Tax incentives for R&D: a critical evaluation

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Bozeman, B., & Link, A.N. "Tax Incentives for R&D: A Critical Evaluation," *Research Policy*, 1984, 13(1): 21-31. https://doi.org/10.1016/0048-7333(84)90004-0

Abstract:

A number of policy proposals have recently been presented that seek to address the problem of declining productivity growth. Many of these are aimed at encouraging private R&D spending through tax incentives. This paper first reviews some of these proposals, then evaluates tax incentives per se as a policy tool for encouraging R&D growth, and finally offers suggestions for redesigning R&D related tax incentive policies.

Keywords: R and D | tax incentives | productivity

Article:*

1. Introduction

Productivity is one of the most important factors influencing economic well-being. Productivity growth is not only essential to a higher standard of living, but also it is vital to a sound economic and political environment. It is no wonder then that the slowdown in productivity growth in the United States since the mid-1960s has generated much concern, and at the same time, a number of public policy proposals for reversing this trend.

Although many factors have been cited as correlates and possible causes of the productivity growth slowdown,[1] the curtailment of public and private sector research and development (R&D) has attracted much public attention. There are perhaps at least two reasons for this focus on R&D. One, movements in total R&D spending as a percentage of GNP is highly correlated with movements in the average annual rate of growth in labor and total factor productivity in aggregate sectors. Two, there is a well developed literature linking R&D spending, in total and by character of use, to residually measured productivity growth at both the firm and industry levels (e.g. [3;4]).

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* This paper has benefited from the suggestions and comments of Eleanor C. Thomas, Richard C. Levin, and three anonymous referees. We are also indebted to Kenneth Ruscio who provided useful documents and unpublished materials. An earlier version of this paper was presented at the Association for Public Policy Analysis and Management meetings, October 1982.

[1] These factors include, among others, changes in energy prices, capital intensity, government regulations and workers' hours and attitudes. See Link [1] or Christainsen and Haveman [2] for a literature review.

Among policy proposals centering on R&D spending, approaches range from increasing governmental support for extramural research, to establishing cooperative research centers, to stimulating industrial research through various tax mechanisms. While all of these are important, our objective in this paper is to provide an overview of tax policies designed to stimulate industrial R&D and then to assess the political and economic variability of tax incentives as a policy tool for promoting R&D growth.

2. Tax policies for stimulating R&D[2]

At the present time there is much interest in tax incentives for R&D;[3] however, one should not infer from the topical nature of incentives that the idea for using tax policy as a targeted stimuli for R&D is unprecedented.

The adoption of Section 174 of the Internal Revenue Code in 1954 codified and expanded the tax laws pertaining to firms' R&D expenditures. This provision permits businesses to deduct fully research and experimental (R&E) expenditures, but not development or research application expenditures, in the year incurred. There is also the option to capitalize R&E expenditures and amortize them over a period of not less than five years, beginning with the month in which benefits are first realized. By assumption, these benefits occur in the month in which the product or process gained from the R&E activity first produces income. This deferral option was intended to benefit the small newer firms who had little or no taxable income during their early years.

The Internal Revenue Service made clear that the expending option was limited to direct R&E expenditures and was not applicable to expenditures on capital assets necessary for the conduct of R&E activities. However, the costs of such depreciable assets as machinery, equipment and facilities is partly recovered through depreciation allowances which apply for investments in any depreciable property.

Expenditures for R&E are given preferential treatment under Section 174 but there was little indication initially regarding those activities which qualified as R&E. Stipulations and limits were provided in subsequent Department of Treasury regulations. Research and development costs in the experimental or laboratory sense include all such expenditures which are incident to the development of an experimental or pilot model, a plant process, a product, a formula, an invention or similar property, and improvements to existing property similar to these types. As well, it includes the cost of obtaining a patent, such as attorney fees incurred in making or perfecting a patent application. Specifically excluded are expenditures for testing or inspection of materials or products for quality control, management studies, advertising and promotion. A number of court decisions have further codified the legal meaning of research and experimental expenditures.[4]

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[2] This discussion in this section draws extensively from Slitor [5], Kaplan [6], Collins [7], and Ruscio [8].

[3] Since programs for direct government support of R&D are almost all within the "controlled" portion of the federal budget, the prospects for increasing government R&D in the current political climate are uncertain. The administration's focus on tax incentives seems well placed.

[4] An important precedent regarding the value of R&E deductions for the individual taxpayer was set in the *Snow* case (Edwin A. Snow, et ux., vs. Commissioner of Internal Revenue, 1974). By unanimous vote, the Supreme Court held that a taxpayer is allowed to deduct his pro rata share of a partnership's R&D expenses under Section 174 even

While the immediate expensing of R&E expenditures is viewed generally as a tax incentive, Kaplan [6] argues that Section 174 is more an administrative convenience than a *per se* tax incentive. While there is a consensus about the salutary effects of R&E expenditures on both innovation and the creation of marketable products, the marginal contribution of R& E is difficult to determine as it is closely intertwined with a host of other inputs such as management structure, quality control, marketing strategy and level of employee creativity. According to Kaplan (6, p. 7):

> Rather than get immersed in estimating the benefits from this whole range of intangible assets, it seems prudent for Congress and the IRS to allow full deductability of expenditures on such intangibles as an administrative convenience rather than as a tax incentive. If Congress had truly wanted to supply a tax incentive for R&D, it could have allowed an immediate writeoff for investment in tangible R&D assets (building, machinery, and equipment).

Indeed, one of the continuing interests of business leaders has been the expansion of tax incentives to include writeoffs or tax credits for tangible R&D assets; such a proposal was given the highest priority by the Committee for Economic Development [9].

A number of additional elements, other than Section 174, of the Tax Code are generally viewed as R&D incentives. Individuals and corporations are allowed to deduct, according to Section 170a, contributions to educational and scientific organizations held to be operating in the public interest. There are limits on such deductions: individuals may deduct not more than 50 percent of adjusted gross income for such contributions and corporate deductions are limited to 5 percent of taxable income. Furthermore, the income of scientific and educational organizations operated in the public interest is exempt from Federal income tax. According to Sections 50la-c, organizations qualify for this exemption if they are conducting scientific research that is "directed toward benefiting the public." The operating standard is that the work must result in information "published in a treatise, thesis, trade publication, or in any other form that is available to the interested public." If met, the organization qualifies for the exemption even if the research is performed under "a contract or agreement under which the sponsor or sponsors of the research have the right to obtain ownership or control of any patents, copyrights, processes, or formulae resulting from such research."[5]

Another provision viewed as a tax incentive pertains to individual inventors. An individual inventor may treat proceeds from the sale of a patent as a capital gain instead of ordinary income. To obtain this benefit, the inventor must transfer "all substantial rights": that is, he must sell the patent rights or grant an exclusive license, as a nonexclusive license does not qualify. In such a

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though the firm was not "carrying on trade or business" as required under Section 162(a) for a trade or business expense. The Court ruled that a business is entitled to deduct R&E expenses incurred in the development of its initial product even though no product has as yet been fully developed and marketed. Other codifications of Section 174 include *Coors Porcelain Co.,* 52 TC682, 1970; *Charles O. Anderson* (9 Cir/ 2-6-79); *Beaumont Co.,* 3 BTA822. 1970; *RevRul* 77--27, 1977; *RevRul* 77-253, 1977.

[5] This provision in Sections 50la-c has attracted much attention especially in response to the recent increase in industry-university research relationships.

case the more favorable capital gains tax rate applies to the inventor but not to the employer or puchaser of the rights.

3. The Economic Recovery Act of 1981 and related proposals

One of the most significant, and in some cases controversial, changes in the tax treatment of R&D expenditures and R&D assets was provided in the Reagan Administration policy centerpiece, the Economic Recovery Tax Act of 1981 (hereafter the Tax Act). The four major changes embodied in the Tax Act include (1) faster depreciation of R&D assets, (2) a two year suspension of Treasury Regulation 1.861-8 to study its impact,[6] (3) an increase in the deduction promoted for contributions of newly manufactured research equipment to universities, and (4) a tax credit for R&D expenditures.

Since our primary interest is on incentives entailing a tax credit for R&D our focus is specifically on the last provision in the Tax Act, a tax credit for R&D. The credit is for R&D expenditures in excess of the average amount spent during the previous three taxable years. Expenditures qualifying include in-house expenditures for R&D wages and supplies, 65 percent of the amount paid for contracted research, and 65 percent of corporate grants to universities and scientific research organizations for basic research. Expenses must be paid by the taxpayer during the taxable year and must pertain to the carrying on of a trade or business. The credit is effective for R&D expenditures paid or incurred after June 30, 1981 and before January 1, 1986 when, in the absence of further legislation, the credit will no longer exist.

The tax credit is 25 percent of the excess of the taxpayer's research for the taxable year over the average of the taxpayer's yearly research expenditures during the base period. The base period is generally defined to be the three years immediately preceding the taxable year for which the credit is claimed. However, the base period expenditures cannot be less than half of the expenditures for the current year.[7]

Several limitations are worth noting. In the first place, the requirement for "carrying on a trade or business" means that expenses incurred in connection with trade or business but not pertaining to development of potentially marketable goods and services fail to qualify. Perhaps just as important, the credit does not apply to research expenditures paid or incurred prior to commencing a trade or business. Only wages paid for doing actual research work qualify for the credit. Thus wages for laboratory scientists and engineers and their immediate supervisors would qualify but wages for general administrative personnel or other auxilliary personnel (such as computer technicians working in a multipurpose computer and information processing department) would not.

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[6] Since 1977 Treasury Regulation 1.861-8 has required US multinational firms to allocate some of their domestic R&D expenditures against income from foreign sources. The rationale is, if a form spends money for R&D in the US and the resulting products or processes are sold abroad, then a portion of these R&D costs should be allocated against foreign sales. The combined effect of this regulation and the tax laws governing foreign income is to increase the effective tax rate on foreign income and perhaps to encourage multinational firms to export a portion of their R&D overseas [8].

[7] A number of special base-period computations have been specified for new firms or firms just beginning to engage in R&D. See Barth and Cordes (10] and Barth et al. [11] for reviews.

The effects of the tax credit were much debated before adoption and will continue to be a subject of controversy. In fact, a recent McGraw-Hill survey [12] showed that firms intended to raise R&D spending by 17 percent in 1982 despite the economic recession. Furthermore, Bozeman and Link [13] report that a panel of R&D vice-presidents in manufacturing firms forecast that the percentages of R& D allocated to basic research and to long-term exploratory research will double by 1984 and quadruple by 1990. But, as Press [14] notes, the pattern of sacrificing long-term R&D spending to protect short-term investments appears to have collapsed well before the Tax Act was formulated.

The R&D tax credit incorporated in the Tax Act cannot be viewed in isolation from the accelerated cost recovery system for capital expenditures first established by the Tax Act, but later amended by the Tax Equity and Fiscal Responsibility Act of 1982. These legislations provide firms an incentive to invest in capital equipment by classifying investments into a three year life (automobiles, light trucks, and R&E related equipment) or a five year life (most other non-real property). An investment tax credit of 6 percent applies to the three year property and a credit of 10 percent applies to the five year property. In a broad sense this initiative is at odds with the tax credit for R&D also established in the Tax Act owing to the fact that a firm has at least two sources for acquiring new technologies. These sources are crudely dichotomized as being an internal source, that is technology generated from in-house R&D, or an external source, that is technologies embodied in capital equipment and purchases by the firm. It is too early to generalize about the extent, if any, of crowding-out caused in the area of innovative activity.[8]

The Tax Act has not pre-empted other proposals for R&D incentives and there is considerable legislative activity aimed at refining or extending the tax incentives provided for in the Act. The R&D Tax Planning Act (S.2256) was recently introduced and would make permanent the 25 percent tax credit as well as the suspension of Treasury Regulation 1.861-8. Additionally, in the 97th Congress H.R. 4667 was introduced to broaden the definition of institutions eligible under the Tax Act to receive credited R&D equipment donations from corporations. Another proposal, H.R. 5344, was introduced to extend these benefits to new businesses. Both legislations died in the Ways and Means Committee.

One of the more sweeping proposals for stimulating R&D is the Stevenson-Wydler Act. This Act, which is only in the early stages of implementation, is traditional in the sense that it depends on government management and direct support of R&D, yet it is non-traditional in the sense that it is not oriented towards a grants assistance program. Among the provisions in this Act that relate to R&D are (1) the establishment of an Office of Industrial Technology within the Department of Commerce, (2) the creation of a grants program for Centers for Industrial Technology (so-called "generic technology centers"), and (3) a requirement that each federal agency with a R&D laboratory commit 0.5 percent of its R&D budget for technology transfer. Budgets for FY1982 and FY1983 have not included funding for the Act and plans for FYl984 call for only minimal levels of implementation.[9]

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[8] An empirical analysis of the relative incentives established by each of these aspects of the Tax Act is in Angell and Link [15].

[9] The FY1984 projection is based on a personal communication with Dr. Lance Felker. Director, Office of Productivity, Technology and Innovation, US Department of Commerce.

Certain objectives of the Stevenson-Wydler Act were partially realized in the Small Business Innovation Act passed in November, 1982. This latter Act involved the coordinated activities of eleven federal agencies in stimulating small business research. The Small Business Administration is charged with the overall administration of the program.

4. Other recent proposals

In addition to the R&D proposals discussed in the previous section that have culminated in legislative action, several alternatives have been advanced by scholars, interest groups and professional organizations. Some pre-date the Tax Act and thus obviously had some impact on its ultimate form and focus. Such proposals include those by the Committee for Economic Development [9] and the National Academy of Engineering [16].[10] While the two are somewhat different in their enthusiasm for tax incentives (the National Academy of Engineering report is less sanguine), they each come to a similar conclusion regarding the need to consider tax incentives in conjunction with broader macroeconomic policies aimed at stimulating investments and productivity growth.

Other proposals recently advanced include those by Klein [18], Hufbauer [19], and Bozeman and Link [13,20]. The Klein proposal seeks to provide benefits to firms for risk taking (while at the same time suppressing inflationary tendencies), by tying rewards to performance and reducing the sensitivity of R&D spending to the cycle. The chief tenet of the proposal is that risk-taking should benefit from reduced taxes.

The Hufbauer proposal is related to tax policy pertaining to patents. It suggests that receipts from publicly registered licenses or from the sale of patents should be tax-free to the seller and should remain tax deductible to the buyer.

The Bozeman and Link proposal is designed to stimulate research which is nearer the basic end of the applied/basic research continuum. It is argued that current tax credit policies do not deal adequately with the public goods characteristics associated with knowledge, and that much of the R&D investment stimulated by the Tax Act will be directed (through the firms' own profit maximizing calculus) to applied research or even development. The Bozeman and Link proposal argues for a tax credit for joint venture R&D on the assumption that antitrust advantages [13,;21], as well as the need for a broader base for multi-firm R&D, will voluntarily lead to a higher proportion of research near the basic end of the continuum.

A related issue concerns possible tax incentives targeted at research partnerships, a special form of limited partnerships [22;23]. In establishing research partnerships, firms conducting research (usually basic) solicit investors for well-defined activities. Often, the firm conducting the research has insufficient resourcs to pursue a broad line of research. Rather than "sell out" in the traditional manner to venture capitalists, the firm courts investment in a particular research program or investment in new ideas. As a research partner, a firm or individual can at the end of the partnership be permitted special stock options or royalty payments. This arrangement allows the research-producing firm to remain substantially unchanged, but investors can typically experience a 90 percent tax deduction for their investment and, at the same time, share in the

[10] An excellent review of these two proposals is in Cordes [17].

proceeds from sales of products generated from the research. There is, however, a limit of 20 percent to the tax deduction that can be claimed. Thus far the government's role in limited partnership has been limited to providing guidelines for taking advantage of existing tax incentives – using government publications and government-sponsored workshops as a vehicle – but the Commerce Department has reviewed recently possible additional tax incentives for encouraging research partnerships [24].

5. Tax incentives as a policy tool: Pros and cons

As indicated from our discussion above, tax incentives are becoming a major policy tool for achieving R& D policy goals. Before we discuss (in the following section) how such tools should be designed, we evaluate the pros and cons associated with tax incentives *per se.*

(1) *Tax incentives entail less interference in the marketplace than grants assistance, and relatedly, allow more private decisionmakers to retain autonomy.* It is claimed in the Committee for Economic Development report that" tax incentives [for R&D expenditures] do not require that government officials make difficult, subjective judgments concerning the relative results of various innovations and technologies" and that tax incentives do not create artificial markets since "firms are still free to design, price, and sell in response to real demand, rather than in response to government-created demand" [9, p. 35].

It is difficult to find fault with the first point, at least from an empirical standpoint. Tax incentives do, indeed, seem to provide more discretion for private decisionmakers. However, it is not clear that there is any necessity for grants assistance programs to encumber private decisionmaking since it is theoretically possible to devise grants assistance and subsidy programs which entail very few controls. By the same token, it is possible to formulate tax incentive programs which specify so many qualifying criteria that the effects are quite similar to a tightly controlled grants assistance program. Nevertheless, it is true that tax incentive programs tend to rely more on the discretion of private decisionmakers and less on the preferences of government officials.

(2) *Tax incentives require less paper work than grants assistance and thus fewer layers of bureaucracy.* The red tape, paperwork and additional accounting associated with many grants assistance programs is all too familiar. Tax incentives require administration and paperwork, but the administrative burden is significantly less. Furthermore, government bureaucracy (the Internal Revenue Service) is already established and well trained in auditing and tax administration [25]. Also, there is an administrative advantage to tax incentives over grants assistance programs since the "rules of the game" change less rapidly. One of the greatest boons to administrative practice is predictability, and policy flowing from tax incentives is more predictable and stable than policies which require yearly appropriations and are subject to rapid legislative changes.

Survey [26] takes issue with this claim that tax incentives require less government interference contending that there is little value of comparing a direct assistance policy which is tightly controlled to a tax incentive policy which has almost no controls. If it is controls that are the cutting issue it is possible to devise grants assitance programs that entail almost no controls, just

as it is possible to devise tightly controlled tax incentive policies. The same argument can be advanced in connection with the alleged advantages of tax incentives in promoting private decisionmaking. Moreover, the fact that the existing tax incentives are indeed less structured than most direct expenditure programs is a virtue limited to the eye of the beholder. In some instances lack of structure in tax incentives represents little more than a retreat from planning and decisionmaking responsibility.

(3) *Tax incentives avoid the need to make difficult distinctions or to set nebulous and particularistic requirements for receiving assistance.* There is an administrative benefit to being able to avoid particularistic requirements with regard to efficiency and equity. With regard to R&D, tax incentives are ideally designed to reward past behavior, of course this implies that past behavior has been successful and is worth rewarding.

(4) *Tax incentives have the psychological advantage of achieving a favorable industry reaction vis-a-vis grants assistance or subsidies.* The supposed psychological advantages of tax incentives vis-a-vis assistance programs is difficult to document. Cole [25] argues that, irrational as it may be, people do react differently to tax incentives than to direct assistance. Tax incentives seem to draw nourishment from the rich taproot of the free enterprise symbol. The free enterprise ethic has considerable symbolic capacity, and it would be surprising not to find a differential reaction among businessmen. Of course, the real question is the behavioral significance of these (possibly) different reactions. If businessmen were more likely to eschew, for psychological reasons, money provided via assistance programs this difference would be important.

(5) *Tax incentives are more permanent and stable in that they do not require an annual budget review.* Firms are more likely to make fundamental changes in their plans and investment strategies if they perceive that a policy has some stability. Thus, a tax credit which has a known long-term or open-ended effective life will be more likely to lead to adjustments in behaviour than a grants assistance program or subsidy which is here today but may be gone with tomorrow's round of budget cutting. This seems to be one of the most powerful arguments for permanent tax incentives as a policy tool for shaping R&D activity.

(6) *Tax incentives have a high degree of political feasibility.* It is often the case that tax incentives face less political opposition than direct assistance policies. What better evidence of this than the rapid growth of the tax expenditures budget even as officials scour budgetary lines for possible spending reductions. Also, there is a different constituency for tax incentives than for assistance programs. Tax incentives are typically the "favored child" of conservative politicians and their business constituencies, not only in the US but in other industrial nations. One of the first steps that newly-elected conservative administrations take is to expand tax incentives: one of the first steps that liberal administrations take (or at least give lip service to) is to close the "loopholes". One very pragmatic argument for tax incentives for R&D expenditures is (to borrow a worn cliche) that one should not look a gift horse in the mouth. If conservative Republican administrations choose to use this means of encouraging R&D spending, why resist? By the same token, when tax incentives go out of fashion we can (to mix equine metaphors) shift horses in the middle of the race and advocate some other politically feasible approach to enhancing R& D spending.

Of course, critics of tax incentives may disagree with these alleged advantages. Perhaps even more compelling than simple disagreements are the critics' arguments for the disadvantages of a tax incentive approach.

(1) *Tax incentives bring about unintended windfalls by rewarding people for doing things they would have done without the tax incentive.* This proposition requires, for strict verification, knowledge which in principle is unobtainable. Once a tax incentive is actually introduced we can never know with certainty how people would have behaved had it not been introduced. But, the logical dilemma has not (or never will) curtailed speculation or *post hoc* analysis.

In most instances windfalls are inefficiencies rather than intended consequences of policies. Windfalls can be avoided simply by introducing adequate controls and qualifications but this introduces complexities and, moreover, resurrects the very problem that tax incentives are supposed to treat: government intervention. Alternatively, the magnitude of the windfall can be curtailed if the tax credit is for incremental R&D (as in the Tax Act) rather than for average R&D. In regard to the incentives introduced under the Tax Act, it is not yet clear that windfalls are resulting (and if so, in what magnitude) or that firms are being rewarded for actions they would have taken in the absence of an additional tax incentives. But the fact that industrial R&D has steadily increased during recent years and that R&D managers forecast even more substantial real growth in industrial R&D for both the short and intermediate term at least gives pause [13].

(2) *Tax incentives often result in undesirable inequities.* Surrey [27] contends that tax incentives are likely not only to introduce inequities but also to mask those inequities. There are adverse industry effects on horizontal equity and individual (via income taxes) effects on vertical equity. The problem is that tax incentives are a blunt instrument and that highly specific provisions would have to be written into the tax code to deal effectively with inequities (and thereby bring about prodigious administrative problems).

It is not simply that differential rewards are provided under tax incentives – indeed differential rewards are often undesirable – but there is a tendency for "upside-down benefits" as well [26]. Typically, taxpayers in higher income brackets benefit the most from tax incentives. This is especially a problem in the case of tax incentives for R&D since many new firms have no tax liability and are not profitable during the early years in which they develop products and invest initially in R& D assets. But in many cases those are the very firms which most often warrant assistance. Carry forward provisions can in some instances begin to address this most troublesome of inequities, but even then there is potential for "cooperate regressivity" in tax incentives. According to Ruscio [8] tax incentives as a policy tool toward R&D are most effective when they are least necessary and may influence those firms who need them the least.

(3) *Tax incentives "raid" the Federal treasury in that tax rates end up higher than they would otherwise be.* Tax expenditures represent foregone revenue and, *ceteris paribus,* the tax rate would have to be elevated just to maintain revenues. However, all else is not equal since revenue is not simply a function of tax rates. Supply-side arguments, such as those presented by Brimmer and Company [28], tell us that tax expenditures can ultimately lead to an increase in revenues provided that the incentives lead ultimately to productivity growth. Nevertheless, it is important to note that tax incentives are usually open-ended with no limit on the amount (only on the

percentage) a taxpayer can earn. There is an unpredictable element to any tax incentive since the effects are determined by a great many economic and political variables [29].

(4) *Tax incentives often undermine budget control and public accountability.* The stabilizing influence provided by tax incentives vis-a-vis grants assistance is not without costs. Congress has, essentially, forfeited its oversight function in providing assistance through the tax credit policy tool. This has a number of ramifications. In the first place, tax incentives are awarded a status not enjoyed by other government initiatives since they represent, essentially, an "off budget" and uncontrollable expenditure. This not only has the effect of reducing control and coordination of policy, but also shifts the locus of control from the substantive authorizing committees and the budget sub-committees – the bodies that should have the most expertise and responsibility for R& D policy – to the tax committees (the Senate Finance Committee and the House Ways and Means Committee). Congress passed the Congressional Budget and Impoundment Control Act of 1974 in part as a means to exert managerial control of the budget and eliminate "backdoor spending". Tax expenditures are an especially pernicious form of backdoor spending since it is the revenue committees themselves (rather than the authorizing committees) that are opening the backdoor. Unless there is a clear conviction that policies implemented via tax expenditures merit an immunity not granted to other R&D assistance programs, the result is an unnecessary abrogation of policy leadership. In an era of budget-cutting, any step that limits the ability of Congress to manage its policy priorities should be given close scrutiny.

6. Questions of policy design[11]

Assuming that tax incentives for stimulating R&D are needed, then an analysis of the criteria for assessing various R&D tax incentive schemes is paramount. The specific design characteristics which seem to us, and to others [5;7;8;30;31], to be important are discussed below.

(1) *Effects on basic research.* There are theoretical reasons to argue that government policies should be aimed at enhancing basic research since research nearer the basic end of the continuum is likely to provide significant social benefit. There are fewer disincentives for industry investment in applied research and development since the benefits are more appropriable, the level of uncertainty (as opposed to risk) is less, and there are fewer externalities. In our view basic research should receive highest priority in any government attempt to stimulate R&D spending.

The Tax Act does not fare so well by this standard. While there are prohibitions against market research, demonstration projects, and quality control research, applied research or development can qualify as easily (or perhaps more easily since no product can be identified during the basic research stage) as basic research for the tax credit. We do not imply that an increase in applied research is undesirable, only that it is a less desirable target for government incentives. Of course there is a good argument for the structuring of the tax credit: it does not require difficult and perhaps unrealistic distinctions between applied and basic research. Parenthetically, one of the apparent advantages of the Bozeman and Link [13] joint venture tax credit proposal is that it

[11] This discussion draws extensively from Bozeman and Link [13].

does not require such explicit demarcation but, instead, provides a theoretical rationale for firms to move in the direction of more basic research as a means of serving their self-interest.

(2) *Differential treatment.* We are impressed with the arguments that tax incentives are too often a b1unt instrument and that they often reward the wrong taxpayers while doing little for those who could most use the help to underwrite more innovative R&D. A particularly important consideration is that new firms are less likely to benefit from a tax credit of any kind, especially one for incremental R&D. Even if there are generous carry-forward provisions, the risk-bearing R&D-intensive new firm may not be around to enjoy tomorrow's tax benefits. This is a problem that is, incidentally, widely recognized and legislation is pending that would give more favorable treatment to new firms.

A major problem with tax incentives for R&D expenditures is that they often fail to deal with the crucial differences among industries [32] and among firms of different size [33]. One of the advantages of grants assistance programs is that such clear-cut distinctions can easily be made and differential rewards and incentives can be structured according to the apparent social benefit derived from assistance. It is possible to structure tax incentives so that they provide distinctions between industries. But it is not a simple matter to write tax provisions that are sufficiently precise but not hopelessly confusing. Nevertheless one important consideration for the effectiveness of tax incentives is that they have some power to grant benefits to those parties that offer adequate social returns; likewise, benefits – especially windfalls – to unintended parties should be avoided. Otherwise tax incentives are likely to prove highly inefficient, and to foster a potential for wasting resources.

A related issue is the need to reward R&D success rather than R&D activity. Again, the bluntness of most tax incentives means that they hold little promise for distinguishing R&D activity from *successful* R&D activity. But tax incentives that can make some headway in this direction are highly preferable. The exception, of course, is that it is often desirable to reward new firms for R&D activity even if the R&D does not lead immediately to commercialization of technology. As Link [34] shows, firm size is not a prerequisite for successful R&D activities beyond some modest threshold level. Since larger firms will likely benefit more from a tax policy, the thrust of a tax policy approach is less than optimal.

(3) *Administrative ease.* One of the supposed advantages of tax incentives is that they avoid the bureaucratic entanglements and red tape of many grants assistance programs. In most cases there is little art to designing a tax incentive program that is simple to administer; the problem is that administrative schemes are sometimes simple only because the policy is overly broad and insensitive to important, and policy relevant, differences in taxpayers. The key is to strike the proper balance, and if it is not possible to strike a balance then some other policy tool should be considered.

It is important to remember that tax incentives are not a "non bureaucratic" approach to public policy. Often less bureaucracy is entailed initially, but sometimes the bureaucratic morass created by tax legislation is just as troublesome as even those grants assistance programs that have become legendary for their Byzantine administrative structures. Many tax policies avoid a bureaucracy of experts to approve and supervise expenditures, but in its place substitute tax

administrators, tax planners, and a tradition of protracted administrative litigation and controversy [27]. In sum, there is some great appeal to eliminating the need for bureaucratic rule-makers, but if tax incentives simply replace one set of bureaucrats with another and one set of complex rules with another, there is little gain.

(4) *Capacity building.* Both tax incentives and grants assistance programs can generate significant externalities. One of the traditional advantages of grants assistance programs, however, is that those aimed at university-performed R&D have the effect of enhancing graduate education both by providing funds directly to students and supporting projects from which the students learned their trade. With the advent of indirect cost payments, grants assistance programs also supported university infrastructures and other educational and R&D assets. While there is no unanimous agreement as to the benefits of federal research assistance to the universities [35,36], most observers agree that federal support of university-based research has helped build capacity. While capacity building has sometimes been viewed as ancillary to civilian R& D programs, defense programs have been more directly concerned with capacity building.

Tax incentives can also be used for capacity building and one standard for evaluating particular proposals is whether they sew as well as they reap. There are already several provisions in the tax code that may be viewed as incentives for the private support of education and research, and the Tax Act has extended the benefits for allowable deductions for contributions of new manufactured research equipment to universities. As universities and industries look to form closer ties with one another, capacity building criteria should prove even more important.

(5) *Political feasibility.* A few words are in order about the significance of political feasibility as a criterion for evaluating tax policies for R&D. We do not claim for political feasibility anything more than secondary importance; it makes little sense to advance a policy on the basis of feasibility if that policy is, on balance, not desirable. Our basic point is that the economic efficiency of a proposal should not be the only consideration. Sometimes there is a tendency to evaluate proposals exclusively on the basis of economic efficiency (and even then relying on assumptions of perfect rationality having little correspondence with observed patterns of business decision-making or citizens' preferences). As an example, though not an extreme one, we can consider Boskin's [37] recommendations for changing tax policy to enhance R&D and industrial productivity.[12] Even if we assume that each of these proposals makes perfect economic sense, it seems clear that even in a political climate favorable to business there is virtually no chance that many of these provisions would be written into the tax code.

7. Conclusions

Herein we have attempted to review the issues related to stimulating R&D spending through tax incentives. The policy system for supporting R&D in the US is moderately complex, but nevertheless interconnected. Many aspects of R&D policy are in dynamic tension, others appear to be at cross purposes, and still others seem complementary. Any attempt to provide an

[12] Boskin's recommendations include integrating the corporate and personal income tax, gradually reducing and eliminating the capital gains tax, and increasing slowly the number of vehicles and amounts available for tax-free saving and investment.

evaluative overview is less than complete if it focuses on only a part of the policy system (industrial R&D) and on only one policy tool (tax incentives). While a more comprehensive treatment is beyond the scope of this paper, we would be remiss if we failed to note that piecemeal assessments such as ours must ultimately give way to consideration of the multiple tools and multiple purposes of R&D policy.

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