

Hassett, Kevin A.; Viard, Alan D.

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AMERICAN ENTERPRISE INSTITUTE

**The Taxation of Corporate Gains on Sales of  
Depreciation Property: An Economic Analysis**

Kevin A. Hassett

*AEI*

Alan D. Viard

*AEI*

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The Taxation of Corporate Gains on Sales of Depreciable Property:  
An Economic Analysis

Kevin A. Hassett and Alan D. Viard  
American Enterprise Institute for Public Policy Research

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Kevin A. Hassett is a Resident Scholar and Director of Economic Policy Studies at the American Enterprise Institute and Alan D. Viard is a Resident Scholar at the American Enterprise Institute.

This study examines the taxation of corporate capital gains on depreciable business property, an important topic that has received little attention in the economic literature. The analysis reveals that current law, in which gains on such sales are taxed at ordinary tax rates and buyers are allowed to depreciate their purchase cost, places a tax penalty on sales and raises the cost of capital, thereby discouraging investment. In a simple model, three policies would eliminate the impact on user cost and investment; zero taxation of capital gains with recapture of excess depreciation allowances at ordinary tax rates, zero taxation of capital gains with the seller's basis carrying over to the buyer, and reduced tax rates on capital gains. The basis-carryover and reduced-rate policies appear to be preferable in a more general framework.

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## I. INTRODUCTION

The statutory rate on corporate capital gains currently is equal to the statutory tax rate on ordinary corporate income. Although individual capital gains taxes have received an enormous amount of attention, both in the popular media and in the academic literature, corporate capital gains have received very sparse attention. In principle, however, the distortions that arise from corporate capital gain taxation are analogous to those that might arrive from individual capital gains taxation. Corporations might face a higher user cost of capital and they could find that their previous purchases have been “locked in” in the sense that asset sales are avoided because of their tax consequences.

As a general rule, corporate capital gains taxation has been ignored in the investment literature, and corporate capital gains tax rates have been excluded from studies that have attempted to examine the impact of taxation on firm-level investment. For example, a recent review of the literature in this area by Kevin A. Hassett and R. Glenn Hubbard does not mention a single study that addresses the theoretical or empirical impact of corporate capital gains taxation on firm behavior.<sup>1</sup>

More recently, a 2004 paper by Mihir A. Desai and William M. Gentry<sup>2</sup> and a 2006 paper by Desai<sup>3</sup> have begun the inquiry into the impact of the corporate capital gains taxation. They highlight a number of important findings:

1) Despite the potential for a lock-in effect, corporate capital gains still account for approximately 20 percent of corporate income in a typical tax year.<sup>4</sup>

2) Using Compust data, Desai estimates the value of the stock of unrealized capital gains to be, at a minimum, about \$839 billion in 2004.<sup>5</sup> This large number suggests that the potential gains from eliminating the lock in effect could be enormous.

3) Most countries other than the United States already either exempt corporate capital gains from taxation, or provide special treatment for such gains. For example, Hong Kong, Singapore, New Zealand, Costa Rica, Jamaica and Kenya do not tax the income at all. France exempts 95 percent of gains from taxation, and Germany does the same. Elsewhere in Europe---Sweden and the Netherlands, for example---gains are exempted from taxation if they involve at least a 5 percent share of one company in another.<sup>6</sup>

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<sup>1</sup> “Tax Policy and Business Investment,” *Handbook of Public Economics*, v. 3, ed. Alan J. Auerbach and Martin Feldstein (Elsevier Science B.V., 2002), pp. 1293-1343.

<sup>2</sup> “The Character and Determinant of Corporate Capital Gains,” *Tax Policy and the Economy*, v. 18, ed. James M. Poterba (MIT Press, 2004), pp. 1-36.

<sup>3</sup> “Taxing Corporate Capital Gains,” *Tax Notes*, March 6, 2006, pp. 1079-1092.

<sup>4</sup> Desai and Gentry, *supra* note 2, p. 21; Desai, *supra* note 3, p. 1081.

<sup>5</sup> Desai, *supra* note 3, p. 1081.

<sup>6</sup> Desai, *supra* note 3, pp. 1083-1084; Desai and Gentry, *supra* note 2, pp. 8-9.

4)The elasticity of realizations of capital gains appears to be quite high. Using time-series regressions, Desai and Gentry estimate that it is about -1.13.<sup>7</sup>

5)Making conservative assumptions, Desai calculates that more than \$100 billion of realizations are displaced each year because of the lock-in effect, resulting in a welfare loss to society of about \$20 billion per year.<sup>8</sup>

These findings suggest that the potential consequences of a reduction in the corporate capital gains tax are significant. Indeed, Courtney H. Edwards, Mark H. Lang, Edward L. Maydew and Douglas A. Shackelford studied a large reduction of the German corporate capital gains tax and found that it had a very large and statistically significant effect on stock prices.<sup>9</sup> In particular, firms with large cross holdings significantly outperformed other firms at the time of the reduction.

Perhaps because of these findings, a significant amount of attention is beginning to be paid to the corporate capital gains tax in the United States. However, the analysis to date only looks at one piece of the puzzle. Corporate capital gains taxes certainly have a lock-in effect, but they also have the potential to increase the cost of capital as well. Because of this, a reduction in the corporate capital gains tax could have additional effects on capital investment.

The purpose of this study is to explore this cost-of-capital effect, and to use that exploration to provide some guidance for potential reforms. Our discussion is limited to the taxation of corporate gains on depreciable business property; we do not discuss the taxation of corporate gains on financial assets.

In Part II, we describe the current taxation of corporate capital gains in the United States. In Part III, we consider a simple model with relatively specific assumptions about why sales of used capital might occur. In Part IV, we apply this simple model to the U.S. tax system. The analysis reveals that current law, in which gains on sales of used capital are taxed at ordinary tax rates and buyers are allowed to depreciate their purchase cost, raises the cost of capital because sales of used capital face a tax penalty. The tax penalty is larger for longer-lived property. We identify three reforms that would eliminate the tax penalty in the simple model; zero taxation of capital gains with recapture of excess depreciation, zero taxation of capital gains with the seller's basis carrying over to the buyer, and reduced tax rates on capital gains. In Part V, we discuss extensions to the model and conclude that basis carryover and reduced rates may be the preferable policies. We conclude in Part VI.

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<sup>7</sup> Desai and Gentry, *supra* note 2, p. 24 report an elasticity of -1.3. Desai, *supra* note 3, p. 1088 corrects the number to -1.13.

<sup>8</sup> Desai, *supra* note 3, pp. 1088-1089.

<sup>9</sup> "Germany's Repeal of the Corporate Capital Gains Tax: The Equity Market Response," *Journal of the American Taxation Association*, 26, supplement, 2004, pp. 73-97.

## II. CURRENT TAX TREATMENT

The corporate tax rate is generally 35 percent for large C corporations.<sup>10</sup> Capital gains are generally taxed at the same rate as ordinary income.<sup>11</sup> As a result, the distinction between ordinary income and losses, on the one hand, and capital gains and losses, on the other, is generally relevant only for corporations seeking to deduct losses.<sup>12</sup>

The gain on the sale of depreciable property is generally the sale price minus the firm's cost basis. The cost basis is generally the nominal purchase price minus the nominal depreciation allowances claimed on the property.

Gains from the sale of depreciable property are not always taxed as capital gains. For equipment and other personal property, all nominal depreciation allowances (up to the amount of the taxable nominal gain) are recaptured as ordinary income under section 1245; only the excess, if any, of the sale price over the original nominal purchase price is treated as capital gain. There is, however, no recapture on structures and other real property; those gains are treated as capital gains.<sup>13</sup> Since both types of income face the same tax rates, the recapture provisions are not relevant for corporations under current law, unless they seek to deduct losses against these gains.

Buyers of depreciable property generally may claim the same depreciation deductions and other tax treatment as buyers of new property.<sup>14</sup>

In some cases, depreciable property may be disposed of without current taxation under section 1031. The firm must engage in a like-kind exchange in which it receives replacement property that is in the same General Asset Class or the same Product Class as the original property; the firm then carries over its basis in the original property to the replacement property. Of course, this treatment is only available if the firm is willing to acquire similar property. Moreover, the acquisition and disposition of the two properties must be linked to each other; the favorable tax treatment is denied if a firm engages

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<sup>10</sup> Section 11 imposes a 35 percent rate on corporate income in excess of \$10 million. (Unless otherwise noted, section references are to the Internal Revenue Code of 1986, as currently in effect). Under section 199, 6 percent of net income from qualified production activities may be deducted in 2007 through 2009 and 9 percent may be deducted thereafter, lowering the effective tax rate for those activities to 32.9 or 31.85 percent.

<sup>11</sup> Section 1201 allows firms to choose a flat-rate 35 percent tax on their net capital gains, but that option does not lower tax liability.

<sup>12</sup> Corporations generally may not deduct capital losses against ordinary income. Complex rules govern the combination and netting of short-term and long-term gains and losses. See Desai and Gentry, *supra* note 2, pp. 6-7 and Desai, *supra* note 3, pp. 1090-1091.

<sup>13</sup> Although section 1250 includes a recapture provision for real property, it applies, under section 1250(b)(1), only to depreciation in excess of that allowed under the straight-line method. Under section 168(b)(3)(B), however, structures are now depreciated using the straight-line method.

<sup>14</sup> Although the statement holds for general depreciation allowances, some special incentives are restricted to new property. For example, under section 168(k)(2)(A)(ii), partial expensing, now expired, was offered only to property for which "the original use ... commences with the taxpayer." The investment tax credit, now repealed, also featured an original-use requirement in some cases.

separately in a sale and a purchase. Among other things, the replacement property must be identified within 45 days of the disposition of the original property and must be acquired within 180 days. The participants in the transaction must comply with complex identification and reporting requirements. Given the tight restrictions imposed on these transactions, we do not further consider like-kind exchanges in our analysis of the tax treatment of sales of depreciable property.<sup>15</sup>

The acquisition of a corporation can sometimes be structured and taxed as the purchase of its stock rather than as the purchase of its assets. In that case, there is no corporate capital gains tax on the firms' depreciable property or other assets, but the firm's stockholders are taxed at the individual capital gains rate on the gains on their stock holdings. We also do not examine stock-sale transactions.

In general, firms that dispose of depreciable property pay a 35 percent tax on their gains.

### **III. MODEL OF CORPORATE CAPITAL GAINS TAXATION**

In subpart A, we review the standard model of the user cost of capital, with no sales of used capital. We introduce those sales in subpart B and subsequently analyze their tax treatment.

#### **A. Standard Framework: No Sales of Used Capital**

We sketch briefly how the cost of capital is derived in the traditional framework in which depreciable property is never sold. To facilitate the numerical computations presented in Part IV, below, we assume that production and tax payments occur at one-year intervals.

At date zero, a new unit of capital is produced, with a production cost of one consumer good. The unit produces no output at that date, but one year later, at date one, it produces  $C$  units of consumer goods. One year after that, at date two, it produces  $C(1 - \delta)$  units of consumer goods. It continues to produce output thereafter, with its output in year  $t$  equal to  $(1 - \delta)^{t-1}$  units of consumer goods. The parameter  $\delta$ , which is between zero and one, is the true, or economic, depreciation rate of this capital.

Because of the specific assumptions about how capital is produced, one unit of  $t$ -year-old capital will yield exactly the same output in every future year as  $(1 - \delta)^t$  units of newly produced capital. If old and new capital face the same tax treatment, then, a unit of  $t$ -year-old capital must sell for the same amount as  $(1 - \delta)^t$  units of new capital. We assume that firms incur no additional costs to install the capital.

In this standard framework, capital, once purchased by a firm, is always capable of producing output (of the above-described amount) in the hands of that firm. There is,

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<sup>15</sup> If anything, these restrictions may be further tightened. A Senate Finance Committee aide recently stated that Congress may want to curtail like-kind exchanges, as reported by Dustin Stamper, "Like-Kind Exchanges Possible Target, Tax Aide Warns," *Tax Notes*, March 12, 2007, p. 971.



then, no reason to sell the capital to another firm. To be sure, there is also no reason not to sell, but such sales have no consequences in this framework and can therefore be ignored. In the real world, of course, there are many non-tax factors that may stimulate a sale, and we turn to these in subpart B, below.

Firms are willing to invest up to the point at which a new unit of capital yields an after-corporate-tax real return of  $r$ . In other words, the firm is indifferent between a claim on one consumer good today and a claim to  $1+r$  consumer goods next year. This real return covers the compensation that households demand to supply funds to the firm (rather than consuming, investing abroad or investing in another sector of the economy), as well as any taxes that households pay on investment returns.

With no taxes, what is the equilibrium level of  $C$ ? The firm equates the present discounted value (discounted at rate  $r$ ) of the output produced by the unit of capital to its purchase cost. To obtain the present value of the output, we sum the geometric progression  $C(1-\delta)^{t-1}/(1+r)^t$  from  $t$  equals 1 through infinity, obtaining  $C/(r+\delta)$ . Equating this present value to one (the production cost of the capital) yields

$$(1) \quad C = r + \delta.$$

In economic terminology,  $r+\delta$  is the *user cost of capital* in this no-tax world. The result makes intuitive sense; the product must yield the required real return  $r$ , after covering depreciation  $\delta$ .

With corporate taxes, the capital must generally have a higher marginal product to provide the required after-tax real return. Let  $\tau$  be the corporate income tax rate, which is the same for all firms. Firms are allowed to claim depreciation deductions on their capital, which are also the same for all firms, although they differ across the various types of capital. Suppose that the present value of the deductions, discounted back to date zero at discount rate  $r$ , is  $Z$ .

In analyzing tax policy, the standard framework continues to ignore possible sales of used capital. Given its other assumptions, this is not surprising. We have already seen that this framework offers no non-tax reason for such sales. Assuming that the tax system does not subsidize such sales, they will also not occur with taxes. Again, the framework's neglect of sales is strongly counterfactual and we will modify it in subpart B, below.

With the corporate tax, the present value of the after-tax cash flows is  $C(1-\tau)/(r+\delta)$ . But, the firm enjoys tax savings with date-zero present value  $\tau Z$  from its depreciation deductions, reducing the net purchase cost of the capital to  $1-\tau Z$ . The firm sets the present value of after-tax cash flows equal to the net purchase cost, which yields

$$(2) \quad C = \frac{(r+\delta)(1-\tau Z)}{1-\tau}.$$

With no taxes, equation (2) simplifies to equation (1). It is useful to define an effective tax rate, as follows,

$$(3) \quad ETR = 1 - \frac{r}{C - \delta}.$$

In this expression,  $C - \delta$  is the before-tax return to capital, net of depreciation, while  $r$  is, by assumption, the after-tax return, also net of depreciation. The effective tax rate therefore measures the fraction of the net-of-depreciation before-tax return that is paid in taxes rather than received by the investors. For example, if  $r$  is two-thirds of  $C - \delta$ , the effective tax rate is one-third, indicating that taxes absorb one-third of the before-tax return and that investors receive the remaining two-thirds.

Note that an increase in the user cost implies a reduction in investment. Such an increase means that capital investment must yield a higher before-tax return to be viable.

## **B. Introducing Sales of Used Capital**

The standard framework's treatment of sales of used capital is clearly at odds with reality. As discussed in Part I, above, firms engage in a substantial amount of sales, even though, as we shall soon see, such sales are penalized by the tax system. It is quite clear that sales take place for non-tax reasons; there must, then, be circumstances in which it is economically beneficial for capital to be held by one firm instead of another. We now introduce such sales in a specific, simple manner that illustrates the potential impact of tax policy.

We assume that,  $T$  years after each firm purchases a unit of capital, the firm loses its ability to use that unit. The firm's operations no longer "fit" the unit of capital and the unit can produce no further output in the hands of that firm. Nevertheless, the capital can still be used to produce output (in the amounts described above) if it is transferred to another firm, where it will remain operational for another  $T$  years.

In the no-tax world, the equilibrium outcome is clear. The firm that originally held the capital would sell it to another firm and such sales would be repeated every  $T$  years. At each relevant date  $t$  ( $T$ ,  $2T$ ,  $3T$ , and so on), the equilibrium sale price is  $(1 - \delta)^t$  units of consumer goods, because that is the cost of producing  $(1 - \delta)^t$  units of new capital, for which this used capital is a perfect substitute. No buyer would pay more, since it could produce new capital instead; no seller would accept less, since even the slightest discount would draw a large number of firms eager to pay less than the cost of new capital.

Any tax penalty on sales now has real effects. To be sure, under our assumption that the capital becomes completely worthless when it is held more than  $T$  years, there is no lock-in effect (unless the tax absorbs the entire value of the capital). The firm will sell, even at a tax penalty, rather than hang on to worthless capital. Nevertheless, the anticipation of paying this tax penalty when the used capital is sold will increase the user cost and depress investment.

### C. User Cost of Capital With Sales of Used Capital

We make the following general assumptions about the tax system. These general assumptions will generally encompass the current U.S. tax system and the reform options that we consider in Part IV, below. First, the sale proceeds, net of the firm's cost basis and any recapture amount, are taxed at rate  $\gamma$ , which may, but need not, equal the ordinary tax rate  $\tau$ . Second, any recapture amount is taxed at the ordinary tax rate  $\tau$ . Third, purchasers of used capital receive the same tax treatment as purchasers of newly produced capital.

The last assumption, which will be modified for one of the reform options, has the important implication that the real sale price of the unit of  $t$ -year-old capital is still  $(1 - \delta)^t$ , as it was in the no-tax world. The unit of old capital remains a perfect substitute for that many units of newly produced capital, because it has the same tax treatment, as well as the same future output.

At date zero, when the first firm buys the capital, it equates the present value of the after-tax output generated during its anticipated  $T$ -year holding period to its net cost of purchasing the unit.

To obtain the date-zero present value of the after-tax output generated by the unit of capital during the holding period, we sum the geometric progression

$$C(1 - \tau)(1 - \delta)^{t-1} / (1 + r)^t \text{ from } t \text{ equals } 1 \text{ through } T, \text{ obtaining } C \frac{1 - \tau}{r + \delta} \left\{ 1 - \left( \frac{1 - \delta}{1 + r} \right)^T \right\}.$$

The firm's initial purchase cost for the unit of capital is one, but there are four modifications to the purchase cost. First, as before, the firm enjoys tax savings from depreciation deductions. However, the date-zero present value of the tax savings is now  $\tau Z(T)$  where  $Z(T)$  is the present value of the cumulative depreciation deductions available to a firm that sells at date  $T$ . Second, the date-zero present value of the firm's after-capital-gains-tax sale proceeds, ignoring the basis deduction and recapture, is

$$(1 - \gamma) \left( \frac{1 - \delta}{1 + r} \right)^T.$$

Third, the firm enjoys tax savings with a date-zero present value of  $\gamma B(T)$  from the basis deduction, where  $B(T)$  is the present value of the deduction allowed for a date- $T$  sale. Fourth, the firm pays additional tax  $(\tau - \gamma)D(T)$ , where  $D(T)$  is the date-zero present value of the depreciation recapture amount that applies to a date- $T$  sale.

The firm sets the after-tax cash flows equal to the net purchase cost, yielding

$$C \frac{1 - \tau}{r + \delta} \left\{ 1 - \left( \frac{1 - \delta}{1 + r} \right)^T \right\} = 1 - \tau Z(T) + (\tau - \gamma)D(T) - (1 - \gamma) \left( \frac{1 - \delta}{1 + r} \right)^T - \gamma B(T), \text{ or}$$

$$C = \frac{r + \delta}{1 - \tau} \left\{ 1 - \left( \frac{1 - \delta}{1 + r} \right)^T \right\}^{-1} \left\{ 1 - \tau Z(T) + (\tau - \gamma) D(T) - (1 - \gamma) \left( \frac{1 - \delta}{1 + r} \right)^T - \gamma B(T) \right\}.$$

After some manipulation, this can be rewritten as

$$C = \frac{r + \delta}{1 - \tau} \left\{ 1 - \tau Z + \frac{\gamma \left[ \left( \frac{1 - \delta}{1 + r} \right)^T - B(T) - D(T) \right] + \tau \left[ \{Z - Z(T)\} + D(T) - Z \left( \frac{1 - \delta}{1 + r} \right)^T \right]}{1 - \left( \frac{1 - \delta}{1 + r} \right)^T} \right\}.$$

The advantage of writing the expression in this form is that it facilitates a comparison with (3) and thereby highlights the impact of selling the capital. Specifically, selling at date  $T$  rather than holding the capital forever changes the cost of capital by

$$(4) \quad \Delta C = \frac{r + \delta}{1 - \tau} \frac{\gamma \left[ \left( \frac{1 - \delta}{1 + r} \right)^T - B(T) - D(T) \right] + \tau \left[ \{Z - Z(T)\} + D(T) - Z \left( \frac{1 - \delta}{1 + r} \right)^T \right]}{1 - \left( \frac{1 - \delta}{1 + r} \right)^T}.$$

These equations generalize the results derived by Alan J. Auerbach in 1981, who performed a similar analysis for a specific tax system, as discussed below.<sup>16</sup> In drawing out the economic implications of these equations, we rely heavily upon his cogent analysis. We will also refer to work by Roger H. Gordon, James R. Hines, Jr., and Lawrence H. Summers, who performed numerical computations of this type for structures investment.<sup>17</sup>

#### D. Economic Analysis

Expression (4) has the same sign as the following expression, which we call the *tax factor impacting sales (TFIS)*,

$$(5) \quad TFIS \equiv \gamma \left[ \left( \frac{1 - \delta}{1 + r} \right)^T - B(T) - D(T) \right] + \tau \left[ \{Z - Z(T)\} + D(T) - Z \left( \frac{1 - \delta}{1 + r} \right)^T \right].$$

<sup>16</sup> "Inflation and the Tax Treatment of Firm Behavior," *American Economic Review*, 71(2), May 1981, pp. 419-423. Auerbach assumed that production and tax payments occur continuously, rather than at one-year intervals, but that difference has no impact on the substantive results.

<sup>17</sup> "Notes on the Tax Treatment of Structures," in *The Effects of Taxation on Capital Accumulation*, ed. Martin Feldstein (Chicago: University of Chicago Press, 1987), pp. 223-254.

If  $TFIS$  is positive, the tax treatment of capital resale raises the user cost and thereby depresses investment; if it is negative, then the tax treatment lowers the user cost and boosts investment.

As Auerbach stressed, there are two relevant effects.<sup>18</sup> We will label them as follows:

- *The Capital-Gain-Tax Effect*: The sale triggers taxation at the capital gains rate on the difference between sale price and basis, net of any amount that is recaptured as ordinary income. This effect is reflected by the presence of

$$\gamma \left[ \left( \frac{1-\delta}{1+r} \right)^T - B(T) - D(T) \right] \text{ in (5).}$$

- *The Depreciation-Allowance Effect*: This effect arises because the sale changes the tax depreciation allowances available on the capital. By selling the capital, the firm loses deductions with date-zero present value  $Z - Z(T)$ , the allowances that it has not yet had time to claim. It is also taxed on a recapture amount with date-zero present value  $D(T)$ . But it receives a sale price that incorporates the buyer's ability to claim depreciation deductions with date-zero present value

$$Z \left( \frac{1-\delta}{1+r} \right)^T \text{ on this capital. (Alternatively, the firm could replace the capital with}$$

that many units of new capital, on which it could claim those deductions). This

$$\text{effect is reflected by the presence of } \tau \left[ \{Z - Z(T)\} + D(T) - Z \left( \frac{1-\delta}{1+r} \right)^T \right] \text{ in (5).}$$

Without more information on the tax system, we cannot say whether either effect, let alone the combined effect, is positive or negative.

Indeed, as demonstrated in the Appendix, both effects are zero for one textbook income tax system, namely a system of true economic depreciation, involving inflation indexation for both depreciation and basis, with no depreciation recapture. Economic, inflation-indexed, depreciation results in an effective tax rate equal to the statutory tax rate with sales at any date or at none, provided that basis is computed in a consistent inflation-indexed manner. The capital-gain-tax effect disappears because basis is always equal to sale price, so that no gain or loss occurs on any sale. The depreciation-allowance effect disappears because one unit of used capital receives the same depreciation treatment as  $(1-\delta)^T$  units of new capital.

Of course, the U.S. tax system differs significantly from the above textbook system. In particular, depreciation allowances are accelerated, meaning that they are more favorable for young assets than for old ones. Due to rapid depreciation, basis is reduced below market value, a disparity that is reinforced by the tax system's failure to index basis for

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<sup>18</sup> Auerbach, *supra* note 16, p. 420. Also see Mark H. Robson, "Measuring the Cost of Capital when Taxes are Changing with Perfect Foresight," *Journal of Public Economics*, 40(3), December 1989, pp. 261-292, at pp. 269-273.

inflation. As a result, the capital-gain-tax effect *discourages* sales, because the sale results in a taxable capital gain. On the other hand, the depreciation-allowance effect *encourages* sales. That occurs because the used capital has relatively little depreciation allowances remaining to be claimed by the selling firm (none if the tax life has ended), while the buying firm is allowed to depreciate its purchase cost in the same manner as if it had purchased new capital.

We now examine the net impact of the two effects in the U.S. tax system.

#### **IV. APPLICATION TO U.S. TAX SYSTEM**

##### **A. Tax Penalty on Sales of Used Capital**

We now apply the simple model to the U.S. tax system's treatment of equipment, software and structures. We set the regular and capital-gains tax rates equal to .35, in accordance with section 11.

We first consider 3-year, 5-year and 7-year property, as defined in section 168(e). We use the tax depreciation schedules applicable to these types of property, which are computed in accordance with section 168, reflecting the half-year convention allowed by section 168(d)(1). These schedules are tabulated in recent work by Darrel S. Cohen, Dorte-Pernille Hansen and Kevin A. Hassett (CHH).<sup>19</sup>

We also consider nonresidential real property ("structures"). Such property is depreciated straight-line over a 39-year period under sections 168(b)(3)(B) and 168(c); the mid-month convention is allowed under section 168(d)(2)(B). We assume that the property is placed in service during the sixth month of the tax year.

We assume that the first-year depreciation allowance is deducted at the purchase date, not one year later. For a sale at date  $T$ , the present value of depreciation allowances  $Z(T)$  is the sum of the present values of the depreciation allowances for years 0 through  $T$ . The nominal basis at date  $T$  is one minus the nominal depreciation deductions claimed through  $T$ , since there is no inflation indexation of basis. The half-year convention applies to equipment and software in the year of sale. The mid-month convention applies to structures in the year of sale; the sale is assumed to occur in the sixth month of the tax year.

Under our assumptions, the nominal sale price is always below the nominal purchase price, so section 1245 recaptures all of the gain on equipment and software sales as ordinary income. With the two tax rates equal, however, the recapture is of no significance and can be disregarded for present purposes.

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<sup>19</sup> "The Effects of Temporary Partial Expensing on Investment Incentives in the United States," *National Tax Journal*, 55(3), September 2002, pp. 457-466, at p. 460.

Following CHH and recent work by Robert Carroll, Kevin A. Hassett and James B. Mackie III (CHM),<sup>20</sup> we set the inflation rate equal to .03. We set the interest rate  $r$  equal to .05, which is generally consistent with the .04 required return at the household level that CHM assume, with some markup due to household level taxes. Under these assumptions, the present value of depreciation deductions,  $Z$ , equals .930 for three-year property, .874 for five-year property, .825 for seven-year property, and .313 for structures.

Following CHH, we take the economic depreciation rates for equipment and software to be the reciprocal of the tax lives; .333 for three-year property, .2 for five-year property, and .143 for seven-year property. Following Gordon, Hines and Summers, we set the depreciation rate for structures at .0247.<sup>21</sup>

For these benchmark parameters, we display effective tax rates for different holding periods  $T$  in Table 1:

TABLE 1: EFFECTIVE TAX RATES (percent)  
(Current Law)

	$T$				
	No Sale	20	10	5	3
<b>Three-year</b>	22.5	22.5	22.7	24.5	28.1
<b>Five-year</b>	25.3	25.4	26.6	31.3	35.2
<b>Seven-year</b>	26.7	27.0	29.5	35.2	38.2
<b>Structures</b>	35.6	40.0	42.6	44.2	44.9

Allowing for the sale of used capital can significantly increase the effective tax rate, depending on the holding period and the durability of the capital. The effects are larger, of course, for shorter holding periods (more frequent sales). For any given holding period, the effects are larger for longer-lived property, for which a larger portion of the property remains to be sold. Also, the depreciation-allowance effect, which works to reduce the tax penalty, is smaller for longer-lived property, since depreciation allowances are claimed more slowly on such property.

With sales every 20 years, for example, the effective tax rate rises by 0.0 percentage points for three-year property, 0.1 percentage points for five-year property, 0.3 percentage points for seven-year property, and 4.4 percentage points for structures. With sales every 10 years, the increases are 0.2, 1.3, 2.8 and 7.0 percentage points.

Not only does the tax penalty on sales discourage investment, it is also likely to distort the allocation of investment because it varies across different types of capital, depending upon durability and expected holding periods.

<sup>20</sup> “The Effect of Dividend Tax Relief on Investment Incentives,” *National Tax Journal*, 56(3), September 2003, pp. 629-651.

<sup>21</sup> Gordon, Hines, and Summers, *supra* note 17, p. 233.

The tax penalty on sales is larger (smaller) with higher (lower) inflation, because basis is lower (higher) relative to sale price. As shown in the Appendix, however, the impact of inflation is relatively modest.

The impact of the tax penalty on investment can be noticeable. If sales occur every 10 years, then the tax penalty on sales increases the user cost of capital (not shown) by 0.04 percent for three-year property, 0.45 percent for five-year property, and 1.30 percent for seven-year property. CHH report that roughly 20 percent of equipment and software spending goes to three-year property and roughly 40 percent each to the other two categories.<sup>22</sup> The weighted percentage increase in user cost for equipment and software is then 0.7 percent.

In their survey of the literature, Hassett and Hubbard state, “Recent empirical studies appear to have reached a consensus that the elasticity of investment with respect to the tax-adjusted user cost of capital is between -0.5 and -1.0.”<sup>23</sup> That result suggests a 0.35 to 0.7 percent reduction in equipment and software gross investment. Since such investment is about \$1 trillion annually, these results suggest a \$4 to \$7 billion reduction in annual gross investment.

Of course, the impact is sensitive to the holding period. With a holding period of 20 years, the weighted increase in the user cost falls dramatically, to 0.07 percent.

For comparison, note that CHH found a weighted reduction of 3.1 percent for the section 168(k) temporary partial-expensing provision.<sup>24</sup> With a 10-year holding period, the effect of the tax penalty is one-fourth the size of the effect of partial expensing. With a 20-year holding period, however, the impact is only one-fortieth as great.

The effect on structures is an order of magnitude larger than the effect on equipment and software. The increase in user cost is 9.3 percent for a 10-year holding period and 5.5 percent for a 20-year holding period.

We now identify and discuss three reforms that would eliminate the tax penalty on sales in this simple model.

## **B. Three Equivalent Reforms**

Under the first policy (*the recapture policy*), the capital gains tax rate  $\gamma$  is set to zero, eliminating the capital-gains-tax effect while the depreciation-allowance effect is negated through a recapture provision. The desired policy sets the date-zero present value of the recapture amount equal to

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<sup>22</sup> Cohen, Hansen and Hassett, *supra* note 19, p. 460.

<sup>23</sup> Hassett and Hubbard, *supra* note 1, p. 1325.

<sup>24</sup> Cohen, Hansen and Hassett, *supra* note 19, p. 463, Table 3. The results are taken from the “new law” column of the table and from the intermediate-adjustment-cost assumption that  $\omega$  is .5.



$$(6) \quad D(T) = Z(T) - Z + Z \left( \frac{1-\delta}{1+r} \right)^T,$$

which results in a zero value for the depreciation-allowance effect in equation (5).

Since  $D(T)$  is the date-zero present value of the recapture amount, the actual date- $T$  recapture amount is  $(1+r)^T$  times larger and can be written as

$Z(1-\delta)^T - (1+r)^T \{Z - Z(T)\}$ . The two terms in this expression have intuitive interpretations:

- The first term,  $Z(1-\delta)^T$ , is the date- $T$  present value of the depreciation that would still be left to claim *if, holding the present value  $Z$  fixed, the depreciation allowances had been allocated across years in proportion to the depreciation that actually occurred in each year.* With this uniform allocation, the value of remaining depreciation allowances would always be  $Z$  times the market value of the capital.
- The second term,  $(1+r)^T \{Z - Z(T)\}$ , is, by definition, the date- $T$  present value of the depreciation allowances actually remaining to be claimed.

If the latter term is smaller, as it is in the U.S. tax system, it indicates that too little of the lifetime depreciation allowance is still unclaimed, which means that too much has already been claimed. That excess is recaptured as ordinary income under this policy.

The second policy (*the basis carryover policy*) sets the capital gains rate to zero, without imposing any recapture obligation on the seller, but requires the buyer to depreciate the capital in the same manner and to the same extent that it would have been depreciated by the buyer. Of course, for any sale that occurred after the tax life had ended, the buyer would take the seller's zero basis and would have nothing to depreciate.

If the buyer must follow exactly the same rules as the seller, this effectively places the obligation to pay the recapture tax on the buyer rather than the seller. Under the maintained assumption in this simple model that all firms have the same tax rates, it makes no difference which firm bears the obligation. The sale price simply declines to reflect the buyer's obligation.

To be sure, the basis carryover policy has little precedent in the current Code. An unrelated buyer is rarely, if ever, required to carry over the seller's basis. The Code does contain provisions, such as sections 1031 and 1033, pertaining to like-kind exchanges and certain rollovers, under which capital gains tax is not imposed on the seller and the *seller* takes a carryover basis in the replacement property. Sections 362 and 723 sometimes require a corporation or partnership to which a taxpayer contributes property (without payment of capital gains tax) to take a carryover basis in the property. Under section 1015(a), a person who receives property as a gift carries over the donor's basis, if less than market value. None of these policies, however, require an unrelated buyer to take a carryover basis. The denial of depreciation deductions to a buyer who pays real money to

acquire used capital, simply because the capital has already been fully depreciated by the seller, may seem counter-intuitive, even when the seller receives a price reduction to compensate for the denial of deductions.

The third policy lowers the capital gains tax rate, with no depreciation recapture or basis carryover. The capital gains tax rate required to set *TFIS* to zero depends upon the holding period and is given by:

$$(7) \quad \gamma(T) = \tau \frac{Z \left( \frac{1-\delta}{1+r} \right)^T - \{Z - Z(T)\}}{\left( \frac{1-\delta}{1+r} \right)^T - B(T)} .$$

This policy is, under the assumptions of the current model, equivalent to the recapture policy and hence to the basis-carryover policy. The recapture policy taxes part of the gain at rate  $\tau$  and leaves part of it untaxed while this policy achieves the same outcome by taxing the entire gain at a single blended, rate.

Under any of these three policies, the following outcome emerges:

TABLE 2: EFFECTIVE TAX RATES (percent)  
(Recapture, Basis Carryover, or Reduced Rate)

	<i>T</i>				
	No Sale	20	10	5	3
<b>Three-year</b>	22.5	22.5	22.5	22.5	22.5
<b>Five-year</b>	25.3	25.3	25.3	25.3	25.3
<b>Seven-year</b>	26.7	26.7	26.7	26.7	26.7
<b>Structures</b>	35.6	35.6	35.6	35.6	35.6

### C. Simplified Reduced-Rate Policy

Basis carryover may be a relatively novel policy, but it is straightforward to describe. In contrast, the recapture formula (6) and the reduced capital gains rate (7) are somewhat complex, varying by holding period as well as by the depreciation rate of the property.

It is possible, however, to adopt a simplified form of the reduced-rate policy. Consider a sale that occurs after the tax lifetime, so that  $B(T)$  is zero and  $Z(T)$  is  $Z$ . Then, (7) reduces to  $\gamma(T) = \tau Z$ . One way to simplify the reduced-rate policy is to also set  $\gamma(T) = \tau Z$  for sales within the tax lifetime. Although the rate still varies by type of property, it can be stated in a simple form and does not depend upon the holding period.

Using the values of  $Z$  previously reported, then, the simplified policy applies tax rates of 32.5 percent to gains on three-year property, 30.6 percent to gains on five-year property, 28.9 percent to gains on seven-year property, and 11.0 percent to gains on structures.

Recall that there is no recapture and no basis carryover. The following effective tax rates emerge:

TABLE 3: EFFECTIVE TAX RATES (percent)  
(Simplified Reduced Rate)

	<i>T</i>				
	No Sale	20	10	5	3
<b>Three-year</b>	22.5	22.5	22.5	22.5	23.2
<b>Five-year</b>	25.3	25.3	25.3	25.8	27.8
<b>Seven-year</b>	26.7	26.7	26.7	28.8	29.5
<b>Structures</b>	35.6	36.5	37.4	37.9	38.1

In general, the tax penalty on sales is essentially negated for holding periods within the tax life. Sales at date one (not shown) are subsidized, so it would probably be necessary to modify the policy for such sales.

In his 1981 analysis, Alan Auerbach also concluded that neutrality results if  $\gamma$  is equal to  $\tau Z$ .<sup>25</sup> Although Auerbach restricted his analysis to the case in which nominal depreciation allowances decay at rate  $\delta$ , the result generalizes to any tax system in which depreciation allowances follow a geometric schedule and are not indexed for inflation, as shown in the Appendix. Of course, even that general case does not describe the U.S. tax system. Still, we have seen that this policy achieves exact neutrality for sales that occur after the property has been fully depreciated and, as shown in Table 3, results in approximate neutrality for most sales within the tax life.

#### D. More Modest Reforms

If the recapture tax is imposed, there should be no capital gains tax, not even one at a preferential rate. A more modest reform would, however, impose a positive capital gains tax with basis carryover or the recapture rule described by equation (6). Table 4 displays the resulting effective tax rates:

TABLE 4: EFFECTIVE TAX RATES (percent)  
(15 Percent Capital Gains Rate, with Recapture or Basis Carryover)

	<i>T</i>				
	No Sale	20	10	5	3
<b>Three-year</b>	22.5	22.5	22.6	23.4	25.0
<b>Five-year</b>	25.3	25.3	25.9	28.0	29.9
<b>Seven-year</b>	26.7	26.8	27.9	30.6	32.1
<b>Structures</b>	35.6	37.5	38.8	39.6	40.0

<sup>25</sup> Auerbach, *supra* note 16, p. 420.

This policy removes four-sevenths of the tax penalty on sales that appears in Table 1, but leaves a significant penalty in place.<sup>26</sup>

A related reform would introduce the 15 percent rate, while leaving section 1245 in place. The recapture rule in Section 1245 is more stringent than our recapture rule (5), but it applies only to equipment and software, not to structures. The resulting effective tax rates are shown in Table 5:

TABLE 5: EFFECTIVE TAX RATES (percent)  
(15 Percent Capital Gains Rate, With No Change to Section 1245)

	<i>T</i>				
	No Sale	20	10	5	3
<b>Three-year</b>	22.5	22.5	22.7	24.5	28.1
<b>Five-year</b>	25.3	25.4	26.6	31.3	35.2
<b>Seven-year</b>	26.7	27.0	29.5	35.2	38.2
<b>Structures</b>	35.6	37.1	38.3	39.1	39.4

For the three categories of equipment and software, the results in Table 5 are the same as the current-law results in Table 1. The reason is that, under the assumptions of this simple model, the nominal sale price is always lower than the original purchase price, so that section 1245 continues to recapture all of the gain as ordinary income. For structures, on the other hand, current law imposes no recapture requirement, so the results differ from the corresponding results in Table 1.

Another proposal to mitigate capital gains taxation is to index basis to inflation. The effects are shown in Table 6:

TABLE 6: EFFECTIVE TAX RATES (percent)  
(Current Law, With Inflation-Indexed Basis)

	<i>T</i>				
	No Sale	20	10	5	3
<b>Three-year</b>	22.5	22.5	22.7	24.5	27.3
<b>Five-year</b>	25.3	25.4	26.6	30.8	31.5
<b>Seven-year</b>	26.7	27.0	29.5	32.4	33.0
<b>Structures</b>	35.6	36.7	36.0	35.4	35.1

The effects are modest for equipment and software. A key reason is that basis indexation matters only when basis is positive, which is true only for sales within the tax life of the property. Basis indexation is, however, quite beneficial for structures. With a 20-year holding period, for example, the tax penalty on sales is reduced from its current-law value

<sup>26</sup> The current-law policy described in Table 1 can be viewed as implementing the recapture policy with gains taxed at 35 percent. (With the gains rate and the ordinary rate equal, we can view any amount, or none, as recaptured.) The policy in Table 3 is therefore four-sevenths of the way from Table 1 to Table 2 and the reduction in the user cost of capital, not shown, is four-sevenths as great. The reduction in the effective tax rates shown in the table is not exactly four-sevenths, however, because the effective tax rate depends upon the user cost in a non-linear manner, as indicated by equation (3).

of 4.4 percentage points to 1.2 percentage points; with a 10-year holding period, the penalty is reduced from 7.0 percentage points to a mere 0.5 percentage points. Note that basis indexation actually results in a small subsidy to sales at short holding periods and could, therefore, encourage churning of structures.

A large rate reduction with no recapture or basis carryover encourages sales, because the capital-gains-tax effect becomes smaller than the depreciation-allowance effect. The Appendix considers, for example, the consequences of reducing the rate to 15 percent, with no depreciation recapture. Firms would then engage in tax-motivated sales and every unit of capital would be turned over every year. Anti-abuse rules could try to prevent sales that were purely tax motivated with no business purpose. But, even the sales that have some business purpose should not be artificially encouraged. Although subsidizing such sales lowers the cost of capital, it is a distortionary way of doing so, relative to a policy that is neutral toward sales.<sup>27</sup>

Fortunately, there has been little or no interest in such policies. Proposals for reduced capital gains rates generally retain a recapture provision for equipment and software.

## V. EXTENSIONS

The basic conclusions from Part IV hold in a more general context, but some complexities are introduced. On the whole, the basis carryover and reduced-rate policies seem preferable in the more general context.

### A. Lock-In Effect

The simplest modification is to assume that capital does not become worthless after it has been held for  $T$  years, but instead simply becomes somewhat less productive. This has little real impact on the analysis. A tax penalty on sales remains undesirable, but the form of the inefficiency changes to some extent and its magnitude becomes smaller. The key difference is that, with a sufficiently large tax penalty on sales, the tax will cause the capital to not be sold. This is the familiar lock-in effect.

The tax penalty on sales of used capital always continues to raise the user cost of capital, however, because the penalty results in either a tax payment on sale or in the inefficient retention of less productive capital, either of which reduces the profitability of the initial investment. When the capital is retained, the resulting loss of output must be less burdensome than the tax payment (otherwise, the firm would not have chosen to hold on to the capital), so the availability of this option does reduce the initial burden on investment. Note, however, that since no revenue is collected from the capital gains tax in that case, the burden rises as a fraction of revenue.

All of the key results still apply with this modification. It is still desirable to eliminate the tax penalty on sales of used capital, regardless of the exact form or mix of distortions that

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<sup>27</sup> Gordon, Hines, and Summers, *supra* note 17, concluded that individuals, but not corporations, had an incentive to churn structures under the laws in place prior to the Tax Reform Act of 1986.

are caused by such a penalty. And if the other assumptions of the above simple model are retained, any of the three reforms described above would eliminate the tax penalty.

Things become more complicated, though, when we introduce fluctuations in the price of used capital.

## B. Price Fluctuations

In the actual economy, the sale price of  $T$ -year-old capital may be higher or lower than  $(1 - \delta)^T$ . For example, the production cost of the perfectly substitutable new capital may have changed, which would automatically change the value of used capital. Or, the used capital may remain fully productive for the selling firm, but have extra value for the buying firm, which for some reason, cannot produce perfectly substitutable capital at the original cost. In general, the U.S. tax system ignores any fluctuations in the value of capital until and unless it is sold; we assume any reform continues to do the same.<sup>28</sup>

A desirable policy has two parts. First, it sets the depreciation schedule in a way that delivers the desired *expected* user cost of capital. That criterion can be satisfied by any of the policies that we have considered by choosing the correct depreciation schedule. Second, a desirable policy neither penalizes nor subsidizes any sales that may occur, regardless of what the sale price ends up being. Some of the policies that we have considered do not result in such neutrality.

The basis-carryover policy achieves neutrality. Even when the sale price  $P(T)$  deviates from  $(1 - \delta)^T$ , this approach still preserves neutrality. The selling firm pays no tax and receives no deduction; there is also no change in depreciation deductions, except that they are claimed by the buyer rather than the seller. Everything continues as if the capital had never changed hands, under our maintained assumption that all firms face the same tax rates.

To study the other policies, it is easiest to consider the case in which the sale occurs after the property's tax life has ended. The tax on the selling firm is

$\gamma P(T) + (\tau - \gamma)D(T)(1 + r)^T$  while the tax savings from the buyer's depreciation allowances are  $\tau ZP(T)$ , so that the net tax effect of the sale is

$$(8) \quad (\gamma - \tau Z)P(T) + (\tau - \gamma)D(T)(1 + r)^T.$$

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<sup>28</sup> If property is destroyed or damaged by fire, storm, shipwreck or other casualty, however, the resulting decline in market value – but no more than the cost basis – may be deducted as a casualty loss under section 165(a) and Treasury Regulation section 1.165-7. Also, under Treasury Regulation section 1.167(a)-8, a firm may be able to deduct its remaining basis in a property if the firm permanently withdraws the property from use in the trade or business.

Note that, under current law, with  $\gamma$  equal to  $\tau$  and  $D(T)$  irrelevant, the net tax on the sale is  $\tau(1-Z)P(T)$ . Of course, as we have seen, there is a penalty on sales even if  $P(T)$  equals  $(1-\delta)^T$ ; the penalty is larger (smaller) at higher (lower) values of  $P(T)$ .

Now, consider the reduced-rate and recapture policies discussed in Part IV, above.

Recall that, for sales after the tax life has ended, the reduced-rate policy sets  $\gamma$  equal to  $\tau Z$  and  $D(T)$  equal to zero. It is immediately clear that, under this policy, (8) is equal to zero for all values of  $P(T)$  and neutrality is preserved.<sup>29</sup>

In contrast, the recapture policy does not achieve neutrality. Recall that this policy sets  $\gamma$  equal to zero and, for sales after the tax life has ended, sets the recapture amount  $D(T)(1+r)^T$  equal to  $Z(1-\delta)^T$ . Under this policy, (8) is equal to  $\tau Z\{(1-\delta)^T - P(T)\}$ . It can be shown that this expression also holds for sales within the tax lifetime. This expression differs from zero whenever the sale price differs from  $(1-\delta)^T$ . If the price exceeds that value, the sale is subsidized, because the seller pays no tax on the additional gain, being liable only for the fixed recapture amount, but the buyer depreciates the higher purchase price. Conversely, if the price is lower than that value, the sale is penalized, because the seller remains liable for the fixed recapture amount, but the buyer's depreciation allowances are smaller because of the smaller purchase price.

A more realistic version of the recapture policy might cap the recapture amount at the amount of taxable gain, which, for sales after the tax life has ended, is the sale price. In other words, if  $P(T)$  was lower than  $Z(1-\delta)^T$ ,  $D(T)(1+r)^T$  would be limited to  $P(T)$ . In that case, (8) is equal to  $\tau(1-Z)P(T)$ , which is the same as current law. Since this is positive, the sale is still penalized, but by less than the above calculation indicated.

Under the recapture policy, resale decisions would, therefore, be affected by the tax system. This analysis therefore indicates that the basis-carryover and reduced-rate policies are the better policies. As noted in Part IV.B, above, however, the basis carryover policy has little precedent in the current Code.

### C. Differences in Firms' Tax Treatment

Another complication is that firms may not face the same tax rates. Some may be pass-through entities rather than C corporations, some may be subject to the corporate alternative minimum tax, and some may be in loss-carryforward situations. Such differences in tax treatment already cause some problems under current law. The basis-carryover policy is not appropriate for this situation, since the movement of property

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<sup>29</sup> For sales within the tax lifetime, the reduced-rate policy, neither its exact form given by (7) nor its simplified form ( $\gamma$  equal to  $\tau Z$ ) results in exact neutrality. Interestingly, under the simplified policy, fluctuations in the sale price do not change the tax penalty on sale, which remains the same as in our basic model. Recall, though, that the simplified policy did not achieve perfect neutrality for sales within the tax lifetime, although it was fairly close, as shown in Table 3, above. The exact reduced-rate policy, which did achieve perfect neutrality in the simple model, is slightly affected by fluctuations in the sale price.

between firms results in a change in tax treatment. None of the policies work perfectly in this environment, however, so it is difficult to make a clear comparison.

## **VI. CONCLUSION**

The taxation of corporate capital gains is an important topic that has received little attention in the literature. Our analysis reveals that current law, in which gains on sales of used capital are taxed at ordinary tax rates and buyers are allowed to depreciate their purchase cost, places a tax penalty on sales and raises the cost of capital. In a simple model, we identify three policies that are equivalent to each other and that eliminate the impact on user cost and investment: a zero tax rate on capital gains with recapture of excess depreciation allowances at ordinary tax rates, zero taxation of capital gains with the seller's basis carrying over to the buyer, and reduced tax rates on capital gains. In more general models, the basis-carryover and reduced-rate policies appear to be preferable.



## APPENDIX

### No Tax Penalty on Sales With Economic Depreciation

The depreciation allowance at each date  $t$  has *real* value  $\delta(1-\delta)^{t-1}$  and date-zero present value  $\delta(1-\delta)^{t-1}/(1+r)^t$ . Summing these present values for  $t$  from 1 through  $T$  reveals that  $Z(T)$  is  $\frac{\delta}{r+\delta} \left\{ 1 - \left( \frac{1-\delta}{1+r} \right)^T \right\}$ , so that  $Z$  is  $\frac{\delta}{r+\delta}$ . The basis remaining after claiming the date- $T$  depreciation allowance has real value  $(1-\delta)^T$  and date-zero present value  $B(T)$  of  $\left( \frac{1-\delta}{1+r} \right)^T$ . Substituting these values into equation (6) reveals that *TFIS* equals zero for all values of  $T$ ,  $\tau$  and  $\gamma$ . Alternatively, substituting these values into equation (4) reveals that  $C = \frac{r}{1-\tau} + \delta$  and  $ETR = \tau$ , for all values.

### Sensitivity to Inflation

TABLE A1: EFFECTIVE TAX RATES (percent)  
(6 Percent Inflation)

	<i>T</i>				
	No Sale	20	10	5	3
<b>Three-year</b>	28.0	28.0	28.2	30.2	34.3
<b>Five-year</b>	30.8	30.9	32.2	37.4	41.8
<b>Seven-year</b>	32.0	32.4	35.2	41.4	44.9
<b>Structures</b>	38.0	43.2	47.5	50.4	51.7

TABLE A2: EFFECTIVE TAX RATES (percent)  
(Zero Inflation)

	<i>T</i>				
	No Sale	20	10	5	3
<b>Three-year</b>	15.7	15.7	15.8	17.2	20.0
<b>Five-year</b>	18.0	18.1	19.1	22.8	25.9
<b>Seven-year</b>	19.4	19.6	21.7	26.2	28.5
<b>Structures</b>	30.7	33.7	34.4	34.6	34.6

### Generalizing Auerbach Result to All Geometric Nominal Depreciation

With tax depreciation rate  $d$  and inflation rate  $\pi$ , the depreciation allowance at date  $T$  has date-zero present value of  $d(1-d)^{T-1}/(1+i)^T$ , where  $(1+i) \equiv (1+r)(1+\pi)$ , resulting in

$$Z(T) = \frac{d}{i+d} \left\{ 1 - \left( \frac{1-d}{1-i} \right)^T \right\}, \quad Z = \frac{d}{i+d}, \quad \text{and} \quad B(T) = \left( \frac{1-d}{1-i} \right)^T. \quad \text{Substituting into (5)}$$

yields  $TFIS = (\gamma - \tau Z) \frac{(1-\delta)^T (1+\pi)^T - (1-d)^T}{(1+i)^T}$ , which is zero if  $\gamma$  equals  $\tau Z$ .

Preferential Capital Gains Rate with No Recapture or Basis Carryover

TABLE A3: EFFECTIVE TAX RATES (percent)  
(15 Percent Capital Gains Tax Rate, With No Recapture and No Basis Carryover)

	<i>T</i>				
	No sale	20	10	5	3
<b>Three-year</b>	22.5	22.5	21.2	5.0	-48.7
<b>Five-year</b>	25.3	25.0	20.2	-3.7	-21.3
<b>Seven-year</b>	26.7	25.9	19.3	8.4	-2.8
<b>Structures</b>	35.6	37.1	38.3	39.1	39.4

For equipment and software, this tax rate results in a tax subsidy to sales, pushing the effective tax rate lower than in the no-sale case. Indeed, the rates become negative, often extremely negative, for short holding periods, indicating that the before-tax net-of-depreciation marginal product is lower than  $r$ .