Appendix G.—Tax Policy and Research and Development on Medical Devices[1]

Introduction

Much attention has been paid to potential effects of tax policy on incentives for innovation. Renewed interest in this question has recently been prompted by enactment of the Economic Recovery Tax Act of 1981 (ERTA) and the Tax Equity and Fiscal Responsibility Act of 1982 (TEFRA). As a result of both ERTA and TEFRA, basic changes were made in both the personal and the corporate income tax including: 1) changes in marginal tax rates on personal income, 2) changes in the tax rules for depreciation of capital goods, and 3) enactment of new provisions applying to research and development (R&D).

Assessing the impact of these tax changes on the financial incentives for innovation generally, let alone innovation in medical devices, is extremely complex. However, it is possible to identify two distinct ways in which tax policy changes such as ERTA and TEFRA can affect incentives for innovation. First, tax incentives may alter the expected after-tax returns received by prospective purchasers of goods that embody innovations, thereby stimulating, or inducing, the demand for such innovations. Second, both personal and corporate income taxes will cause after-tax prices in capital markets to diverge from pre-tax prices. Both the size of this divergence and its pattern among different types of investments may influence the willingness of firms and individuals to invest in R&D and innovation.

Taxes and Induced Innovation

There is some evidence that the level of innovative activity in the development of particular goods is related to the overall level of demand for those goods. A particularly important example of such induced innovation is the case of capital goods innovation, where several empirical studies have shown that the level of capital spending by industry affects the level of innovation in capital goods (273, 276). Because ERTA/TEFRA permit firms to deduct the costs of depreciable assets more rapidly than was previously allowed, these tax policy changes are expected to stimulate greater capital spending by industry. According to the induced-innovation hypothesis, such increased capital spending should also stimulate innovative activity among those firms producing capital goods.

Many medical devices are clearly capital goods. However, the market for medical devices differs from the market for other capital goods in one important respect. Because many of the purchasers of medical devices are not subject to taxation, their demands for medical devices should not be directly affected by tax rules governing depreciation of capital goods. Thus, the tax provisions of ERTA/TEFRA may be expected to have a smaller impact on the capital spending decisions of purchasers of medical devices than of purchasers of other capital goods.

This situation implies that any induced innovation attributable to ERTA/TEFRA will also be less in the case of medical devices than other capital goods. Of course, TEFRA contained a section specific to Medicare payment of hospitals, which, with its subsequent modifications under the Social Security Amendments of 1983 (Public Law 98-21), dramatically altered the incentives of hospitals to purchase medical technology (see ch. 3 for details).

Another, perhaps more important, way in which the tax code can affect the demand for medical devices is through the tax treatment of employer-paid health benefits. Because such benefits are typically treated as nontaxable fringe benefits, employees, particularly those facing high marginal tax rates, have a tax incentive to receive part of their labor compensation in the form of such benefits. The growth of health benefit plans has been one of a number of factors contributing to growth in demand for health services during the postwar period, and this growth in demand may also have encouraged innovations in medical devices.

Although the tax-exempt status of fringe benefits has not been affected by ERTA/TEFRA, there has been some support for changes in tax law which would limit the tax exemption currently enjoyed by all fringe benefits, included employer-paid health benefits. If these changes were enacted, it is likely that both the level and composition of demand for health services would be affected, and this change in turn could have some impact on the level and type of R&D in the medical devices industry.

Taxes and Suppliers of Innovation

The ultimate suppliers of innovations are the individuals or firms who choose to allocate resources to R&D rather than to other investment projects. In part, such choices are made outside the boundaries of the firm in external capital markets by individual investors who must decide how to allocate their portfolios of

[1]This appendix was written for OTA by Barth and Cordes *(27)*.

wealth among different investments. In part, such choices are made within the firms by managers who must choose among competing uses of a firm's capital budget. In both cases, however, the tax treatment of different investment options is an important factor in the ultimate investment decision.

Two alternative investments may be equally productive before the income from such investments is taxed and yet earn different after-tax returns if one investment is taxed relatively more heavily than the other. In such an event, two investments which are equally attractive insofar as social returns are concerned are not equal in the eye of the prospective investor, who will choose the investment with the higher after-tax return.

In the case of R&D investments, there are two principal ways in which the tax code affects their after-tax return compared to other investment activities. The first is the tax treatment of capital gains. The second is the tax treatment of inputs specific to the innovation process.

Taxation of Capital Gains

The expected returns on an investment may be realized through annual flows of income, through capital gains or losses resulting from changes in the asset price of the investment, or through some combination of annual flows and changes in asset values. In the absence of taxation, the manner in which the return was expected to be received would be irrelevant to the ultimate investment decision. All that would matter would be the total expected return (annual expected flows plus or minus capital gains and losses) and the expected risk (the variance of realized returns around the total expected return). However, because capital gains and capital losses are treated differently from income under U.S. income tax, investments whose returns are realized primarily through capital gains or capital losses will be evaluated on a different after-tax basis from investments whose returns are realized through annual flows of ordinary income.

At present, capital gains are not taxed until they are actually realized into cash through sale of the asset. More importantly, if the asset is held for longer than 1 year, the capital gain that is realized is taxed at a rate which is generally 40 percent of the tax rate applied to ordinary income. Thus, for example, if a person's tax rate on ordinary income were the maximum rate of 50 percent, the tax rate applied to each dollar of long-term capital gain would be 20 percent. If the investment should prove unsuccessful, and a capital loss is realized, the loss maybe offset dollar for dollar against capital gains. However, if reported capital losses are greater than the capital gains, the net capital loss may be only partially applied as a deduction against ordinary income.

In effect, the U.S. tax system provides preferential treatment to investments which pay off in the form of capital gains, while providing less than complete tax offsets to investments which result in capital losses. Assessing the impact of such a system on the propensity of investors to take risk—and by implication to invest in innovative activities—is an extremely complex task, and the conclusions that emerge from such an assessment depend on the standard used for comparison.

If the alternative is a tax system which taxed capital gains in full but also allowed full and complete deductibility of capital losses, it would be impossible to ascertain on theoretical grounds which of the two tax regimes—the current one, or the alternative-is the most favorable to risk-taking because the differences would work in opposite directions. However, compared with an alternative system which taxed capital gains the same as ordinary income but continued to allow only partial tax offsets for capital losses, preferential tax treatment of capital gains encourages more risk-taking. That is, given that loss offsets are incomplete, partial rather than full taxation of capital gains may be one way of preserving incentives for risk-taking.

Two groups of individuals for whom the tax treatment of capital gains would appear to be particularly important are the entrepreneur-founders of new ventures and the venture capitalists who provide external financing to such ventures. Those who choose to become entrepreneurs have in effect chosen to forgo relatively certain returns to their human capital (i. e., labor) which could be earned from salaried employment, as well as returns to any personal financial capital they invest, in order to develop an idea or invention into a new product or service.

Presumably, this decision is motivated by a variety of considerations and is certainly not limited to tax factors. However, the fact that the expected returns to entrepreneurship will typically be realized in the form of increases in the value of the entrepreneur's ownership share in the firm, which in turn will be taxed favorably as capital gains, would at the margin encourage rather than discourage entrepreneurship. Indeed, there is some empirical evidence that the preferential tax treatment of capital gains has influenced the decision of individuals 'between salaried employment and entrepreneurship (151).

Similar considerations apply to individual venture capitalists. Although such persons are not themselves actively engaged in the development of innovations, they typically share in both the risks and rewards of entrepreneurship through equity participation in the entrepreneurial firm. The fact that any returns to such participation are likely to be realized through appreciation in stock values, and therefore to be taxed favorably as capital gains, would, at the margin, encourage the commitment of venture capital.

Data provided to OTA on the organized venture capital market suggest that venture capitalists are more likely to commit funds to the early stages of firm development in the case of medically oriented ventures than they are in the case of other industrial ventures (see table 30 in ch. 4). The data also show that capital provided to medical device ventures is more likely to come from private, independent sources than from corporations or small business investment companies (443). These two considerations imply that ***individual*** tax incentives which encourage the commitment of risk capital may be of special importance to innovation in medical devices.

Finally, the current tax treatment of capital gains interacts with the double-taxation of dividends at the corporate level to encourage earnings retention rather than dividend payout. If earnings are paid out in dividends, such income will be taxed in full at ordinary income tax rates. However, if the earnings are retained and reinvested, stockholders can defer paying personal taxes until any expected capital gains are realized through sale of stock, and then do so at preferential capital gains tax rates. As a result, the effective tax on income from corporate equity is less under earnings retention than under dividend payout. At the margin, this encourages firms to retain earnings and, if retained earnings are an important source of funds for some innovations, enhances the financial resources available for innovative activities.

The current tax treatment of capital gains would appear to provide benefits to investments in medical device innovations which are equal to those provided to other risky investments, However, the overall value of the tax preference on capital gains to the highest income investors has been somewhat reduced by ERTA, which lowered the maximum tax rate on "unearned income" from 70 to 50 percent.

Corporate Tax Policy

In the case of relatively established firms, the decision to engage in R&D requires that resources be used to develop and produce a new product which could instead be used to enhance the firm's ability to produce its existing products. If the firm's ultimate objective is to maximize its value, this implies that capital should be allocated to R&D up to the point where the last dollar allocated earns a risk-adjusted expected after-tax return equal to that earned from a dollar invested in a more traditional investment activity.

If the tax code is neutral in its treatment of the productive inputs used in different investment projects, tax considerations will not influence the firm's allocation of capital among competing investment activities. However, if the tax code favors the use of certain inputs, and if these favored inputs are specific to certain types of investment projects, tax considerations will affect the amount of capital allocated to different projects. In effect, investments that use tax-favored inputs will be encouraged, because they will need to earn a lower pre-tax return in order to earn a given after-tax return than will investments that do not use tax-favored inputs.

Tax Treatment Before and After ERTA/TEFRA.–In the case of R&D, the issue is whether the inputs used for R&D are treated more or less favorably than inputs used in other investment activities. The two principal inputs needed to develop innovations are tangible capital in the form of depreciable assets and intangible capital arising from expenditures on R&D.

Prior to the enactment of ERTA/TEFRA, tangible capital used in conducting R&D was treated the same as tangible capital used for other purposes. Firms using such capital were entitled to claim an investment tax credit on new equipment, but not structures, and could then claim a stream of depreciation deductions over a number of years based on guidelines established by the Department of Treasury. However, neither the amount of the investment credit nor the speed at which the asset could be depreciated were related to the type of investment project in which the asset was used—i.e., to whether the asset was used in R&D or in a more traditional investment activity.

Other costs of R&D were, however, given special treatment. Specifically, section174 of the Internal Revenue Service Code allowed the salaries and expenses incurred to develop R&D to be deducted immediately in the year incurred. This "expensing" of R&D was viewed as preferential treatment because R&D salaries and expenses were seen as part of the costs of acquiring an intangible asset which was capable of providing services to the firm over a number of years. Under this view, expensing confers favorable tax treatment on R&D activities.

Enactment of ERTA/TEFRA has altered the relative position of different kinds of investments in three ways. First, though the rules governing R&D expensing were not changed by ERTA/TEFRA, the rules governing depreciation of other capital assets have been liberalized considerably by adoption of the Accelerated Cost Recovery System (ACRS). Second, for the first time, tax depreciation rules treat equipment used in R&D as different from equipment used in other

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activities. Third, for the first time, R&D outlays which qualify for expensing may also qualify for a tax credit. In the remainder of this section, we examine how these measures-both singly and in combination-affect the relative attractiveness of innovative investments generally, and innovation in medical devices specifically.

Accelerated cost recovery. ACRS, enacted as part of ERTA with some modifications in TEFRA, speeds up the rate at which the costs of using depreciable assets may be recovered.

Depreciable capital assets (e.g., equipment and buildings) are important inputs into R&D. However, the capital intensity of R&D differs among projects so that the impact of changes in cost recovery rules will be greater for some types of R&D projects than for others. Liberalized cost recovery favors R&D projects that are relatively capital-intensive.

Detailed data on the capital intensity of R&D in different industries do not exist. However, National Science Foundation (NSF) data can be used to construct a crude index of factor intensity in R&D: the ratio of R&D expenditures to scientists and engineers employed in R&D. Other things being equal, this ratio should be higher in industries in which R&D is more capital-intensive. Based on this ratio, one may therefore ascertain whether R&D activities in any given industry benefit relatively more or less from ACRS.

While NSF data do not permit the above ratio to be calculated specifically for medical device producers, the ratio can be calculated for producers of optical, surgical, and photographic equipment (Standard Industrial Classification (SIC) codes 383-387). Between 1976 and 1979, the R&D capital-intensity ratio for this industry group exceeded the average ratio for all manufacturing industries. This suggests that the R&D investments of medical device producers in these SIC codes benefit relatively more from ACRS than do R&D investments of other manufacturers.

The overall effect of the ACRS on R&Din medical devices is unclear, however, because ACRS moves the tax treatment of non-R&D capital closer to that of R&D expensing. This reduces the relative attractiveness of using business funds for R&D expenditures that qualify for expensing. While ACRS has a scale effect favorable to all investment projects using depreciable capital, it has a substitution effect which tends to favor capital investments that do not involve R&D (27). That is, while ACRS reduces effective tax rates on all investments, it reduces them more for investment projects which are relatively less intensive in the type of R&D which qualifies for expensing. The net effect of the two effects on R&D in medical devices is unknown.

Special treatment of R&D equipment, One provision of ACRS which applies specifically to depreciable assets used in R&D is the assignment of all R&D equipment to the "3-year recovery class." Because of this provision, all equipment used in R&D must be depreciated over 3 years, even though the ACRS guidelines would normally require that the same equipment be depreciated over a longer period of time if used for other purposes. Because non-R&D equipment is assigned to either the 5- or 10-year recovery class, this provision would appear to favor R&D by allowing the capital costs of equipment to be deducted more rapidly if the equipment is used for R&D rather than in other activities. However, while equipment used in R&D may be written off more rapidly, all equipment in the 3-year recovery class qualifies for a smaller investment tax credit—6 percent—than equipment in the longer lived asset classes, which is eligible for a 10-percent investment credit.

Under ERTA, the disadvantage of receiving a smaller investment credit was large enough to offset the advantage of more rapid writeoff. However, because of changes made in TEFRA which reduced the value of the writeoff, this no longer appears to be the case. Given the current set of tax rules, the net effect of grouping R&D equipment into a special recovery class is favorable to equipment used in R&D. (For a more elaborate discussion, see Barth, Cordes, and Tassey, 1984 (27); Collins, 1983 (65); Zakupowsky and Sunley, 1982 (466).)

Tax ***credit*** *for* ***incremental R&D.*** As a result of ERTA, firms can also claim a tax credit for certain R&D spending. The amount of the credit equals 25 percent of the amount of which "qualified research expenses" during a year exceed the base period level of such expenses. The base period level is the average qualified expenses of the 3 preceding years, while qualified expenses are those defined in keeping with section 174 (the R&D expensing provision). If the firm pays other parties to conduct R&D, 65 percent of such purchases are deemed to be qualified research expenses. The R&D credit is scheduled to expire as of January 1, 1986.

Predicting the impact of the existing R&D tax credit is difficult for two reasons. First, the R&D credit is temporary rather than permanent. Second, the amount of the credit is based on incremental rather than total expenditures. A detailed analysis of the effect of the R&D credit is beyond the scope of this discussion (see Barth, Cordes, and Tassey, 1984 (27) for a complete treatment), but it is possible to make a rough assessment of the benefits which producers of medical devices have thus far derived from the R&D credit in relation to firms in other industries.

In a preliminary sample of 1981 tax returns taken by the Department of Treasury, producers of optical, medical, and ophthalmic goods claimed R&D credits equal to 5.4 percent of total eligible R&D spending, while the corresponding figure for producers of other electrical equipment, including manufacturers of electronic medical devices, was approximately 3.5 percent (418). These percentages may be compared with the percentage for all of the manufacturing firms sampled, which was 4.8 percent.

Results reported by Eisner and colleagues for 1981, based on data in the Compustat tapes, are qualitatively consistent with these estimates. Specifically, Eisner and colleagues calculate that firms in the NSF industry group "optical, surgical, and other instruments" claimed R&D tax credits equal to 4.6 percent of eligible R&D, as compared with all manufacturing firms, which claimed R&D credits equal to 3.3 percent of eligible R&D (98a). However, their predictions for 1982 based on simulations indicate that producers of optical, surgical, and other instruments would be eligible to claim R&D credits equal to only 2.6 percent of qualifying R&D, as compared with all manufacturing firms, which would be able to claim credits equal to 2.8 percent of eligible R&D spending.

The differences reflect differences among the sampled firms in the rate of growth in eligible R&D. However, because the numbers pertain only to eligible R&D, they provide but a partial view of the relative impact of the R&D credit. The reason is that total R&D spending consists both of outlays for eligible R&D and outlays for R&D depreciable capital. Unfortunately, because R&D depreciable capital does not qualify for special tax treatment, firms are not required to report this component of R&D in their tax returns. Hence, it is difficult to estimate precisely the amount of R&D claimed as a percent of all R&D.

A crude estimate of this latter magnitude may be obtained as follows. In the case of all manufacturing firms, it has been estimated that total company R&D spending equals roughly 2 percent of sales (423). However, the total amount of eligible company R&D reported by manufacturing firms in the Treasury sample equals only about 0.66 percent of the receipts reported by the firms (418). This figure suggests that eligible R&D spending equals roughly 33 percent of all R&D spending by firms in the sample. In this case, the amount of R&D credits claimed as a percentage of *all R&D spending* would be 1.6 percent (one-third of 4.8 percent).

By comparison, NSF estimates that producers of optical, medical, and surgical instruments that perform R&D spend amounts on R&D which equal roughly 5 percent of sales (423). The total amount of eligible R&D reported by sampled producers of optical, medical, and ophthalmic goods equaled 0.8 percent of reported receipts. Thus, eligible R&D equaled roughly 16 percent of all R&D spending by this group of firms, so that the amount of R&D credits claimed as a percentage of all R&D would be 0.9 percent. With the same procedure it is estimated that producers of other electrical equipment (including medical electronic devices) claimed credits equal to 0.5 percent of total eligible R&D.

Thus, as a percentage total of R&D spending, the amount of R&D credit claimed by medical device producers may be less than that claimed by all manufacturing firms. Of course, the industry classifications make it difficult to generalize about medical devices per se. The difference arises because eligible R&D may be a smaller share of total R&D among medical device producers than it is among all manufacturing firms.

Conclusion

The analysis above suggests that the current tax system is generally favorable to R&D investments, but the incentives differ both among different types of innovation and among different phases of the innovation process. With respect to medical devices, the limited data available suggest that R&D is relatively capital-intensive. Consequently, medical device R&D should benefit somewhat more than other industries' R&D from the recent liberalization of tax depreciation allowances. However, to the extent that the innovative process in medical devices is more capital-intensive, the incentive effects of the incremental tax credit for R&D may be somewhat less for medical device producers than it is for firms whose R&D is more 1abor-intensive, because the special tax treatment of R&D does not apply to capital expenditures.