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Does the Estate Tax Raise Revenue?

1. Introduction

Proponents of transfer taxation argue that well-designed levies on estates and gifts serve two primary objectives. First, such taxes may promote an equitable distribution of economic resources by breaking up large concentrations of wealth. Yet many commentators have noted that common estate-planning techniques allow wealthy individuals to transfer vast fortunes while paying little or no tax (see, e.g., Cooper (1979)). Accordingly, it is possible that this first objective is served only in cases where individuals have little or no desire to avoid taxation. Second, transfer taxes raise revenue. In practice, levies on gifts and estates have raised roughly \$6 billion per year over the last five years. This sum is certainly substantial, but one should bear in mind that it represents less than 1 percent of all federal revenues for the same period, despite the imposition of high statutory marginal tax rates. One might therefore be inclined to conclude that transfer taxation achieves the second objective with perhaps a modicum of success.

Unfortunately, this conclusion is premature. To measure the true revenues associated with transfer taxation, one must determine the net incremental contribution that these taxes make to total federal revenues, or, to put it another way, one must estimate the amount by which total revenues would decline if these taxes were eliminated. This figure may bear very little relation to measures of collected revenue reported by the government. In particular, many of the same estate-planning techniques that allow wealthy individuals to escape transfer taxation also have important income tax implications. Thus, elimination of transfer taxes might significantly affect income tax revenues.

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In this paper, I argue that, as a consequence of behavioral responses to estate taxation, a substantial amount of capital income is taxed at lower marginal rates under the personal income tax. I emphasize two major channels through which this occurs. First, estate planners agree that perhaps the best method of avoiding estate taxes is to make substantial *intra vivos* gifts, and to make them as early in life as possible. Typically, wealthy individuals can do this in ways that minimize or entirely eliminate gift tax liabilities. The net effect is to transfer wealth, typically from parents to children, during a period of life in which children tend to pay lower marginal rates under the personal income tax. Although differences between marginal income tax rates alone create incentives for wealthy individuals to make *intra vivos* gifts,¹ the estate tax adds to this incentive, presumably generating larger transfers. The government effectively forgoes a portion of its tax claim on incrementally transferred assets. Second, since charitable bequests are deductible from gross estate for tax purposes, the estate tax creates a substantial incentive to make such contributions. Even though one might well deem this a desirable outcome, it is important to recognize that it too has important consequences for the income tax. In this case, resources are transferred from individuals with positive marginal tax rates to tax-exempt institutions. As a result, the government forgoes its entire claim on the transferred assets.

Unfortunately, it is extremely difficult to measure these effects precisely. The most important obstacle is the availability of extensive financial data on a sample drawn from the wealthiest 5 percent of the population. Although most of this information is, in principle, contained in federal personal income, estate, and gift tax returns, the IRS is reluctant to release such information for fear of violating the confidentiality of wealthy taxpayers. Even if this data became available, the measurement of *intra vivos* transfers (which are often well disguised) would pose severe conceptual difficulties. My strategy in this paper is to estimate true revenues on the basis of the best available evidence. Since this evidence is admittedly sketchy, it is appropriate to think of my calculations as suggestive rather than precise.

Two major conclusions emerge from this study. First, the indirect effects of estate taxation on federal personal income tax revenue are potentially of the same order of magnitude as the reported revenue collected by this tax. Thus, these reported figures may lead one quite far astray.

1. For this reason, changes in the taxation of personal income affect estate tax revenues, just as estate taxation affects income tax revenues. We return to this point in section 6.

Second, available evidence suggests that, historically, true revenues associated with estate taxation may well have been near zero, or even negative. Recent tax reforms that reduce the progressivity of federal personal income tax rates only partially vitiate this conclusion. Far from "backing up" the income tax as some have claimed, the estate tax may actually generate a rise in income tax avoidance activities sufficient to offset revenue collected through estate levies.

This paper is organized as follows. In section 2, I briefly review the history of federal estate and gift taxes, paying special attention to provisions that play prominent roles in the following analysis. I elaborate upon the incentive effects of estate taxation in section 3, and present evidence documenting significant behavioral adjustments to changes in the tax code in section 4. Section 5 contains estimates of net revenue raised through estate taxation, which are adjusted to account for the behavioral responses discussed in sections 3 and 4. In section 6, I turn my attention to several additional considerations, some of which introduce potentially countervailing forces. Special attention is given to various provisions of the Tax Reform Act of 1986 (TRA). Section 7 contains conclusions.

2. A Brief History of Federal Estate and Gift Taxation

The modern estate tax has been in effect since 1916. The original legislation provided for a \$50,000 exemption, with progressive marginal tax rates rising from 1 percent to 10 percent for estates over \$10 million. The gift tax was instituted in 1924. Rates ranged from 1 percent to 25 percent, matching estate tax rates in the same year. Donors were provided with a \$50,000 exemption, plus a \$5,000 annual exclusion per donee. As of 1932, gift tax rates were reduced relative to estate tax rates and remained 25 percent lower than estate rates through 1976.

From 1943 to 1976, the basic provisions of federal estate and gift taxes remained essentially unchanged. The law provided for a \$60,000 estate tax exemption, with progressive rates ranging from 3 percent to 77 percent. The gift tax exemption was fixed at \$30,000, with a \$3,000 annual exclusion per donee. Decedents were allowed to bequeath one half of their gross estates to their spouses tax free (the marital deduction), and all charitable bequests were deductible. In addition, recipients of bequests were allowed to step up the basis on all assets for purposes of capital gains taxation to the fair-market value of those assets at the time of their benefactor's death. A step-up of basis was not allowed for assets transferred by gift.

Congress significantly altered the structure of federal transfer taxes in

the TRA of 1976. Most importantly, this act provided for unification of estate and gift taxes. Since 1976, all cognizable transfers have been taxed jointly under the same progressive schedule, which originally includes a maximum rate of 70 percent. Lifetime giving is still slightly favored because the gift tax is imposed only on the net transfer, whereas the estate tax base also includes amounts used to pay the tax. The act also established a unified credit that provided tax relief equivalent to a \$60,000 exemption, but which was designed to rise in steps over a period of years. The \$3,000 yearly gift tax exclusion was retained, and the marital deduction was liberalized, so decedents could transfer the maximum of \$250,000 and 50 percent of gross estate tax free. Finally, Congress removed the step-up of basis at death, but this provision was later repealed.

The Economic Recovery Tax Act of 1981 (ERTA) embraced four major changes to this system of transfer taxation. First, the unified credit was increased in steps to a maximum of \$192,800 in 1987 (equivalent to a \$600,000 exemption). Second, the maximum marginal tax rate was decreased in steps from 70 to 50 percent. Third, all limits on the marital deduction were removed. Finally, the annual gift tax exclusion was raised to \$10,000.

3. *Incentive Effects of Estate Taxation*

In this section, I argue that the federal estate tax has generated strong incentives for individuals to transfer large amounts of accumulated wealth to their intended heirs prior to death, and to do so as early in life as possible. Furthermore, I note that the deductibility of charitable bequests enhances the attractiveness of leaving a portion of one's estate to charity. In subsequent sections, I document the effects of these incentives on behavior and compute the attendant impact on federal personal income tax revenues.

3.1 INTRA VIVOS GIFTS

Before 1977, the federal tax system treated gifts more favorably than bequests. Despite the unification of gift and estate taxes in the TRA of 1976, virtually all estate planners still recommend a plan of systematic lifetime giving as perhaps the most important method of transfer tax avoidance (see Brosterman (1977), Kess and Westlin (1982), Esperti and Peterson (1983), Clay (1982), and Cooper (1979)). Cooper argues that

The first major goal of good estate planning is to freeze the size of a client's estate at its current level and divert future growth to the natural objects of the client's bounty. . . . it is far easier to divert future growth than it is to disgorge wealth

already accumulated, and good estate planning attempts to get estate-freezing action into operation as soon as possible [emphasis added] so as to cut off wealth accumulation before it becomes a more serious planning problem.

In practice, there are many ways to accomplish this while simultaneously minimizing or entirely avoiding gift tax liability. Since these planning techniques have been reviewed at length elsewhere, I will provide only a brief summary of the major strategies.

3.1.1. Undisguised gifts Since a substantial amount of gifts is entirely exempt from taxation, a simple plan of undisguised lifetime giving is, for the majority of families, the most effective estate planning tool. By splitting gifts, a married couple can now transfer \$20,000 (\$6,000 prior to 1982) per year to each intended heir without incurring any gift tax liability whatsoever. Thus, a couple with two children could divest itself of \$1 million over a twenty-five year period simply by taking advantage of the gift tax exclusion. If the couple is willing to contemplate gifts to grandchildren or to spouses of children or grandchildren, the potential for transfer tax avoidance grows enormously.

It is, however, essential to begin taking advantage of the gift tax exclusion as early as possible. For one thing, the timing of each individual's death is uncertain, and all assets remaining in his possession at the time of his death are taxable as part of his estate. In addition, the exemption is not cumulative, so failure to take advantage of it in any particular year implies that one opportunity to make tax-free transfers has been lost forever. This consideration may be quite important for very wealthy individuals who, despite programs of systematic lifetime giving, still expect to die with substantial estates.

The TRA of 1976 also provides substantial unified credits against estate and gift tax liabilities. At first, it might appear as though this provision treats gifts and bequests neutrally. However, this impression is erroneous. As long as donors plan to exhaust the credit completely, its value is inversely related to the date at which they choose to take it. This principle is easily demonstrated. For simplicity, assume that the credit is fixed at its 1987 level of \$192,800 so that it corresponds to an exemption of \$600,000. Consider a wealthy man who, among other things, owns a piece of property worth \$600,000. He may transfer the entire parcel to his heirs immediately without incurring any tax liability. Upon his eventual demise, his estate will pay taxes only on the residual assets. If, on the other hand, he holds the property until his death, it will ordinarily escalate in value. Suppose he dies ten years later and the property is then worth \$1 million. The first \$600,000 would be exempt. However, his es-

tate would then pay taxes not only on the residual assets but also on the \$400,000 gain.² At current rates, this would imply an incremental estate tax liability of between \$150,000 and \$200,000.

3.1.2. Diversion of Profitable Investment Opportunities Perhaps the most common and informal estate planning activity entails the diversion of profitable investment opportunities to one's intended heirs. Parents can provide valuable information and advice concerning potential investments without incurring gift tax liability. In many cases, parents devote great effort to locating and arranging profitable business deals and then bring their children in as coinvestors. Such diversions do not generate any incremental tax liabilities, even though their success may depend upon expert services supplied by the parent. If children lack the necessary capital, parents can lend it to them. As long as these loans are made at prevailing rates of interest and observe arms-length regulations, no gift tax liability is incurred even if the child would have been unable to obtain a similar loan from a third party. Alternatively, parents can help their children to obtain a loan at favorable rates by guaranteeing repayment, without risk of transfer taxation. Finally, parents can provide assurances that, should the deal fail, they will pick up the loss. In the event a loss actually occurs, parents will be compelled to pay gift tax on the associated transfer. However, from the point of view of a risk-averse child, the parents' guarantee amounts to an insurance policy, the value of which exceeds their expected loss.

For parents who own large portions of businesses or closely held corporations, additional opportunities for diversions arise. In many cases, parents can shift profitable activities from their primary business to a separate partnership or enterprise owned partially or completely by their children. Parents may also bring their children into a family partnership as silent partners, thereby diverting a share of the earnings and appreciation from their business. To accomplish this while minimizing taxable transfers, they must arrange the partnership as early as possible.

3.1.3 Sophisticated Estate Tax Avoidance Various sophisticated estate-planning techniques allow wealthy individuals to transfer resources intra vivos in ways that escape notice under the gift tax. Important techniques are the use of preferred stock recapitalizations in closely held firms, installment sales, and life insurance.

2. In general, only part of this gain will be due to inflation. Thus, the argument remains valid even if the credit is indexed.

In a preferred stock recapitalization, parents cancel outstanding common stock and issue in its place a combination of preferred and common stocks. They distribute the preferred stock primarily to themselves (or other current owners), the common stock primarily to their children (or other intended heirs). If desired, this can be accomplished without transferring significant control over the corporation to the children. By selecting an appropriate dividend entitlement for the preferred stock, the parent can reduce the value of the common stock to a negligible level, reflecting only the speculative growth potential of the corporation. In this way, parents entirely avoid the gift tax but succeed in transferring all future corporate growth, brought about in part by their own expertise and effort, to their children. One difficulty is that parents may be forced to accept a high level of taxable personal income from the preferred stock. Nevertheless, in many cases such income is desirable and estate planners tend to recommend the recapitalization.

Installment sales are frequently used to transfer real property. Parents sell this property to their children while simultaneously providing financing. They then typically forgive interest payments as they come due. In some cases, they use the property for business activities and lease it back from the children. Rental payments then partially offset interest payments, and the remaining interest is typically forgiven. All forgiven interest is potentially taxable as a gift. The primary advantage of the installment sale is that parents can transfer all accumulation on the entire parcel immediately, despite the fact that the bulk of actual gifts (forgiven interest payments) will not be made for many years. In addition, when parents use the property for business activities, they may be able to develop it with the ultimate benefit eventually accruing free of tax to their children. Finally, it is even possible to provide, as part of the terms of the original sale, that the installment payments will terminate upon the parents' death, without drawing the unpaid portion into the parents' estate. The primary disadvantage of the installment sale is that it forces parents to realize a capital gain. However, they can defer realization by using balloon payments. Furthermore, upon the parents' demise, it appears possible to largely eliminate capital gains obligations on the remaining portion.

Life insurance provides a particularly attractive estate planning tool for highly paid executives. It is quite common for corporations (particularly those closely held) to provide their executives with large amounts of life insurance as a fringe benefit. An executive may assign ownership in this insurance to prospective heirs, thereby excluding it from the estate. Although premiums over a certain threshold are taxable to the ex-

ecutive under the personal income tax, assignment of ownership in such a policy to heirs is apparently not cognizable as a gift. As a result, this scheme completely avoids transfer taxes. Since this arrangement can be used for ordinary life insurance as well as group term insurance, the net effect can be to transfer resources into an accumulating whole life policy. Since investment income accruing to policyholders within life insurance companies is tax exempt, the government thereby forgoes its entire claim on the transferred assets until the executive's death.

3.1.4 Evasion Many families presumably engage in simple gift tax evasion. It is certainly possible for individuals to make substantial gifts in forms that are difficult, if not impossible, for the IRS to trace. Outright gifts of cash and durable goods (clothes, furniture, appliances) fall into this category.

Each of these techniques for avoiding estate and gift taxes has the ultimate effect of transferring resources from parent to child at a relatively early date. Indeed, in most cases, effective planning requires these transfers to be made as early as possible. To the extent children face significantly lower marginal rates under the personal income, significant losses of tax revenue may result.

It is important to bear in mind that wealthy individuals are not solely motivated by the desire to minimize taxes. Indeed, estate planners emphasize that this goal often conflicts with other legitimate concerns, such as retaining control over one's assets, maintaining one's desired standard of living, and providing one's children with appropriate incentives. Proper estate planning balances the costs and benefits of tax avoidance at the margin. For this very reason, we would expect changes in the tax treatment of gifts and bequests to affect *intra vivos* transfers significantly.

3.2 CHARITABLE BEQUESTS

Incentives for charitable giving arise directly from the deductibility of such bequests for estate tax purposes. If, for example, an individual faces a marginal estate tax rate of 50 percent, she can by forgoing \$0.50 of bequests to her heirs provide \$1 to charity. The effective price of contributing \$1 to charity is therefore only \$0.50 (in general, this price is $$(1 - t)$, where t is the testator's marginal estate tax rate). Sophisticated estate planners may also recommend the use of front-end trusts, which provide that the income from an estate be used for charitable purposes over some specified period, after which all assets are returned to the decedent's heirs. Such an arrangement can virtually eliminate all estate taxes while preserving substantial value for one's descendants.

4. Behavioral Evidence

The estate tax creates strong incentive for wealthy individuals to make *intra vivos* gifts and charitable bequests; however, this does not necessarily imply that these tax incentives have a significant effect on behavior. Accordingly, I now present empirical evidence concerning actual behavioral responses. As we shall see, the evidence strongly supports the view that these responses are extremely large.

4.1 INTRA VIVOS TRANSFERS

Unfortunately, data on gifts are virtually impossible to obtain, in part because they are often disguised as other sorts of transactions (recall the discussion in section 3). Although one can obtain some information on trusts from IRS fiduciary income tax data, it is not possible to distinguish between the formation of revocable and irrevocable trusts. A revocable trust is not a consummated gift and is therefore treated as part of the donor's assets for tax purposes. As a result, this data is uninformative.

One can, nevertheless, document the sensitivity of *intra vivos* transfers to tax code provisions indirectly. Note in particular that the choice between making a gift or a bequest is essentially one of timing. Parents can transfer wealth to their children immediately or hang on to it for some time, eventually making the same transfer upon death. This decision is therefore closely related to the choice of whether to bequeath assets to one's spouse or directly to one's ultimate heirs. In this case, the couple can choose to transfer wealth to its children immediately upon the death of the first spouse, or hang on to it and eventually make the same transfer upon the death of the second spouse.³ Again, the issue is simply one of timing. However, unlike *intra vivos* transfers, ample information is available concerning bequests to spouses. Furthermore, ERTA fundamentally changed the tax treatment of spousal bequests as of 1982 by eliminating all limitations on the marital deduction. In addition, the reduction of tax rates in 1977 somewhat diminished the penalty associated with double taxation of wealth passed first to one's spouse and eventually to one's ultimate heirs. Finally, the reduction of maximum tax rates in 1982 somewhat vitiated the importance of planning for very wealthy decedents to split transfers to children or other ultimate heirs evenly between spouses' estates. Thus, by examining trends in spousal bequests over the last ten years or so, one can infer the importance of

3. One obvious difference is that an individual might not be sure that his or her spouse would make the same bequests later on that he or she would have made. However, it is possible to overcome this difficulty through the use of a trust,

estate tax provisions in determining the timing of transfers to ultimate heirs.⁴

To measure behavioral responses to changes in the tax code, I will compare IRS statistics on bequests to spouses from 1977 and 1983 returns. Most returns filed in any year concern the estates of individuals who died in the previous year. Thus, the 1977 returns primarily contain estates treated under 1976 law (pre-TRA of 1976), and the 1983 returns consist primarily of estates taxed under ERTA.

Since the filing requirement changed dramatically between 1976 and 1982 (from \$60,000 to \$225,000), the 1977 and 1983 returns reflect radically different samples. In addition, data are only available on 1983 returns for which the gross estate exceeded \$300,000. To restore comparability, one must restrict attention to 1977 returns on which reported gross estate is sufficiently large. In particular, the \$300,000 threshold is, adjusting for inflation, roughly equivalent to \$180,000 in 1976. Unfortunately, the IRS is no longer willing to release data on individual returns, so it is necessary to employ aggregated statistics. The IRS does, however, report sample averages for these data, grouped by size of gross estate. Thus, it is possible to restrict attention to 1977 returns on which the gross estate exceeded \$150,000 or \$200,000. In practice, we consider all estates exceeding a \$200,000 threshold, in part because this is closer to \$180,000, and in part because this selection criterion produces a sample of 59,553 returns. Given their similar sizes, there is every reason to believe that

4. Unfortunately, this period also witnessed the adoption of significant income tax reforms (under ERTA). Thus, changes in gift and bequest behavior may reflect a combination of effects (see footnote 1). One would not, however, expect income tax provisions to significantly affect the fraction of bequests left to spouses, because after the testator's death, all primary heirs (spouses and children) will ordinarily pay similar high-bracket marginal personal income tax rates. In addition, the limitation of the marital deduction was undoubtedly the single most important tax-related determinant of spousal bequests, and its elimination probably swamped all other effects. For these reasons, data on spousal bequests may actually be preferable to data on *intra vivos* transfers.

Table 1 A COMPARISON OF 1977 AND 1983 ESTATE TAX RETURNS

	<i>1977 Returns</i>	<i>1983 Returns</i>
Minimum gross estate in sample	\$200,000	\$300,000
Percent gross estates of married decedents left to spouses	47.7	59.4
Percent married decedents claiming marital deduction	89.8	95.3
Percent gross estates of all decedents left to charity	8.09	5.05

these two samples reflect nearly identical segments of the population. I should mention, however, that the use of \$150,000 (rather than \$200,000) as a selection criterion would not significantly alter my conclusions.

Comparison of statistics for these samples reveals the following pattern (see Table 1). For returns filed in 1977, married individuals left \$0.477 out of every dollar to their spouses. For returns filed in 1983, this figure climbed to \$0.594 on the dollar, a net increase of 24.5 percent.⁵

Although this response is enormous, one might well wonder why it was not even more pronounced. After all, ERTA allows individuals to transfer unlimited resources to their spouses absolutely tax free. There are at least three explanations. First, individuals may adjust their wills somewhat slowly in response to changes in estate tax provisions. Indeed, one should recall that 1982 was the first year in which decedents were allowed an unlimited marital deduction; this deduction may have been used to an even greater extent in subsequent years. Second, many decedents exhausted the benefit of the marital deduction by driving their estate taxes to zero. Indeed, 78.6 percent of those claiming the marital deduction paid no tax. Overall, the effective tax rate on married decedents was a mere 4.7 percent, as compared to 17.5 percent for the rest of the sample. Third, even with an unlimited marital deduction, it is not always optimal to bequeath all assets to a surviving spouse, since this strategy could lead to a large estate tax liability upon the death of the second spouse.

A comparison of 1977 and 1983 returns also reveals an increase in the frequency with which individuals claimed the marital deduction (refer again to Table 1). For the 1977 returns, 102 out of every 1,000 married decedents failed to claim this deduction. By 1983, this figure had fallen to 47 out of every 1,000 married decedents, a decline of 53.9 percent. One cannot attribute this trend to the elimination of limitations on the marital deduction under ERTA, since those not claiming the deduction were not constrained by these limitations. Rather, this trend is a direct reflection of the decline in estate tax rates, which reduce the penalty associated with transferring wealth first to one's surviving spouse, and subsequently, upon the spouse's death, to one's heirs.

Overall, this evidence confirms the view that the timing of transfers to one's ultimate heirs is extremely sensitive to estate tax provisions. Accordingly, there is a strong presumption that *intra vivos* gifts exhibit a similar sensitivity.

5. After subtracting liabilities such as funeral and administrative expenses, debts and mortgages, one finds that bequests to other heirs increased by roughly the same proportion.

4.2 CHARITABLE BEQUESTS

Previous investigators have directly estimated the effect of estate tax provisions on charitable bequests (see, e.g., McNees (1973), Feldstein (1977), Boskin (1976), Barthold and Plotnick (1983), and Clotfelter (1984)). In general, these estimates suggest that the behavioral response is extremely large. For example, Clotfelter found that a 1 percent rise in the effective price of charitable bequests (see section 3.2) would cause such bequests to decline by roughly 1 percent, and perhaps by as much as 1.5 percent. Clotfelter used his estimates to simulate the effect of ERTA on charitable giving. On the basis of his calculations, he predicted that ERTA would depress charitable bequests by 34 percent to 52 percent.

In this instance, economists have the rare opportunity to determine the accuracy of a prediction based upon econometric estimates of behavioral responses by examining actual responses pursuant to a policy change. Unfortunately, the IRS has not made any data on estate tax returns available for any year between 1977 and 1983. Thus, of necessity, the data samples used here span both the 1976 and 1981 tax reforms. Accordingly, any changes in behavior reflect responses to both acts. On the other hand, ERTA was phased in over several years, so its full effect was not felt in 1982. These two factors roughly offset each other, so that one can still obtain a feel for the accuracy of Clotfelter's predictions by comparing charitable bequests across two samples.

Specifically, we find that for 1977 returns, decedents left \$0.0809 out of every dollar to charity. By 1983, this figure had fallen to \$0.0505 on the dollar (see Table 1). The magnitude of this decline (37.6 percent) is roughly in line with the low end of the range of possible responses predicted by Clotfelter. Since, once again, individuals may adjust their wills slowly in response to changes in estate tax provisions, the observed response should be thought of as a lower bound. Actual experience therefore provides striking confirmation of *ex ante* econometric forecasts.

Having established that estate taxation not only creates incentives for *intra vivos* giving and charitable bequests but also that these incentives have an enormous impact on behavior, we now consider the implications for personal income tax revenues.

5. *True Estate Tax Revenues*

I have argued in previous sections that reported estate tax revenue figures may be quite misleading. To calculate true revenues, one must net out indirect effects. As a first step, it is essential to determine proper methods for measuring revenues. When an individual holds an asset,

the government effectively owns some claim on that asset. However, the value of the government's claim depends in a fairly complex way upon the individual's marginal tax rate and upon his or her behavior.

Consider, for example, the effect of transferring a consol worth \$1 from one taxpayer to another. Suppose that the interest rate is 10 percent, so the consol pays \$0.10 each year. Taxpayer A is now, and always will be, in the 50 percent marginal tax bracket. Furthermore, suppose that A would hold the consol indefinitely, consuming all of the after-tax income it produces. If A owns the consol, then the government has a claim on a stream of \$0.05 payments in every subsequent year. Taxpayer B is now, and always will be, in the 25 percent marginal tax bracket. Furthermore, B would also hold the consol indefinitely, consuming exactly its after-tax proceeds. If B owns the consol, then the government has a claim on a stream of \$0.025 payments in every subsequent year.

To compare these streams with measures of current revenues, one must calculate present values. The appropriate discount rate for the government is the after-tax rate of return for some average government bondholder (see Feldstein (1974)). Suppose that this average bondholder is in the 40 percent tax bracket. Then if A owns the consol, the value of the government's claim is \$0.833, whereas if B holds the consol, the value of this claim falls to \$0.417. Accordingly, if some policy induces A to give B the consol, the government loses \$0.417.

I remarked earlier that the value of the government's claim depends not only upon the individual's marginal tax rate but also upon his or her behavior. To illustrate, suppose that A and B would, if given the consol, sell it immediately (before receiving any income) to C and consume all the proceeds. Then any policy that induces A to give the consol to B obviously has no income tax implications, despite differences in the marginal tax rates of these individuals. This hypothetical case raises a general point: as taxpayers' marginal propensities to consume their resources rise, the value of the government's claim on their wealth falls. Since investments produce taxable income, reinvestment is tantamount to transferring a portion of the after-tax claim to the government. If, as one would expect, wealthy individuals have higher propensities to reinvest, then transfers of assets from high- to low-bracket taxpayers will have an even greater impact on income tax revenues than indicated by the preceding hypothetical calculation.

Although I have cast this discussion in terms of a consol, the same reasoning applies equally well to all coupon bonds (by rolling these over, one can effectively produce a consol). Since capital gains have always received special treatment under the tax law, analogous calculations for stocks and real property are a bit more complex. One must specify the

fraction of earnings paid out as current income (dividends or rent) and the frequency with which individuals turn over assets, in addition to marginal tax rates and propensities to consume. Details of all such computations appear in the Appendix.

Throughout the following analysis, I employ the revenue valuation formulas derived in the Appendix. I assume a nominal interest rate of 8 percent. In addition, I take the dividend/earning ratio on stocks to be 0.5. Finally, I assume that investors turn over about 10 percent of their assets each year. This implies that corporate shares are held on average for 10 years (see King (1977)). I make no special calculations for real estate holdings, but treat them analogously to stock.

5.1 INTRA VIVOS TRANSFERS

I now turn to the problem of estimating the indirect revenue effects of induced intra vivos transfers. The first task is to measure the average ratio of gifts to bequests in a given year. I infer this ratio by combining several available figures. Kotlikoff and Summers (1981) estimated that in 1974 total intra vivos transfers were approximated 1.56 times the size of intergenerational bequests.⁶ Unpublished data collected by Paul Menchik and Martin David from 1967 estate tax records and reported by Kotlikoff and Summers allow us to determine the fraction of gross estates bequeathed across generations by sex and marital status of the decedent. Combining the Menchik–David figures with estate tax data on the distribution of gross estates over the same categories of decedents, I find that approximately \$0.338 out of every dollar of gross estates is bequeathed across generations. Thus, for every dollar of reported bequests, individuals concurrently transfer approximately \$0.527 ($= 1.56 \times \0.338) intra vivos. One can use this figure to estimate the likely magnitude of gifts in any desired year. For example, in 1983 the total value of all gross estates exceeding \$300,000 was \$50.4 billion. Accordingly, surviving individuals of similar economic status (age adjusted) probably transferred about \$26.5 billion ($= 0.527 \times 50.4$ billion) intra vivos in 1983.⁷

6. Specifically, they estimated that transfers across generations totaled about \$70 billion, and they attributed approximately 60.9 percent of this to intra vivos transfers. Intra vivos transfers include life insurance policies in which the incidents of ownership have been transferred to the beneficiary and which are therefore excluded from gross estate.
7. One could question this calculation on several grounds. First, wealthy individuals have more incentive to engage in estate planning and therefore probably make a larger fraction of their transfers intra vivos than do average individuals. For this reason, the calculation probably understates the true magnitude of such transfers. Second, a number of significant tax reforms took place between 1974 (the year for which Kotlikoff and Summers made their calculations) and 1983. These reforms included (i) the unification of

Not all of this is attributable to the estate tax. However, it seems reasonable to conclude on the basis of the evidence presented in section 4 that elimination of estate levies would have reduced this number by at least 25 percent. I have already argued that this evidence probably understates the true behavioral response for a variety of reasons. Indeed, estate planners often emphasize that lifetime gifts have various adverse nontax consequences, including loss of control over resources and premature enrichment of one's children, and they often recommend that individuals consider such transfers only if the tax advantages are deemed sufficiently important (see, e.g., Kess and Westlin (1982)). It therefore seems more likely that the estate tax motivates closer to 50 percent, and conceivably as much as 75 percent, of lifetime gifts. I will present separate calculations for each of these assumptions (25, 50, and 75 percent).

The actual revenue loss associated with the transfer of an asset worth \$1 depends upon several factors. The first is the nature of the tax system prevailing subsequent to the transfer, and the associated marginal tax rates of the concerned parties. I will provide separate calculations for hypothetical policy regimes in which pre-ERTA and ERTA income tax rate schedules are assumed to persist indefinitely, as well as similar calculations for the 1986 TRA. Table 2 contains marginal tax rate assumptions for donors, recipients, and average bondholders for each tax system. Note that I always place the donor in the highest tax bracket. The recipient's marginal tax bracket under the current law corresponds roughly to a married individual reporting taxable income (after deductions) of \$30,000 per year. I will return to these assumptions at the end of this section.

The second important factor concerns the propensity of each individual to consume out of current income. I consider two cases. In Case I, the

gift and estate taxes, (ii) the reduction in estate tax rates, (iii) the reduced progressivity of income tax rates, and (iv) the liberalization of the unified credit and yearly gift tax exclusion. The first three factors would tend to reduce *intra vivos* giving, but the fourth has the opposite effect. In view of the enormous importance of the unified credit and yearly exclusion to most individuals, I suspect that the \$26.5 billion figure is, if anything, on the low side.

Table 2 MARGINAL INCOME TAX RATE ASSUMPTIONS

	<i>Donor</i>	<i>Recipient</i>	<i>Average bondholder</i>
pre-ERTA	0.7	0.25	0.5
ERTA	0.5	0.25	0.4
TRA of 1986	0.28	0.15	0.23

donor consumes one half of realized nominal income, but the recipient consumes all of it. For Case II, I change the recipient's marginal propensity to consume to 0.7. Both cases reflect an assumption that, over the relevant time period, recipients tend to consume a higher fraction of current income. I expect this pattern because recipients usually anticipate substantial gifts and bequests in the future and are therefore less inclined to save. Although the difference between the marginal propensity to consume of donors and recipients does somewhat affect my results, the actual levels of these parameters appear to make very little difference.

The third factor concerns the timing of the gift. If the donor chose not to make an *intra vivos* transfer of wealth, the recipient would inherit this wealth upon the donor's death anyway. Consequently, my calculations should reflect lost revenues only between the time of the gift and the donor's eventual death. I will refer to this as the "acceleration factor." In section 3, I argued that good estate planning requires individuals to transfer resources as early in life as possible. Although I present calculations using acceleration factors of five, fifteen, and thirty years, I tend to prefer those based upon the larger figures.

The fourth and final factor concerns the nature of transferred assets. I present separate calculations for stylized stocks and bonds (see the Appendix for details). The characteristics of actual assets might differ from case to case.

Tables 3 through 5 contain results. Each entry in these tables indicates, under specified assumptions, the revenue loss (in cents) induced by a private transfer of assets worth \$1. Unfortunately, I have no direct evidence either on actual acceleration factors or on the composition of assets transferred *intra vivos*. To avoid conveying a false sense of precision, I simply eyeball these tables and select a figure that corresponds roughly to an acceleration factor between fifteen and thirty years and a portfolio consisting of stocks and bonds in equal proportions. For pre-ERTA income tax law, I surmise that the revenue loss per dollar transferred was close to \$0.40; for ERTA, it was roughly \$0.20; for the 1986 TRA, it is somewhere between \$0.10 and \$0.20.

In Table 6, I calculate the displacement factor (i.e., the fraction of *intra vivos* transfers attributable to estate taxation) and the value of lost income tax revenues under alternative sets of assumptions about the revenue loss per dollar of transferred wealth. I take the total value of *intra vivos* transfers for the target population to be \$26.5 billion, which corresponds to the estimated level of such transfers in 1983. My preferred estimates of revenue loss per dollar transferred, combined with a dis-

Table 3 LOSS PER DOLLAR TRANSFERRED—PRE-ERTA (IN CENTS PER DOLLAR)

<i>Acceleration factor</i>	<i>Case I</i>		<i>Case II</i>	
	Bonds	Stocks	Bonds	Stocks
5	16.6	6.4	16.3	6.4
15	45.0	18.3	42.3	18.1
30	77.2	33.8	68.8	31.5

Table 4 LOSS PER DOLLAR TRANSFERRED—ERTA (IN CENTS PER DOLLAR)

<i>Acceleration factor</i>	<i>Case I</i>		<i>Case II</i>	
	Bonds	Stocks	Bonds	Stocks
5	9.4	3.9	9.1	3.8
15	26.7	11.2	24.3	10.9
30	47.0	20.8	40.7	19.5

Table 5 LOSS PER DOLLAR TRANSFERRED—TRA OF 1986 (IN CENTS PER DOLLAR)

<i>Acceleration factor</i>	<i>Case I</i>		<i>Case II</i>	
	Bonds	Stocks	Bonds	Stocks
5	4.9	2.8	4.7	2.7
15	14.1	8.6	12.6	8.3
30	25.5	17.2	21.5	16.0

Table 6 REVENUE LOSS FROM INDUCED INTRA VIVOS TRANSFERS (IN BILLIONS OF DOLLARS)

<i>Revenue loss per dollar of wealth transferred</i>	<i>Displacement factor</i>		
	0.25	0.5	0.75
0.1	0.7	1.3	2.0
0.2	1.3	2.7	4.0
0.3	2.0	4.0	6.0
0.4	2.7	5.3	8.0
0.5	3.3	6.6	10.0

placement factor of 0.5, generate the following conclusions. Under the highly progressive pre-ERTA income tax rates, income tax losses associated with intra vivos transfers induced by the estate tax would amount to between \$4.5 billion and \$5 billion. Under ERTA rates, this figure would be between \$3 billion and \$3.5 billion. By making the income tax system less progressive, the 1986 TRA would reduce this loss to perhaps \$2 billion (the effect of this Act is somewhat vitiated by the removal of the capital gains exemption). To put these numbers in perspective, one should bear in mind that the federal government collected \$5.17 billion from levies on estates with gross values exceeding \$300,000 in 1983.⁸

It is unfortunately not entirely appropriate to compare revenue loss calculations based upon the level of intra vivos transfer in 1983 with estate tax revenues in 1983 for two of the three tax regimes. Income tax rates during this period were established by ERTA, and taxpayers probably expected these rates to persist indefinitely. I have already remarked that differentials between marginal personal income tax rates by themselves provide incentives for individuals to make gifts rather than bequests. Had taxpayers expected pre-ERTA income tax rates to prevail after 1983, the division of transfers would probably have been more skewed toward gifts. Accordingly, official estate tax revenues would have been lower, and the true revenue picture would have been even worse. Conversely, had taxpayers expected the 1986 TRA rates to prevail after 1983, the division of transfers might have been more skewed toward bequests. Although this would make the total revenue picture a bit better than my calculations suggest, I suspect that the resulting bias is very small.⁹

At this point, it is appropriate to reflect on the accuracy of the marginal tax rate assumptions employed throughout this exercise. For a number of reasons, these may be erroneous. First, the children of wealthy individuals may in many cases be wealthy themselves, especially after accumulating significant gifts. Second, even comparatively wealthy individuals may have relatively low taxable incomes upon retirement. Third, it is well known that many taxpayers shelter enormous amounts of income. Some may even drive their marginal tax rates to zero through vigorous use of

8. Total estate tax revenues were slightly higher than this, because before 1984 the filing requirement was below \$300,000. Unfortunately, the IRS has only released data on estates with gross values exceeding \$300,000 for 1983. Accordingly, my calculations are intended to approximate the true net revenue associated with taxing this group.

9. According to my calculations, transferring an asset worth \$1 intra vivos lowers the present value of income tax payments by approximately \$0.20 under ERTA rates and \$0.15 under TRA rates. The effect of this reform on intra vivos transfers should therefore be more or less equal to the effect of cutting the estate tax rate by only 5 percent. Other aspects of the TRA may reduce this effect even further. See the discussion in section 6.3.

provisions such as the investment tax credit. On the other hand, many of the techniques discussed in section 3 for avoiding estate tax also allow such individuals to pass surplus tax shelters to their children, thereby reducing income tax revenues through a related channel. One should also recall that several techniques (i.e., the use of life insurance and pension funds) provide for free accumulation subsequent to the transfer. In addition, children may often use transferred funds to purchase homes, in which case subsequent implicit income escapes taxation entirely. Finally, my calculations completely ignore the revenue losses associated with avoidance activities that reduce gross estates below the filing requirement. It is, however, impossible to account properly for any of these factors without access to currently unavailable IRS records.

5.2 CHARITABLE BEQUESTS

I now turn my attention to charitable bequests. In 1983, decedents with gross estates exceeding \$300,000 left approximately \$2.5 billion to charities. To calculate the indirect impact on income tax revenues, one must first determine the fraction of this attributable to estate taxation.

I employ Clotfelter's behavioral estimates to compute the impact on charitable bequests of eliminating estate taxation. Using parameters from his most conservative case,¹⁰ I find that charitable bequests would decline by 79.3 percent, or, for 1983, about \$2 billion. Such bequests would have all but disappeared for estates under \$1 million and would have fallen by more than 76 percent for estates exceeding \$1 million.

What is the revenue loss per dollar bequeathed to charity? Here, the relevant comparison is between having the family retain the wealth indefinitely, passing the unconsumed portion from generation to generation, and having it bequeath the same wealth to a tax-exempt institution. I assume that the family is always taxed at the highest statutory marginal rate, and I calculate revenue losses per dollar of transferred assets. Table

10. For estates of less than \$1 million, I assume price and income elasticities of -1.6 and 0.4 , respectively, and a marginal estate tax rate of 39 percent. For estates exceeding \$1 million, these figures are -1.0 , 0.4 , and 45 percent, respectively.

Table 7 REVENUE LOSS PER DOLLAR OF CHARITABLE BEQUEST (IN CENTS PER DOLLAR)

	<i>Bonds</i>	<i>Stocks</i>
pre-ERTA	142.9	119.8
ERTA	200.0	137.6
TRA OF 1986	68.3	111.6

7 contains results for stylized stocks and bonds under the three tax systems considered earlier. Again I eyeball this table and select figures that roughly reflect a portfolio divided equally between stocks and bonds. Under pre-ERTA income tax law, the revenue loss exceeded \$1.50 on each dollar of induced charitable bequests, or (for 1983 levels of charitable bequests) about \$3 billion in the aggregate. For rates prevailing subsequent to ERTA, the loss appears to have been about \$1.25 on each dollar, or \$2.5 billion in the aggregate. Under the tax reform bill, the loss is between \$0.80 and \$1 on the dollar, or between \$1.5 billion and \$2 billion in the aggregate.

I have presented estimates of revenue losses from intra vivos giving and charitable bequests for three hypothetical policy regimes in which, respectively, pre-ERTA, ERTA, and TRA income tax rates are assumed to prevail and to persist indefinitely after 1983. Combining these estimates produces striking results. Under my preferred assumptions, estate taxation would have induced a net loss of federal tax revenues roughly equal to \$3 billion in 1983 for the highly progressive pre-ERTA income tax regimes. The estate tax probably would have broken even in 1983 or even generated a small loss under the ERTA income tax regime (the total net reduction of income tax revenues, \$5.5 billion to \$6 billion, slightly exceeds official estate tax revenues for the target group). For rates adopted in the 1986 TRA, indirect losses would have been in the neighborhood of \$3.5 billion to \$4 billion, or roughly 70 to 80 percent of reported revenues. Even under the more conservative view that estate taxation is responsible for only 25 percent (rather than 50 percent) of intra vivos transfers, true revenues would still have been negative under pre-ERTA income tax rates, perhaps 10 percent of reported revenues under ERTA, and less than half of reported revenues under the TRA rates.

I caution against attaching too much importance to any particular set of numbers. It seems clear that indirect revenue effects may be large relative to reported revenues, but available data simply do not permit precise calculations.

6. Additional Considerations

6.1 ANCILLARY EFFECTS OF SOPHISTICATED ESTATE PLANNING TECHNIQUES

The income tax implications of many estate-planning techniques are complex. In addition to shifting income between taxpayers, some techniques create taxable income, and others generate new shelters. A complete analysis of all indirect effects would represent a major undertaking. For the time being, I simply note that estate planners tend to recommend

against techniques in cases where they would create significant income tax liabilities. I have, for instance, already remarked that the preferred stock recapitalization is typically applied only when the parent desires a high level of current income for his or her personal purposes.

6.2 STEP-UP OF BASIS AT DEATH

Another factor that deserves careful consideration is the step-up of basis at death for income tax purposes. If the estate tax causes individuals to transfer assets through gifts that they would otherwise have held until death, then, upon the eventual sale of such assets, total capital gains tax liabilities will be greater. Although this consideration somewhat vitiates our conclusions, I suspect that it is of comparatively minor importance for four reasons.

First, individuals concerned with tax avoidance clearly have an incentive to transfer *intra vivos* all assets that they do not intend to hold until death before transferring any assets that they never intend to sell. Thus, the relevant question is whether or not donors tend to turn over marginal assets at regular intervals. The evidence presented in section 5 suggests that affluent individuals transfer roughly one third of their total holdings *intra vivos* and two thirds at death. Thus, as long as these individuals tend to turn over at least one third of their assets, I would not expect them to retain the marginal asset until death.

Second, if a parent is inclined to hold onto an asset for his or her entire life, the heirs may well feel similarly inclined. This is particularly true when the asset in question is a family business or closely held corporation. Thus, the date of eventual sale may be quite distant even at the time of the parent's death, in which case the discounted value of the incremental tax would be quite small.

Third, when individuals hold assets until death, they often go to great lengths to undervalue these assets, thereby minimizing estate tax liability. In fact, Cooper (1979) points out that, through manipulating a series of special factors that cause tax courts to reduce the assessed market value of assets (particularly in closely held corporations), decedents have succeeded in sheltering as much as two thirds of actual asset value for estate tax purposes. Of course, in the process, these decedents also lose the step-up of basis.

Fourth, families that deliberately avoid estate tax may also be fairly sophisticated about avoiding income tax. In particular, by appropriately timing the realization of gains and losses, taxpayers may be able to minimize, or even entirely eliminate, capital gains tax liabilities (see Stiglitz (1983)). Although it appears that very few investors do this in their daily portfolio management (see Poterba (1985)), they may well find it worth-

while to do so when realizing large gains on assets that have been held for a very long time.

Consideration of the step-up of basis at death raises a related issue. This provision probably does not significantly vitiate my conclusions, but it may well deter taxpayers from transferring *intra vivos* substantially more assets than they do already. Indeed, estate planners agree that by removing the opportunity to pass on property at death free of capital gains tax, Congress would "increase greatly interest in estate tax avoidance" (Cooper (1979, p. 11)). Accordingly, such action would be likely, on balance, to depress federal revenues, contrary to common wisdom.

6.3 THE TAX REFORM ACT OF 1986

Throughout this discussion, I have emphasized that the 1986 TRA reduces the progressivity of federal income tax rates and thereby attenuates the revenue loss per dollar diverted from bequests to gifts. The Act may also have other important effects, to which I have alluded only briefly. Specifically, this decline in progressivity by itself reduces incentives for *intra vivos* transfers. Under the new Act, we might therefore expect both bequests and estate tax revenues to be higher, whereas the marginal effect on lifetime giving of eliminating the estate tax might well decline.

However, the Act also introduces countervailing forces. First, it eliminates several opportunities for wealthy individuals to accumulate resources tax free (e.g., through individual retirement accounts (IRAs)). Second, it removes numerous tax shelters (e.g., the investment tax credit, the capital gains and dividend exclusions, investment interest deductions, and passive business loss offsets) through which many wealthy individuals currently achieve significant reductions in their marginal tax rates. The net effect of these changes remains to be seen.

In addition, I have been somewhat conservative by assuming that wealthy parents will face marginal income tax rates of 28 percent. The Act includes a surcharge on taxable income between \$71,900 and \$149,250 for couples (\$43,150 and \$87,560 for single individuals) that may well produce an effective marginal tax rate of 33 percent for many wealthy taxpayers.

Other provisions also bear on these issues to a lesser degree. Unearned income for children under fourteen is now counted as taxable income for the parent; this somewhat attenuates the ability of parents to arrange significant transfers of resources very early in life. The Act also curtails income splitting through trusts, eliminates the advantages of Clifford and Spousal Remainder Trusts, and strengthens the Generation

Skipping Tax. Yet it is difficult to imagine that these provisions would have a large effect on the overall picture described here.

7. Conclusions

In this paper, I have suggested that the indirect effects of estate levies on personal income tax revenues are extremely large relative to estate tax collections. Although it is very difficult to estimate these effects precisely, in recent years true estate tax revenues may well have been negative. I have emphasized that these conclusions are highly dependent on the progressivity of the personal income tax, but I have also shown that indirect revenue effects would continue to be extremely important even under the new tax reform bill. Accordingly, common planning techniques severely cripple the ability of the federal government to achieve the dual purposes of promoting equity and raising revenue through estate taxation.

Nevertheless, the existence of this tax does appear to effect a diversion of substantial resources (upward of \$2 billion per year) to charity, and many may view this as sufficient justification for its retention. Furthermore, avenues for curtailing estate tax and gift tax avoidance have not yet been fully exhausted. By pursuing such avenues, the federal government might well succeed in reducing large concentrations of wealth while significantly enhancing total federal revenue. Yet in the absence of far-reaching reform, it seems unlikely that the estate tax will do much more than benefit charitable causes.

APPENDIX

In this Appendix, we derive formulas that express the value of the government's claim on a privately held asset as a function of the holder's characteristics, the tax system, and the nature of the asset.

First, consider a bond (consol) that pays \$ i per year forever. Suppose that the interest rate is i , so the value of the bond is \$1. Each year, the bondholder, whose marginal tax rate is m , consumes a fraction γ of nominal after-tax income generated by the bond and reinvests the remainder in new bonds. Bonds pay interest at the beginning of each year starting in year 1, so at the end of year t the investor owns bonds worth

$$(1 + i(1 - m)(1 - \gamma))^t$$

and pays taxes of

$$im(1 + i(1 - m)(1 - \gamma))^{t-1}$$

in period $t + 1$. If \bar{m} is the marginal tax rate of the average bondholder, the present discounted value of this revenue stream through year T is

$$\begin{aligned} & \sum_{t=1}^T \frac{im(1 + i(1 - m)(1 - \gamma))^{t-1}}{(1 + (1 - \bar{m})i)^t} \\ &= m \left[\frac{1}{(1 - \bar{m}) - (1 - \gamma)(1 - m)} \right] \\ & \quad \left[1 - \left(\frac{1 + i(1 - m)(1 - \gamma)}{1 + (1 - \bar{m})i} \right)^T \right]. \end{aligned}$$

To calculate the revenue loss associated with transferring the bond from one taxpayer to another for a period of T years, we simply calculate the change in the value of this expression associated with changing the values of m to γ .

Next, consider a stock that, in year 0, represents a claim on capital assets worth \$1. These assets yield after-corporate income tax earnings of ρ at the beginning of each year, starting in year 1. The company always pays out the fraction α of earnings as current dividends and retains the remainder, investing it in new capital assets. Thus, at the end of year t , one share of stock represents a claim on capital assets worth $[1 + \rho(1 - \alpha)]^t$.

Let A_τ^t denote the number of shares of vintage τ stock (shares bought in period t) that the investor still holds at the end of period $t \geq \tau$. We take $A_0^0 = 1$. Each year, the investor sells a fraction λ of his stock, irrespective of vintage. Thus,

$$A_\tau^t = A_\tau^\tau (1 - \lambda)^{t-\tau}. \quad (1)$$

He consumes the fraction γ of realized after-tax nominal income and re-invests the proceeds in stock. Once again, we use m to denote the investor's marginal tax rate and \bar{m} to denote the marginal tax rate of the average bondholder. In addition, we assume that the fraction e of realized capital gains is exempt from taxation. Accordingly, in period t , the investor pays taxes of

$$\begin{aligned} R_t = m \sum_{k=0}^{t-1} A_\tau^t \{ & \rho\alpha(1 + \rho(1 - \alpha))^{t-1} \\ & + \lambda(1 - e)[(1 + \rho(1 - \alpha))^t - (1 + \rho(1 - \alpha))^k] \} \quad (2) \end{aligned}$$

and purchases

$$A_t^t = (1 + \rho(1 - \alpha))^{-t} \sum_{k=0}^{t-1} A_k^t \{ \rho \alpha (1 - \gamma) (1 - m) (1 + \rho(1 - \alpha))^{t-1} + \lambda (1 + \rho(1 - \alpha))^k [1 + (1 - \gamma)(e + (1 - m)(1 - e)) / ((1 + \rho(1 - \alpha))^{t-k} - 1)] \} \quad (3)$$

shares of new stock. Although we were unable to obtain a nice closed-form expression for total revenues, (1)–(3) form a system of difference equations that can be solved numerically. We then value the revenue stream by discounting, as above.

As a final step, we relate ρ to i through capital market equilibrium conditions. Under traditional views of capital market equilibrium (see Poterba and Summers (1985)),

$$\rho = \frac{i(1 - m)}{\alpha(1 - m) + (1 - \alpha)(1 - z)}$$

where

$$z = \frac{\lambda(1 - e)m}{\lambda + i(1 - m)}$$

is the effective tax rate on capital gains (see King and Fullerton (1984)).

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