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WOULD A RESEARCH TAX CREDIT BE A GOOD INVESTMENT FOR TEXAS?

THE TEXAS LEGISLATURE is considering a new corporate income tax credit for research and development (R&D) spending within the state. Economists generally believe society benefits when government encourages R&D. The federal government and more than one-third of the states currently offer corporate tax credits to subsidize R&D. Is an R&D tax credit a good idea for Texas? And what would be the best way to structure such a credit?

Roughly $221 billion was spent on R&D activities in the United States in 1998, according to the National Science Foundation. As a share of gross domestic product (GDP), R&D investment was approximately 2.6 percent in 1998. Relative to GDP, the United States spends slightly less on R&D than Japan, but more than Germany, the United Kingdom, Canada and Italy.

Of total U.S. R&D spending in 1998, 15 percent funded basic research—original investigations for the advancement of scientific knowledge that generally do not have specific commercial objectives. Twenty-three percent funded applied research—investigations

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directed to new scientific knowledge that have specific commercial objectives. The other 62 percent of R&D spending went to development—the systematic use of the knowledge gained from research directed toward production of useful materials, devices, systems or methods, including design and development of prototypes and processes.

The private sector funds the majority of R&D activity in the United States. In 1998, industry funded $144 billion, the federal government funded $67 billion, and state and local governments, universities and nonprofit institutions funded $10 billion of R&D activity. Federal research funding as a percent of GDP has declined over the last decade because of the sharp cutback in defense-related research.

Motivation for Encouraging Research

Economists generally oppose tax incentives or subsidies limited to specific categories of investment because they believe the free market and a neutral tax system—one that treats all businesses equally—will direct resources to the uses with the highest return. This does not apply, however, to investments that yield spillover benefits—gains to society that the firm making the investment cannot capture. Some forms of research, such as biotechnology, can produce significant spillover benefits.

For example, if a pharmaceutical firm invests in a new factory and produces more medicine, it can capture the resulting social benefit by selling the medicine. But if the firm invests in a research project and discovers a new medicine, its profits may not fully reflect the resulting benefit to society. The firm can capture part of the social benefit by patenting the new medicine and collecting royalties from its users for a limited period, but there are likely to be spillover benefits the firm cannot capture. Others can freely exploit the ideas embedded in the discovery for other purposes and can produce the new medicine after the patent expires. As a result, the firm may find the new factory more profitable than the research project, even though the research project has higher total benefits to society. Thus, society can benefit if government provides a subsidy that induces the firm to undertake the research project.

Studies estimate that research can have extremely high spillover benefits. For example, Charles Jones and John Williams estimate that R&D spending offers a total return for society of 30 percent per year, compared with 7 percent for other investment. They conclude that R&D spending should be increased by at least a factor of four.[1]

Federal Research Incentives

The federal government employs both direct funding and broad tax incentives for private research. Direct funding is generally used to subsidize research that has very low private returns and very high spillover benefits, because firms are reluctant to engage in such research, even with incentives. Basic research often falls into this category. In 1998, the federal government funded roughly 30 percent of the nation's total R&D investment, but 57 percent of basic research.

Tax incentives may be appropriate for research that has a commercial application and a significant private return, but also has a spillover benefit. In these cases, firms will engage in some research without a tax incentive, but less than is socially optimal. The federal government provides two tax benefits for research spending. First, firms may deduct R&D costs when they are incurred (expense them) rather than amortize them over the period in which the firm expects to profit from the research. Second, some costs qualify for a 20-percent research and experimentation (R&E) credit. In fiscal 1998, firms doing research reduced their federal tax liability by $300 million by expensing research costs and by another $2.1 billion by using the R&E credit.

How the Federal Tax Credit Works

Although a wide range of research costs may be expensed, the R&E credit has been limited (since 1986) to "qualified research expenses" that meet sev-

Federal Definition of "Qualified Research Expenses"

Research must consist of a "process of experimentation" in engineering, physics, biology or computer science and must seek "technological" information not commonly known to skilled professionals. The research effort need not be successful. The information sought must be useful in developing a "new or improved" business product or technique and must relate to function, performance, reliability or quality, and not style. The credit does not apply to "reverse engineering," market research, routine quality control or research following commercial production.

The credit applies to the cost of research supplies and wages paid to workers performing, supervising or supporting research, but not to payments for land, structures or equipment (except payments to lease computers). Research must be conducted within the United States and cannot be funded by grants.

SOURCE: Internal Revenue Code and Treasury regulations.

eral criteria specified by Congress. These criteria, summarized in the box, generally exclude development, which Congress felt had little spillover benefit. Since firms do little basic research, the credit largely benefits applied research. Many of the criteria are subjective, and the IRS and firms continue to dispute their interpretation.

The federal R&E credit is a temporary provision, which keeps firms uncertain about its long-term availability. It has been renewed nine times since its enactment in 1981. In four cases, the credit was extended before it expired. In the other five cases, the extension was adopted as long as 417 days after the expiration. In four of those cases, the credit was reinstated retroactively to its expiration date. But in one case, after the credit expired on June 30, 1995, the extension was unexpectedly made retroactive only to July 1, 1996, denying any credit for expenses in the preceding year. The nine extensions have been for periods ranging from six to 36 months. The credit expires again on June 30, 1999.

The R&E credit is an incremental credit, applying only to qualified research expenses in excess of a base amount. During 1981–89, the credit used a rolling base period, in which each firm's base amount in each year depended on its research spending during the preceding three years. The credit now uses a fixed base period. Each firm's base amount equals its average gross receipts during the previous four years multiplied by the 1984–88 ratio of its qualified research expenses to its gross receipts (special rules apply to firms established since 1984).

Manufacturing firms claim approximately three-quarters of the credit, with the largest amounts going to the pharmaceutical, electrical equipment, transportation equipment and machinery industries. Many military and aerospace firms receive little benefit from the credit because their current research spending is below their 1984–88 levels. Large firms claim the bulk of the credit.[2]

How Do States Encourage Research?

Nearly all states provide some tax relief for companies investing in research and development. A quick overview of the bewildering variety of state tax rules provides a vivid reminder of the burden placed on firms complying with multiple state tax codes. Many states provide exemptions or credits against sales or property tax for R&D investment.[3]

Forty-five states, including Texas, impose a corporate income tax.[4] All of these states allow research costs to be expensed, but, as shown in Chart 1, only 21 of them provide R&D credits. Each state's credit applies only to research conducted within the state. The Mississippi and Vermont credits are linked to R&D employment, and the New York credit is linked to purchases of R&D equipment. The other 18 state credits apply to R&D spending.

As Table 1 details, these 18 state R&D tax credits are nearly all incremental, with substantially different marginal credit rates and base periods. West Virginia uses a nonincremental credit, while Connecticut allows firms to claim both an incremental credit and a nonincremental credit. Five states use rolling base periods, 11 states use a 1984–88 fixed base period (the same as the federal credit), and Maine uses both a roll-

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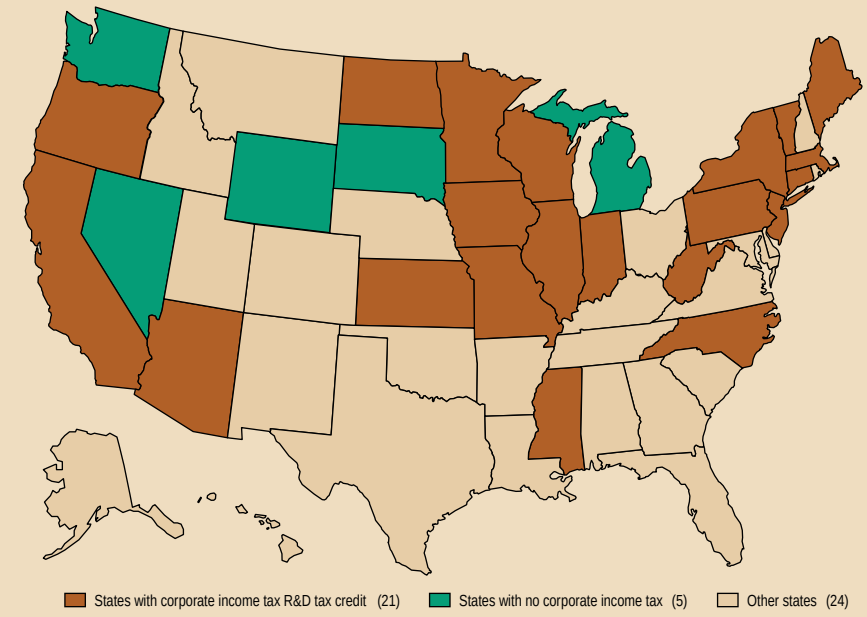
The federal credit and most state credits are designed to subsidize only the incremental increase in R&D spending.

CHART 1
STATES OFFERING R&D TAX CREDITS
(Corporate Income Tax)



SOURCES: Texas State Comptroller; Technology Business Council.

ing and a fixed base period (1995–97). The number of firms claiming the credit and the total amount claimed vary widely among states. Missouri and Pennsylvania impose statewide limits on the amount of credit available, providing the credit to firms on a first-come, first-served basis. The California credit is the largest in absolute terms, with over 1,700 firms claiming $314 million.

The R&D credits are nonrefundable, so firms cannot use the credit in excess of their tax liability. Many states further limit the credit to a fraction of tax liability, which curtails the credit for many firms in states with higher credit rates.

The state credits usually apply to the "qualified research expenses" that receive the federal credit, but Connecticut and Kansas provide credits for any research spending that the federal tax code allows to be expensed. The West Virginia credit includes payments for land, structures and equipment (all excluded from the federal definition), but the credit is only available to firms that produce manufacturing and natural resource products or electric power. The North Carolina credit is also limited to particular industrial sectors, primarily manufacturing and software firms.

The types of industries claiming the credit are generally similar to those claiming the federal credit. Seed companies are important users of the Iowa credit. Large firms generally receive most of the credits.

Advantages and Disadvantages of Incremental Credit

The federal credit and most state credits are designed to subsidize only the incremental increase in R&D spending. The primary advantage of an incremental credit is that it can provide greater marginal incentives with lower revenue losses (more bang for the buck). The ideal incremental credit would set each firm's base amount equal to the amount of research that the firm would have done without any credit. For example, a firm that would spend $100 on R&D without any credit could be offered a 20-percent credit for any R&D spending in excess of $100. This credit offers a 20-percent marginal incentive for R&D spending but at much lower revenue cost than a 20-percent nonincremental credit. If the firm

TABLE 1
STATE CORPORATE INCOME TAX CREDITS FOR R&D SPENDING

State	Took effect	Marginal rate (percent)	Base period	Number of firms	Credit amount (millions of dollars)	Expiration
Arizona	1994	20, 0[1]	1984–1988	81	7	2003
California	1987	11	1984–1988	1,704	314	P
Connecticut	1993	20	Preceding year	236	21	P
"	1993	1, 2, 4, 6[2]	NI	177	9	P
Illinois	1990	6.5	3 preceding years	N/A	35	1999
Indiana	1989	5	1984–1988	37	15	1999
Iowa	1983	6.5	1984–1988	N/A	N/A	P
Kansas	1988	4.33	2 preceding years	47	1	2000
Maine	1996	5	3 preceding years	10	1	P
"	1998	100	1995–1997	N/A	N/A	P
Massachusetts	1991	10	1984–1988	817	62	P
Minnesota	1987	5, 2.5[3]	1984–1988	268	17	P
Missouri	1994	6.5, 0[4]	3 preceding years	67	16[5]	P
New Jersey	1994	10	1984–1988	150	19	P
North Carolina	1996	5	1984–1988	N/A	N/A	2001
North Dakota	1988	8, 4[6]	1984–1988	< 5	< .5	P
Oregon	1989	5, 0[7]	1984–1988	80	8	2001
Pennsylvania	1997	10	4 preceding years	299	15[8]	2004
West Virginia	1986	10	NI	5–10	1–2	P
Wisconsin	1986	5	1984–1988	170	12	P

[1] Arizona credit is 20 percent of creditable spending but cannot exceed $500,000.
[2] Connecticut nonincremental credit is 1 percent of first $50 million of spending plus 2 percent of next $50 million plus 4 percent of next $100 million plus 6 percent of additional spending.
[3] Minnesota credit is 5 percent of first $2 million of creditable spending plus 2.5 percent of additional creditable spending.
[4] Missouri credit is 6.5 percent of creditable spending, but with no additional credit for spending in excess of double the base amount.
[5] Starting in 1999, Missouri limits statewide credits to $10 million.
[6] North Dakota credit is 8 percent of first $1.5 million of creditable spending plus 4 percent of additional creditable spending.
[7] Oregon credit is 5 percent of creditable spending but cannot exceed $500,000.
[8] Pennsylvania limits statewide credits to $15 million.

NOTES: Table does not reflect all details of each state credit. Credit rates refer to 1998; number of firms and credit amount generally refer to 1996 or 1997. Connecticut and Maine each allow firms to claim two credits. NI: Nonincremental credit. P: Permanent credit. N/A: Not available.

SOURCES: Texas State Comptroller; Technology Business Council; state revenue departments; authors' analysis of state statutes and tax forms.

To calculate an incremental credit, each firm's base amount is linked to its past research spending, which can be a poor estimate of the amount it would have spent today without the credit.

increases its research spending to $110, this credit has a revenue loss of $2. A 20-percent nonincremental credit should stimulate the same increase in R&D spending (since the marginal incentive is the same), but the revenue loss would be $22. The incremental credit is cheaper because it does not give the firm $20 to encourage research that it was going to do anyway.

Unfortunately, real-world incremental credits do not work as well as hypothetical examples. To calculate an incremental credit, each firm's base amount is linked to its past research spending, which can be a poor estimate of the amount it would have spent today without the credit. If the firm in the above example were assigned a $70 base amount and spends $110 on R&D, a 20-percent incremental credit would be $8. This amount is much larger than the ideal incremental credit. More disturbingly, if the firm were assigned a $130 base amount, it would continue to spend $100 because it would receive no subsidy for increasing its spending to $110. The lack of marginal incentives for firms with high base amounts reduces the overall stimulus to research and distorts the allocation of research across firms, since research at high-base-amount firms may have large spillover benefits.

Of course, the incremental credit is also more complex than a credit that applies to all qualified research spending, because firms and the IRS must reconstruct baseline R&D spending. Rules must also specify the treatment of

firms' base amounts during mergers and spin-offs.

How Do Tax Credits Affect Firms' R&D Decisions?

Firms look at many factors when making location and investment decisions.

Several studies have attempted to estimate the effect of the federal tax credit on business behavior. In general, the evidence suggests that the credit has increased R&D spending, but the size of the impact is uncertain and the spillover benefits from the additional R&D have not been estimated.

In 1996, the General Accounting Office surveyed eight studies that examined the effects of the federal R&E tax credit.[5] All studies concluded that the credit increased R&D spending, but the estimated magnitude of the increase differed greatly. Four studies estimated that R&D spending induced by the credit exceeded its revenue loss (by a factor as high as two), while the other studies suggested that the increase in R&D was smaller than the revenue loss. None of the studies specifically measured the spillover benefits from the research induced by the credit or determined which types of research had been increased.

There has been virtually no examination of the effectiveness of state R&D credits. If R&D is sensitive to incentives, as suggested by the studies of the federal credit, then state credits may also stimulate R&D, although the credits may just induce firms to relocate R&D from one state to another.

Firms look at many factors when making location and investment decisions. Land and construction costs, the location of suppliers, distribution facilities and labor, as well as natural amenities, such as climate, all contribute to a state's attractiveness for investment. Government regulations, overall tax level and tax structure, and the mix of available public services, such as roads and education quality, also influence corporate decision making. Although it is possible that an R&D tax credit could tip the balance in this process, the value of state R&D tax credits is relatively small compared with the huge investment necessary for most research projects. In fact, each state R&D credit amount is generally about 1 percent or less of total R&D spending in the state. Even in states with credit rates comparable with the 20-percent federal rate, firms are likely to have insufficient tax liabilities to fully use the credits, although they can carry them forward.

In fact, although new R&D tax credits have been adopted recently in some states, there also has been movement in the other direction, in part because of concern that the credits are ineffective. New Hampshire's R&D credit was recently allowed to expire, and the Missouri legislature is considering a proposal to suspend the state's R&D credit.

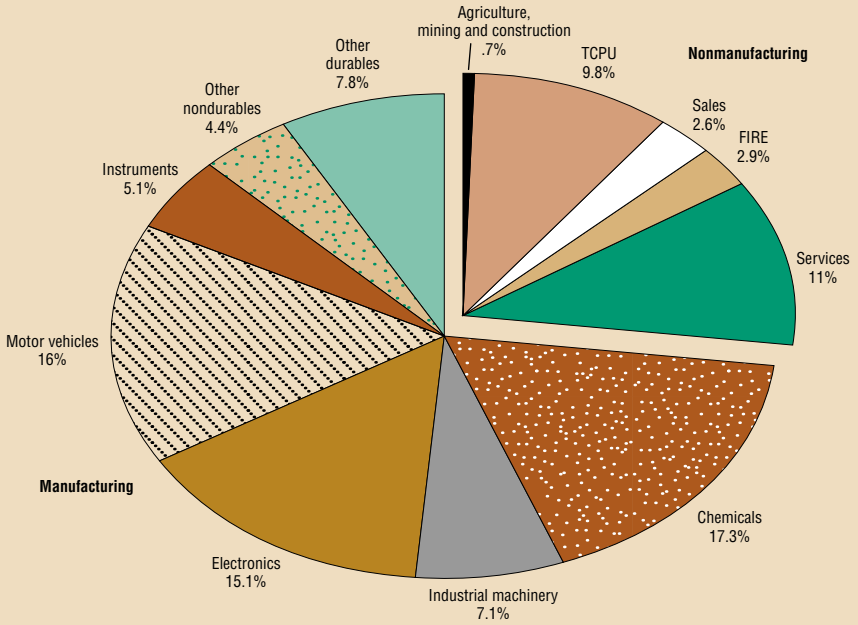
A Texas R&D Credit?

Texas ranks sixth among states in the amount of R&D performed by industry, according to 1995 data gathered by the National Science Foundation. The five states with more R&D—California, Michigan, New York, New Jersey and Massachusetts—either have no corporate income tax or offer an R&D credit.

Can Texas benefit from subsidizing R&D activities within the state? As noted above, most economists believe that the public benefits of R&D are greater than the private benefits, suggesting that it may be appropriate public policy to subsidize these expenditures. But no studies have evaluated the benefits to a state that subsidizes R&D investment. Although a state subsidy might stimulate additional R&D spending and produce spillover benefits, it is not clear that the spillover benefits would accrue in that state. A state might profit from letting other states provide the subsidies and enjoying the spillover benefits from the additional research in those states, without imposing revenue losses on its own firms and residents. If a state R&D credit merely changes the location of R&D activity, there would be no spillover benefits in the form of additional innovation. In this case, there might be little economic rationale for a state R&D credit.

Of course, a state R&D tax credit would create additional jobs and income in industries performing R&D, much as a municipal subsidy for the

CHART 2
INDUSTRIES EXPECTED TO USE TEXAS R&D CREDIT
(Nonincremental Credit)



NOTES: Percentages sum to less than 100 percent because of rounding. TCPU is transportation, communications and public utilities and FIRE is finance, insurance and real estate.

SOURCE: Texas State Comptroller.

construction of a sports stadium would create additional jobs and income in sports-related industries. But such incentives may not stimulate an area's economic growth as effectively as broad-based incentives for job creation.

Some economists have argued that a state should design its incentives to attract well-educated high-wage workers because they may provide greater economic benefits for the state. Clearly, an R&D credit would tend to attract these types of workers. Even so, it may be more efficient to provide incentives for all firms hiring well-educated workers, rather than only firms that conduct research. Adding tax preference for firms engaging in research requires increasing the tax burden on other firms, who may hire equally valuable workers.

If Texas adopts an R&D tax credit, the state should consider a nonincremental credit, which would be more neutral than an incremental credit because it would offer the same percentage marginal subsidy to any firm investing in research and development. A nonincremental credit would also be easier to administer.

As is true for the federal credit, manufacturing firms are expected to be the largest recipients of a Texas R&D credit. As shown in Chart 2, if Texas adopted a nonincremental credit, manufacturing industries—mostly firms producing automobiles and parts, chemicals and telecommunications equipment—would receive over 70 percent of the credit. Service firms, like software developers and research labs, would also benefit.

The allocation of the credit would be slightly different if Texas adopted an incremental R&D credit. The share of the benefits going to manufacturing industries would be still higher, 78.5 percent, and the share accruing to most other firms would be smaller. Service firms would receive 8.5 percent of an incremental credit, while transportation, communications and utilities firms would receive roughly 8 percent.[6]

Summary

Federal incentives for research and development activities may be a good investment because research may produce spillover benefits for society in addition to the private benefits accruing to the firm performing the research. It is less clear whether the same is true for a state subsidizing research within its borders.

Even when state R&D subsidies increase nationwide research, not enough of the spillover benefits may accrue to an individual state to warrant the revenue loss of a credit. When research incentives merely shift the location of research activities, they generate no spillover benefits in the form of additional innovation. A state R&D credit could generate indirect spillover benefits by attracting well-educated or high-wage workers, but this goal might be achieved more efficiently through broad-based incentives for the hiring of such workers in all industries.

If Texas adopts an R&D credit, it should consider using a nonincremental credit because it would be easier to administer and would offer the same percentage subsidy to R&D investment by any firm.

—Fiona Sigalla
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Notes

1 Charles I. Jones and John C. Williams, "Measuring the Social Return to R&D," *Quarterly Journal of Economics*, November 1998, pp. 1119–35.

2 Office of Technology Assessment, "The Effectiveness of Research and Experimentation Tax Credits," Congress of the United States, September 1995, pp. 18–20.

3 The State Science and Technology Institute provided a detailed list of state research and development tax incentives available in 1996.

4 The Texas corporate franchise tax is based partly on capital or net assets and partly on earned surplus or net income.

5 General Accounting Office, *Review of Studies of the Effectiveness of the Research Tax Credit*, GAO-GGD-96-43, May 1996. One of the eight studies actually examined the effects of tax rules related to research by multinational firms rather than the R&E tax credit.

6 The authors thank Craig Doherty of the Texas Comptroller's Office for these estimates.