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3 Corporate Capital Budgeting Practices and the Effects of Tax Policies on Investment

Lawrence H. Summers

The importance of depreciation and investment tax credit provisions in determining the level and composition of investment is widely recognized. Corporations carefully take account of depreciation tax benefits in their capital budgeting decisions. Therefore, economists analyze investment incentives by postulating that the present value of depreciation tax deductions along with the investment tax credit determines the effective purchase price of new capital goods, which in turn determines the cost of capital. Measures of the cost of capital are used widely in evaluating the likely effect of proposed tax reforms on the total level of investment and in assessing the distortions across capital goods caused by tax rules.

In both corporate investment decisions and economists' evaluations of tax policies, the present value of the depreciation deductions associated with specific investments plays a key role. Therefore, the choice of a discount rate to use in calculating this present value is fairly important. For example, the adverse effect of inflation in conjunction with historic cost depreciation on investment results from the increased discount rate that must be applied to future nominal depreciation allowances. At a zero discount rate, all depreciation schedules that permitted assets to be fully depreciated would be equal. It is only because

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of discounting that depreciation schedules affect investment decisions, and their effects depend critically on the assumed discount rate.

Tax reform proposals often change the extent to which depreciation tax benefits are "backloaded." For example, Auerbach and Jorgenson's proposal (1981) would have given firms all of their depreciation benefits in the year that investments were made. On the other hand, the president's recent proposal (U.S. Treasury Department 1985) stretches out the tax benefits associated with investment outlays by indexing depreciation allowances and abolishing the investment tax credit. A comparison of either of these proposals with current law depends critically on the discount rate applied to future tax benefits in computing the cost of capital.

Despite its importance to both corporate decision making and economic analysis, the choice of an appropriate discount rate for depreciation allowances has received relatively little attention from tax analysts. This paper examines both theoretically and empirically the discounting of depreciation allowances and its implications for tax policy; I conclude that economic theory suggest that a very low and possibly negative real discount rate should be applied to future tax benefits. However, empirical evidence from a survey of 200 major corporations suggests that most companies use very high real discount rates for prospective depreciation allowances. This conflict makes alternative tax policies difficult to analyze. It surely suggests that there is little basis for confidence in tax policy assessments based on specific assumed discount rates that are constant across companies.

The paper is organized as follows. Section 3.1 argues that, given the risk characteristic of depreciation tax shields, a very low or negative real discount rate should be applied. Section 3.2 reports survey results on the actual capital budgeting practice of firms and discusses possible reasons for the apparent conflict between the recommendation of theory and firms' reported behavior. Section 3.3 concludes the paper by discussing the implications of the analysis for the assessment of alternative tax policies.

3.1 How Should Depreciation Allowances Be Discounted?

I begin by discussing the theory of capital budgeting and its application to the discounting of depreciation allowances. Economic theory provides clear guidelines as to how profit-maximizing corporations ought to treat future depreciation allowances. Because prospective depreciation allowances are very nearly riskless, they are more valuable than other prospective sources of cash flow. Safe cash flows, like the stream of future depreciation deductions, should be discounted at a lower rate than risky physical investments. The present value of depreciation

deductions can then be used to assess potential investment projects. At current levels of inflation and interest rates, it appears that only a negligible real interest rate should be assumed in evaluating alternative tax policies.

In theory (and in practice, as demonstrated below), firms decide whether or not to undertake investments by computing the present value of the net cash flows they generate and using a discount rate corresponding to their cost of funds.[1] In a world of certainty, this process is completely straightforward. There is only one available rate of return, and firms invest to the point where the marginal project earns just this rate of return, that is, the net present value of the marginal project evaluated at the required rate of return is zero.

If a project is risky, the problem of capital budgeting becomes much more difficult. The normal procedure is to use a "risk-adjusted discount rate" appropriate to the project under consideration. In general, this rate will depend on the extent to which the project's returns move with aggregate returns in the economy. In the special case in which returns on a given project mirror the entire firm's returns, the appropriate discount rate may be inferred from the firm's stock market beta.

A fundamental principle in finance is that the valuation of a stream of cash flows is the same regardless of how it is divided into components. This insight shows how depreciation allowances should be treated, at least to a first approximation. Consider an arbitrary investment project. After an initial outlay, the project will generate a stream of uncertain future operating profits that then will be taxed. It will also generate a stream of future depreciation deductions that can be subtracted from the firm's income to reduce its tax liabilities. These two streams can be valued separately. It is difficult to value the profit stream without a satisfactory way to gauge its riskiness, but valuing future depreciation tax shields is much easier because they are close to riskless.[2] Therefore, they should be evaluated by using riskless discount rate. Since depreciation tax shields represent after-tax cash flows, they should be discounted at an after-tax rate of return. Then their present value can be added to the present value of the profit stream, evaluated at an appropriate risk-adjusted discount rate to calculate the total return on an asset.

The same conclusion follows from an arbitrage argument (as in Ruback 1987). Consider a set of prospective depreciation deductions that a firm may use. Imagine instead that the firm has a portfolio of Treasury bills designed so that the after-tax coupon payments in each period

1. For a general discussion of capital budgeting principles, see Brealey and Myers (1984).

2. The risk characteristics of depreciation tax shields are considered in a later section.

exactly equal the value of the tax deductions. It should be obvious that the firm has an equally valuable asset in either case. It follows that the appropriate discount rate for valuing depreciation deductions is the same as that for the Treasury bill portfolio: the after-tax nominal interest rate on safe assets. Note that the after-tax nominal interest rate is likely to be much lower than the appropriate discount rate for a project's operating cash flows.

Nominal interest rates on safe assets are currently less than 10%. With a corporate tax rate of 46%, corporations should discount future depreciation allowances at no more than a 5% nominal rate. This means a real rate very close to zero, at current levels of long-term expected inflation, rather than the 4% real rate assumed in many calculations of the effects of tax incentives.

So far, the assumption that prospective depreciation deductions represent a riskless asset has been maintained. In fact, though, future depreciation deductions are subject to some risks. Depreciation deductions will be useless for firms that have losses, become nontaxable, or are unable to use carryback and carryforward provisions. Auerbach and Poterba (1987) suggest that this is not an important factor for most large firms. There is also the possibility of changes in tax rules. Since depreciation deductions represent a hedge against changes in tax rates, this source of uncertainty may drive the appropriate discount rate down rather than up. Finally, there is the possibility that the depreciation rules will be changed with respect to assets already in place. This has never occurred in the United States. On balance, it seems fair to conclude that depreciation tax shields represent an essentially riskless asset.

The arguments made so far indicate that firms should discount expected operating profits and depreciation deductions separately at different rates. Firms might use a common discount rate for all the components of cash flow on a given project, reflecting their average degree of riskiness in some way, but this would not be correct: there is no way to know how much weight to give each component of cash flow until its value is determined, which in turn requires the choice of a discount rate. Even if an appropriate rate could be found, it would vary across projects depending on the value of prospective depreciation deductions. Moreover, a weighted average rate is unlikely to be varied when tax rules change and alter the share of a project's value represented by depreciation tax shields.

Before examining tax policies, I will report evidence on firms' actual capital budgeting practices. In general, they do not conform to those recommended in this section. The divergence between theory and corporate practice makes the analysis of tax policy difficult.

3.2 How Are Depreciation Deductions Discounted?

To learn how depreciation deductions are discounted by actual major corporations, a brief questionnaire was sent to the chief financial officers of the top 200 corporations in the Fortune 500. A copy of the questionnaire and cover letter are provided as an appendix to this paper. Usable replies were received from 95 corporations. No effort was made to raise the response rate by following up on the initial mailing, but there is little reason to suspect systematic differences in capital budgeting procedures between responding and nonresponding firms. The questionnaire was designed to find out whether capital budgeting procedures embodied the principles suggested in the preceding section and to find out what discount rates firms actually apply to depreciation deductions.

The survey results are reported in table 3.1. As the table indicates, the vast majority of corporate respondents stated that they had capital budgeting procedures and that these procedures were of "considerable" but not "overriding" importance in corporate investment decisions. Only 7% of the responding companies indicated that they discounted different components of cash flow on a given project at different rates, and even several of these companies did not distinguish operating profits and depreciation allowances. Many of the responding companies indicated that they dealt with risk issues by discounting projects emanating from different divisions or locations at different rates but that they discounted all the cash flows from a given project at the same rate. It is clear that the practice of separately discounting safe and unsafe components of a project's return, as suggested by theory, is a rarity in American industry.

Table 3.1 **Survey Results on the Discounting of Depreciation Allowances**

Capital budgeting procedure is of	
Overriding importance	6
Considerable importance	91
Little importance	3
Cash flow components discounted at different rates	6
Yes	94
No	
Discount rate applied to depreciation allowances	
< 12%	13
13%–15%	48
16%–18%	16
19%–21%	13
22%+	10

The lower part of the table indicates the distribution of the rates used by companies to discount depreciation allowances. In most cases, the figure refers to the common nominal discount rate applied to all cash flows. The reported discount rates for depreciation allowances were surprisingly high with a median of 15% and a mean of 17%, far in excess of the after-tax nominal interest rate. Given that depreciation tax shields have very similar risk characteristics across firms, it is also noteworthy that the rate at which they are discounted varies widely. The discount rates reported by firms varied 8%–30%. This variability is almost certainly the result of firms applying a common discount rate to all cash flows.

It is difficult to reconcile the level and variability of depreciation discount rates with the standard capital budgeting theory developed by financial economists and taught to practitioners. One explanation for the divergence between actual and recommended practice is that managers find the theory described earlier too complex to implement, given the benefits that can be expected. Another possibility is that managers fail to distinguish riskless and risky cash flows because shareholders do not make the distinction. In either event, analyzing tax policies using standard capital budgeting methods seems perilous. This issue is discussed in the next section.

3.3 Tax Policy Implications

This section treats two aspects of the relationship between tax policy and the discounting of depreciation allowances. First, I illustrate the sensitivity of judgments about the effects of alternative tax policies on incentives to the discount rate applied to future depreciation allowances. Second, I argue that the high and variable discount rates for depreciation used by firms may create important distortions themselves, which the tax structure may either mitigate or exacerbate.

Table 3.2 presents estimates of the sum of the present value of appreciation allowances and the deduction value of the investment tax credit under current tax law, the president's proposal of May 1985, and the House of Representatives' 1985 tax bill using alternative discount rates for depreciation.

Calculations indicate that the effects of alternative tax rules are quite sensitive to the assumed discount rate for depreciation allowances. At the theoretically appropriate zero real discount rate, only the House bill is less generous than a policy of immediate expensing of investment outlays. Current law provides a substantial subsidy to the purchase of new equipment because of the availability of the investment tax credit. On the other hand, with a 10% real discount rate applied to depreciation allowance, as suggested by the survey results, all three tax laws provide

Table 3.2 **Effects of Alternative Discount Rates on the Present Value of Depreciation Deductions under Alternative Proposals**

	ACRS Asset Class					
	I	II	III	IV	V	VI
$d = 0$						
Current law	1.06	1.08	1.08	1.08	.939	.736
President's proposal	1.00	1.00	1.00	1.00	1.00	1.00
House bill	.916	.890	.853	.807	.654	.624
$d = .1$						
Current law	.972	.938	.938	.938	.709	.487
President's proposal	.891	.862	.820	.759	.694	.351
House bill	.794	.741	.667	.583	.396	.366

Note: The present value of depreciation includes the value of the investment tax credit. A value of 1.0 corresponds to expensing. All calculations assume a 5% inflation rate. The discount rate is denoted by d.

benefits significantly less generous than expensing. Especially for long-lived equipment in asset class IV, both the Treasury bill and the House proposal would lead to a substantial increase in the effective purchase price.

The choice of a discount rate is especially important in evaluating the incentives provided for long-lived investments in structures. At a zero discount rate, the president's proposal provides far more incentives to structures investment than does current law. On the other hand, at a 10% rate, current law is more generous than the president's proposal.

The fact that firms use very high discount rates in evaluating projects suggests that the investment tax credit is likely to be a very potent tax incentive per dollar of government revenue forgone. The government should presumably trade off tax revenue at present and in the future using its borrowing rate. If firms discount future tax benefits at rates higher than the government borrowing rate, then tax incentives can be enhanced with no additional permanent cost to the government by restructuring tax incentives to move the benefits forward without changing the present value of the forgone revenue. The investment tax credit is frontloaded in this way. Still greater frontloading of tax incentives is possible through accelerating depreciation allowances, since this keeps the sum of the allowable deductions on an investment constant while increasing their present value. On the other hand, indexation of depreciation allowances tends to increase the duration of tax benefits.

The fact that firms use widely varying and inappropriate discount rates for depreciation allowances suggests that patterns of investment may be very substantially distorted in ways not considered in standard analyses of the efffects of tax incentives. Certainly the returns de-

manded on marginal projects vary by much more across firms than do conventional measures of the cost of capital.

The reasons for these patterns are a potential subject for future research. One possible clue is that corporations and individuals seem to apply very different discount rates to depreciation allowances. The frequency with which individuals churn structures suggest that they apply a much lower (and more appropriate) discount rate than do corporations. This raises the possibility that agency issues may help to explain observed patterns of corporate capital budgeting. If so, then they may have an important bearing on the linkage between tax policies and investment decisions.

Appendix

Cover Letter

20 September 1985

Dear ———:

As part of its ongoing program of research on the economics of capital formation, the National Bureau of Economic Research is studying the effects of proposed reforms in the investment tax credit and tax depreciation schedules. The effects of alternative proposals depend critically on how taxes are factored into companies' capital budgeting procedures. I am therefore attempting to systematically gather information on major corporations' capital budgeting techniques.

I would be very grateful if you could fill in the enclosed questionnaire regarding your company's capital budgeting procedure, and return it in the enclosed envelope. Information identifying individual companies will not be presented in any of our research reports. I will of course furnish you with the results of the study when it is completed.

Thank you for your consideration.

Sincerely,

Lawrence H. Summers
Professor of Economics
Harvard University

LHS/mh
Enclosure

Questionnaire

1) Does your company use a capital budgeting procedure based on evaluations of the discounted cash flows from proposed projects?
   _____ yes _____ no
2) If yes, would you say that the present value of the cash flows from proposed projects is of _____ overriding importance
   _____ considerable importance
   _____ some consequence
   _____ little consequence
   in determining whether they are undertaken?
3) What is the hurdle rate of return you apply to new projects? Specifically in your capital budgeting procedure, what discount rate do you apply to the after tax nominal cash generated by the typical project? _____
   (Alternatively, please provide the real discount rate which you use and the expected inflation rate which enters your calculations.)
4) In evaluating projects some companies discount different components of cash flow at different rates because of their different risk characteristics. For example, some companies discount prospective depreciation tax shields at a low rate because there is not much uncertainty associated with them. Does your company treat different components of cash flow differently?
   _____ yes _____ no
5) If so, what discount rate do you apply to each of the following types of cash flow: _____ operating profits
   _____ scrap value
   _____ depreciation tax benefits
   _____ investment tax credits
   _____ rental income

Comments:

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