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ABSTRACT

This paper shows that previous analyses of IRA-type plans have miscalculated their effect on tax revenue and therefore on national saving by ignoring their impact on corporate tax payments. Recognizing the important effect of IRA plans on corporate tax revenue changes previous conclusions about the revenue effects of IRA plans in fundamental ways. The revenue loss associated with IRAs is either much smaller than has generally been estimated or is actually a revenue gain, depending on the time horizon and key parameter values.

In addition to analyzing the effects of traditional tax-deductible IRA plans, the paper presents an alternative nontaxable IRA (in which contributions are not deductible and no subsequent tax is levied on earnings or withdrawals) and shows that, for the most plausible parameter values, the net revenue effect is positive in every year.

Although each individual participant eventually withdraws all of his own contributions and accumulated earnings from his IRA account, the net impact on the national capital stock of that individual's participation remains positive even after his death because of the favorable cumulative effects on tax revenue. This is true for traditional deductible IRA plans as well as for the nontaxable IRAs.

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The Effects of Tax-Based Saving Incentives on Government Revenue and National Saving

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The low rate of saving and investment in the United States is a major impediment to national economic growth and rising real wages. Study after study confirms that the primary explanation of intercountry differences in economic growth is the share of GNP devoted to investment.[1] Moreover, despite the increasing integration of the world capital markets, the rates of investment in the major industrial countries are closely related to their rates of saving.[2] During the 1980s, gross saving in the United States averaged 16.3 percent of GNP while gross investment averaged 18.3 percent of GNP, the gap being financed by a capital inflow from abroad. In contrast, Japan's 31.6 percent saving rate financed investment equivalent to 29.4 percent of GNP with the excess used to finance overseas investment. These are not isolated examples but part of a general pattern; Feldstein and Bacchetta (1991) report that on average about 80 percent of each additional dollar of saving in the OECD countries remained in the country of origin.

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*Professor of Economics, Harvard University and President, the National Bureau of Economic Research. I am grateful to Todd Sinai for assistance with the calculations presented in this paper and to David Bradford, Glen Hubbard, Jonathan Skinner and David Wise for discussions about this research. This paper is part of the NBER's study of the economics of saving.

[1]See for example recent papers by Mankiw et al., 1990; Romer, 1989; De Long and Summers, 1991; and Hatsopoulos et al., 1988.

[2]See Feldstein and Horioka (1980), Feldstein and Bacchetta (1991) and Frankel (1991) and the references cited there. Over time, the increasing flow of capital within the European Community has weakened the correlation between saving and investment rates in this group of countries.

Although there are several possible reasons for the low rate of saving in the United States, one of the primary suspects is the low or negative real after tax return that households receive on savings. Consider an individual whose savings are invested in money market mutual funds where they earned 7.9 percent in 1990. With a federal marginal tax rate of 28 percent and a net state marginal tax rate of 5 percent, the net return was 5.3 percent and the net real return was a negative -0.8 percent.[3] Although offsetting income and substitution effects imply that lowering the rate of return has an ambiguous impact on saving, the analysis of Summers (1981) suggests that in practice the likely effect of a lower rate of return is a lower rate of saving. Moreover, as Feldstein and Tsiang (1968) noted, the theoretical ambiguity disappears for individuals who initially do no financial saving; for such individuals, savings would unambiguously be increased by a rise in the real net rate of interest.

Empirical research on this issue is particularly difficult because of the problems involved in measuring the expected long-term real net-of-tax return on savings. It is not surprising, therefore, that econometric studies have produced a wide range of results including Boskin's (1978) estimate of a substantial positive effect of interest rates on saving and Hall's (1988) estimate that the interest elasticity is near zero.

Many countries around the world have developed tax rules to encourage saving or, more accurately, to neutralize the adverse effect of ordinary income tax rules on the rate of

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[3]The year 1990 was not atypical. For the previous two decades the nominal pretax return on short term money market instruments averaged 8.3 percent while the CPI inflation rate averaged 6.3 percent. Since it is the nominal return that is subject to tax, the real aftertax return was negative.

return to savers. All of these have the general effect of excluding some amount of interest income or other investment income from taxable income. In the United States, the primary saving incentive at the personal level is the Individual Retirement Account. David Wise and Steven Venti have presented extensive evidence that IRAs raise personal saving and have argued that IRAs can raise saving even if saving is generally insensitive to the net rate of return because IRAs are perceived by householders as a special way to save for retirement and not just as a more favorable rate of return; see Venti and Wise (1992) and the references to their earlier studies cited therein.

This paper shows that previous analyses of IRA-type plans have miscalculated their effect on tax revenue and therefore on national saving by focusing exclusively on their impact on personal tax payments. In addition, IRA-type plans have important positive effects on corporate tax revenue. Recognizing the effect on corporate tax revenue changes the conclusions about the revenue effects of IRA plans in fundamental ways. The revenue loss associated with IRAs is smaller than generally estimated or is actually a revenue gain.

The next section describes existing IRA rules and summarizes the econometric evidence on their effect. The second section discusses the importance of recognizing the corporate tax effects of IRAs and summarizes the implications of doing so. Section 3 presents an explicit analysis of the effects of a traditional tax-deductible IRA plan on personal and corporate tax revenues. Section 4 then links together a growing population of individual IRA participants to calculate the aggregate effects of the IRA program over time. Section 5 discusses an alternative type of nontaxable IRA (in which contributions are not deductible and no subsequent tax is levied on earnings or withdrawals) and shows that, for the most

plausible parameter values, the net revenue effect is positive in every year. There is then a brief concluding section that comments on the implications of the present analysis for the revenue effects of a wider variety of saving incentives.

1. Individual Retirement Accounts

Since the Tax Reform Act of 1986, two types of IRAs have existed. The first type is a tax-deductible IRA. Eligible taxpayers may contribute $2,000 per employed person to a special account with a bank, mutual fund or securities firm. The $2,000 is deducted from taxable income and the interest receipts and other earnings on the fund are not subject to tax as they accrue. Funds can be withdrawn without penalty after the individual reaches the age of 59 1/2. At that time, all withdrawals are subject to income tax.

The Tax Reform Act of 1986 limited the use of this type of deductible IRA to married taxpayers with income under $40,000 and single taxpayers with incomes under $25,000 (with a phase out to $50,00 for married taxpayers and to $35,000 for single taxpayers), and to all taxpayers who do not have a retirement plan where they work. All other taxpayers are permitted to contribute after-tax income to an IRA in which the accruing income is untaxed. When the funds are withdrawn after age 59 1/2, the principal is not subject to tax but the accumulated income is taxable. This second type of IRA provides a higher rate of return than ordinary savings (since the tax on the interest and dividend income is deferred) but a lower rate of return than the original deductible IRA (since the principal contribution is not deductible).

Although IRAs have been very popular and widely adopted, critics argue that the induced increase in personal saving is more than offset by a reduction of tax revenue, leaving national saving less than it would have been without an IRA program.[4] In the extreme case in which an individual who would have saved $2,000 or more without an IRA deposits his savings in an IRA account, there is no increase in personal saving but a loss of tax revenue and therefore an increase in government dissaving; national saving as a whole declines. Alternatively, an individual who transfers previously accumulated taxable funds to an IRA receives a tax benefit without any increase in personal saving.

Although such behavior does occur, there are strong reasons to believe that its importance is quite limited in practice, especially after a brief two or three year transition period after the introduction of an IRA program. Most Americans do very little financial saving and have very little in accumulated financial assets. According to the Federal Reserve Board Survey of Consumer Finances, the median financial assets of households in 1984 was only $2,600. Even among households in the middle quintile of the income distribution headed by an individual between 55 and 64 years old, the median financial assets were only $10,000. This shows both that individuals save very little each year and that the accumulated stock of past saving is only enough to finance at most a few years of IRA contributions without additional saving.[5]

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[4]See, for example, Gravelle (1991) and the references cited therein.

[5]This point was emphasized and several related measures were presented in a study of possible IRA-type accounts by Feldstein and Feenberg (1983) that was done before IRAs were enacted.

The analysis of actual IRA experience generally confirms that deductible IRA's have been quite effective in raising national saving. The increase in personal saving substantially exceeds the decline in tax revenue. On the basis of several studies using different bodies of data, Wise (1987) concluded that an incremental dollar of deductible IRA contribution is financed by approximately a 45 cent to 55 cent reduction in consumption, a 35 cent reduction in taxes, and a reduction of other saving of 20 cents or less.[6]

Although the statistical evidence on balance implies that an expanded IRA plan (e.g., a return to the universal deductibility of IRAs that prevailed before the Tax Reform Act of 1986) would increase national saving, the political process is reluctant to make any change in tax rules that would reduce tax revenue and enlarge the budget deficit even if on balance it leads to an increase in national saving.[7] Although some economists might be tempted to argue that this is a misplaced emphasis because the deficit is important only to the extent that it depresses national saving, the political reluctance to countenance any revenue reduction is part of a larger process designed to enforce discipline on total government spending and taxation. Perhaps more fundamentally, an increase in the public debt is itself a burden on

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[6]See also Venti and Wise (1986, 1987, 1988, 1990, 1991 and 1992) and Feenberg and Skinner (1989). Although Gale and Scholz (1990) reach a different conclusion, their estimates are not consistent with other analyses of the same data. The Venti and Wise analysis also indicates that IRAs even raise saving among those who would have saved the maximum IRA contribution even without an IRA, supporting their view that IRAs are thought of by at least some households as separate from other types of saving.

[7]The Budget Enforcement Act of 1990 formalized this by requiring that any decrease in tax revenue during the first five years after a tax change must be balanced by a revenue neutral increase in some other taxes or decrease in government nondefense discretionary spending.

the economy even if it is balanced by a rise in private saving because the interest on the public debt has to financed by distortionary taxes that impose an excess burden.

2. IRAs and Corporate Tax Receipts

The effect of IRAs on tax revenue is therefore a particularly important parameter. The analysis that follows shows that existing calculations of the revenue effects of IRA-type plans have overstated the revenue loss or turned an actual revenue gain into an estimated revenue loss by ignoring the impact of IRAs on corporate tax receipts. An increase in private saving increases the capital stock and the return on this additional capital increases corporate tax payments that offset the loss of personal income tax revenue.

Correcting this mistake has a very substantial impact on the estimated effect of an IRA program on total tax revenue. For a wide range of different parameter values, the present analysis shows that recognizing the effect of the IRA on corporate tax receipts has four implications:

First, the estimated revenue loss caused by the introduction of a deductible IRA plan is reduced substantially by the corporate tax revenue during the first five years after enactment of the IRA program. With the most likely parameter values, the corporate tax revenue offsets 34 percent of the decline in personal tax revenue during those five years and 67 percent of the decline in 10 years.

Second, over a longer time period the IRA program actually increases total tax revenue and does so by so much that the present value of the change in annual tax revenues is positive. This implies that the national debt is eventually permanently lower than it would

have been without the IRA program. Although each individual eventually withdraws all that he has accumulated in the IRA, the national capital stock is therefore permanently higher because the increased government receipts have permanently reduced the national debt.

Third, if other taxes are adjusted each year to keep the annual deficits unchanged, the time path of the required revenue changes is such that the present value of the deadweight losses associated with raising taxes when there is a revenue decline are outweighed by the reduced deadweight losses when there is a net revenue gain.

Fourth, it is possible to construct an alternative IRA plan with an equivalent impact on the incentive to save for which there is likely to be no loss of revenue in any year because the increased corporate tax revenue outweighs the loss of personal income tax revenue in every year. Such a plan would allow individuals to contribute after-tax dollars into an IRA account but, unlike the current non-deductible IRAs, would then impose no tax on either the accruing interest and dividend income or the ultimate withdrawal of funds. Such a "non-taxable IRA" would have the same rate of return as the current fully deductible IRA (in which withdrawals are taxed in full.)

There is a further potential complication in the analysis of the effect of an IRA program on corporate tax revenue. If the IRA increases the size of the government deficit in any year, i.e., if any revenue decline is not offset by changes in other taxes or government spending, the government's financing of that increased deficit may crowd out corporate capital formation and thereby reduce future corporate tax revenue. The extent of this effect depends on whether the increased government borrowing is financed by a capital inflow from abroad (in which case there is no change in domestic corporate capital formation) or by

domestic borrowing. If the increased deficit is financed in part by domestic borrowing, the impact on future corporate tax revenue depends on how much that borrowing crowds out corporate investment and how much it crowds out the construction of owner-occupied housing and other consumer spending. To the extent that an increased budget deficit in one year does reduce corporate investment and therefore future corporate tax revenue, each initial dollar of increased deficit implies a larger equivalent rise in the present value of current and future deficits. A similar "multiplier" effect is associated with any initial decrease in the budget deficit.

To avoid adding extra complexity in the analysis that follows, I will not elaborate this secondary impact of budget deficits. Three things are worth noting about the implication of not explicitly incorporating this secondary effect:

First, since each dollar of initial change in the budget deficit is equivalent in present value to some multiple of a dollar of deficit, the results derived below (and summarized above) about the effect of an IRA program on the present value of future deficit changes and the present value of the deadweight losses associated with those changes would not be altered by taking the secondary effect into account.

Second, if there is a secondary increase in the deficit, the tax-deductible IRA plan would induce a larger increase in the deficit during the first several years after enactment than the calculations which follow indicate. It remains true however that the induced rise in corporate tax receipts reduces the primary revenue loss during these years so that the tax increases or spending reductions that would be needed to balance the near-term revenue losses of a tax-deductible IRA are smaller than they appear in conventional calculations that

do not recognize the favorable effect of the IRA on corporate tax receipts. If such other tax increases or spending reductions are used to balance the annual revenue effects of the IRA program, there is no scope for the secondary effect of a deficit on future corporate tax receipts.

Third, since the direct effect of the alternative "nontaxable IRA" described above (including the impact on corporate as well as personal tax revenues) will in the most plausible parametric cases be shown to increase revenue in every year, the secondary effect only enhances the favorable impact of the "nontaxable IRA" on the time path of the national debt. More specifically, since the positive effect on corporate tax revenue exceeds the loss of personal tax revenue, the direct effect of the nontaxable IRA is to reduce the deficit each year. To the extent that that reduction in government borrowing leaves more funds available for corporate investment, the future tax revenue on that additional stock of corporate capital means that in future years there will be even smaller budget deficits and an even smaller national debt.

3. Tax Revenue Consequences of IRA Participation

To assess the full revenue consequences of an IRA program and the role of the corporate tax in particular, I begin by examining the effect of a single individual's participation in a traditional tax-deductible IRA plan. After analyzing a particular central case, I discuss the sensitivity of the results to alternative parametric specifications.

Consider an individual who starts an IRA account at age $\underline{a}$. He contributes C_t a year through age 64, a total of 65 - $\underline{a}$ contributions. The accumulated fund and the interest on it are then used to finance a constant annual withdrawal from age 65 through age 79. The annual contributions are deductible by the individual in calculating his taxable income. The income earned in the IRA is not subject to personal income tax but the withdrawals from the account are fully taxable.

Thus during the individual's preretirement years the value of the account evolves according to:

$$(1)\quad A_t = [1 + (1 - \tau)\, r]\, A_{t-1} + C_t \qquad t = \underline{a},\ldots,64$$

where A_t is the value of the account at the beginning of year t, C_t is the contribution to the account (assumed to be made at the beginning of the year), r is the pretax rate of return on additions to the corporate capital stock, and τ is the marginal rate of tax on corporate profits. This way of writing the accumulation equation emphasizes that the return on saving in an IRA is exempt from personal tax but not from corporate tax. The analysis abstracts from inflation, implying that r is a real rate of return and that the contributions and accumulated fund are real magnitudes. The analysis also ignores the distinction between corporate debt and equity finance as well as the possibility that some of the funds in the IRA might finance such noncorporate investments as owner-occupied mortgages or be invested outside the United States.

The individual accumulates A_{64} at the start of his 64th year and retires at the end of that year. At ages 65 through 79 he withdraws 15 constant annual amount R that satisfy

(2) $A_t = [1 + (1 - \tau)\, r]\, A_{t-1} - R \qquad t = 65,\ldots,79$

with A_{64} given by equation 1 and $A_{79} = 0$.

The usual analysis of the revenue effect of such an IRA program focuses exclusively on the changes in personal tax revenue. Since contributions are deductible and withdrawals are fully taxed, the direct effect of the IRA on personal tax revenue is $-\theta_t(C_t - R_t)$ where θ_t is the individual's marginal rate of personal income tax and $R_t = R$ for $t = 65,\ldots,79$ and $R_t = 0$ during the preretirement years. In addition, personal tax revenue is reduced because some of the funds in the IRA account would have been saved even without the IRA and the interest and dividends on those savings would have been subject to personal income tax.

To calculate the loss of tax revenue on the accumulated pool of diverted savings, assume that the fraction of the IRA contribution that is diverted from other saving is a constant λ in each year. The capital stock that would have been accumulated with such savings is therefore:

(3) $B_t = [1 + (1-\theta_t)(1-\tau)r]\, B_{t-1} + \lambda\, C_t - W_t$

where B_t is the diverted capital stock at the beginning of year t, λ is the fraction of the IRA contribution that would otherwise have been saved, and W_t is the withdrawal that would have

been made from the diverted capital stock at the beginning of year t. Assuming that the funds accumulated in this way would also have been withdrawn at a constant rate during retirement, the rate of withdrawal W satisfies equation 3 for t = 65 through t = 79 with $B_{79} = 0$ and B_{64} given by the solution of equation 3. Note that the individual would earn a rate of return on the diverted capital stock that is net of both the corporate and the personal tax rates.

The diversion of saving into the IRA thus reduces personal tax revenue on the diverted capital income in year t by $\theta_t(1-\tau)rB_t$. The combined net effect on personal tax revenue is thus a revenue loss of $\theta_t[(C_t-R_t) + (1-\tau)rB_t]$. There is an unambiguous loss of personal tax revenue of $\theta_t[C_t + (1-\tau)rB_t]$ during preretirement years. During the early retirement years the revenue effect is ambiguous since the revenue gain of $\theta_t R_t$ must be balanced against the revenue loss of $\theta_t\ (1-\tau)rB_t$.

These traditional calculations ignore the potentially more important effect of the IRA on corporate tax revenue. When an IRA increases national savings, the additional savings are divided between the corporate sector capital stock, the noncorporate sector capital stock (primarily real estate), and net foreign investment. Each of these forms of investment implies some increase in taxable business income (except for owner-occupied housing), with the exact amount depending on the mixture of debt and equity financing. To simplify the analysis at this point, I now assume that all additional savings are added to the corporate sector capital stock in the form of equity capital. This assumption will be modified in the empirical implementation that follows. With this assumption, the change in the corporate tax revenue in year t that results from the IRA is $\tau(A_t - B_t)r$, the tax revenue on the stock of

capital accumulated through IRA contributions minus the tax revenue lost on the stock of capital foregone because of the diverted savings. The net effect of the IRA on total tax revenue is thus:

$$(4)\quad T_t = -\theta_t [C_t - R_t + (1-\tau)rB_t] + \tau (A_t - B_t)r.$$

If the annual contributions during the preretirement period are constant ($C_t = C$) and the personal tax rate remains unchanged ($\theta_t = \theta$) during those years, the revenue effect during the preretirement years is easily shown to be:

$$(5)\quad T_t = -\theta C - \theta \lambda C \{[1 + (1-\theta)(1-\tau)r]^t - 1\}/(1-\theta) + [C \tau /(1-\tau)] \{[1+(1-\tau)r]^t -1\} - [\lambda C \tau /(1-\theta)(1-\tau)]\{[1+(1-\theta)(1-\tau)r]^t -1\}.$$

The first two terms reflect the changes in personal tax revenue and the last two terms reflect the changes in corporate tax revenue. The change in personal tax revenue is negative in each year and becomes larger as the preretirement period progresses. The corporate tax effect is positive at $t = 1$ and grows in relative importance with time because the funds in the IRA account earn a higher rate of return (a return of $(1-\tau)r$) than ordinary savings (where the return is $(1-\theta)(1-\tau)r$. If the preretirement period lasts long enough, the corporate tax effect will eventually dominate the loss of personal tax revenue and the total annual revenue effect will be positive.

Note that the eventual domination of the positive corporate tax effect is true even if all of the IRA contribution is financed by a reduction in other saving ($\lambda=1$) since over time the individual's wealth is larger because of the higher net return earned in the IRA account.[8] In the opposite extreme in which other saving is not reduced at all to fund the IRA contribution ($\lambda=0$), the effect of the IRA on tax revenue in the preretirement years becomes simply

$$(6)\quad T_t = -\theta C + \tau C \{[1 + (1-\tau)r]^t - 1\}/(1-\tau).$$

If the marginal corporate tax rate is $\tau = 0.34$ and the pretax real return on corporate capital is $r = 0.1$, by the fourth year the extra corporate tax revenue exceeds the personal tax loss if the personal tax rate is $\theta = 0.15$. If $\theta = 0.25$, the extra corporate tax revenue exceeds the loss of personal income tax revenue in the seventh year.

The analysis is more complicated in the realistic case in which some fraction of the IRA contribution is diverted from other savings. To illustrate this effect and to examine the evolution of revenue in the postretirement period as well, it is useful to consider a variety of numerical examples. These also indicate the sensitivity of the basic results to variations over time in the source of the IRA contribution (e.g., a higher λ and more diverted savings initially than at a later date) and in the individual's marginal personal income tax rate (e.g., a lower rate in retirement than during the working years.)

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[8]This assumes that the higher accumulated wealth does not in itself affect consumption and saving.

Consider an individual who starts an IRA at age 45 and contributes $2,000 a year for 20 years. If the pretax real return on capital is r=0.10 and the marginal corporate tax rate is $\tau = 0.34$, the net return to the individual is 6.6 percent and the IRA value grows to $78,497 after 20 years.[9] With a 6.6 percent return in the IRA account, this accumulation can finance a constant annuity of R = $8402 a year for the 15 year retirement period.

If the individual faces a 25 percent marginal tax rate during his working years and has the same rate in retirement, the direct revenue effect is a revenue loss of $500 a year in the preretirement period and a revenue gain of $2100 a year during retirement. The indirect loss of personal tax revenue is $\theta\ (1\text{-}\tau)r\ B_t$ where B_t is the size of the capital fund that would otherwise have accumulated from the savings diverted into the IRA. If the diverted fraction is $\lambda = 0.2$, the fund that would have accumulated after 20 years would only have been $13,157, far less than the $78,497 accumulated in the IRA. The maximum loss of revenue from this source would occur when the diverted fund would be at its maximum, i.e., when the individual is age 64. The revenue loss would then be $\theta\ (1\text{-}\tau)r\ B_t = 0.25\ (0.66)(0.1)\$13157 = \$217$. Thereafter it would decrease as the size of the displaced fund would have been reduced through withdrawals.

Combining these two gives a loss of personal tax revenue that starts at $507 when the individual is age 45 and reaches a peak of $717 when he is age 64. The effect of the IRA on personal tax revenue becomes sharply positive at age 65 immediately after retirement when

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[9]A pretax real return of 10 percent is conservative in the sense that it is likely to understate the favorable effect of corporate tax revenue in offsetting the personal tax revenue lost through the deduction of IRA contributions. Feldstein, Poterba and Dicks-Mireaux (1983) estimated that the real return on additions to the stock of nonfinancial corporate capital was 11.5 percent from 1948 to 1979 and showed no trend over that time.

the tax of $2100 on the annual withdrawal exceeds the revenue loss of $207 on the income earned on the displaced capital stock. By age 79, the annual revenue gain is the full $2100.

If there are no offsetting changes in other taxes or government expenditures, these annual changes in personal tax revenue add directly to the national debt. The cumulative effect on that debt includes both these revenue changes and the interest that the government must pay on that additional debt. If the relevant real interest rate for the government is 2 percent,[10] the IRA increases the national debt by an amount that rises to a peak of $14,300 at the time that the individual retires in the twentieth year of the program. After that, the annual revenue gains outweigh the interest on the additional national debt so that the national debt is reduced each year. By the time the individual reaches age 79, the national debt is $14929 less than it would have been without the IRA program.

Explicitly recognizing the impact of the IRA on corporate tax revenue has a very substantial effect on these results. After four years (when the individual is 49 years old), the increase in the corporate tax revenue ($313) is large enough to offset more than half of the loss of personal income tax revenue ($536 at age 49). By the ninth year, the increase in corporate tax revenue more than offsets the entire loss of personal tax revenue, implying that the IRA has a net positive effect on total tax revenue in the ninth year and beyond. Accumulating the revenue losses and gains at a real government bond rate of 2 percent shows

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[10]The current real interest rate on government debt is between 1.5 percent on treasury bills and approximately 4 percent for long term bonds. To the extent that this debt is held by taxable individuals, the government's net cost is less. A lower interest rate reduces the accumulation of the government debt. When the corporate tax revenue is introduced into the calculation, the lower interest rate makes the accumulated value of the revenue changes positive at an earlier date.

that the government debt is lower after 14 years than it would have been without the IRA program. By the time that the individual retires at age 65, the IRA program has reduced the government debt by $6397, a sharp contrast to the $14,300 addition to the government debt that is implied by the loss of personal tax revenue with no regard for the effect on corporate tax revenue. After the individual retires, the combination of increased personal and corporate tax revenue causes a rapid reduction in the existing government debt. By the time the individual reaches the end of the 79th year, 35 years after starting the IRA, the government debt is $64,906 below what it would have been without the IRA program.

An important implication of this is that after the individual has withdrawn all of the funds in his IRA account (including the accumulated income as well as his contributions) the national capital stock is permanently higher because the size of the government debt has been reduced.

The general properties shown in this example are quite robust to plausible variations in the key parameters. To reflect the fact the not all incremental savings are added to the stock of equity corporate capital, I have analyzed the case in which the effective marginal corporate tax rate is reduced in half from τ=0.34 to τ=0.17. This should not be interpreted as corresponding to an estimate that half of incremental saving is added to corporate equity capital since tax revenue is collected on the income of unincorporated businesses and in practice a positive rate of inflation can raise the effective marginal rate of taxation on corporate equity income above the statutory rate. The value of 0.17 is thus a conservative estimate of the revenue effect per dollar of earnings on the increased capital stock. For simplicity, I will still refer to this effective tax rate as a measure of the "corporate" tax rate.

I have also examined other combinations of parameter values selected to reduce the positive revenue effect of the IRA. These variations include a lower personal tax rate during retirement years when IRA withdrawals are taxed and a higher share of the IRA contributions coming from other savings. Although these changes alter the precise timing and magnitudes of the IRA effects, certain key conclusions remain. Thus while the IRA reduces personal income tax revenues in every preretirement year, the increase in corporate income tax receipts offsets the personal income tax losses and generally makes the net tax effect positive during the preretirement period. The impact of the IRA on the size of the government debt, including the accumulated interest effects, is therefore positive long before it would be if only the personal tax revenue were affected.

Over the entire period of the IRA, the present value of the personal income tax changes is positive for most but not all of the parametric variations considered but the positive contribution of the increased corporate income tax revenue makes the combined present value of all tax changes positive in every parametric case examined. When the personal and corporate taxes both make positive contributions, the effect of the corporate income tax is always greater. The overall effect is therefore to have the national capital stock higher than it would be without the IRA program.

Table 1 shows 12 such combinations of parameter values, beginning with the case that has just been examined in detail. All of the calculations are for an individual who starts an

IRA at age 45, contributes $2000 a year for 20 years, and then withdraws a constant annuity for 15 years.[11] The pretax rate of return is always 10 percent.

The first five columns describe the combinations of parameter values: the corporate tax rate (τ), the personal tax rate in the preretirement years (θ_1), the personal tax rate after retirement (θ_2), the proportion of IRA contributions diverted from other savings during the first two years of the IRA (λ_{12}), and the proportion of IRA contributions diverted from other savings during the remaining preretirement years (λ_{3+}). In the first case, the corporate tax rate is 34 percent, the personal tax rate is 25 percent during both preretirement and postretirement years, and 20 percent of IRA contributions are diverted from other savings. The corporate and personal tax rates correspond to prevailing values while a 20 percent diversion ratio is at the top of the 10 to 20 percent estimated by Wise (1987).

Column 6 records the year in which the increase in the corporate tax revenue is enough to offset more than one half of the lost personal income tax revenue, i.e., large enough to cut the net revenue loss to less than half of what is traditionally calculated when the corporate income tax is ignored. In case 1 this happens in the fifth year of the IRA program. Column 7 indicates the year in which the increased corporate tax revenue exceeds the reduced personal tax revenue and therefore in which the total net revenue effect is positive. In case 1 this happens in the ninth year. By the fifteenth year the cumulative effect of the increased corporate tax revenue is enough to outweigh not only the reduced personal tax receipts but also the accruing interest on the national debt, making the national debt

[11]The revenue effect of the IRA program is more favorable if the individual starts his IRA contributions at an earlier age or delays the age of retirement. The favorable effects are reduced if the IRA is started at a later age or if retirement comes earlier.

Table 1

Revenue Effects of Individual Participation in a Deductible IRA

Case	Parameter Values					Year in which			
						Corporate Tax Revenue Exceeds			
	τ	θ_1	θ_2	λ_{12}	λ_{3+}	½ PIT Decline	PIT Decline	National Debt Declines	Change in National Debt after IRA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1)	0.34	0.25	0.25	0.20	0.20	5	9	15	-$64,906
(2)	0.34	0.25	0.15	0.20	0.20	5	9	15	-51,127
(3)	0.17	0.25	0.25	0.20	0.20	8	14	21	-55,004
(4)	0.17	0.25	0.15	0.20	0.20	8	14	22	-36,688
(5)	0.34	0.25	0.25	0.50	0.20	7	10	18	-58,486
(6)	0.34	0.25	0.25	0.50	0.50	8	14	22	-41,947
(7)	0.17	0.25	0.25	0.50	0.20	10	16	22	-49,358
(8)	0.17	0.25	0.25	0.50	0.50	14	21	25	-35,649
(9)	0.17	0.25	0.15	0.50	0.20	10	16	23	-31,450
(10)	0.17	0.25	0.15	0.50	0.50	14	21	26	-19,063
(11)	0.34	0.25	0.15	1.00	0.20	8	13	21	-34,663
(12)	0.17	0.25	0.15	1.00	0.20	13	20	25	-22,721

Calculations refer to an IRA started by a 45 year old who contributes $2000 a year for 20 years and then withdraws a constant annuity for 15 years. The pretax real return is 10 percent and the real interest rate on general debt is 2 percent. IRA contributions are excluded from income taxable at θ_1 but all IRA withdrawals are subject to tax at rate θ_2

lower than it would have been without the IRA program; this is shown in column eight. By the time that the individual has withdrawn all of the funds from the IRA account (at age 79), the national debt is $64,906 lower than it would have been had the individual not participated in the IRA program; this is shown in column 9.

Changes in the tax rates and in the share of IRA contributions that displace other saving alter the specific years and the amount of the reduction of the national debt but do not change the general results of the basic case. Since retirement only occurs after 20 years, case 2 shows that a lower personal tax rate in retirement does not alter the time at which the corporate revenue exceeds the decline in personal taxes or the date at which the national debt is actually reduced. It does lower the revenue that the government collects on the IRA withdrawals, decreasing the final reduction in the national debt but still leaving a national debt decline of $51,127.

Although cutting the effective "corporate" tax rate in half (case 3) postpones the time until the additional corporate tax revenue offsets the decline in personal taxes, even with this unfavorable assumption the additional corporate tax revenue offsets half of the loss of personal tax revenue by the eighth year and produces a net annual revenue gain by the fourteenth year. The change in the national debt after the end of the IRA account is only 15 percent less than in the first case (in which $\tau = 0.34$).

The assumption that fifty percent of the IRA contributions come from other saving and 25 percent from the reduction in personal tax revenue, so that reduced consumption accounts for only 25 percent of the IRA funds, is examined in case 6. This corresponds to only about half of the consumption reduction estimated by Wise (1987). This reduces the

additional capital on which corporate tax is paid. In comparison to case 1, this postpones the time at which the corporate tax revenues outweigh the loss of personal tax revenue and lowers the ultimate net reduction in national debt but still leaves a net debt reduction of $41,947.

The effect of combining all three unfavorable parameter values -- a low corporate tax rate (17 percent), a low personal tax rate in retirement (15 percent), and a permanently high rate of private saving displacement (50 percent) -- is shown in case 10. The gain of corporate tax revenue exceeds the loss of personal tax revenue until the twenty-first year. But even in this case of unlikely and very adverse parameter values, five years of surpluses are enough to repay the accumulated additional national debt and to make the debt lower than it would have been without the IRA participation. By the time that the individual retires, the national debt is $19,063 lower than it would have been without the IRA.

Case 12 is another extreme set of parameter values: a low corporate tax rate (17 percent), a low personal tax rate after retirement (15 percent), and 100 percent rate of private saving displacement during the initial two years. This means that the individual finances the initial IRA contributions by transferring funds from existing savings and actually increases consumption by the amount of the initial tax saving. Although this delays the time until the positive corporate tax revenue effects outweigh the loss of personal tax revenue, by the time the individual has exhausted his IRA funds the national debt is lower by $22,721 and the national capital stock is increased by an equal amount.

4. The IRA in a Growing Economy

To understand the aggregate revenue and capital accumulation effects of an IRA program requires going from the individual cases of section 3 to an analysis that links successive cohorts of IRA participants. Although each individual eventually dissaves all of the funds in his own IRA account, in the aggregate economy new individuals are adding to national saving as earlier generations dissave. In an economy with a growing population and rising incomes, the additional saving of the savers will outweigh the dissaving of the dissavers and the net volume of private saving will be positive. Similarly, the aggregate tax changes reflect the fact that for each individual the IRA implies an initial period of lower tax payments (including the combined changes of both personal and corporate taxes) followed by a period of higher tax payments. The analysis presented in this section shows that even though the period of revenue loss after the introduction of an IRA program lasts longer in the aggregate than it does for the representative individuals considered in section 3, the total revenue change eventually becomes positive and grows with time.

The previous section examined in detail a basic case in which a 45 year old starts an IRA account, contributes $2000 a year for 20 years and then withdraws a constant annuity for 15 years. The pretax rate of return of 10 percent is subject to a corporate at 34 percent and a personal income tax at 25 percent. Twenty percent of IRA contributions are diverted from other sources. Consider now a growing economy in which the number of 45 year olds starting IRAs increases at 2.5 percent per year. It does not matter whether this increase is due to population growth alone or to a combination of increasing population and rising incomes that causes more individuals to establish IRAs each year. For numerical simplicity,

the analysis starts with a single 45 year old participant and then increases the "number" of 45 year olds at 2.5 percent a year.[12] Individuals are assumed to remain alive until the age at which they just exhaust their IRA fund.

How do aggregate saving and aggregate tax revenue behave in such an economy? Before looking at a variety of parametric cases, consider in detail the specific example described above. In the first year, the single 45 year old deposits $2000 in an IRA. This saves him $500 in taxes directly. Indirect effects on personal and corporate taxes reduce the net decline in tax revenue to $452. These "aggregate" figures are of course the same as the base case for a single individual discussed in the previous section. In the second year, the initial individual is now 46 years old. He again deposits $2000 in his IRA. In the second year, the net decrease in tax revenue associated with this individual is only $401 because of the greater role of the corporate tax receipts. At the same time, the new cohort of 45 year olds saves a total of $2050 and causes a net tax reduction of 1.025($452) = $463. The combined net revenue loss of both cohorts in year two is thus $864. By the third year the initial cohort is causing a revenue loss of $346, the second cohort's revenue loss is 1.025 ($401) = $411, and the third cohort's revenue loss is $(1.025)^2$ $452 = $475. The total revenue loss in year three is thus $1232.

Looking further ahead, the tax loss reaches a peak of $2205 in the eighth year and then declines until it is only $524 in the fourteenth year. After that, the additional tax

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[12]Although it would seem natural to increase the size of the IRA contribution as the economy grows, the simulation uses a fixed $2000 real contribution as a compromise between the notion of increasing the contribution with the real growth of the economy and the actual political experience in which the nominal size of the allowable IRA contribution has remained fixed.

revenue is positive each year[13] and rises rapidly. Based on a scale in which the number of new $2000 accounts is one in the first year and grows at 2.5 percent a year, the positive annual revenue effect reaches $6320 in the twentieth year, $26720 in the twenty fifth year and more than $50,000 in the thirty-second year. It is worth noting that these are all in the same constant dollars as the initial $2000 contribution and that by the thirty-second year the number of new IRA accounts has only increased from one to 2.15. Thus while new IRA accounts in that year contribute only $4300 and total gross IRA contributions from all preretirement cohorts are only $34355, the annual increase in national saving from additional tax revenue associated with the IRAs is more than $50,000.

The primary source of the additional tax revenue is the increase in corporate tax receipts. In the fifth year the IRA program depresses personal income tax collections by $2737 but raises corporate tax receipts by $926. By the tenth year the corresponding figures are a $6056 reduction in personal tax revenue and a $3989 increase in corporate tax revenues. And in the twentieth year the personal taxes are down by $15018 while corporate taxes are higher by $21338, implying a revenue gain of $6320.

Variations in the basic parameter values do not change the three primary conclusions about the effect of an IRA program in a growing economy:

First, although it takes longer for the change in aggregate tax receipts to shift from negative to positive than it does for the tax receipts associated with a representative

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[13]This shift from a negative to a positive revenue impact comes later for the aggregate than it does for a representative individual because new revenue-losing IRAs are being started when the representative individual's tax impact becomes positive (in year nine).

individual, the shift to positive revenues eventually occurs. As time passes, the positive annual revenue effect becomes quite large relative to the annual IRA contribution.

Second, the combined changes in private saving and government revenue imply a net increase in national saving in every year.

Third, the national debt rises at first but then declines. The national debt is eventually reduced by substantial amounts relative to the size of the IRA program.

Each of these conclusions is valid for the 12 combinations of parameter values previously explored in Table 1 (as well as for different assumptions about the age at which the IRA is started and the age at which retirement occurs.) Instead of presenting detailed information about each parameter combination, consider only the case from Table 1 that has the least favorable IRA revenue effects. In case 10, the effective marginal corporate income tax is only 0.17 percent (implying less corporate tax revenue), the personal tax rate drops from 25 percent during working years to 15 percent after retirement (implying less personal tax revenue on withdrawals) and the share of IRA contributions diverted from other saving is a very high 50 percent (compared to 20 percent in the base case). In this extreme case, the annual revenue change is negative for twenty-six years, reaching a peak loss of $12,121 in the twentieth year. But after it turns positive, the revenue gain grows rapidly, reaching $14,174 after a decade and continuing to rise after that.

If there are no offsetting changes in other taxes or in government spending, these revenue changes imply that the total national debt grows until the positive annual revenue is large enough to offset the interest payments on previous revenue shortfalls. Although this does not occur in this least favorable case until year 46, by the end of the simulation period

in year 50 the national debt is $70,300 less than it would have been without the IRA program and shrinking rapidly.

It is interesting to consider the alternative assumption that other taxes are increased in each year when the revenue effect of the IRA program is negative and then decreased in the future when those revenue effects become positive. What are the effects of these annual revenue changes on the deadweight loss of the tax system in each year and on the present value of those changes in deadweight loss. Although the present value of the changes in tax revenues is positive,[14] it does not immediately follow that the present value of the associated changes in deadweight loss will also be positive since the years in which the revenue effect of the IRA program is positive are years in which the economy is larger and therefore the revenue increases may be relatively smaller than the revenue decreases. Since the deadweight loss changes depend on the implied change in other tax rates needed to offset the impact of the IRA program, the present value of the deadweight loss is ambiguous without further analysis.

To pursue this issue, I will assume that the rest of the tax system can be summarized by a single marginal tax rate (M) that would be constant in the absence of the IRA program and that the deadweight loss of the tax system as a whole can be approximated as proportional to the square of the marginal tax rate. If T_t is the revenue change in year t caused by the IRA program, the change in the overall marginal tax rate needed to offset the IRA revenue effect can be approximated by $T_t/Y_0(1+g)^t$ where Y_0 is the size of the tax base in the year when the IRA program begins and g is the rate of growth of the tax base. The

[14]This follows from the fact that the national debt is eventually permanently smaller.

marginal tax rate with the IRA program thus becomes $M + [T_t/Y_0(1+g)^t]$. The change in the deadweight loss associated with the IRA is therefore proportional to $[M + T_t/Y_0(1+g)^t]^2 - M^2 = 2M(T_t)/Y_0(1+g)^t + [T_t/Y_0(1+g)^t]^2$. Since the second of these terms is of a lower order of magnitude, the change in the deadweight loss can be approximated as proportional to $2M(T_t)/Y_0(1+g)^t$. If the present value of these annual deadweight losses is calculated by discounting at rate δ, the present value of the change in the deadweight loss in year t is proportional to $T_t/(1+g)^t(1+\delta)^t$.

With this approximation, the numerical calculations show that in the basic example considered above (case 1) the IRA program implies a revenue loss and therefore an increased deadweight loss of the tax system as a whole for each of the first 14 years followed by a revenue gain and a reduced deadweight loss in each subsequent year. If the tax base grows at $g = .04$ and deadweight losses are discounted at $\delta = .04$, the present value of the reductions in the deadweight losses in years 15 through 22 is sufficient to outweigh the previous increases. Thus for every horizon of 22 years or longer, the cumulative present value of the changes in the deadweight losses represents a reduction in the overall deadweight loss of the tax system.

Even with the extreme parameters of case 12 -- a low corporate tax rate, a personal tax rate that declines after retirement, and a 100 percent diversion of other saving into the IRA during the first two years followed by a 20 percent diversion -- the cumulative present value of changes in the deadweight loss is positive by the end of the fifty year simulation period.

5. An Alternative IRA Plan with No Revenue Loss in Any Year

The analysis in this paper has shown that a traditional IRA program eventually causes a rise in annual tax revenue and a permanent decline in the national debt as well. The political process is however justifiably suspicious of all proposals that claim future fiscal benefits that must be financed by short-run revenue losses. It is useful therefore to consider an alternative to the traditional IRA that can provide a saving incentive with no loss of tax revenue in any year.

A "nontaxable IRA" plan to which contributions are made with after-tax dollars, in which funds accumulate without personal income tax, and from which all funds are eventually withdrawn without any tax, will for likely parameter values involve no loss of tax revenue in any year. This no-revenue-loss feature is true despite the loss of personal tax revenue on the investment income earned in the IRA account because the extra corporate tax revenue that results from the increased capital stock more than offsets the personal tax revenue that is lost because the income in the IRA account is not taxed.

Before exploring this no-revenue-loss feature of the nondeductible IRA, it is useful to note that such a plan provides the same rate of return to the participant as the traditional deductible IRA and should therefore have the same effect on savings.[15] Consider an individual who contributes C dollars of pretax earnings to a traditional IRA where it accumulates at rate i for N years. If the funds are then withdrawn from the account and subjected to personal tax at rate θ, the net funds available for consumption are $(1-\theta)(1+i)^N C$.

[15]This nontaxable IRA is thus more generous than the existing nondeductible IRA in which a tax is levied on the accumulated investment income when it is withdrawn.

With a nontaxable IRA, the individual must pay tax before making his IRA contribution. The C dollars of pretax earnings therefore finances a contribution of only $(1-\theta)$ C dollars. Since this amount accumulates at rate i and can be withdrawn without tax at time N, the amount available for consumption at time N is $(1-\theta)C(1+i)^N$, exactly the same as with the traditional deductible IRA.[16] The two methods define the same budget line and therefore should imply the same savings response.[17]

Although the nontaxable IRA does not involve a reduction of personal tax revenue when funds are contributed, the exemption from personal tax of the income earned in the IRA does involve a reduction of personal tax revenue to the extent that the funds would otherwise have been saved in a taxable form. This loss of personal tax revenue has made even a nondeductible IRA difficult to enact because of the budget rule requiring an offsetting tax increase to prevent any net revenue loss in the first five years.

Such a revenue analysis is incorrect because it ignores the effect of the IRA on corporate tax revenue. The gain in corporate tax revenue will under plausible parameter values outweigh the loss of personal tax revenue in every year. Even with quite unfavorable assumptions, the cumulative effect on tax revenue within the initial five years will be positive.

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[16]This assumes that the marginal tax rate is the same at both dates.

[17]Although the lack of an immediate tax deduction may make the nontaxable IRA appear less attractive, over time taxpayers should come to recognize the equivalence of the two. The two options could also be made to appear absolutely identical to the taxpayers by permitting banks and other IRA fiduciary institutions to lend the taxpayer an amount equal to the tax reduction that he would obtain with a deductible IRA, charging nondeductible interest equal to the rate of return in the IRA account.

Before looking at specific numerical values, consider the general analysis of a nontaxable IRA. The basic accumulation equations that govern the value of the nontaxable IRA account (A_t) during preretirement and retirement years are the same as for the traditional deductible IRA (equations 1 and 2 of section 3). If a fraction λ of the contributions to the IRA would have been saved without the IRA, the diverted capital stock (B_t) also evolves as described by equation 3. The key difference from the deductible IRA is that the net effect on the total tax revenue is now:

$$(7)\quad T_t = -\theta\,(1-\tau) r\, B_t + \tau\, r\, [A_t - B_t]$$

instead of equation 4 of section 1. The first term here refers to the loss of personal tax revenue on the interest that would have been earned on the stock of diverted funds (B_t). The second term refers to the additional corporate tax revenue earned on the increased stock of capital (the difference between the funds in the IRA account, A_t, and the funds that would have accumulated without the IRA, B_t). In contrast to the traditional deductible IRA, the tax effect does not involve a loss of personal tax revenue of $\theta\, C_t$ during preretirement years and then a revenue gain of $\theta\, R_t$ during retirement.

Combining equations 1, 2 and 7 implies that, with a constant annual contribution of C, the annual change in tax revenue associated with an individual participant evolves during his preretirement years according to:

$$(8)\quad T_t = -\theta\lambda C\{[1+(1-\theta)(1-\tau)r]^t - 1\}(1-\theta)^{-1} + \tau C\{[1+(1-\tau)r]^t - 1\}(1-\tau)^{-1} - \tau\lambda C\{[1+(1-\theta)(1-\tau)r]^t - 1\}(1-\theta)^{-1}(1-\tau)^{-1}.$$

This equation implies that whenever the tax change is positive in the year ($T_1 > 0$) it will remain positive and grow larger in subsequent years. In the first year, moreover, equation 8 simplifies to

$$(9)\quad T_1 = r C [(1-\lambda)\tau - \lambda\theta(1-\tau)].$$

Thus the change in revenue will be positive in the first year (and in each subsequent year) if τ is high relative to $\lambda\theta$. With plausible values of $\tau = 0.34$ and $\theta = 0.25$, $T_1 > 0$ under the very likely condition that $\lambda < 0.67$, i.e., revenue will increase in the first year as long as not more than two-thirds of the contribution to the IRA comes from other saving. With $\theta = 0.15$, the requirement is even weaker; revenue increases as long as not more than 77 percent of the IRA contribution comes from other saving. Even with the much less favorable parametric assumption that $\tau = 0.17$ and $\theta = 0.25$, the first year revenue change will be positive if $\lambda < 0.45$.

A summary of simulations of the effect of individual participation in a nontaxable IRA for a variety of parameter values is presented in Table 2. The parameter values for each simulation are shown in columns 1 through 5. Column 6 then shows the year in which total revenue change (personal plus corporate) becomes positive and column 7 shows the year in

Table 2

Revenue Effects of Individual Participation in a Nontaxable IRA

Case	Parameter Values					Year in which		
	τ	θ_1	θ_2	λ_{12}	λ_{3+}	Annual Revenue Becomes Positive	National Debt Declines	Change in National Debt After IRA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1)	0.34	0.25	0.25	0.20	0.20	1	1	-$44,931
(2)	0.34	0.25	0.15	0.20	0.20	1	1	-45,683
(3)	0.17	0.25	0.25	0.20	0.20	1	1	-22,682
(4)	0.17	0.25	0.15	0.20	0.20	1	1	-23,835
(5)	0.34	0.25	0.25	0.50	0.20	1	1	-38,511
(6)	0.34	0.25	0.25	0.50	0.50	1	1	-21,972
(7)	0.17	0.25	0.25	0.50	0.20	4	5	-17,035
(8)	0.17	0.25	0.25	0.50	0.50	11	15	-3,327
(9)	0.17	0.25	0.15	0.50	0.20	4	5	-18,597
(10)	0.17	0.25	0.15	0.50	0.50	11	15	-6,210
(11)	0.34	0.25	0.15	1.00	0.20	6	8	-29,219
(12)	0.17	0.25	0.15	1.00	0.20	10	17	-7,624

Calculations refer to an IRA started by a 45 year old who contributes $2000 a year for 20 years and then withdraws a constant annuity for 15 years. The pretax real return is 10 percent and the real interest rate on general debt is 2 percent. IRA contributions are not excluded from income when they are made but all IRA withdrawals are untaxed.

which the cumulative revenue becomes positive (i.e., the national debt is reduced). Column 8 shows the change in the national debt after the individual IRA has been completed and all funds withdrawn.

In the basic case of $\tau = 0.34$, $\theta_1 = \theta_2 = 0.25$ and $\lambda_{12} = \lambda_{3+} = 0.2$, the total tax revenue change is positive in the first year and thus the cumulative change also becomes positive in that year. By the time that the IRA is completed and all funds withdrawn, the national debt has been reduced by $44,931.

Each of the first six cases in Table 2 shows the same basic result. Thus even with a lower corporate tax rate or a lower personal tax rate in retirement or a higher diversion of other saving into the IRA, the revenue change is favorable in every year beginning with the very first year. Even the combination of a lower corporate tax rate and a lower personal tax rate in retirement (case 4) does not change this conclusion.

Some other combinations of unlikely and unfavorable parameter values could in principle delay the date at which the additional corporate tax revenue outweighs the loss of personal tax revenue. For example, if the corporate tax rate is only 17 percent and half of the IRA contributions initially come from other saving (so that only 25 cents per dollar of IRA contribution represents reduced consumption), the combined revenue effect only becomes positive in the fourth year. But even in this case, the additional revenue in the fourth and fifth years outweighs the revenue loss in the first three years, making the national debt lower in year five than it would have been without the IRA. The more extreme assumption that half of the IRA contributions are permanently diverted from other saving (something not possible in practice because of the low value of other financial assets that

individuals have) would delay for a decade the time until the net revenue effect was positive and to the fifteenth year the time at which the national debt was reduced by the IRA.

In a growing economy of successive cohorts of participants, the aggregate effect of the IRA program on tax revenue is of course positive in the first year and in all subsequent years whenever it is positive in the first year for each individual participant. Since each new cohort makes a positive contribution to tax revenue from its first year, the aggregate must remain positive and grow with time.

When the revenue effect for a representative individual switches from negative to positive after a few years (as in case 7), the aggregate effect must be examined explicitly. Using the same assumptions as in the previous section (an economy in which the number of participants grows at 2.5 percent a year while the real contributions per participant remain constant at $2000), the aggregate tax effect becomes positive in the fifth year and the national debt is lower than it would have been without the IRA program in year 6.

The maximum increase in the national debt in this case occurs in year 5 when the debt is $47 higher than it would have been without the IRA program. This is trivially small in comparison to the additional private saving that has accumulated by that time. With contributions starting at $2000 in year one and growing at 2.5 percent a year, the aggregate contributions by year 5 total more than $30,000 and the aggregate net addition to private saving (even allowing for a 50 percent displacement of other saving during the first two years for each individual) exceeds $21,000. The positive tax revenue that begins in year 5 grows rapidly, causing the national debt to be $56 lower in year 6 than it would have been

without the IRA program. The decline in the national debt becomes $525 in year 8 and then continues to grow at an increasingly rapid rate.

In the extreme example of case 8 in which half of all IRA contributions are permanently withdrawn from other saving (something which given existing asset distributions would simply not be possible), there are 14 years of aggregate revenue loss before the net tax effect becomes positive. The national debt is higher than it would have been without the IRA for 19 years, reaching a peak debt increase of $909 in year 16. Once again, however, the debt increase is trivially small in comparison to the rise in private saving. By year 19, the oldest participant alone has contributed $38,000 of which the part that is not just a displacement of other saving is $19,000. The total increase in the national debt is therefore less than five percent of the contributions of a single cohort of participants. The combined net contributions of all 19 cohorts is then $19,000. After year 19, the national debt begins to fall rapidly relative to what it would have been without the IRA; by year 21, it is down by $1460, a greater decrease than the peak increase in year 19.

These extreme cases make the point that even when the fiscal effects of a nontaxable IRA are temporarily adverse, they are very small relative to the increase in private saving. It should be stressed, however, that with the parameter values that correspond to the actual tax rates (including $\tau=0.17$ as well as $\tau=0.34$) and with a rather pessimistic estimate of the extent to which IRA contributions would be diverted from other saving (including case five in which 50 percent of the IRA contribution comes initially from other saving), the nontaxable IRA produces a revenue gain from the first year of its introduction and in each subsequent year. There is an immediate increase in private saving and a decrease in

government borrowing, causing the national saving rate to rise immediately and stay permanently higher.

6. Conclusion

This paper has focused on the effects of individual retirement accounts on corporate tax revenue. The analysis shows that when the positive effect of increased saving on corporate tax revenue is taken into account, the revenue consequences of traditional IRAs is more favorable than previous calculations have estimated. In addition, realistic parameter values imply that a nondeductible and nontaxable IRA can provide a similar saving incentive to the current deductible IRA with no loss in revenue in any year.

These implications apply not only to individual retirement accounts but also to any other tax-based saving incentive: taking into account the positive effect that increased personal saving has on corporate tax receipts implies a more favorable overall revenue effect and therefore a greater increase in national saving.

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