exempt (pension, foreign, endowment and foundation) investors are not the principal source of funding for venture capital funds. The confusion was most probably occasioned by analysis of only one of the segments of the venture capital industry, the independent private venture capital firms, but their $11.4 billion represents only 71% of the total industry capital. The other sectors, Small Business Investment Companies ($1.6 billion) and corporate subsidiaries ($3.0 billion) are almost exclusively taxable entities.

Analysis of the complete data shows that the increase in venture capital between 1978 and 1984 was slightly over $13 billion. Tax-exempt investors provided almost $5.4 billion of this total. The current capital committed to the organized venture capital industry is approximately $16 billion of which at least 62% is from taxable sources and only 38% from tax-exempt investors. If one considers informal venture investments from taxable individuals, which some analysts estimate to be greater than the organized activity, tax-exempt investors are even less significant.

Pension fund investors are important to the process since some portion of their more than $1 trillion of investment assets must be attracted to finance new business development. While they will not be directly influenced by tax considerations, they do in fact seek investment opportunities in favorable environments that have been stimulated by tax incentives. Even though many like to credit them with a leadership role, the fiduciary responsibilities of pension, endowment and foundation investors mandate a followers role in new investment trends, after others have served as pioneers.

Potential opportunity, not tax consideration, stimulates institutional investment. Innovators perceiving a favorable environment will create investment opportunities and institutional capital investment will flow towards the proven successes.

It is critical that we understand the real forces that drive new business development -- the perceptions of the entrepreneur. The

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belief that he or she will succeed in building a major new business and significant personal wealth despite the fact that most new businesses fail is a perception that often overcomes stark reality.

The favorable capital gains tax differential not only reinforces this perception, but it is critical in enabling the entrepreneur to attract the key employees who will leave large corporation comforts to work 80-hour weeks to make the vision a reality.

Incentives are relevant because entrepreneurs perceive them to be necessary. How can any of us ignore the sterility of new business development from 1969 through 1977, the period during which there was no differential between capital gains and ordinary income tax rates?

The rationale behind the current Treasury Department tax reform proposal overlooks two important factors. First, increasing the capital gains rate while decreasing the tax rate for dividends and interest income benefits the wealthy at the expense of those seeking to build wealth. In effect, we would hamper the most powerful instrument for social mobility in our economy -- not just for the Steve Jobs' (Apple Computer), but for the many hundreds of middle class employees who joined the effort and shared the success.

The capital gains tax differential can enable young businesses to compete with large corporations for both the capital and, by making Incentive Stock Option plans attractive, the management talent.

Second, our entrepreneurial climate and venture capital infrastructures are key competitive advantages internationally. The Europeans and Japanese recognize this and are attempting to develop a similar environment. Should we take an opposite course and signal entrepreneurial disfavor by eliminating the capital gains tax differential?

There has been discussion recently about providing special treatment for the venture capital industry. I strongly believe that narrowly targeted tax incentives are not feasible in the long term. Entrepreneurs, venture capitalists and investors should be rewarded for success, for achieving growth of jobs and economic benefits, for the creation of new wealth and value, not reimbursed for unsuccessful attempts. The capital gains tax differential rewards risk-taking and patience without undue targeting.

Very truly yours,

Stanley E. Pratt, Chairman
Publisher VENTURE CAPITAL JOURNAL

SEP/

cc: The Honorable Richard G. Darman
Deputy Secretary of the Treasury

The Honorable Ronald H. Pearlman
Assistant Secretary for Tax Policy

Senator WALLOP. Each of you have talked about capital gains treatment. But none of you have mentioned the capital loss treatment. Would either of you care to speculate on the administration's proposal with regard to the losses in risk ventures?

Mr. ACKERMAN. I think that for the professional investing, the loss provisions, you have always been able to offset gains and losses in the same category. So what we are really talking about is how much capital losses could you use to offset ordinary income. As an industry, that's not important to us. It is important, obviously, to smaller individual investors.

Senator WALLOP. So in terms of venture capital firms, it's not relevant, but in terms of somebody who might individually wish to invest, it's quite relevant, is it not?

Mr. ACKERMAN. Yes, it is.

Senator WALLOP. Would you care to expand on your statement about the elimination of the deductibility of State and local taxes. Is there a raise in capital gains?

Mr. ACKERMAN. Yes. I'll give you an example. In the State of New York, the top rate is about 14 percent. So that is deductible now, and so the effective rate is about 7 percent because of the present 50 percent tax rate. In the future with the capital gains rate at 17½ percent, it is purely additive 14 percent. So it would be roughly a 31-percent tax rate as opposed to 20 percent plus 7, which would be 27 percent.

So for a New York resident at the margin, the combination of 17½ percent rate and the New York law as it stands is about a 17-percent increase in the capital gains tax rate between the State, local, and Federal.

Senator WALLOP. I suggest you move to Wyoming or Texas. [Laughter.]

That's a spotty effect, then?

Mr. ACKERMAN. Yes, it is. And New York is the extreme. But other States also—have that effect. But the change from 20 percent to 17½ percent takes the edge off of that problem pretty much. There are just a few high tax States that remain a serious problem.

Senator WALLOP. It's conceivable that that's a problem that they would be confronted with.

Mr. ACKERMAN. Yes.

Senator WALLOP. Not a bad thought of and by itself, is it? You don't have to answer that. The Governor is certainly listening. [Laughter.]

I'm really quite impressed with the growth figures, both in employment in your industry and in the investment commitment chart there. That really ought tell even a Treasury Department something about the value to the country and even overall to them. The biggest problem that we have here on the Finance Committee and in Congress is that Treasury cannot permit itself to deal with the dynamics; only in static figures. Their assumption is, as it was in 1978, that if you drop the maximum rate of tax on your capital gains down from *x* percent to another percentage, Treasury loses that segmental figure. And its projection goes into budget deficits and every other kind of way. And it makes it extremely difficult for us to confront static logic with dynamics which are, in essence, substantiated only by experience, which they are reluctant and

hesitant to get into. I think charts like this do great service to us in our effort to try to make something realistic out of this.

Mr. MOORE. Senator, when we first saw Treasury 1, we descended on this like commandos.

Senator WALLOP. Well, it's a stupid proposal.

Mr. MOORE. In excess of 100 company presidents, all of whom had some variation of this chart. And when we first sat down at Treasury—and, of course, there is a new cast of players there now—but when we first sat down at Treasury, factoring in whatever kind of marginal errors they wanted to factor in and our numbers, you cannot deny the slope of the curve in both the capital investment and the job creation in our industry. So I think that has been a very compelling visual presentation throughout all this.

Senator WALLOP. We thank you for it.

Steve.

Senator SYMMS. Well, I thank you very much, Mr. Chairman, and thank both of the witnesses here. I have been very concerned about the subject that Senator Wallop brought up, and this is our failure to be able to compute what people's behavior will be next year under a new Tax Code and the Treasury people computing it based on what happened last year under the old Tax Code. As a result of that, the President, I think, in his good intentions to not have a tax increase has been worshipping at the shrine of revenue neutrality, which means the bill will raise the same amount of money, but some people are going to pay more taxes and some people are going to pay less taxes to come out on that.

And I would just ask both of you, coming from a high tech industry—there are an awful lot of people in my State who earn a living in mining and forest products and agriculture and basic raw material resource production who are going to find out under the current arrangement of the bill that they are going to have to pay more taxes, which means less jobs or less capital or less value in those ventures, as you are all aware of. So what do you recommend to us as members of the committee? How do we handle the situation that some of us want to stretch out and not do away with certain deductions now enjoyed by some of those resources, like mineral depletion allowances. I can be very candid about it. If you do away with mineral depletion allowances, most of the hardrock mines in Idaho under the current pricing of metals, would stop operations because that's what provides them with the ability of cash flow.

How do you answer that? What would you do?

Mr. ACKERMAN. Senator, we are not experts on those industries, but the kinds of companies that we back typically sell to other companies. And usually they are productivity improving products and so on. So we are very much interested in the health of the overall economy; not just the class of companies that we are dealing with.

So we don't want to see tax policies that diminish the economic growth of this country.

Senator SYMMS. Well, let's just say, for example, that Senator Wallop and I have a lot of people in our States that earn a living mining, and it appears to me anyway, at this point, that some of those people are going to lose their jobs if the mineral depletion al-

lowance is really taken away. And the chairman of the committee and the President and the Treasury, they all say, well, you have to have revenue neutrality. Where's a place to pay for it? And what would you recommend? If we have to come up with some money, where do we get the money? A revenue-neutral bill based on static numbers means that if one person pays less taxes, based on those static, inaccurate numbers, that they are assuming that somebody else or company is going to pay more. How do you advise us to handle that?

Mr. MOORE. Let me jump in for a second. First of all, good Jesuits at Georgetown used to always talk about granting assumptions about things when you started a debate. And the one assumption that as an individual that I questioned a number of people on back in November or December of last year is why the absolute requirement for revenue neutrality. And why the absolute requirement for not considering the Tax Code as an instrument of national competitive policy.

Now that was an argument that we weren't equipped to pursue at any great length, but man to man, Senator, I still don't understand why those assumptions are rooted as deeply in concrete as they are.

Senator SYMMS. I agree with you. I mean that's exactly the argument I've been making. If it's a good thing to have a lower capital gains rate, which you have been able to show and demonstrate—that it has been more business, more growth, more jobs, more revenue, more everything—why should we be so concerned about doing something that really would be to the disadvantage of an already-operating industry? Why not do more of the things that are good and leave those other things alone?

Mr. ACKERMAN. I think the problem is the issue of static analysis versus dynamic analysis, and that the Treasury looks oftentimes to the small end of things rather than the larger thing. And I will give you an example from our industry.

We have researched the data of venture-backed companies over the last 15 years, and the conclusion we reach is that for the equity capital left in the companies—that is, invested capital and retained earnings—the return to the Government in the form of corporate taxes, payroll taxes, and Social Security averages over 30 percent. Now if you and I could do 30 percent on our personal portfolios, we would be delighted. And I would submit that the Government ought to be delighted that they leave dollars in corporations for the benefit of creating future corporate tax dollars, payroll dollars, and Social Security dollars. But, unfortunately, Treasury analysis does not look at that side. Does not look at it as the return on investment analysis.

Senator SYMMS. Thank you both very much.

Senator WALLOP. Let me just make an observation here that I think you can help us with charts like that, and with some assistance getting this into the hands of the press for comments on various provisions of the Tax Code. One of the static assumptions that is most damaging has nothing to do with revenue. The static assumption is that a privileged capital gains treatment is an opportunity only for the wealthy. You have the—the dynamics of that is the employment which is a great purpose, especially if you are out

of work. And somehow or another what American industry has not been able to get across is that they are tied. That one treatment is not just for the rich with no effect on the rest of Americans. And I don't know how we go about that. But, clearly, you have demonstrated it. And yet it doesn't get into press commentary.

Mr. ACKERMAN. I would like to make a couple of comments, Senator. Treasury 1 basically cut the taxes on ordinary—on secure investment income by 30 percent. If you invest in government bonds or utility bonds, you have improved your after-tax yield by the 30-percent cut in taxes. On the other hand, Treasury 1 proposed a 75-percent increase in taxes on risk investment. So what that proposal does is bias investment toward conservative, secure income-oriented investments, and away from job creating, growth-oriented investments.

Second, it favors established wealth over the creation of new wealth. The opportunity is no longer there to create wealth by virtue of creating new companies to the same degree it was and the flow of funds into that is a lot less, because if you bias the after-tax investment returns to the secure, that's where the money will go. And, finally, it favors established companies over new companies. And on that point, I would like to emphasize that in a report to the President on status of small companies, it pointed out that approximately 50 percent of the job growth in this country is created by companies with less than 100 employees. And another 30 percent by companies with 100-1,000 employees, and only 20 percent by companies with over a thousand employees, and that's heavily biased at the smaller end of the over 1,000.

The Fortune 1,000 list are just 1,000 companies in this country; have in the last decade had no net job increase. And that's not a criticism of them because in many cases they are slow-growth industries and improving productivity is the best thing they can do.

But the dynamic aspect of our economy is on the small company side and the life blood of a small company is getting outside capital, because by definition they are growing faster than they can grow with internally generated funds. And the capital formation, the capital availability is the crucial issue to those companies.

Senator WALLOP. Let me suggest to you that as you hold your meetings, Mr. Moore, with your association and the other things that you do, that you never talk of just how the tax treatment effects that segment. That you always couple it with the kinds of witness that you have given us today.

Mr. MOORE. Senator, let me also offer our assistance because we see this as a tough job for you and for this committee and for all of Congress. We are doing a lot of work in this area, as I tried to mention at the opening. We are trying to do as much as we can to dramatize the issue as much as you see on these charts here.

And the offer that I would make, for example—I sat this morning listening to Mr. Smart being questioned. I'm told often that you cannot run the government like you run a business, and yet if you look at the slopes of the lines that you see here, which are positive, or you take the slope of the trade deficit line, which is negative and accelerating, any businessman would argue for a bold change in those areas. And we have a lot of that kind of dramatic, relatively uncontrovertible, given whatever factoring area you want to put in

there, that says, look, we are in trouble, we are hemorrhaging in a certain area or we are doing very well, therefore, let's double our bet. Now it's somewhat simpleminded when you begin to do regression analysis and form linear programs and so forth. That most human beings can understand the direction of those lines and appreciate what we are talking about. We would be glad to make that available to you at any time.you see fit.

Senator WALLOP. Well, I really appreciate what you have brought to us this morning. And we seek and need your help both in the public arena where you talk with the press and whatever—you know, the rotary clubs or whatever. I mean surely that your industry explain it around and about, and that it's important that that tie always be made. That there is more than tax treatment involved. You know, there are future jobs, economic prosperity and the kinds of things that you have demonstrated.

Thank you very much. We appreciate your testimony this morning.

The committee stands adjourned.

[Whereupon, at 11:30 a.m., the hearing was concluded.]

[By direction of the chairman the following communications were made a part of the hearing record:]

51-235 O - 86 - 8

THE SECRETARY OF COMMERCE
Washington, D.C. 20230

JUL 12 1985

Honorable Lloyd Bentsen
United States Senate
Washington, D.C. 20510

Dear Lloyd,

During my testimony on June 26, I promised to check the status of the input-output tables prepared by the Bureau of Economic Analysis (BEA) and the publication of "International Economic Indicators" prepared by the International Trade Administration. Both of these programs will continue, but the international economic indicators publication was halted temporarily for the staff to review our data needs and adopt lower cost computer technology.

The comprehensive benchmark input-output (I-O) tables are prepared every five years, primarily from the quinquennial economic census conducted by the Bureau of Census. The most recent census became available to BEA in mid-1981 and the compilation and publication of the 1977 I-O table was completed in May 1984. BEA also publishes summary annual I-O tables to update the benchmark tables. The first update for the 1977 I-O table will cover 1980 and is scheduled for publication later this summer. As the BEA I-O staff reduce the backlog caused by preparation of the 1977 benchmark table the lag between the reference year and the annual update publication will decline to four years. In Japan, the I-O program also consists of benchmark tables and annual updates, and is based primarily on quinquennial economic census data. The latest benchmark I-O table for Japan is for 1980 and was published in March 1984. Japan's latest annual summary table covers 1982.

There are several major reasons for the differences in the U.S. and Japanese publication schedules. In Japan the major source data became available much sooner. When the data became available, they were tabulated by the collecting agency in accordance with classifications and definitions needed for the I-O table, however, in the United States, this work must be done at BEA and adds about one year to the compilation process. The BEA has approximately 20 people working on the detailed tables and five on the annual updates. Japan has more than 100 persons who work on the detailed tables.

The BEA is trying to speed up the publication schedule for the benchmark and summary update I-O tables and major changes have been made to computer systems used to prepare the tables.

In March 1985, the publication of the "International Economic Indicators" was suspended to help convert the data base from paper files to computer files. The revised publication, however, will be prepared for the internal use of the U.S. Government; we do not plan to resume a subscription publication. This publication had about 900 paid subscribers, mostly libraries. Similar information is available from several private sector firms, both in on-line computer systems and printed publications.

Sincerely,

Secretary of Commerce

ABBOTT

Abbott Laboratories
North Chicago, Illinois 60064

June 24, 1985

Chairman Bob Packwood
Senate Finance Committee
219 Dirksen Senate Office Building
Washington, D.C. 20510

Dear Chairman Packwood:

I understand the Finance Committee Committee has scheduled a hearing in late June on the research and development aspects of tax reform. Among the topics to be covered will be the R&D tax credit which is scheduled to expire at the end of 1985.

Abbott Laboratories strongly supports the retention of this credit. Two pieces of legislation, S. 58 and H.R. 1188, were introduced in Congress earlier this year which would make permanent the R&D tax credit. As of June 17th, the House bill had 185 co-sponsors and the Senate bill had 30. In addition, the Administration has included in its tax reform proposal a three year extension of the credit.

Abbott's expenditures for research and development reached $219 million in 1984, an increase of more than 18 percent over the previous year. Our investment in new products and technology has grown at a compound rate of 21 percent over the past five years. Only through ever-increasing expenditures in R&D can Abbott and hundreds of other American firms, large and small, develop the sophisticated products needed to compete in today's marketplace.

When your Committee examines R&D it should do so with the understanding that technology is the one area where American firms have a competitive advantage. If the United States hopes to continue to be the world leader in technological innovation, we must maintain and increase the level of R&D that is performed in the United States. The R&D tax credit is instrumental in encouraging American companies to make these R&D expenditures.

Thank you for your consideration.

Sincerely,

John Lussen
Vice President, Taxes

ADVANCED
MICRO
DEVICES
INC.

901 Thompson Place
P.O. Box 3453
Sunnyvale
California 94088
(408) 732-2400

June 18, 1985

The Honorable Robert Packwood
Chairman, Senate Finance Committee
257 Russell Office Building
Washington, D.C. 20510

Dear Senator Packwood:

Advanced Micro Devices is one of the leading semiconductor companies in the world. Our investment in R&D as a percent of sales is surpassed by no other company in the industry. The U.S. semiconductor industry is one of the country's leading investors in R&D.

We support the permanent extension of the R&D tax credit because it will help us maintain our worldwide competitiveness. We are pleased that so many members of Congress and the Administration are also supporting the credit.

But we are deeply disturbed at the efforts of some members of Congress (indeed even some cosponsors of the R&D tax credit bills) who are advocating treating R&D expensing as a corporate tax preference.

As you may already know, the semiconductor industry recently has dropped into a severe recession. Profits for many comanies in 1985 will be small or not at all. Some companies will even have losses in 1985. Yet these companies are the country's leading investors in R&D. The treatment of R&D expense as a corporate preference item would result in tax payments for them when they have little or no taxable income. In effect, the Congress would be imposing a penalty tax on those who engage in R&D - a result which is just the opposite of what the President, the Administration and many members of Congress want.

If the semiconductor industry is to maintain its worldwide competitive position, it should not be subjected to penalty taxes on R&D which diminish the cash flow needed to do R&D investment.

Please do everything in your power to make sure R&D expensing is not a preference item for corporate minimum tax purposes.

Sincerely,

Clifford E. Jernigan

Clifford E. Jernigan
Director, Government Affairs

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June 18, 1985

The Honorable Robert Packwood
Chairman, Senate Finance Committee
257 Russell Office Building
Washington, D.C. 20510

Dear Senator Packwood:

I am writing to you about the importance of the R&D tax credit to our company and our industry.

At a time when the United States is trying to maintain its worldwide technological leadership, it would be very unfortunate if the Congress permits the R&D tax credit to expire at the end of 1985.

As indicated by our own internal studies and by numerous published studies (for example, the CRS and the Lawrence, Bailey and Data Resources' studies), the R&D tax credit during the short period it has been in existance has effectively helped stimulate R&D spending. And, due to new product introductions resulting from this R&D spending, the U.S. Treasury is beginning to collect corporate income taxes at a rate of 2-3 times the amount of credits claimed by industry 2-3 years ago.

The R&D tax credit is critical if the United States is to be a first rate high technology country. Please help extend it by voting for passage of S 58.

Sincerely,

Clifford E. Jernigan

Clifford E. Jernigan
Director, Government Affairs

CEJ:cp

American
Psychological
Association

TESTIMONY OF

Michael S. Pallak, Ph.D.

Executive Officer

The American Psychological Association

on behalf of

THE AMERICAN PSYCHOLOGICAL ASSOCIATION

before the

UNITED STATES SENATE

COMMITTEE ON FINANCE

on the subject of

THE RESEARCH AND DEVELOPMENT TAX CREDIT

July 10, 1985

Honorable Bob Packwood, Chair

SD-215 Dirksen Senate Office Building

Mr. Chairman, Members of the Committee:

I am Dr. Michael S. Pallak, Executive Officer of the American Psychological Association (APA), and I am pleased to be here today representing the over 76,000 members of APA. We are grateful for the opportunity to testify on the tax credit for industrial research and development.

APA supports the basic thrust of this tax credit. However, we believe the tax credit overlooks important areas of research that have the potential to significantly increase the productive capabilities of our society: Specifically, we ask that behavioral and social science research be included as "qualified research" for which corporations may take a tax credit.

Concern over productivity in the United States has grown over the past decade as the rate of economic growth has slowed considerably. American industry and government are being confronted with important strategic decisions on how best to revitalize the economy and promote technological growth. In many organizations, and in most public discussion of these issues, the investment that businesses have in human capital is overlooked. There is inadequate recognition of the fact that behavioral and social science technologies hold enormous promise for improving employee job satisfaction and motivation, as well as employee efficiency. These improvements will in turn reduce employee absenteeism and increase overall employee productivity. The U.S. has been slower than many other industrialized nations to recognize the importance of this approach and put it to productive use.

A well-known example of a country that has successfully used the results of behavioral and social science research to dramatically increase economics is Japan. From the start of the rebirth of Japanese industry following World War II, the Japanese have been highly receptive to utilizing the results of behavioral and social science research on industrial organizations. As a result, Japan has been able to achieve its enviable improvements in rates of productivity and product quality. Ironically, most of the concepts adopted by the Japanese to achieve these impressive results, including quality control circles we hear so much about, were developed by behavioral and social scientists in the United States.

When the Economic Recovery Tax Act of 1981 provided tax credits to corporations for most kinds of new research, the intention was to stimulate private sector research and development, with the hope that this in turn, would increase technological innovation and productivity. However, ERTA explicitly excluded social science research from qualifying for such tax credits. The behavioral and social sciences have made tremendous contributions to productivity and economic growth in this country. Executives from numerous U.S. firms have stated publicly the value of the behavioral and social sciences to their firms in enhancing such important factors as productivity, employee satisfaction, and the match between person and job. To exclude social and behavioral research from the favorable tax treatment offered to corporations through this tax credit is to create disincentives for firms to invest in this valuable research. Industry and society as a whole lose potential benefits.

Creating and implementing new technologies depends as much on humans as on industrial hardware. People are indispensable components of the economic system, and the appropriate use of human skills and efforts for maximum productivity requires considerable research into such areas as: what factors determine how well a person will perform a job; how people function best in various organizational settings; and how the introduction of new technology into a work setting will affect these and other factors.

Let me demonstrate the direct link between behavioral and social science research, productivity and innovation by citing a few contributions of American behavioral and social science research in this area.

Human Factors Engineering

Human factors engineering is concerned with the design of workplaces, working environments and equipment, to improve the safety, efficiency, or effectiveness of people in systems. A worker's ability to perform can be very much improved by the design of work settings in keeping with humans abilities and limits. Examples range from the arrangement of control rooms in nuclear power plants to the design of airplane cockpits.

In the field of aviation, a great deal of work has been invested in the design and placement of gauges and controls in the aircraft cockpit for maximum readability and efficiency of control. These are critical elements when many human lives and millions of dollars in equipment depend upon rapid and accurate human judgment and performance in an extremely complex work

setting. One dramatic example involves the Boeing 727 airplane that we have all flown in. In the six months following the introduction of the 727, a series of four tragic airplane crashes occurred, all involving night landings. A psychologist at Boeing researched the problem and discovered a visual illusion that was the major cause of the fatal accidents. The result was the elimination of a problem which had been measured not only in dollars, but in human lives.

The nuclear power industry has paid dearly for not considering human factors engineering at early stages. The accident at Three Mile Island demonstrates that behavioral and social science elements can be as important as physical and technological factors. The Kemeny Commission, which investigated the accidents, concluded that it was primarily "people-related problems and not equipment problems" that brought the nation so close to a major tragedy. The Nuclear Regulatory Commission has since shown considerably more interest in such approaches, and has enlisted the assistance of human factors specialists to aid in the upgrading of these elements of nuclear plant design and operation.

Robotic Technology

The study of how the increased use of robotics, or automation, will affect the individual worker in terms of productivity, morale, work conditions, and motivation is a new and important field of study. Most of the research in robotics to date has been on its technological aspects. However, the human implications of robotics must be more fully understood if industries are to

benefit in the longer term. We need to assess the impact of the technology on individuals, the economy, and on the American society as a whole. Some of the robotics-related areas being studied by psychologists include: how a change in work environment and retraining affect productivity and morale; how a worker's role in an organization changes as he or she interacts with robotic equipment; and the design of equipment and workplaces so that they do not adversely affect the worker.

Artificial Intelligence

In studying artifical intelligence, a field related to robotics, psychologists are examining the nature of intelligence and how it arises out of primitive cognitive functions. Behavioral scientists work with computer specialists to develop increasingly complex computer systems to support powerful problem-solving and learning mechanisms. This work translates directly into more powerful applied systems. Research in artificial intelligence can help industries to understand not only how computers carry out human-like activities, but also the ways in which they may be able to exceed human performance. Another related line of research investigates the design of information systems so that they can be more fully understood and more effectively used by humans.

Again, APA supports the basic thrust of this tax credit for research and development, but we believe the exclusion of behavioral and social science research severely limits the potential of the tax credit to increase industrial innovation and productivity. We strongly urge you to expand the categories of research expenditures to include these critical areas of study.

If the Committee desires additional information on this subject, please contact APA's Office of National Policy Studies at (202) 955-7742. Thank you for this opportunity to present our concerns to the Committee.

The Research and Development Tax Credit

Testimony by

The American Society for Engineering Education
Suite 200
Eleven Dupont Circle
Washington, D.C., 20036

W. Edward Lear
Executive Director

Committee on Finance
U.S. Senate

51-235 O - 86 - 9

Mr. Chairman and members of the committee:

On behalf of the American Society for Engineering Education I am pleased to submit for the record notice of our strong support for a permanent extension of the research and development tax credit scheduled to expire at the close of this year. The carefully-crafted adjustments and enhancements detailed in the legislation introduced earlier this year in the Congress (S.58/H.R.1188) are vital, we believe, to a sound strategy for tackling the economic and technological challenges of the future.

ASEE draws its membership from a spectrum of individuals and groups which share a deep concern for the health of the country's engineering education enterprise. Members include the professional engineering societies, over 125 engineering-oriented industries, several government agencies, the more than 250 accredited engineering schools of the nation and over 10,000 individuals, most of whom are faculty and students. They are bound together by a common interest in assuring that this country's future engineers receive the finest education available.

The quality of that education is currently under attack. A continuing shortage of qualified engineering faculty poses a serious threat to the ability of schools to maintain both the quantity and quality of needed engineering graduates. Latest figures estimate a faculty vacancy rate of 8.5% -- actually 23% when you consider the quantity needed to restore the student-faculty ratio of the 1960's. The disincentives for young, bright students to pursue academic careers in engineering are many. They include sparse graduate support, obsolete university facilities and equipment in laboratories, the lure of higher pay and more advanced equipment in industry, and overcrowded classrooms and laboratories. Unless these conditions are reversed, engineering schools stand to lose

out on bidding for the finest engineering minds to teach and to conduct the fundamental engineering research that sustains the schools and U.S. technology.

Some useful facts:

** While student enrollments in the past decade in engineering have doubled, the number of engineering faculty has increased by only 10 percent.

** The disparity between student and faculty growth has resulted in a 32% decrease in the student-faculty ratio over the last decade.

** The number of engineering doctoral degrees awarded to U.S. citizens by U.S. universities declined 42% between 1968 and 1982, while the number of such degrees awarded to foreign nationals by U.S. universities nearly tripled.

** Nearly half of the Ph.D.'s awarded in engineering go to foreign nationals.

** Demographics project a 17% decrease in 22 year-olds by 1990. This decrease will further limit the pool of engineering students who will continue on to the Ph.D. and ultimately choose academic careers.

** Studies of the equipment shortage in engineering schools carry estimates up to $2 billion to provide university lab experiences paralleling the industrial environment. This does not include computers.

** An Association of American Universities report to the National Science Foundation in 1980 concluded that equipment used in top-ranked universities has a median age twice that of instrumentation available in leading industrial research laboratories.

** A recent study by the National Science Foundation found that 43 major research universities classified 25% of their equipment as obsolete and only 16% of it as state-of-the-art.

Right now, we're pretty fortunate. We currently have such bright and motivated young people in our engineering programs that they are able to rise above these leaks in the pipeline. On the surface we appear to be doing a better job than ever. The plain truth, however, is that we're losing far too many of those best and brightest to industry without so much as a second glance on their parts at an academic career. If we must continually accept less than the best as teachers and researchers in our engineering schools, the repercussions

will ripple throughout the system -- with long-term impact on the industry and government which employ our products and on the future of U.S. technology. Yes, we can get by, if we have to, but I believe that we do ourselves and future generations a serious disservice by making do. "Getting by" is simply not a formula for success and is, in fact, antithetical to the American spirit which has made us the world leader that we are.

Clearly, the global economic contest in which we find ourselves is here to stay. We can no longer depend on our vast natural resources to overwhelm the competition. Our enviable cultural traditions of academic and economic freedom prohibit us from copying wholesale some of the sharply-focused methods employed by our most formidable competitors. It is all the more important, therefore, that we remove barriers which prevent close and freely-formed links among academe, industry and government. We must foster an environment in which it is desirable and easy for the partners in this enterprise to make every possible contribution to U.S. success.

One method which reflects perhaps the best elements of Yankee ingenuity is the R&D tax credit under discussion here today. Before I comment directly, however, on the exciting potential the proposed extension of the credit represents, allow me to paint in broad brushstrokes a clearer and bolder picture of the shared benefits to be had from closer relationships between our schools, our industries and our government.

The country's engineering schools have in recent years been turning out record numbers of B.S. graduates, the vast majority of whom go directly into engineering practice. In the four undergraduate years given to them, faculty must instill in students a thorough understanding of fundamental engineering principles, an ability to tackle complex problems, communication skills, and a sense of professional responsibility, among other things. This task is becoming increasingly difficult. The average B.S. degree in engineering actually requires 4.3 years to complete, the summer months often absorbing the

overflow. As engineering knowledge expands and becomes more interdisciplinary the problem of adequately preparing a young B.S. to practice engineering will only worsen. An increasingly important element in the education process will be the vivid hands-on exposure to systems and processes available only in well-equipped laboratories -- either in schools, on industrial sites or both. The opportunity for students to work on industry-relevant research can reinforce classroom knowledge while providing real-life experience.

Faculty as well as students benefit from industry participation in the classroom and laboratory. Continuing professional development is vital for teachers who must keep pace with progress in their fields. Contact with industry helps faculty to assess constantly the relevance of curricula to real-life engineering practice. The availability of industry resources and expertise can support creative classroom teaching. Perhaps of particular importance in light of our critical faculty shortage, professors can also derive personal and professional satisfaction from exposure to the dynamic industrial environment -- while providing vital service to our schools.

As the employer -- directly or indirectly -- of 30% of the country's engineers, the federal government itself clearly holds a direct stake in the vitality of our scientific and engineering enterprises. Strong national security, an improved standard of living, and unchallenged global technological leadership are clear benefits to be had from a strong educational environment for our engineers. Increased workplace productivity and a strengthened trade balance will go further to achieve our national goals of economic and military security than any gain to Treasury through taxation of cooperative efforts between industry and academe.

The R&D tax credit under review by your committee is an example of a responsible partnership approach to our problems. We applaud those provisions of the proposed revision of the credit which encourage industry to undertake a tangible role in helping our schools -- through research and through gifts of equipment. And we applaud the federal government for recognizing that the price tag of

such encouragement is actually a vital investment in this country's human resources and research infrastructure. Without well-trained people with imaginative ideas and the tools to realize those ideas we will lose the technological race before we even get out of the starting gate.

We are particularly pleased by the proposal in S.58/H.R.1188 for a new 20% credit designed specifically to enhance research relationships between industry and academe. Within it are the seeds of new Silicon Valleys and Route 128's. The economic and educational potential is unlimited. As you know, technology transfer -- the key to translating basic research into marketplace successes -- depends on the easy flow of ideas among people who can turn dreams into reality. I am confident that we will see the first footprints of what will become well-trod paths between schools and industries if this credit is made permanent. The careful, more narrow, definition of the work which qualifies under the credit will guarantee that innovative ideas receive red-carpet treatment.

The "High Technology Research and Scientific Education Act of 1985" also includes among its proposals several important changes regarding gifts of equipment to schools. We recognize that no one program, policy, or agency can hope to address fully our $2 billion equipment need. The partnership approach is vital. The equipment provision is just one of many important avenues we must pursue to find creative solutions to our problems. By expanding the current categories of eligible equipment donations to include basic instructional purposes, the proposed revisions allow schools needed flexibility in making the most of available resources. I hope that serious consideration will be given to the problem of maintaining these often delicate and sophisticated pieces of equipment needed by our schools. Approximately 10% of an item's purchase price is the expected annual expenditure to keep that equipment in usable condition. This can represent an unmanageable burden to a school and results in the perverse circumstance of machinery gathering dust or donations of equipment being regretfully refused.

I hope that my comments on behalf of the engineering educators of the country will prove helpful in your review of the tax policy of this nation. We are all grateful for your willingness to undertake such a vast and difficult task. As you weigh the impact of our country's tax system on our economic and social well-being, I hope that you will give serious consideration to the potential represented by such policies as the R&D tax credit for assuring that this nation remains the strong technological leader that it is today for generations to come.

Thank you.

W. Edward Lear
Executive Director
American Society for
Engineering Education

$6.00

SUMMER 1985

ISSUES
IN SCIENCE AND TECHNOLOGY

THE R&D TAX CREDIT: A Flawed Tool

Robert Eisner

PROLOGUE: *Finding irrefutable evidence that the R&D tax credit is an effective device to stimulate corporate spending on R&D has proved difficult. Total corporate R&D expenditures have increased since the credit was enacted, but they were rising at an even faster rate before the credit became available. Other incentives to raise R&D spending are also at work, and it is not easy to gather valid data on what motivates corporate managers.*

Critics say that the credit works unevenly, benefiting only those companies that pay corporate taxes and offering little incentive to start-up firms or older smokestack industries, even though the credit can be carried forward for up to 15 years to reduce the tax bite on future profits.

Here, economist Robert Eisner examines the evidence and finds the R&D tax credit seriously flawed. On purely analytical grounds, he argues, the current credit will have limited positive effects and may in some instances even have perverse effects. But even if the defects in the current law were corrected, Eisner says, it is questionable whether government efforts to promote R&D spending by private firms are appropriate in a competitive, free-market system.

Robert Eisner received his B.S.S. degree from City College of New York in 1940, his M.A. from Columbia University in 1942, and his Ph.D. from Johns Hopkins in 1951. A fellow of the American Academy of Arts and Sciences and of the Econometric Society, he is the William R. Kenan Professor of Economics at Northwestern University. He is the author of Factors in Business Investment *(1978) and has written extensively on issues of monetary and fiscal policy, unemployment, and economic growth.*

The road to hell, it is said, is paved with good intentions. I am not about to argue that the R&D tax credit, euphemistically labeled "R&E" for "research and experimentation," will in itself lead the nation to doom. But it has proved to be a misguided step in an uncertain direction.

The argument for government support of R&D in a free enterprise economy is simple. To the extent that benefits of research flow outside of firms undertaking it, each individual company is likely to underinvest, undertaking only those expenditures for which its own likely benefits exceed its costs. But accepting the principle—as I do—that government policy should encourage more research does not answer the question of how that should be done. The current tax credit for research and development, scheduled to expire at the end of 1985, has proved something of a monstrosity, costing the U.S. Treasury some $1.5 billion per year with no clear payoff. It has been an expensive experiment.

The current tax credit for research and development has proved something of a monstrosity.

II

Under the current law businesses are offered a tax incentive to increase R&D. Specifically, they are allowed a credit against tax liabilities equal to 25 percent of the excess of qualified R&D expenditures over their "base," now defined as the greater of (1) the average of their expenditures over the three previous years, or (2) half of current expenditures. If the firm cannot currently use the tax credit because it has insufficient tax liabilities, or none at all, it can carry unused credits back 3 years and forward 15 years.

On purely analytical grounds the potential of the current credit can be shown to be substantially limited. First, it clearly offers no tax benefit and no incentive to firms whose R&D is below the base established by previous R&D expenditures. In fact, such firms will rationally *reduce* their current R&D spending in the expectation that by lowering their future base they will enjoy a tax benefit later.

Second, those firms that were already planning to increase R&D spending by more than 100 percent of their base will actually enjoy a credit on any additional R&D spending of only 12.5 percent rather than the nominal 25 percent. For such firms the base will be 50 percent of current expenditures, and each additional dollar of R&D spending, because it increases the base by 50 cents, will increase the excess over base by only 50 cents. The credit of 25 percent, applied to this 50 cent excess, will thus amount to only 12.5 cents.

For these firms too, then, the presumed tax incentive for R&D is actually perverse. They would be better off reducing their spending to a level that constitutes no more than a 100 percent increase over the average of their previous spending. They would be losing only 12.5 cents per dollar of reduced R&D spending in terms of current taxes, but could expect to gain 25 cents in future tax benefits by lowering their base.

Third, many firms, especially in the rapidly growing high-tech field, have no tax liabilities against which to apply the credit. Unless they have had such liabilities over the past three years, which is particularly unlikely for new firms, they gain nothing from the carryback provision. And since, as we shall

see, the benefit of the tax credit is in the present value of postponing taxes, they are likely to perceive little gain from the carryforward provision, and no gain at all if tax liabilities are not anticipated over the next three years.

A fourth and overwhelming problem with the current credit is the calculation of a base that adjusts with the firm's own previous expenditures. This vastly reduces the incentive effects of the credit, and this defect would become critical if the credit were made permanent. Firms would then reckon that any increase in current R&D expenditures would raise the base to be subtracted in calculating the credit for future expenditures. Firms with generally increasing R&D expenditures (whether real increases or increases due to inflation) would not obtain the benefit of a reduction in taxes but only the benefit of postponing them over a three-year period.

For example, a $12 increase in R&D spending would reduce taxes by $3 in the current year, but it would raise the base by $4 and raise taxes by $1 in each of the succeeding three years. Except for the fact that time is money, and it is better to pay taxes later than to pay them now, the firm would have no benefit at all.

Since time *is* money, we should indeed calculate the difference between the $3 current tax saving and the present value of the increased tax of $1 in each of the next three years. At a 10 percent rate of discount (reasonable with current interest rates), that present value becomes $2.49, thereby wiping out all but 51 cents of the original $3 gain. Thus, the nominal tax credit of 25 percent translates into a gain of 51 cents on $12 in R&D expenditures, or an effective tax credit of only 4.3 percent.

Paradoxically, firms would have a much greater incentive to increase R&D if they did not expect the credit to last. If Congress were to make it clear that the current credit would not be extended beyond 1985, the effective credit would be the full 25 percent, because increasing current expenditures would bring no offset of a reduced credit and higher taxes in the future.

An analysis of special tabulations of 1981 tax returns prepared for me by the Office of Tax Analysis of the Treasury, as well as other data, indicate that there is real substance to these analytical perversities.

First, as against a "tentative credit" of $872 million (for the half year of 1981 that the credit was in effect), the credit actually claimed was only $630 million, indicating a shortfall of 28 percent due to lack of current tax liabilities. Of $13.4 billion of reported qualified R&D expenditures, as shown in Table 1, only $9.2 billion, or 68.6 percent, were incurred by firms with sufficient tax liabilities to claim all of their potential 1981 credit.

Second, the proportion of qualified R&D by firms that reported R&D up by more than 100 percent, so that their nominal marginal credit was cut in half, came to 9.2 percent. Of the $9.2 billion of R&D on which a credit was claimed, $0.7 billion was spent by firms with R&D spending increases of more than 100 percent. Thus, only 63.2 percent of total qualified R&D expenditures ($8.5 billion out of $13.4 billion) were incurred by firms with tax liabilities against which they could claim the full credit. And this does not take into account some 6 percent of expenditures by firms who would not have sought the credit because their 1981 expenditures were below their base.

Another count against the current R&D tax credit is that it is procyclical.

R&D expenditures, like all other expenditures, tend to slacken during recessions. Since the credit is tied to the rate of growth of R&D expenditures, it is particularly sensitive to such slackening. A decline in rate of growth from, say, 12 percent to 6 percent would cut the credit in half. Further, since more firms suffer losses in a recession, tax liabilities against which the credit can be claimed are reduced. Our examination of Standard and Poor's Compustat data revealed that in the recession year of 1982 the proportion of R&D expenditures undertaken by firms with tax liabilities and expenditures above base was down to 52.7 percent. On both counts, therefore, the R&D tax credit tends to be lower in a recession, when tax reductions would appear particularly desirable to stimulate the economy, and higher in booms, when a tighter tax policy might appear useful to prevent inflationary excesses. Indeed, since

TABLE 1
R&D EXPENDITURES, 1977-80 (PRE-CREDIT) AND 1981-84 (CREDIT)

YEAR	COMPANY FUNDS FOR R&D		RATES OF GROWTH	
	Current Dollars	1972 Dollars	Current Dollars	1972 Dollars
	(Millions)		(Percent)	
1977	$19 340	$13,809	10 9%	4 6%
1978	22,115	14,702	14 3	6 5
1979	25 708	15,731	16 2	7 0
1980	30,476	17,081	18 5	8 6
1977 to 1980 Per Annum Growth			16 4%	7 3%
1981	$35 428	$18 [illegible]2	16 2%	6 0%
1982	39 512	19 053	11 5	5 2
1983	42 600	19 783	7 8	3 8
1984, Projected	47 712	21 359	12 0	8 1
1980 to 1983 Per Annum Growth			11 8%	5 0%
1980 to 1984, Projected Per Annum Growth			11 9%	5 7%

Source: National Science Foundation, Research and Development Industry, 1983, *forthcoming. Rates of growth and conversion of current dollars to 1972 dollars (using GNP implicit price deflators) provided by the author. Projection for 1984 from the 12 percent increase over 1983 indicated in* Science Resources Studies Highlights, *NSF 84-329, October 15, 1984.*

the credit relates to increases in nominal R&D expenditures, inflation serves to increase the credit and reduce taxes, again the opposite of what would be indicated by appropriate countercyclical policy.

III

It is easy for naive or biased investigators to claim that the tax credit has contributed to growth in R&D, for company-funded R&D has been growing. The rates of growth, however, have been declining. They were 16.2 percent in 1981, the first year (or half-year) of the credit, 11.5 percent in 1982, and 7.8 percent in 1983, to a total of $42.6 billion in that year, as shown in Table 1.

The rates of growth were generally higher, and rising, before the tax credit was instituted: 14.3 percent in 1978, 16.2 percent in 1979, and 18.5 percent in 1980. With adjustment for inflation, the rates of growth for the three years preceding the credit were 6.5 percent, 7.0 percent, and 8.6 percent. With the credit, from 1981 to 1983, real rates of growth were 6.0 percent, 5.2 percent, and 3.6 percent. The per annum real growth from 1977 to 1980 was 7.3 percent, while from 1980 to 1983 it was only 5.0 percent. Inclusion of projected expenditures for 1984 raises the real post-tax credit growth rate to 5.7 percent, but that is still less than the rate of growth before the credit became effective.

Sober analysis offers little, if any, hard evidence of much increase in real R&D spending as a consequence of the credit. The Division of Policy

TABLE 2.
QUALIFIED RESEARCH AND EXPERIMENTATION EXPENDITURES BY USABILITY OF CREDIT, 1981

USABILITY	QUALIFIED EXPENDITURES 1981	BASE 1980	GROWTH OVER BASE
	(Millions of Dollars)		(Percent)
Full Use of Credit	$ 9,221	$ 6,576	40.2%
Partial or Zero Use	4,220	3,006	40.4
Total	13,440	9,583	40.3

Source: U.S. Treasury, Office of Tax Analysis

Research and Analysis of the National Science Foundation funded separate projects by Edwin Mansfield of the University of Pennsylvania and by this author to evaluate the R&D tax credit shortly after it was instituted.[1] Mansfield, a distinguished scholar in the area of technological change and innovation, concluded on the basis of surveys and other analysis: "In all countries we studied, R&D tax credits and allowances appear to have had only a modest effect on R&D expenditures. In the United States, Canada, and Sweden, the results are quite similar, each of these R&D tax incentives having increased R&D expenditures by about one percent.... In all of these nations, the increased R&D expenditures due to the tax incentives seem to be substantially less than the revenue lost by the government.... In each country, there was substantial evidence that these tax incentives resulted in a considerable redefinition of activities as R&D, particularly in the first few years after the introduction of the tax incentive."[2]

My own work, which is still proceeding, has failed to uncover any clear evidence that the tax credit has increased R&D spending. One test I applied, for example, was to check in Office of Tax Analysis data to determine whether firms that could use the credit to full advantage—essentially those with sufficient current tax liabilities against which the credit could be claimed—showed a higher rate of growth of R&D spending than those that did not have such current liabilities. The rates of growth, as shown in Table 2, were indistinguishable.

Another test of whether the R&D tax credit was having any effect was to compare differences in R&D spending for firms that would have been above and below base for the years 1976 to 1980, before the tax credit went into effect, and the years 1981 and 1982, when the credit was operative. In the later years an effective tax credit should have increased expenditures for firms over base and, if anything, reduced them for firms below base. Thus, if the credit was effective it should have increased the growth of R&D spending where it was growing and perhaps decreased it further where it was falling. But using this test, there is no evidence that the incremental tax credit had an effect. The differences between the mean excess of R&D over base and the mean shortfall of R&D below base, as percentages of previous R&D, turned out to be no greater, and indeed somewhat smaller, in 1981 and 1982 than in the five years before 1981.[3]

Further evidence comes from a 1984 interview survey conducted by the Industry Studies Group, Division of Science Resources Studies, of the National Science Foundation. Only 33 percent of the surveyed companies, accounting for 22 percent of total company-funded research and development, stated that they were increasing R&D expenditures as a result of the tax credit.[4] This would hardly seem impressive in view of the possibility that even the 22 percent may be an upwardly biased measure, because self-interested respondents would be more likely to evaluate the impact of tax benefits favorably.

The initial surge in claims for the tax credit offers embarrassing evidence of considerable "creative accounting."

That firms, at least initially, claimed substantial increases in R&D for tax purposes is clear. The initial surge in claims for the credit offers embarrassing evidence of considerable "creative accounting." Thus, Office of Tax Analysis data indicate, as shown in Table 1, that qualified R&D spending reported by taxpayers increased by 40.3 percent in the latter half of 1981 over its 1980 base. Yet National Science Foundation data show total company funds for R&D growing by only 16.2 percent from 1980 to 1981, while the Compustat data indicate a 14.1 percent overall increase. If the firms included in the Compustat are limited to those with positive R&D growth to make them comparable to the Office of Tax Analysis sample, we still get a growth over base of only 21 percent, roughly half of what the firms claimed when they filed with the Internal Revenue Service. There is clearly a strong implication that many taxpayers classified as research and development expenditures, in 1981, activities that they did not include in calculating their 1980 base. Analysis of McGraw-Hill survey data collected on our behalf makes it clear that firms did indeed increase their reports of R&D eligible for the tax credit by more than the increases in total R&D.

IV

Some of the problems with the current tax credit are addressed in proposals for its extension by the U.S. Treasury and the Senate. In particular, there is some effort to narrow the definition of research and experimentation. This might reduce the amount of credit claimed for expenditures that have little or nothing to do with technological innovation. The Treasury has also suggested the possibility of indexing base period research expenses to the

general level of prices, so that the credit would relate to real increases in R&D expenditures and not those stemming from inflation. At the risk of proving a devil's advocate, I would propose adding several other amendments.

First, the 100 percent growth limitation, which reduces the nominal credit to 12.5 percent for firms increasing their R&D spending most rapidly, should be eliminated. While the limitation does not apparently affect a large proportion of R&D, its negative incentive effects are considerable where it does come into play.

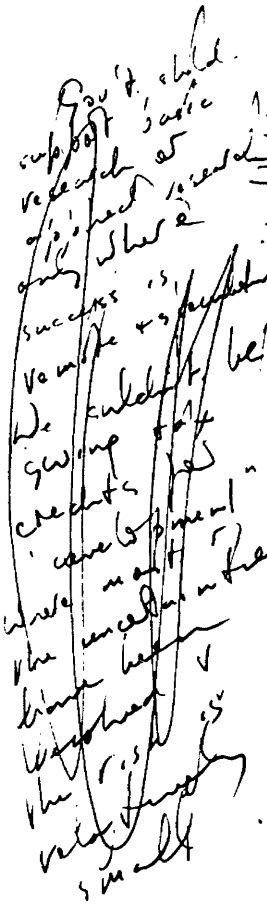
Second, the credit should be made refundable or converted into a direct subsidy. Aside from being aboveboard and allowing Congress and the public to see clearly what government encouragement of R&D is costing, a direct subsidy would exempt government support from the sometimes capricious effects of a tax system already saddled with numerous "incentives" that have less charitably been dubbed loopholes. Clearly, the current tax credit discriminates against firms that lack tax liabilities because they are chronically unprofitable, because they are still new and growing rapidly, or because of substantial indulgence in other tax-reducing activities.

Third, and most important, while retaining the incremental nature of the credit—which may in principle allow it to have a greater "bang for the buck"—we should eliminate the company-specific definition of the base. It is this feature that results in losses in future credits equal to the amounts gained in current credits and that thus may actually encourage some firms to reduce their R&D expenditures.

This provision could be changed by superimposing upon an initial company-specific base—say, the average of 1982, 1983, and 1984 qualified R&D expenditures—an adjustment, year by year, calculated from industry or national movements in R&D. Thus, if a firm were in an industry where R&D in 1985 grew by 10 percent, its base for calculating its tax credit for 1986 would be raised by 10 percent from its 1982–1984 average. The firm would then know that an increase in its current R&D expenditures in 1985 would contribute to raising the base and reducing future credits for all firms in the industry but would have a trivial effect in raising its own base and reducing its own future credits. (The industry should, of course, be defined sufficiently broadly so that no one firm would have a substantial effect on the base.) Having the base depend upon industry behavior rather than the company's own actions would achieve maximum incentive impact with minimal Treasury tax loss.

V

Even if the critical defects in the current law can be corrected, why should there be any tax credit or subsidy for the R&D expenditures of profit-seeking private firms? In general, a free-market system means a minimum of government intervention. As the Treasury has now recognized explicitly in its recent tax reform proposals, this argues against tax subsidies or incentives for business investment in general. In principle, business will invest in what it finds profitable. Companies should not be offered special tax advantages to invest in what otherwise does not appear profitable.



As I stated at the outset, R&D is admittedly another matter, to the extent that there are unusual positive "externalities"—that is, benefits that extend beyond the direct participants in economic transactions. That this is true for basic research is clear. It may also be true for applied research in those cases when the fruits in terms of industrial development and ultimate profit are a long way off.

But of some $42.6 billion in total company-funded R&D expenditures in 1983, according to National Science Foundation data, less than $1.7 billion went to basic research and only $11.2 billion to applied research.[5] Fully $29.8 billion fell in the category of "development," which in many if not most instances relates to converting research findings into profitable products. Should not such expenditures be left to the market test of profitability?

With regard to basic and applied research, where externalities may lead us to expect less than optimum private support, why not look to public support of nonprofit universities and research institutes or to direct government action? Much current research in agriculture, defense, and the basic sciences is, after all, not done by private business.

Nonbusiness, nondefense research, which enjoys little of the lure or sustenance of private profits, cries out for additional support. If we are to encourage research and experimentation—and we probably should—it is there that public funds are needed. Private business should be left free to concentrate on R&D spending that seems profitable without receiving special tax advantages. ■

NOTES:

1 Findings reported in this article or elsewhere are, of course, those of the author and do not necessarily represent the views of the National Science Foundation.

2 Edwin Mansfield, "Fiscal Policy Toward Industrial Innovation: An International Study of Direct Incentives for R&D," presented at Harvard Business School 75th Anniversary Colloquium on Productivity and Technology, 1984, pp. 28–29. See also Mansfield's "Statement to the House Ways and Means Committee on the Effects of the Research and Development Credit," in Subcommittee on Oversight, House Ways and Means Committee, *Research and Experimentation Tax Credit*, 98th Cong., 2d sess., Aug. 2 and 3, 1984, 142–56.

3 Robert Eisner, Steven H. Albert, and Martin A. Sullivan, "Tax Incentives and R&D Expenditures," *Leading Indicators and Business Cycle Surveys*, ed. Karl A. Oppenländer and Gunter Poser (Aldershot, England: Gower Publishing Company Ltd., 1984), 385–419. Reprinted in *Research and Experimentation Tax Credit*, op. cit., see Table 3.22, p. 124. A shorter version appeared in the *National Tax Journal*, as "The New Incremental Tax Credit for R&D: Incentive or Disincentive?", June 1984, 171–83.

4 *Science Resources Studies Highlights*, (Washington, D.C.: National Science Foundation, Oct. 15, 1984), 84–329.

5 *Research and Development Industry, 1983*, (Washington, D.C.: National Science Foundation, forthcoming).

CBEMA

June 20, 1985

The Honorable Robert Packwood
Committee Chairman on the Senate Finance Committee
United States Senate
Washington, D.C. 20510

Dear Senator Packwood:

The Computer and Business Equipment Manufacturers Association (CBEMA) strongly supports passage of S. 58, the "High Technology Research and Scientific Education Act of 1985."

Research and development is vital to the economic future of the United States. Through advances in technology, we enable all industries to modernize, increase productivity, and stay competitive in the world market.

R&D is also essential to the health of the U.S. high-technology industry. A national commitment to advancing our knowledge enables computer and business equipment manufactuers to stay competitive with foreign companies that can undersell us on international markets because their labor costs are lower and because their currencies are undervalued.

Permanent extension of the R&D Tax Credit is the most important way that the U.S. government can support R&D advances in our nation. We urge you to ensure speedy passage of the measure.

Sincerely,

Vico E. Henriques

Vico E. Henriques
President

Computer and Business Equipment Manufacturers Association 311 First Street, N.W., Suite 500, Washington, D.C. 20001 (202) 737-8888

digital

June 21, 1985

The Honorable Robert Packwood
Chairman, Finance Committee
259 Russell Senate Office Buildingg
Washington, DC 20510

Dear Mr. Chairman:

To enable U.S. industry to remain competitive with foreign industry, Congress adopted the R&D tax credit in 1981 to provide an incentive for increases in R&D spending.

While the R&D tax credit was not fully phased until 1983, we believe that the credit thus far has been successful in spurring growth in R&D spending. As shown in the following chart, Digital's R&D spending, as a percentage of revenue, has increased significantly during the past three years. Of course, increased competition within our industry has also been a significant stimulus behind this growth.

FISCAL YEAR	REVENUE ($ million)	TOTAL R&D SPENDING ($ million)	R&D as % of SALES	CONTRACT RESEARCH - UNIVERSITIES ($ million)
1981	$3,198.1	$251.2	7.9	2.0
1982	$3,880.8	$349.8	9.0	6.1
1983	$4,271.9	$472.4	11.0	13.5
1984	$5,584.4	$630.7	11.3	30.7

As the chart indicates, the R&D tax credit's greatest impact at Digital may be in the area of contract research with universities. Fiscal 1985 spending for contract research with universities could exceed $65 million.

The R&D tax credit was the only credit which President Reagan recommended be extended in his recent tax reform proposal. S.58 would improve upon the President's recommendations by making the R&D tax credit permanent. We urge you to give S.58 favorable consideration this year.

Very truly yours,

Ilene Jacobs
Treasurer

IJ/rj

DIGITAL EQUIPMENT CORPORATION, 111 POWDERMILL ROAD, MAYNARD, MASSACHUSETTS 01754-1418
(617) 897-5111 - TWX: 710-347-0212 - TELEX: 94-8457

HEWLETT-PACKARD COMPANY
3000 Hanover Street, Palo Alto, California 94304

DEAN O MORTON
EXECUTIVE VICE PRESIDENT AND
CHIEF OPERATING OFFICER

June 19, 1985

The Honorable Robert Packwood
Chairman
Finance Committee
United States Senate
Washington, D. C. 20510

Dear Senator Packwood:

We are pleased that you have dedicated a day of the tax reform hearings to testimony on research and development, indicating awareness that continued expansion of U.S. industry's research programs is in the national interest. The inclusion in the President's tax reform proposal of the extension of the research and development tax credit is recognition of the importance of continued public incentives for corporate research.

The growing capabilities of our overseas trading partners in manufacturing and marketing have created new competition for U.S. products in global markets. Our lead in technology has, in turn, become a major factor in the international competitiveness of U.S. industry.

As we discussed during our meeting in February, Hewlett-Packard strongly supports the extension of the R&D tax credit, proposed by the President and embodied in S. 58, the High Technology Research and Scientific Education Act, The credit is an effective incentive for U.S. corporations to increase their research programs as required to maintain this technological leadership.

We urge the Committee's positive consideration of S. 58, to make the R&D tax credit permanent before it expires in December.

Sincerely,

Dean O. Morton

DOM/cf

STATEMENT
DR. HANS MARK, CHANCELLOR
THE UNIVERSITY OF TEXAS SYSTEM
June 26, 1985

My name is Hans Mark, Chancellor of The University of Texas System. I would like to respectfully request that my statement be submitted for the record of the hearing of June 26 on the R&D tax credit.

I was pleased to learn that the President's tax reform proposal would extend the existing R&D tax credit for three more years. This is an important step in the right direction and recognizes the major contribution this provision is making to our industrial growth and technological progress. As you know, the Congressional Research Service and several independent studies have concluded that the revenue loss to the Treasury is more than offset by the "social rate of return" and economic growth. In other words, the current tax credit is effective at leveraging private investments in new technologies that in turn create new jobs and international trade opportunities. The Treasury can be expected to recover the lost revenue several fold in increased corporate and individual tax collections as the result of increased productivity.

As Congress grapples with massive spending deficits, it is important to keep in mind another deficit that, while less visible today, has the potential of being equally disastrous: our $123 billion international trade deficit. Although there are many complicated factors which have contributed to the development of this situation, there is widespread agreement that one of the key elements has been the lagging pace of our technological innovation and its commercial exploitation.

With the preceding observations in mind, I would suggest that Congress improve the President's proposal by making the existing credit

permanent and adding new incentives for industrial investment in university research. I would also like to take this opportunity to praise Senators Bentsen and Danforth for their pioneering efforts in this regard. The legislation introduced earlier this year by Senators Bentsen and Danforth, S. 58, does indeed achieve the goals I have outlined, and we heartily endorse it.

The "High Technology Research and Scientific Education Act" would make the existing credit permanent. This would be a major step forward in itself because it would allow corporations to develop long-range R&D strategies in a stable tax environment. Many research initiatives are truly long-term projects that sometimes require decades. Without a permanent incentive, I am sure that many worthwhile projects that do not promise a fairly short-term return on investment never get off the drawing board.

The most exciting aspect of the proposal are the provisions that create a new, non-incremental credit for firms that encrease their expenditures for basic research conducted at universities and enhance the existing equipment donation incentives.

While industrial R&D and campus-based research enjoy a symbiotic relationship, there are major differences that the expiring credit does not fully address. The current credit tends to encourage corporate behavior directed at developing and commercializing new products. This usually requires bursts of rapidly escalating expenditures over a relatively short period. Because the credit only applies to constantly increasing R&D expenditures, it is well suited to this purpose.

However, most campus-based research is so-called basic research, which requires relatively constant levels of support over a longer period of time.

The Bentsen-Danforth bill recognizes this distinction by establishing a new credit for firms increasing their support of basic research at universities. This will better enable businesses to underwrite long-range projects at relatively flat funding levels. The proposal also enhances the existing equipment donation provisions.

The importance of these two mechanisms cannot be over-emphasized.

Most significantly, the level of industrial support for basic research will increase. Basic research is not aimed at developing a commercial product or process. It is intended to expand our body of knowledge of physical phenomena. These insights form the intellectual motor that drives applied research. Without a constantly growing foundation of basic knowledge, the flow of new inventions, cures and production processes would soon come to a halt.

By its very nature, basic research is usually time-consuming and unpredictable. That is, basic research sponsored by an energy company may turn out to have little or no application to the firm's line of business, but it may lead to a major breakthrough of interest to a pharmaceutical company. Therefore, such investments are hard to justify to the stockholders without the new incentives contained in S. 58.

S. 58 will also lead to increased collaboration between industry and academe, including valuable intellectual cross-fertilization. This opens new doors to technology transfer, the process by which laboratory results are translated into useful applications.

This increased collaboration will have other positive spin-offs, such as encouraging more promising students to pursue careers in science and engineering and providing university researchers with a better understanding of the needs of their industrial counterparts.

The university research provisions of S. 58 will also help renew our nation's research capability. In the two decades following World War II, we made a commitment to build a research infrastructure second to none - and we succeeded brilliantly. Our unparalleled economic growth and world leadership was in large part due to this commitment.

In the postwar era, a conscious commitment was made to concentrate our resources on our campuses.

Now, many of the laboratories that were constructed in the 1950s and 1960s are in need of renovation, and most universities cannot replace obsolete equipment and instruments, much less acquire advanced models. Federal support for post graduate fellowships has eroded to the extent that Japan, Western Europe and the U.S.S.R. now produce far more new scientists and engineers than the U.S.

This problem requires a concerted effort at local, state, and federal levels. The High Technology Research and Scientific Education Act will make a significant contribution to this effort. American business is now sensitive to the interdependent nature of university research and commerce, and I am convinced that it will use the incentives in S. 58 to renew a constructive partnership with academia that benefits us all.

This concludes my statement. Thank you for the opportunity to express my views.

WRITTEN TESTIMONY

BEFORE THE SENATE FINANCE COMMITTEE

DONALD S. BEILMAN, PRESIDENT

MICROELECTRONICS CENTER OF NORTH CAROLINA

RESEARCH TRIANGLE PARK, NORTH CAROLINA

Introduction

The Microelectronics Center of North Carolina (MCNC) is an innovative education and research organization which combines the resources of five universities, a related nonprofit research institute, and a major centralized research facility established in order to advance basic knowledge and education in the field of electronics. It is an important opportunity to be able to present my views on the promotion of university research and scientific education as a means to bolster U.S. technology leadership--the public policy aim of the High Technology Research and Education Act of 1985.

Discussion of S.58

MCNC supports the overall objectives of S.58 which are to increase high technology research activities, to foster university research and scientific training, and to encourage the contribution of scientific equipment to institutions of higher education and coalitions of such institutions. These objectives are compatible with the mission of MCNC which is to advance basic knowledge in the field of electronics through focused research and to support educational programs appropriate for the continuing evolution of requirements in this field. The provisions of S.58, with one significant exception in Section 202, facilitate the realization of missions such as ours and encourages additional university collaboration.

The provisions of the Senate's proposed amendments to the Internal Revenue Code of 1954 will encourage industry to increase its support of university education and research.

This encouragement is evident in Section 201 which:

- proposes an expansion of the credit for basic research at universities
- includes qualified non-profit research institutions which are not private foundations

Section 202, however, limits the contribution of research tools to only universities and associations of universities. The donation of equipment to university consortia such as MCNC would be more attractive to industry if Section 202 were to include the central laboratories of such consortia which directly support the education and basic research mission of universities.

Public Policy Aims Supported

Industry support of higher education is important to technological initiatives which address national issues such as international competitiveness in high technology. The proposed legislation, in S.58, encourages research programs which support U.S. technology leadership, and we endorse this objective. In 1984, for the first time, the U.S. experienced a high-technology trade deficit losing its market share in seven of ten international high-technology markets. Recent industry news magazines chronicle write-offs and layoffs in the American electronics industry as well as the capture of over 90% of the 256K RAM market by foreign manufacturers. Significantly increased university basic research is essential if challenges to America's world leadership in high technology manufacturing are to be met.

The meeting of the international economic challenges of the 1980s, and the significantly increased expenses of education and research programs in high technology fields require new approaches. MCNC is an example of one new approach: a nonprofit institution as the central laboratory for a multi-university consortium dedicated to high technology education and research. The innovative and unique features of MCNC are an outgrowth of trends in higher education. These trends emphasize the benefits to be derived from pooled resources, the necessity for closer university collaboration in capital intensive fields such as education and research in modern electronics.

Electronics is also a rapidly changing field, and knowledge learned during graduate studies may be obsolete within two to five years. This accelerated obsolescence rate requires access to quality graduate and continuing education programs that provide training in the latest technologies. Students need the most current coursework and experience in the use of state-of-the-art equipment. This need is in stark contrast to the reality that equipment in most college labs is woefully obsolete, and equipment to teach new "growth technologies" is prohibitively expensive in most cases.

The capital equipment required for comprehensive education and research in electronics makes necessary new approaches such as multi-university consortia and new ways to support the capital requirements of their central laboratories.

MCNC and National Objectives

MCNC was established in order to derive the maximum benefit from the cooperative efforts of five universities in the building of a state-of-the-art electronics education and research consortium. This collaborative effort provides:

- equipment and professional staff in a central laboratory which conducts research in conjunction with the work done at the participating universities
- leverage for the contributions of equipment and research awards obtained by any one of the participating institutions
- sharing of faculty and staff among the universities and the central laboratory through the use of modern telecommunications technology and equipment
- coordination of a comprehensive program for education, the advancement of knowledge, and the transfer of technology

MCNC encourages industry to donate equipment for the consortium's educational and research purposes. One donation may be made to the five universities and the MCNC Central Laboratory and, as a result, industry can maximize the educational benefits from its single contribution. Currently, industry donations of scientific property receive the maximum tax incentive only if made to institutions as defined in IRC Section 170(e)(4). The tax incentive under the Code, as it is presently written, does not clearly apply to the donation of equipment to the central laboratory of a university consortium such as MCNC.

The current provision in the Code. therefore, results in a reluctance of industries to make a donation to an off-campus central laboratory of a consortium such as MCNC because the tax effect is not as favorable as it would be were the equipment donated to a university.

At the same time, industries may be reluctant to donate equipment to a single university which may not make full use of the scientific property either because of the absence of an integrated program or of insufficient support resources. This is particularly true in the field of electronics. Single pieces of equipment may cost millions of dollars and require special facilities such as clean rooms, vibration isolation, and conditioned power. MCNC and its Central Laboratory does provide an integrated program and support capabilities which can make the most efficient and productive use of donated equipment. However, MCNC would not qualify as a recipient of charitable equipment contributions under the Senate's proposed amendments as presently structured in Section 202 of the current version of S.58.

The Provisions of S.58

Section 201, in contrast to Section 202 of the current version of S.58, does address the issue of tax credits given to industry for support of university basic research and also recognizes as qualified organizations:

> "(B) any other organization which—
>
> (i) is described in section 501(c)(3) and is exempt from tax under section 501(a),
>
> (ii) is organized and operated primarily to conduct scientific research, and
>
> (iii) is not a private foundation."

MCNC is an organization described above in Section 201 and could benefit from S.58 because the tax credit encourages industries to contribute to MCNC's research programs.

MCNC's Recommendation

We believe that this same provision in Section 201 should be included in Section 202. If the definition in Section 201 which acknowledges the importance of encouraging research carried on by exempt scientific research organizations is repeated in Section 202, its inclusion would eliminate the disincentives to industry donations to central laboratories of such organizations. This inclusion would recognize the efficiency of creative university consortia which address major national issues through new structural relationships. Including the Section 201 definition in Section 202 would enhance the consistency in S.58 by encouraging research contributions to university consortia with a non-traditional structure and also providing for the contribution of the necessary tools for this research. Also, this modification would bring S.58 into agreement with H.R. 1188. It is our belief that expansion of the research credit for basic research, together with this recommended provision for the deduction for certain contributions of scientific and technical property, would result in increased industry support of university high technology education and research.

Summary

In *The President's Tax Proposals to the Congress for Fairness, Growth, and Simplicity*, the intent of S.58 is supported in Chapter 12.03 "Extend and Modify Research and Experimentation Credit." President Reagan's proposals anticipate legislative efforts to enhance charitable deduction for contributions of scientific equipment to universities as a part of research credit. We believe that these recommended provisions which include consortia such as MCNC can make significant contributions in the preparation of graduate students for their future work in high technology industries, in the harnessing of technology for economic growth, and to strengthening America's competitive position in high-technology world markets.

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June 19, 1985

Honorable Bob Packwood
Chairman
Senate Finance Committee
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

I am pleased to express my support for S. 58, particularly those portions of the bill establishing a permanent tax credit for corporate research and development, enhancing incentivas for corporate support of university basic research, and encouraging corporate contributions of state-of-the-art instrumentation to universities.

For the last two and a half years, I have been privileged to serve as Chairman and Chief Executive Officer of Microelectronics and Computer Technology Corporation (MCC). MCC started as a joint venture of 10 U.S. companies sharing the cost of long range research aimed at significant advances in microelectronics and computer sciences. Since its inception, 11 more companies have joined MCC, and we are now owned by 21 corporations.

In creating such an organization, MCC's founding shareholders took what was perceived at the time to be a substantial risk, since the treatment of precompetitive joint research under antitrust law was unclear. In 1984, Congress studied the real and perceived obstacles to cooperative research, and passed the Cooperative Research Act. Thus, thanks to Congressional leadership, joint research is now recognized as an efficient and valid approach to managing scarce financial and intellectual resources.

The Cooperative Research Act was one of several important Congressional actions which have helped promote the importance of innovation to U.S. competitiveness. Also important, I believe, are tax credits for research and development and broad support, through credits and direct funding, of basic research and accompanying instrumentation ir our universities.

Although various studies present different estimates of the impact of the credit established in 1981, it is clear that industrial R&D spending continued to increase despite the

economic recession of the early 1980's. A study by the Brookings Institution and Data Resources Inc. suggests that the effect goes beyond enhanced R&D expenditures for specific companies, with a multiplier effect potentially adding $17.7 billion annually to the GNP by 1991.

Equally important, however, is the existence of explicit national policy committing the United States to excellence in research. Although much of the current discussion relates to microelectronics and computer research, other future technologies will benefit from a national policy which stimulates R&D. For example, a joint project of the National Academies of Science and Engineering, along with the Council on Foreign Relations, identified six emerging technologies: telecommunications, microelectronics, aerospace, materials, energy, and biotechnology.

The successful creation and commercialization of technology in each of these fields will be critical to our economic and military security. Each has the potential of creating new products and industries, as well as providing new approaches for retooling our basic industries. The application of these emerging technlogies to raise the productivity of our existing basic industries may turn out to be the most significant product of accelerated research. I must also stress that the importance of stimulating research is certainly not limited to new industries, but applies also to research conducted by our older industries as we rebuild the infrastructure of U.S. manufacturing.

This means that our strong foundation of university basic research must be enhanced, and the environment which stimulates private investment maintained and expanded. S. 58 is an important step toward this goal, and its effect is magnified when combined with other efforts currently underway, such as the National Science Foundation's Engineering Research Centers and the Department of Defense University Initiative Program.

I especially wish to acknowledge the leadership of Senator Bentsen and Senator Danforth as sponsors of S. 58 and encourage your favorable consideration of this legislation.

Sincerely,

B.R. Inman
President