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A note on after-tax analysis where capitalized costs are depreciated

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FIELD NOTES[1]

A Note on After-Tax Analysis Where Capitalized Costs are Depreciated

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Forest management often requires relatively long-term and capital intensive investments. Economic analysis of timber management alternatives can therefore be an extremely important aspect of decision-making. Investment analysis techniques are prominent in forest management texts and have also been the subject of many articles in the forestry literature.

Any forestry investment analysis involves several important aspects. Topics included in reports by Gunter and Haney (1984) and Bullard et al. (1986), for example, include the treatment of inflation, income taxes, risk, and the choice of an appropriate discount rate. In this article, we focus on a very specific aspect of after-tax investment analysis—the appropriate, after-tax discount rate where capitalized costs are depreciated. We discuss this aspect in particular because previous forestry texts, reports, and articles have not been explicit in stating that a tax-adjusted discount rate is necessary in such cases.

CAPITALIZED COSTS AND DEPRECIATION

Forest landowners can deduct capitalized operation costs in one of three ways, depending on the type of costs involved. The costs of certain resource-based assets like timber are typically deducted through depletion; the costs of "nonwasting" assets like land are deducted when the asset is sold; and the costs of "wasting" assets like equipment and buildings are generally deducted over time through depreciation (Clutter et al. 1983). Forestry investment analysis often includes depreciation of equipment and structures like buildings, fences, and road improvements. Depreciation is also used, however, when private landowners take advantage of the tax credit and series of deductions allowed for certain reforestation expenses (see Hoover et al. 1989). For landowners that claim a 10% tax credit and deduct 95% of their reforestation costs on eight tax returns, for example, the series of deductions is essentially straight-line depreciation for 7 years. Eight tax returns are involved because only one-half of a full year's deduction is allowed in the first and eighth years.

Deductions reduce income tax liability by lowering taxable income. Where capitalized costs are depreciated, the tax savings are included in investment analyses by discounting the savings to the present with compound interest. Tax liability is estimated by:

$$\begin{aligned}(\text{Income tax due}) = \\ (\text{Marginal tax rate})\,(\text{Income-deductions}) \\ - \text{Credits}\end{aligned} \quad (1)$$

Each deduction therefore lowers the tax bill by (Marginal tax rate) × (Deduction). When a reforestation expense, equipment purchase, or other cost is depreciated, of course, the expense results in a *series* of deductions, and therefore a series of present and future tax savings—all of which can be discounted to the present:

$$\begin{bmatrix}\text{Present value of} \\ \text{tax savings from} \\ \text{depreciation}\end{bmatrix} = \sum_{n=0}^{d}\left[\frac{(\text{Marginal tax rate}) * (\text{Deduction}_n)}{(1+i)^n}\right] \quad (2)$$

Where i is the discount rate, n is the year in which a depreciation deduction occurs due to a specific initial ex-

[1] Edited but nonrefereed contributions from our readers describing useful ideas, shortcuts and findings for the field forester.

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pense, and d is the number of depreciation deductions involved. The total present value of tax savings is subtracted from the initial cost, and the result is the "after-tax present value" of the initial expense. This particular method of assessing investments with depreciation is common in forestry, engineering, and other areas of applied economic analysis.

TAX-ADJUSTED DISCOUNT RATE

In an after-tax analysis, the appropriate discount rate is an interest rate expressed on an after-tax basis. As shown in basic discussions of after-tax investment analysis, the after-tax discount rate is the before-tax rate multiplied by (1-marginal tax rate). A relevant question for forestry investment analysts, however, is "should a tax-adjusted discount rate be used in analyses represented by Equation (1), i.e. where the after-tax present value of depreciation deduction tax savings is calculated?" The answer is yes, but the issue has not been noted clearly in the forestry literature, and the explicit use of such discount rates has therefore been limited. In a review of 12 forestry publications with after-tax analysis discussions, for example, we found only one example where a tax-adjusted rate was clearly used when calculating the present value of tax savings from depreciation deductions (Gunter and Haney 1984, p. 103). The report did not, however, discuss the discount rate, except to demonstrate the tax adjustment in a footnote to a table.

Other authors have failed to be explicit. Three published examples that relate to the after-tax present value of reforestation costs are Holley (1982), Dennis (1983), and Bullard and Straka (1985). In these and other cases in the forestry literature, writers have stated that "i is the discount rate," as in equation (2) above, when a more appropriate definition is that "i is the *tax-adjusted* discount rate."

One may at first feel that this point is somewhat obvious, i.e., it is obvious that a tax-adjusted discount rate should be used in all aspects of an after-tax analysis. This is *not* an obvious point, however, when the subject of analysis includes tax savings from reforestation or other costs that are depreciated for tax purposes. Foresters, landowners, and others evaluating such investments often evaluate the present value of costs on an after-tax basis, but there is a very strong tendency to feel that taxes have been accounted for when equation (2) is applied. The tax savings from each deduction is already included in the analysis, and there is a tendency to think that using a tax-adjusted discount rate would be "double counting" the benefits of the deductions.

APPLICATION

The importance of using a tax-adjusted rate in the present value of depreciation tax savings is apparent by considering a reforestation example. Without cost-shares, a landowner who spends $10,000 on reforestation toward the end of the tax year, is in the 28% marginal tax bracket, and specifies a 10% before-tax discount rate, would have an after-tax present value or "effective" reforestation cost of $7,057.50 if the discount rate is not adjusted (see Table 1). With the tax-adjusted rate of 7.2%, the correct effective cost of reforestation is $6,893.05—a present-value difference of over $164. Using the unadjusted discount rate will always underestimate the present value of the tax savings from depreciation deductions (since they are discounted more heavily), and the resulting "effective" costs will therefore be larger than with a tax-adjusted rate. The inaccuracy increases, of course, as the before-tax discount rate or the marginal tax rate increase. □

Table 1. After-tax present value of reforestation costs. Landowners who qualify for reforestation tax incentives receive a credit and eight separate deductions. A landowner who spends $10,000 on reforestation, who claims a 10% tax credit, and who deducts 95% of the expense on the next 8 tax returns, has the following tax savings (tax rate = 0.28, before-tax discount rate = 10%).

Year	Item	Tax savings	Present value, before-tax discount rate = 10%	Present value, tax-adjusted discount rate (1 − .28)(.10) = 7.2%
0	10% credit	$1,000	$1,000.00	$1,000.00
0	(1/14)($9500)(.28)	190	190.00	190.00
1	(1/7)($9500)(.28)	380	345.45	354.48
2	(1/7)($9500)(.28)	380	314.05	330.67
3	(1/7)($9500)(.28)	380	285.50	308.46
4	(1/7)($9500)(.28)	380	259.55	287.74
5	(1/7)($9500)(.28)	380	235.95	268.42
6	(1/7)($9500)(.28)	380	214.50	250.39
7	(1/14)($9500)(.28)	190	97.50	116.79
	Total present value of tax savings =		$2,942.50[a]	$3,106.95[b]

[a] Effective cost = $10,000 − 2,942.50 = $7,057.50.
[b] Effective cost = $10,000 − 3,106.95 = $6,893.05.[c]
[c] For landowners who receive government cost-shares for reforestation, the effective cost is further reduced to: (1 − s)($6,893.07), where s is the percentage of costs paid by a federal or state program.

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