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Valuing Assets in Retirement Saving Accounts

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MIT and NBER
July 2003

Abstract

Assets in retirement saving plans have become an important component of net worth for many households. While many studies compare household balances in tax-deferred retirement accounts such as 401(k) plans with the amount held in other financial assets outside these accounts, these different asset components are not directly comparable. Taxes and in some cases penalties are due when assets are withdrawn from retirement saving plans. These factors can make assets inside retirement accounts less valuable than assets outside these accounts, particularly for those who are considering withdrawing assets from the tax-deferred accounts in the near future. For younger households who do not plan to withdraw tax deferred assets for many years, there is a countervailing factor – the opportunity for tax-free compound returns in retirement accounts – that can make assets in such accounts more valuable than similar assets outside such accounts. For a long-horizon retirement saver, a dollar inside a tax-deferred retirement saving account may be more valuable than a dollar outside such an account even though the payouts of principal from the retirement account will be taxed at the time of distribution, while the principal outside such accounts is untaxed. This paper illustrates the potential differences in the value of assets inside and outside tax-deferred accounts. It draws on a range of data sources to calibrate the value of the tax burden, and the benefit of compound growth, for assets held in retirement accounts, and describes the differences in relative valuation for households of different ages.

I am grateful to Laurence Kotlikoff for helpful comments, and to Daniel Bergstresser, Sarah Siegel, and Amir Sufi for excellent research assistance. The research reported herein was supported by the Center for Retirement Research at Boston College pursuant to a grant from the U.S. Social Security Administration funded as part of the Retirement Research Consortium, and by the U.S. Department of Labor Pension and Welfare Benefits Administration. The opinions and conclusions are solely those of the author and should not be construed as representing the opinions or policy of the Social Security Administration, the U.S. Department of Labor, or any agency of the Federal Government, or the Center for Retirement Research at Boston College.

The rising importance of assets in tax-deferred accounts has changed the way U.S. households prepare for retirement. Assets in Individual Retirement Accounts and 401(k) plans, which were effectively introduced in the early 1980s, exceeded four trillion dollars at the end of 2001. Projections such as those in Poterba, Venti, and Wise (2000) suggest that if current contribution patterns persist, and if asset returns follow historical patterns, then the assets in retirement saving accounts will become a much more significant part of household wealth in the next three decades.

A substantial literature has addressed the question of whether households change their saving behavior outside tax-deferred accounts when they make 401(k) or IRA contributions. The earliest strands of this literature focused on testing whether the stock of financial assets held by households with 401(k)s or IRAs was lower than that held by similar households without such tax-deferred accounts. Studies in this tradition include Engen and Gale (2000), Engen, Gale, and Scholz (1996), and Poterba, Venti, and Wise (1996, 2001). These studies analyzed on whether contributions to tax-deferred accounts reduced assets held in traditional taxable accounts dollar-for-dollar, or by a smaller amount. While many of the early discussions of these retirement saving plans suggested that there would be substantial crowd-out, most of the empirical literature points to substantial new saving associated with these plans. An implicit premise of the empirical tests that emphasized dollar-for-dollar crowd-out was that a dollar of tax-deferred assets was equivalent to a dollar of assets held in a taxable account.

One important exception to this generalization is Gale's (1998) study of employer-provided pensions and household saving. Gale recognized that simple comparisons may be inappropriate, given the different tax status of assets in taxable accounts and in retirement saving accounts. He estimated the decrease in household saving outside retirement accounts that would keep a household on the same lifetime indifference curve after an increase in retirement saving as before. This approach makes a number of assumptions about household consumption behavior, but it provides an

important first step in considering the specific character of assets held in taxable and tax-deferred accounts.

Taxes generate the differences in the potential value of assets inside and outside tax-deferred retirement accounts. There are taxes and in some cases penalties due when assets are withdrawn from retirement accounts. It is even possible, as Gokhale and Kotlikoff (2003) note, that the tax rates facing a household when assets are withdrawn from a retirement account are greater than the tax rates that were avoided when funds were originally contributed to the account. If this happens, the household may actually be worse off for making these contributions. These considerations, which can make assets in retirement saving accounts less valuable than similar assets outside such accounts, are offset, particularly for long-horizon savers, by the fact that assets in retirement saving accounts can grow tax-free until the time of withdrawal. This "inside build up" can make an asset more valuable inside a tax-deferred account than outside, particularly if the account holder has a long investment horizon.

This paper presents simple calculations that compare the value of assets held inside, and outside, tax-deferred retirement accounts. The central question underlying this analysis is how much an individual needs at various ages, outside a 401(k)-type plan, to provide the same level of retirement income support that a dollar inside a 401(k) could provide. The answer to this question depends upon a range of assumptions, including how long the assets will be held in the retirement account, how the assets will be drawn down during retirement, the rate of return the asset will earn, the individual's income tax rate, and the tax rules that apply to withdrawals from tax-deferred accounts. The paper notes, but does not report detailed calculations about the possibility of leaving retirement account assets to future generations. With well-advised estate planning, it is possible to extend the time period over which assets can accumulate in tax-deferred accounts by deferring withdrawal well into the life of the original contributor's descendents.

The paper is divided into five sections. Section one presents simple calculations that illustrate how taxable account balances can be worth more, or less, than comparable amounts held outside the tax-deferred account. It focuses on the case of bonds held in either location. This section develops the framework that underlies the calculations in the balance of the paper. Section two generalizes this to the case of equity investments, and presents results on the relative valuation of stocks held in tax deferred accounts and in traditional taxable accounts. The third section reports summary information on the distribution of assets held in retirement accounts by age of the household head, marginal tax rate of the account holder, and by asset allocation between stocks and bonds. These distributions are inputs to aggregate calculations of the relative value of assets in tax-deferred and taxable accounts. This section reports preliminary aggregate calculations on the relative value of taxable and tax-deferred assets. The fourth section describes the current tax rules that govern withdrawals from tax-deferred accounts and explains how they can be incorporated in the analysis. When savers with tax-deferred retirement accounts can delay withdrawing assets until late in their own life, or when they can transfer these assets to younger relatives, the value of tax-deferred accumulation rises substantially. This increases the value of building assets in retirement accounts, although it becomes more difficult to discuss this solely in the context of assets available for retirement. A brief conclusion sketches several directions for further work.

1. Valuing Bonds Held in Tax-Deferred Accounts

The central element in any comparison of assets held in taxable and tax-deferred accounts is the trade-off between the deferred taxes that will be due on withdrawals from tax-deferred accounts, which reduces the value of assets in these accounts, and the benefits of tax-free accumulation on the assets in these accounts. This tradeoff can be illustrated most easily by considering an individual who is a years old and who holds interest-bearing bonds worth $D(a)$ in a tax-deferred account. Assume that these bonds were purchased with pretax contributions, so that when funds are withdrawn from the account, all of the proceeds will be fully taxable at the individual's ordinary income tax rate.

Assume further that there is a fixed age A at which the individual plans to withdraw all of the assets from the retirement account, so that the investment horizon is A – *a*.

The central question this paper considers is how much wealth the individual would need to hold in bonds outside a tax deferred account to generate the same after-tax wealth at age A that holding $D_{bond}(a)$ in bonds within the tax-deferred account will provide. Assume for simplicity that the individual's tax rate on the interest and dividend income is constant through time, at least until retirement. The tax rate that applies to withdrawals from the tax-deferred account may differ from the tax rate during the accumulation phase. Let the tax rate on interest income received during the accumulation phase equal τ, and let τ_A denote the marginal tax rate when the assets are withdrawn from the tax-deferred account. Let r represent the interest rate earned on bonds regardless of whether they are held in the taxable or the tax-deferred account.

A tax-deferred account with a bond worth $D_{bond}(a)$ at age *a* will grow to $D_{bond}(A)$ at age A, where

(1) $D_{bond}(A) = D_{bond}(a)e^{r(A-a)}$.

Since withdrawals from the tax-deferred account are fully taxable, the after-tax value of the tax-deferred account is $(1-\tau_A)*D_{bond}(A)$.

Now consider the after-tax value of assets held outside the tax-deferred account. Consider a bond worth $W_{bond}(a)$ that is held in a taxable account at age a. The bond earns interest at the after-tax rate of $(1-\tau)r$, so that by age A, its value will be

(2) $W_{bond}(A) = W_{bond}(a)*e^{(1-\tau)r*(A-a)}$.

For the taxable account to be worth $(1-\tau_A)*D_{bond}(A)$ at age A, the individual needs to hold bonds worth $W^*_{bond}(a)$ at age *a*, where $W^*_{bond}(a)$ satisfies

(3) $(1-\tau_A)*D_{bond}(a)*e^{r(A-a)} = W^*_{bond}(a)*e^{(1-\tau)r*(A-a)}$.

This expression can be solved for the ratio $W^*_{bond}(a)/D_{bond}(a)$, which is the amount of bonds that would need to be held in the taxable account to generate the same after-tax wealth at age A as a one-dollar bond held in the tax-deferred account. This ratio, the "equivalent taxable wealth" or $E_{bond}(a)$, is defined as:

(4) $$E_{bond}(a) = W^*_{bond}(a)/ D_{bond}(a) = (1-\tau_A)*e^{\tau r*(A-a)}.$$

Equivalent taxable wealth is increasing in the investment horizon, A-*a*, and in the rate of return on assets held in the taxable and the tax-deferred account (r). The derivative of the equivalent taxable wealth with respect to the marginal tax rate is ambiguous, however, in the case with $\tau = \tau_A$. At low marginal tax rates, raising the marginal tax rate raises the equivalent taxable wealth, because it makes the value of tax-deferred accumulation greater. At high marginal tax rates, however, the after-tax rate of accumulation is small, and the dominant effect of an increase in the marginal tax rate is a reduction in the value of the tax-deferred account through a higher tax rate on withdrawals.

When the investment horizon shrinks to zero, so that the individual is comparing the value of assets held inside the tax deferred account but being withdrawn immediately with the value of assets held outside the tax-deferred account, A = *a* and $E_{bond}(a) = (1-\tau)$. With a long enough investment horizon, and high enough returns, it is possible for $E_{bond}(a)$ to be greater than 1. This can be illustrated by calculating $E_{bond}(a)$ for a variety of different parameter values.

Table 1 reports equivalent taxable wealth values for nominal interest rates of four, six, and eight percent per year. Current long-term interest rates are in this range for both government and highly-rated corporate bonds. The calculations consider three different marginal tax rates: 15, 28, and 36 percent. The first set of results assumes that $\tau = \tau_A$. Rather than assuming a particular retirement age, the table considers individuals with different horizons until retirement, with ten year increments between zero and fifty years. Fifty years may seem like an excessive horizon for all but the youngest contributors to retirement plans. However, current provisions for minimum

distributions from retirement plans allow individuals and married couples who reach retirement age with tax-deferred assets to postpone withdrawal of a substantial share of those assets until they are in their eighties.

The upper panel of Table 1 presents the results of evaluating equation (4) for $E_{bond}(a)$. The findings show that the equivalent taxable wealth varies substantially as a function of the rate of return, tax rate, and investment horizon. The table also shows that for all parameter combinations that include an investment horizon of at least twenty years, $E_{bond}(a)$ is greater than unity. For a person with a planning horizon of thirty years, for example, a dollar's worth of bonds held within the tax-deferred account (TDA) is worth at least as much as a dollar of fixed income assets in a taxable account for all but one of the tax rate and interest rate combinations. The exception is a case with a low interest rate (0.04) and a high marginal tax rate, which makes the effective tax burden on the withdrawal large, but does not allow a high enough return from tax deferral to offset this high tax burden. At horizons longer than thirty-years, a dollar of fixed-income assets in a tax-deferred account will generate more after-tax wealth at retirement than a dollar in a taxable account, even though taxes have already been paid on the investment principal outside the TDA. The results are generally sensitive to the interest rate assumption. At low interest rates, the deferral horizon needs to be longer to make tax-deferred assets at least as valuable as assets held outside the TDA.

The calculations in Table 1 provide information on the relative value of assets held in different tax settings. They also provide some information on the attractiveness of contributing to a tax-deferred account. A household can allocate one dollar of current earnings either to a tax-deferred account, where it can be used to purchase one dollar of assets, or to a taxable account, where it can be used to purchase $(1-\tau)$ dollars of assets. Comparing $E_{bond}(a)$ and $(1-\tau)$ therefore provides insight on the desirability of contributing to a tax-deferred account. In the case of the upper panel of Table 1, all of the entries for $E_{bond}(a)$ are at least as great as $(1-\tau)$, with strict equality only when the deferral

horizon is zero. Thus in all cases households would find it attractive to make tax-deferred contributions.

The calculations in the upper panel of Table 1 assume that the marginal income tax rate that applies to the accruing interest on the bond held outside the tax-deferred account is the same as the income tax rate that applies to withdrawals from the TDA. For some households, however, marginal tax rates may differ before and after retirement. For households with lower income levels in retirement, marginal tax rates may be lower. For others, however, marginal tax rates may rise in retirement. The next two panels of Table 1 consider these possibilities.

When tax rates are lower in retirement than while working, this increases the relative value of assets held in the tax-deferred account, because the accruing income on the underlying assets is not only taxed later, but also at a lower rate, as a consequence of its position in the TDA. A decline in marginal tax rates after retirement also makes it more attractive to contribute to a TDA, since the marginal tax rate at which contributions to such accounts are deducted is higher than the marginal tax rate at which withdrawals are taxed.

The middle panel of Table 1 extends the calculations of equivalent taxable wealth by allowing for differences between the marginal tax rate on withdrawals (τ_A) and accruing interest (τ). The value of τ_A is set to 0.15, the lowest marginal tax bracket, for all of the calculations in this panel. The entries that assume $\tau = .15$ are the same in the upper and lower panels of the table. For the cases of $\tau = .28$ and $\tau = .36$, however, the equivalent taxable wealth values in the lower panel are greater than the values in the upper panel. In some cases the differences are substantial. For example, in the case of $\tau = .36$ with $r = .06$, the value of $E_{bond}(a)$ rises from 1.52 to 2.02 at a 40 year horizon, and from 1.89 to 2.50 at a 50 year horizon.

For some retirement savers, as Gokhale and Kotlikoff (2002) and Gokhale, Kotlikoff, and Neumann (2000) note, marginal tax rates may be higher after retirement than before. This case is

particularly likely for households that have substantial income tax deductions while they are working, that earn high returns in their retirement accounts, and that face taxation of their Social Security benefits when they retire. It could also happen if an individual withdraws assets from the TDA prior to reaching age 59 ½. In this case, the withdrawal is subject to ordinary income taxation, and there is an addition ten percent penalty tax. To allow for this possibility, the lower panel of Table 1 assumes that the tax rate on withdrawals is ten percentage points higher than the tax rate on interest and dividend income during the household's accumulation phase.

The results show that the higher tax rate on withdrawals raises the required holding period for an investor to break even by holding bonds in a tax deferred account rather than in a traditional taxable account. In no case for the twenty year horizon does the value of the tax-deferred account exceed the value of the taxable account, and even for thirty years, there are five cases with tax-deferred accounts worth more than taxable accounts, and four cases with the reverse finding. By the forty year horizon, the value of a bond in a tax-deferred account exceeds that of a similar-denomination bond in a taxable account for interest rates greater than four percent per year. For higher interest rate values, the tax-deferred assets are clearly more valuable than the taxable assets, as a result of the power of compound appreciation.

2. Equity Investments and the Equivalent Taxable Wealth in Taxable and Tax-Deferred Accounts

The foregoing calculations compare bond investments that could be held inside, or outside, a tax-deferred account. Yet bonds account for only half of the assets in tax-deferred accounts – the remaining assets are held in corporate stock. The tax burden on corporate stock, when held on taxable account, is substantially lower than the tax burden on interest-bearing assets. This differential has been widened by the reduction in dividend and capital gains tax rates that was part of the 2003 tax reform, which capped both rates at 15 percent for at least the next few years. The lower marginal tax rates on equity income alter the equivalent wealth calculation. While bond returns are

fully taxable at the investor's ordinary income tax rate, τ, the returns on stocks are taxed at a lower rate.

To illustrate the tax burden on stocks, consider an investor who holds equity with an expected return of $r_s = d + g$, where d denotes the dividend payout and g is the capital gain or loss. Let c denote the statutory tax rate on realized capital gains. If the stock is purchased in year a, so that the purchase basis for the stock is $W_{equity}(a)$, then the after-tax value of a zero-dividend's stock's shares after (A-a) years will be

(5) $$W_{equity}(A) = W_{equity}(a)*[e^{g(A-a)} - c*(e^{g(A-a)} - 1)].$$

This expression assumes that the investor does not liquidate any of the initial holding until A-a years after the purchase.

If the stock pays a dividend of d and the investor re-invests the after-tax proceeds from each year's dividends, $d*W_{equity}(t)$, the investor will have additional shares at time A that are attributable to these purchases. In this case, the total market value of the investor's holdings in the stock will grow at the annual rate $g+(1-\tau)*d$, and the after-tax value at age A will be

(6) $$W_{equity}(A) = W_{equity}(a)*[e^{(g+(1-\tau)d)*(A-a)}*(1-c)] + c*B(A, W_{equity}(a)).$$

$B(A, W_{equity}(a))$ denotes the investor's tax basis in the stock. The basis evolves according to the differential equation

(7) $$\partial B(t)/\partial t = d*(1-\tau)*W_{equity}(t) = d*(1-\tau)*e^{(g+(1-\tau)d)*(t-a)}*W_{equity}(a).$$

Solving this equation, using the initial condition $B(a) = W_{equity}(a)$, and evaluating at age A yields

(8) $$B(A, W_{equity}(a)) = W_{equity}(a)*[1 + \{d*(1-\tau)/(g+(1-\tau)*d)\}*\{e^{(g+(1-\tau)d)*(A-a)} - 1\}].$$

Substituting (8) into (6) makes it possible to evaluate the after-tax value of a taxable position in corporate stock, subject to reinvestment of dividends.

The value at age A of a tax-deferred account worth $D_{equity}(a)$ at age a and fully invested in equities is more straightforward to compute than the value of a comparable taxable account.

Assuming that dividends have been reinvested and that all assets are withdrawn at age A, the after-tax value of the equity investment is $(1-\tau_A)*D_{equity}(a)*e^{(g+d)(A-a)}$. Note that the tax rate that applies in this expression is the ordinary income tax rate at the time of withdrawal, τ_A. This is the key tax parameter that affects the value of the tax-deferred account balance. Now $W^*_{equity}(a)$, the equivalent taxable wealth in the equity case, must satisfy

(9) $$W^*_{equity}(a)*[e^{(g+(1-\tau)d)*(A-a)}*(1-c)] + c*B(A, W^*_{equity}(a)) = (1-\tau_A)*D_{equity}(a)*e^{(g+d)*(A-a)}.$$

Solving this expression yields

(10) $$E_{equity}(a) = W^*_{equity}(a)/D_{equity}(a)$$

$$= (1-\tau_A)*e^{(g+d)*(A-a)}/\{[e^{(g+(1-\tau)d)*(A-a)}*(1-c)]+c*[1+\{d*(1-\tau)/(g+(1-\tau)*d)\}*\{e^{(g+(1-\tau)d)*(A-a)}-1\}].$$

The Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA) reduced the investor tax burden on dividends and capital gains from investments held outside a tax-deferred account. This legislation capped both c and τ for stocks at fifteen percent, but it did not change the rule that withdrawals from tax-deferred accounts are taxed as ordinary income. This legislation consequently reduces the tax burden on assets outside the TDA, while not changing the tax treatment of TDA assets, so it reduces the value of TDA assets relative to assets held outside these accounts. The tax relief for dividends and capital gains enacted in 2003 is only legislated to remain in force for a few years, so it is difficult to know how to evaluate these reforms. I present results that illustrate the effect of a permanent reform of this type.

To evaluate the equivalent taxable wealth for stocks, it is necessary to choose an equity rate of return. Historical return experience for stocks would suggest nominal return values of roughly 12 percent per year. A number of contemporary analyses, however, such as Campbell (2001), Diamond (2001), and Shoven (2001), suggest that the equity premium is likely to be somewhat smaller in future decades than in the past. In light of these concerns, the calculations reported below consider equity returns of six percent, nine percent, and twelve percent per year. In each case, the dividend

yield is fixed at two percent per year, so the variation in expected returns is reflected in different expected capital appreciation rates. The expected returns throughout this paper are reported in nominal terms.

Table 2 reports equivalent taxable wealth values for equity investments, under various assumptions about the relationship between the ordinary income tax rate and the statutory capital gains tax rate. The table considers four tax regimes, three corresponding to the pre-JGTRRA environment and one assuming that JGTRRA is extended and remains in force forever. The first is for an individual in the 15 percent marginal tax rate bracket for dividend income, and in the 8 percent long-term capital gains tax bracket. This corresponds to a low-income household in the years following the 2001 tax reform. The second case includes an ordinary income tax rate of 28 percent, and a capital gains tax rate of 18 percent. The third case assumes an ordinary income tax rate of 36 percent, again with an 18 percent capital gains tax rate. Both of these cases correspond to tax rules that were in force prior to the enactment of the 2003 tax bill. Finally, the fourth case considers a situation with a 15 percent marginal tax rate on both dividends and capital gains, but a high marginal tax rate, 36 percent on ordinary income such as interest and distributions from tax-deferred accounts.

The first three panels of Table 2 are designed for comparison with the results on bonds in Table 1, so the tax rates are similar. Each horizontal panel has three vertical sub-panels. The upper one assumes that withdrawals from the tax-deferred account are taxed at the same ordinary income tax rate that applied to interest and dividend income during the accumulation phase. The middle panel applies a lower marginal tax rate of 15 percent to withdrawals, and the bottom panel assumes that the marginal tax rate in retirement is ten percentage points higher than the ordinary income tax rate while working, and consequently that withdrawals are taxed at a high rate than the tax rate that applied to ordinary income when contributions were made.

The results in Table 2 suggest that when equities rather than bonds are the investor's asset choice, assets held in a tax-deferred account are less valuable, relative to assets held outside such an

account, than when the underlying assets are bonds. This is particularly true if JGTRRA remains in force. Consider first the three vertical panels that relate to the pre-JGTRRA situation. In the upper panel of Table 2, the investor needs an accumulation profile of nearly 40 years before one dollar of equity inside a tax-deferred account is worth more than a dollar of equity in a taxable account. The situation is more favorable to the tax-deferred assets in the middle panel, which allows for tax-deferred assets to be withdrawn at a tax rate of 15 percent. In this case, when the dividend tax rate is 28 percent or higher, a twenty year investment horizon is sufficient to make the tax-deferred assets more valuable than their taxable counterparts. At very long horizons, such as 50 years, the TDA assets may be worth as a much as 40 percent more than the assets in taxable accounts.

The bottom panel of Table 2 considers the case of a higher tax burden on withdrawals from the tax-deferred account than on labor income during the working life. In this case, a dollar held inside a tax-deferred account is worth less than a dollar of stock in a taxable setting, typically by a substantial margin. Because equities are assumed to yield only a small part of their return in the form of dividend payments, the additional tax burden associated with facing ordinary income tax rates, plus penalty taxes, when withdrawing assets from the tax-deferred account represents a very substantial increase relative to the primarily capital gains tax burden on equity returns outside tax-deferred accounts.

The last vertical panel of Table 2 presents results for the post-JGTRRA setting. The reference household in this case is a high-income household with a 36 percent ordinary income tax rates. The results suggest that assets in TDAs are worth less in this environment, relative to assets outside TDAs, than in the previous three columns. Consider the findings in the first vertical sub-panel, which assumes that the ordinary income tax rate in retirement is the same as that while working. For a twenty year horizon and a nine percent equity return, the equivalent wealth value was 0.843 when the ordinary income tax rate of 36 percent applied to dividends and withdrawals from the TDA. It drops to 0.755 in the fourth panel of Table 2 when dividends are assumed to face a 15

percent tax rate. Lengthening the investment horizon has a smaller effect on the relative value of tax-deferred and taxable assets in this case than in other cases, because the rates of return on equities inside and outside the are separated by only thirty basis points, the product of the fifteen percent marginal tax rate on dividends and the two percent dividend yield.

The bottom panel in the last vertical column of Table 2 shows the effect of combining a ten percent penalty tax on withdrawals from the TDA with the JGTRRA reforms. For an equity return of nine percent, it now takes more than twenty years of tax-deferred accumulation for a contribution to a tax-deferred account to accumulate enough value to offset the tax penalty at withdrawal. Recall that the comparison between a household's current ordinary income tax rate, and the equivalent wealth entry in Table 2, provides information on the attractiveness of contributing to a tax-deferred account. When the tax on TDA withdrawals exceeds the ordinary income tax rate, and when the returns on equities are taxed at less than the ordinary income tax rate, there are now cases in which contributing to a TDA would not make sense unless the investment horizon was very long.

3. Empirical Evidence on Tax-Deferred Asset Holders and Their Investments

The analysis in Tables 1 and 2 assumes that an investor is trying to compare the value of a particular asset, either a bond or a stock, in a taxable account and a TDA. In practice, many investors hold both stocks and bonds in their tax-deferred account, and fail to satisfy some of the "asset location" precepts identified in Shoven (1999). While Amromin (2002) and Bergstresser and Poterba (2002) raise questions about whether investors make tax-minimizing decisions when they decide how to allocate assets in their taxable and tax-deferred accounts, the present analysis will assume that investors would hold the same mix of assets outside a TDA as they hold inside this account In this case, it is natural to construct an average equivalent taxable wealth for investors at a given age as a weighted average of the equivalent taxable wealth values for bonds and for stocks, with weights equal to their portfolio shares. This leads naturally to the search for data on TDA allocation patterns, as well as for information on investment horizons.

This section uses data from the 1998 Survey of Consumer Finances to enrich the calculations regarding equivalent taxable values in several ways. The SCF data provide information on the age distribution of holdings in tax-deferred accounts, the asset mix in these accounts, and, with some imputations, on the marginal tax rates of the households that hold assets in tax-deferred accounts. The 1998 SCF, which is described by Kennickell, Starr-McCluer, and Surette (2000), sampled 4309 households, with 2813 in the random sample and 1496 in the stratified random sample that over-weighted those with high incomes or net worth. By combining an area probability sample with a high-income oversample, the SCF provides accurate information on broad population characteristics, while also offering in-depth information on the households that hold a disproportionate share of financial assets and net worth. Four households are excluded from the public use dataset due to disclosure concerns, leaving a sample with 4305 observations. One fourth of the households in the survey have net worth of over a million dollars. The tabulations presented below weight the various observations in the survey by their sampling weights so that our reported statistics should be representative of the U.S. population. The value of TDA assets equals the sum of assets held in 401(k)s, 403(b)s, IRAs, and supplemental retirement accounts (SRAs). Some assets in some traditional defined contribution plans that do not fall into these categories are excluded, since some of these plans may not allow participants much control over their asset allocation decisions.

3.1 The Age Distribution of Holdings for Tax-Deferred Accounts

The relative value of assets held in taxable and tax-deferred accounts is very sensitive to the amount of time that the assets are likely to be held within the tax-deferred account. Since individuals must begin to withdraw assets from their tax-deferred accounts at age 70 ½, and many take some distributions as early as age 59 ½, the age distribution of account owners is likely to provide key insights on the likely accumulation period for assets in tax-deferred accounts.

Table 3 presents information on the age distribution of tax-deferred account holdings. The table presents both the age distribution of account holders, weighting each account holder equally,

and the age distribution of account balances, in which each account holder is weighted by the value of their account. The data show that nearly half of all assets in tax-deferred accounts are held by households with a household head at least 55 years of age. Only one quarter of the assets are held by households headed by someone under the age of 45. The distribution of accounts is quite different from the distribution of account balances, with almost half of the accounts held by households under the age of 45. The substantial concentration of assets in TDAs held by households near retirement age suggests that only a modest fraction of current assets are likely to be held by households with very retirement accumulation horizons.

3.2 Asset Allocation Patterns in Tax-Deferred Accounts

The differences between the relative values in Tables 1 and 2, for bonds and for stocks, suggest that the equivalent taxable wealth depends on asset allocation in the tax-deferred account. Table 4 presents information on the asset allocation mix in TDAs, again reporting both the percentage of account holders with particular allocations as well as the percentage of assets in accounts with different valuations. The table shows that more than half of all the assets in tax-deferred accounts are held in accounts with more than 80 percent of the assets in equities, while less than a quarter are held in accounts with less than 20 percent of the assets in equities. At least in 1998, the heavily-equity accounts tended to be larger than the accounts with more balanced allocations. Fifty-five percent of the TDA assets were held in accounts with equity holdings of more than 80 percent. These accounts comprised 45 percent of the total set of accounts. The data in Table 4 suggest that the analysis of relative value of taxable and tax-deferred assets should focus on equities rather than just on bond investments.

3.3 Distribution of Marginal Tax Rates

Another key parameter in the formulae for the relative value of tax-deferred assets is the marginal tax rate on ordinary income. Table 5 presents the distribution of these marginal tax rates, again both weighting all account holders equally as well as weighting account-holders by their

overall balances. The marginal income tax rate for SCF households is imputed using an algorithm developed in Poterba and Samwick (2003). This algorithm determines the household's marginal tax rate on the first dollar of interest income, after setting the other components of household capital income to zero. This procedure avoids a potential endogeneity between the structure of the household portfolio and the estimated marginal tax rate. Because the SCF contains only limited information on deductions that households might claim on their income taxes, there is some imprecision in the estimated marginal tax rates.

Table 5 shows the substantial disparity between these two weighting strategies. While five percent of all TDA holders were facing ordinary income tax rates of 39 percent or higher, 24 percent of all TDA assets were held by these taxpayers. Similarly, while 44 percent of account holders had tax rates of fifteen percent or lower, this group accounted for only 15 percent of TDA assets. The median dollar in a TDA is held by a taxpayer in the 28 percent income tax bracket. These statistics provide some insight on the relevant marginal tax rates to consider in the illustrative calculations like those in Tables 1 and 2.

3.4 Summary Equivalent Wealth Calculations

The marginal distributions of ages, marginal tax rates, and asset allocations in the previous tables provide only limited insight on the relative valuation of the assets that are actually held in tax deferred accounts. To combine all of these factors in a single measure, one needs to determine the current marginal income tax rate for a household, make some assumption about the household's retirement investment horizon, and then to compute a weighted average of the equity and debt equivalent wealth measures with weights equal to the relative asset holdings in the two asset classes.

Table 6 presents the results of this calculation. The table is divided into four horizontal panels. The first two assume that the marginal tax rate on ordinary income remains constant during the accumulation and the withdrawal period, and that it equals the marginal tax rate that we calculate from the current household income flows. This is a compromise between the possibility of a lower

marginal tax rate in retirement, and the possibility that high retirement income or other tax circumstances might raise marginal tax rates in retirement. The lower two panels are designed to capture the potential impact of JGTRRA by assuming that the ordinary income tax rate applies only to interest income and withdrawals from the TDA, while a fifteen percent tax rate applies to dividend income and capital gain realizations. In the lower two panels, I again assume that the ordinary income tax rate remains constant for the duration of the accumulation in the TDA.

The table presents results for two possible dates of retirement income withdrawals, age 70 and age 80. The first describes someone who chooses to withdraw the full balance of their tax-deferred account when they reached the beginning of the minimum distribution period, while the second approximates the longer distribution horizon for someone who uses minimum distributions and then leaves the tax-deferred assets to a beneficiary who does not immediately withdraw the assets.

Table 6 computes equivalent wealth values with two assumptions about rates of return. In the first, shown in columns one and two, bonds are assumed to yield six percent, while equities have a nine percent nominal return. Two percent of the equity return is in the form of dividends, while the balance is capital gain. The second return scenario assumes that bonds yield only four percent, while stocks continue to yield nine percent. Because the value of tax-deferred accumulation increases with the return available to investors, this scenario assigns smaller value to the TDA assets relative to outside assets.

Table 6 presents information on the weighted-average equivalent wealth by age groups, as well as for all households headed by someone under the age of 70. The entries in the first and third columns weight all households with TDAs equally. The entries in the second and fourth columns show the average equivalent wealth value, when different households are weighted by the amount that they hold in their tax-deferred account, and each household's debt and equity holdings is weighted by its value.

The results in the upper panel consider the tax situation before JGTRRA. For all age groups, when bonds are assumed to yield six percent, the average wealth equivalent is 0.936 when retirement assets are assumed to be drawn down at age 70, and 1.024 when the drawn-down is assumed to occur at age 80. In the lower return scenario, with bonds yielding four percent, the equivalent wealth value assuming withdrawal at age 70 is 0.902. Withdrawal at age 80 generates a weighted average value of 0.970.

Table 6 also presents results for various age categories. These results illustrate how the age of the household head affects the estimate of the equivalent wealth for tax-deferred assets. In the higher-return scenario, column two, the average wealth equivalent declines from 1.107 for households under the age of 35, to 0.754 for households over the age of 65. This is a reflection of the changing accrual horizon for households at different ages. In the lower return case, column four, the analogous values are 1.044 for those under 35, and 0.750 for those over the age of 65.

When the tax rate assumptions are closer to the provisions of JGTRRA than to the pre-JGTRRA setting, the relative value of TDA assets declines relative to assets held outside these accounts. In the second column, for example, the weighted average with a bond return of six percent drops from 0.936 to 0.888 when withdrawals are assumed to occur at age 70, and from 1.024 to 0.957 with withdrawal at age 80. With lower bond returns, the relative value of the TDA assets is lower still, 0.854 with withdrawal at 70 and 0.903 with withdrawal at 80.

The results in Table 6 provide evidence on the empirical balance between the benefits of pre-tax accumulation within tax-deferred accounts, and the costs associated with deferred taxes on assets held in these accounts. The results suggest that for the average dollar invested in a tax-deferred account, the cost of deferred taxes outweighs the value of pre-tax accumulation. While the relative value of TDA assets is sensitive to various assumptions about rates of return and deferral horizons, in most cases the value of the TDA assets is at least ninety percent of the value of comparable assets held outside the TDA.

4. How Long is the Deferral Horizon? Analyzing Minimum Distribution Rules

The results for different age groups in Table 6 show that the relative value of assets inside and outside a tax deferred account depends on a household's age. This is because such values are very sensitive to the household's deferral horizon. Yet there is very little information on the pattern of withdrawals from existing tax-deferred accounts. Households can begin to draw down their tax-deferred balances at age 59½ without penalty, and they must begin to take withdrawals by age 70½. The assumptions of withdrawal at age 70 and age 80 are designed to describe retirement savers who attempt to preserve the value of their tax-deferred assets for as long as possible. This section considers how distribution requirements affect this possibility.

To ensure that contributors do not use tax-deferred accounts to completely avoid taxation of capital income, account holders over the age of 70½ are required to withdraw minimum distributions from their TDAs. These minimum distributions are determined by the age of the account holder and potentially by the age of the beneficiary who would inherit the account if the account holder were to die. Minimum distribution requirements (MDRs) limit the potential for taxpayers to accumulate assets in tax-deferred accounts without ever paying taxes on the inside build-up. They are specified as an age-dependent fraction of the account balance that must be withdrawn and included in taxable income each year.

One way to summarize their impact on individuals who wish to defer withdrawals from TDAs for as long as possible involves computing the average number of years that assets will remain in the TDA before they are withdrawn. This can be illustrated by considering the case of an individual who reaches age 70½ with one dollar in an IRA. Let IRA assets earn a return of r, and let m(a) denote the minimum distribution requirement at age a, as a percentage of the IRA account value at the end of the previous year. Let the account value at the end of the year when the account-holder celebrates his ath birthday be D(a). If we know the age at death for the account holder, and denote this by p, and further assume that the entire IRA balance is withdrawn in the year when the account

holder dies, then the average age at which distributions are taken, Y(p), where the age for each distribution is weighted by the amount of distribution paid out, is:

(11) $$Y(p) = [\Sigma_{a=70,p}\{a*m(a)*D(a-1)\} + p*D(p-1)]/ [\Sigma_{a=70,p}\{m(a)*D(a-1)\} + D(p-1)].$$

The account value evolves from one year to the next according to the recursion

(12) $$D(a) = (1+r)*D(a-1) – m(a)*D(a-1).$$

The assumption that all IRA assets are withdrawn in the year when the account holder dies is a conservative assumption that understates the potential opportunities for tax-deferred accumulation. With efficient estate planning, IRA assets can remain in a tax-deferred account for many years after the death of the original contributor.

Equation (11) measures the duration of the withdrawals for an individual who dies at age p. For an individual who begins distributions at age 70 ½, however, age at death is unknown, and can be described by the distribution function for dates of death conditional on reaching age 70. If F(p) is this function, then the expected duration of IRA payouts, where the expectation is taken over potential dates of death, is

(13) $$E(Y) = \Sigma_p F(p)*Y(p).$$

The expected duration provides a tractable way of measuring how long assets will be held in tax-deferred accounts when individuals follow minimum distribution strategies. The expected duration will depend on the interest rate on TDA assets, which determines the relative amounts in the TDA at different ages, on the minimum distribution schedule, and on the distribution of dates of death.

Table 7 reports the minimum distribution requirement, as a percentage of tax-deferred account value, for all IRA account holders except those whose IRA beneficiary is a spouse who is more than ten years younger than the account holder. Table 7 also shows the mortality distribution, conditional on reaching age 70, for men and for women. The table is capped at an age of 105, by which point all but 0.2 percent of the men, and 0.6 percent of the women, are expected to have died.

The third and fourth columns of the table show the survival probabilities for men and for women who reach age 70. One interesting feature of these data is that for a married couple in which both spouses are 70, there is more than a fifty percent probability that at least one of the spouses will reach age 90.

The last two columns in Table 7 show the distribution of dates of death for both men and women, with a peak at age 85 for men, and age 90 for women. The mortality distributions apply to the population at large, not for the set of households that have tax-deferred accounts. There is a negative relationship between socio-economic status and mortality rates, which suggests that the reported survivor table may understate the longevity of those with tax-deferred assets.

The horizon over which withdrawals can be made depends upon how long the account holder lives, and on the way the tax-deferred account is transferred to the account holder's beneficiaries. Individual Retirement Accounts typically provide retirement savers with the greatest flexibility in managing the transfer of wealth to survivors, and provide opportunities to stretch the withdrawal period over a long horizon, and thereby to maximize the benefits of tax-deferred accumulation. If the beneficiary is the spouse of the account holder, then the decedent's IRA can be "rolled over" into an IRA for the beneficiary spouse. The spouse can then draw down assets in the IRA according to the general rules that govern distributions. For example, if the IRA account holder dies at age 78, and the beneficiary spouse is 68, the spouse can roll the IRA balance into her IRA, and make no distributions until she turns 70 ½. She can then begin to draw down minimum distributions until her death, at which point her residual balance could be transferred to her beneficiary. This underscores the conservative nature of the assumption in equation (11) that all remaining assets are withdrawn when the account-holder dies.

If the beneficiary of an IRA is someone other than the account holder's spouse, then withdrawals from the IRA must be taken at least as quickly as a minimum distribution table calculated using the life expectancy of the beneficiary at the time of the IRA transfer would require. If the beneficiary is a grandchild of the account holder, for example, this could provide for a very low

rate of initial withdrawal, thereby allowing the assets to continue to accumulate at the pre-tax rate of return for many years after the death of the account accumulator. Slott (2002) provides a detailed description of strategies that permit extending the period of tax deferral beyond the lifetime of the account accumulator.

To illustrate the concept of the expected duration of withdrawals from an IRA, Table 8 reports calculations based on equations (11)-(13). The calculations describe the stream of payouts for a man, or a woman, reaching age 70 ½ with an IRA, and taking minimum distributions from then until their death. The table considers three different cases, with returns of four, six, and eight percent on the assets in the IRA. The entries in the first and third rows of the table embody the conservative assumption that all of the assets remaining in the IRA at the time of the account-holder's death are distributed in the year of death. The second and fourth rows assume that the assets are transferred to a spouse and that the duration of withdrawals by the beneficiary is four years beyond the time of transfer. This is likely to substantially understate the actual addition to the period of tax deferral for the IRA assets.

The entries in the table show that the average age at which withdrawals are made is over 80 for all of the cases considered. This age is nearly 85 for the cases involving female account holders and the assumption that the transfer at death adds four additional years to the average date of payout. Allowing for transfers to younger beneficiaries or for spouses who draw down their assets slowly would further lengthen the accumulation period. The table provides some support for the use of 80 as an accumulation horizon in the earlier tables, since it suggests that for a TDA holder who reaches age 70, and tries to preserve the balance in the account, this is a plausible lower bound on the average date for distributions.

5. Conclusions

This paper presents new evidence on the relationship between the value of assets held in tax-deferred accounts and assets held in traditional taxable formats. The summary information based on

the current age, asset, and tax rate distributions for tax-deferred account holders suggest that the deferred taxes on these assets outweigh the effect of future potential for tax-deferred accumulation. It would therefore require less than one dollar of taxable investment assets outside an IRA or a 401(k) plan to deliver the same resources at retirement as the average dollar of assets held within those plans. This finding is strengthened by the tax changes that were incorporated in the Jobs and Growth Tax Relief Reconciliation Act of 2003, which lowers the tax rate on dividends and capital gains on corporate stock held outside a tax-deferred account, while preserving the taxation at ordinary income rates on withdrawals from tax-deferred accounts. \

The tradeoff between tax-deferred and taxable assets is however very different for households of different ages, and it is also sensitive to household marginal tax rates. A particularly important consideration is the possibility that the household's marginal tax rate may change over time. If tax rates are higher when the household is retired, and drawing assets out of the tax deferred account, than when the household is contributing, this reduces the value of the tax-deferred account.

The present analysis illustrates how assets in tax-deferred accounts could be valued, under various assumptions about accumulation patterns and withdrawal behavior. The range of potential results highlights the need for additional empirical research that provides information on the withdrawal patterns from both Individual Retirement Accounts and other tax-deferred accounts. Some studies, such as Burman, Gale, and Weiner (2001), Burman, Coe, and Gale (1999), and Sabelhaus (2000), have begun to address these issues. Data on the fraction of households with tax-deferred accounts that does not make any withdrawals before the age at which minimum distributions begin would be extremely valuable. So would data on the share of households that begins to take distributions at 59 ½, and possibly draws down all of the assets before reaching age 70. Similarly, there is no information on the pattern of IRA transfers that occurs at death or on the fraction of IRAs that are bequeathed to a surviving spouse. Bequest patterns associated with tax-deferred accounts can have important effects on the valuation of these accounts.

The most important research need involves data on the withdrawal patterns from tax-deferred accounts. This could be combined with information on the pattern of household marginal tax rates over the lifetime, which would make it possible to consider the substantive importance of higher marginal tax rates in retirement than over the course of the working life.

REFERENCES

Amromin, Gene (2002), "Portfolio Allocation Choices in Taxable and Tax-Deferred Accounts: An Empirical Test of Tax Efficiency," mimeo, Federal Reserve Board of Governors.

Bergstresser, Daniel and James Poterba (2002). "Asset Allocation and Location Decisions: Evidence from the Survey of Consumer Finances," NBER Working Paper.

Boskin, Michael (2003), "Deferred Taxes in the Public Finances," NBER Working Paper.

Burman, Leonard, William Gale, and David Weiner (2001). "The Taxation of Retirement Saving: Choosing Between Front-Loaded and Back-Loaded Options," National Tax Journal, 54 (September), 689-702.

Burman, Leonard, Norma Coe, and William Gale (1999), "Lump Sum Distributions from Pension Plans: Recent Evidence and Issues for Policy and Research," National Tax Journal, 52 (September), 553-562.

Campbell, John (2001). "Forecasting U.S. Equity Returns in the 21st Century," in Social Security Advisory Board, Estimating the Real Rate of Return on Stocks Over the Long Term (Washington: Social Security Advisory Board).

Crain, Terry and Jeffrey Austin (1998). "An Analysis of the Tradeoff Between Tax Deferred Earnings and Preferential Capital Gains," Financial Services Review 6 (4), 227-242.

Diamond, Peter (2001). "What Stock Market Returns to Expect for the Future?" in Social Security Advisory Board, Estimating the Real Rate of Return on Stocks Over the Long Term (Washington: Social Security Advisory Board).

Engen, Eric, William Gale, and J. Karl Scholz (1996), "The Illusory Effects of Saving Incentives on Saving," Journal of Economic Perspectives 10 (Fall), 113-138.

Gale, William (1998). "The Effects of Pensions on Household Wealth: A Reevaluation of Theory and Evidence," Journal of Political Economy 106 (August), 706-723.

Gokhale, Jagadeesh, Laurence Kotlikoff, and Todd Neumann (2001). "Does Participating in a 401(k) Raise Your Lifetime Taxes?," NBER Working Paper 8341.

Gokhale, Jagadeesh, and Laurence Kotlikoff (2003). "Who Gets Paid to Save?," in J. Poterba, ed., Tax Policy and the Economy volume 17 (Cambridge: MIT Press)

Kennickell, Arthur B., Martha Starr-McCluer, and Brian Surette. 2000. "Changes in U.S. Family Finances at the End of the 1990s: Results from the 1998 Survey of Consumer Finances." Federal Reserve Bulletin (January).

Poterba, James and Andrew Samwick (2003), "Taxation and Household Portfolio Composition: Evidence from Tax Reforms in the 1980s and 1990s." Journal of Public Economics.

Poterba, James, Steven Venti, and David Wise. (1996). "How Retirement Saving Programs Increase Saving," Journal of Economic Perspectives 10 (Fall), 91-112.

Poterba, James, Steven Venti, and David Wise. (2000) "Saver Behavior and 401(k) Retirement Wealth," American Economic Review 90 (May), 297-302.

Poterba, James and David Wise (1998). "Individual Financial Decisions in Retirement Saving Plans and the Provision of Resources for Retirement," in M. Feldstein, ed., Privatizing Social Security (Chicago: University of Chicago Press), 363-393.

Sabelhaus, John. (2000), "Modeling IRA Accumulation and Withdrawals," National Tax Journal, 53 (December, Part 1), 865-875.

Schott, Ed (2003). The Retirement Savings Time Bomb and How to Defuse It (New York: Viking Press).

Shoven, John B. (1999). "The Location and Allocation of Assets in Pension and Conventional Savings Accounts," NBER Working Paper 7007.

Shoven, John (2001). "What Are Reasonable Long-Run Rates of Return to Expect on Equities?" in Social Security Advisory Board, Estimating the Real Rate of Return on Stocks Over the Long Term (Washington: Social Security Advisory Board).

Table 1: Equivalent Taxable Wealth Calculations for Bond Investments

Number of Years until Withdrawal	Tax Rate = .15			Tax Rate = .28			Tax Rate = .36		
	R = .04	R = .06	R = .08	R=.04	R=.06	R=.08	R=.04	R=.06	R=.08
	TDA Withdrawal Tax Rate Equal to Tax Rate on Accumulating Taxable Assets								
0	0.850	0.850	0.850	0.720	0.720	0.720	0.640	0.640	0.640
10	0.903	0.930	0.958	0.805	0.852	0.900	0.739	0.794	0.853
20	0.958	1.018	1.081	0901	1.008	1.127	0.854	0.986	1.139
30	1.018	1.113	1.218	1.008	1.192	1.410	0.986	1.223	1.518
40	1.081	1.218	1.374	1.267	1.410	1.764	1.139	1.518	2.025
50	1.147	1.333	1.549	1.260	1.668	2.207	1.315	1.885	2.701
	TDA Withdrawal Tax Rate = .15								
0	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
10	0.903	0.930	.958	0.951	1.005	1.063	0.981	1.055	1.134
20	0.958	1.018	1.081	1.063	1.189	1.330	1.134	1.309	1.512
30	1.018	1.113	1.218	1.189	1.407	1.664	1.309	1.625	2.017
40	1.081	1.218	1.374	1.330	1.664	2.082	1.512	2.017	2.690
50	1.147	1.333	1.549	1.488	1.969	2.605	1.746	2.503	3.588
	TDA Withdrawal Tax Rate = Tax Rate on Accumulating Assets + .10								
0	0.75	0.75	0.75	0.62	0.62	0.62	0.54	0.54	0.54
10	0.796	0.821	0.846	0.693	0.733	0.776	0.624	0.670	0.720
20	0.846	0.898	0.953	0.776	0.868	0.970	0.720	0.832	0.961
30	0.898	0.982	1.075	0.868	1.026	1.214	0.832	1.032	1.281
40	0.953	1.075	1.212	0.970	1.214	1.519	0.961	1.281	1.709
50	1.012	1.176	1.367	1.085	1.436	1.900	1.109	1.590	2.279

Source: Author's calculations as described in the text.

Table 2: Equivalent Taxable Wealth Calculations for Stock Investments, Dividend Yield = .02

Number of Years until Withdrawal	Dividend Tax Rate = .15, Capital Gains Rate = .08, Ordinary Income Tax Rate = .15			Dividend Tax Rate = .28, Capital Gains Rate = .18, Ordinary Income Tax Rate = .28			Dividend Tax Rate = .36, Capital Gains Rate = .18, Ordinary Income Tax Rate = .36			Dividend Tax Rate = .15, Capital Gains Rate = .15, Ordinary Income Tax Rate = .36		
Expected Capital Gain	g = .04	g = .07	g = .10	g = .04	g=.07	g=.10	g=.04	g=.07	g=.10	g = .04	g = .07	g = .10
	TDA Withdrawal Tax Rate Equal to Ordinary Income Tax Rate											
0	0.850	0.850	0.850	0.720	0.720	0.720	0.640	0.640	0.640	0.640	0.640	0.640
10	0.898	0.910	0.919	0.806	0.832	0.853	0.729	0.752	0.771	0.691	0.709	0.723
20	0.938	0.953	0.962	0.883	0.917	0.938	0.811	0.843	0.862	0.732	0.755	0.769
30	0.975	0.989	0.996	0.953	0.987	1.005	0.891	0.923	0.939	0.766	0.788	0.800
40	1.009	1.022	1.028	1.021	1.052	1.067	0.970	1.000	1.014	0.797	0.817	0.827
50	1.043	1.054	1.060	1.087	1.117	1.130	1.050	1.079	1.091	0.825	0.844	0.827
	TDA Withdrawal Tax Rate = .15											
0	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.850	0.850	0.850
10	0.898	0.910	0.919	0.952	0.983	1.007	0.968	0.999	1.024	0.918	0.942	0.960
20	0.938	0.953	0.962	1.042	1.082	1.107	1.077	1.119	1.145	0.972	1.000	0.960
30	0.975	0.989	0.996	1.125	1.166	1.186	1.183	1.226	1.247	1.018	1.047	1.021
40	1.009	1.022	1.028	1.205	1.243	1.260	1.288	1.328	1.346	1.058	1.085	1.097
50	1.043	1.054	1.060	1.283	1.319	1.334	1.395	1.433	1.449	1.096	1.121	1.132
	TDA Withdrawal Tax Rate = Ordinary Income Tax Rate + .10											
0	0.75	0.75	0.75	0.62	0.62	0.62	0.54	0.54	0.54	0.540	0.540	0.540
10	0.753	0.746	0.728	0.632	0.624	0.600	0.566	0.562	0.544	0.583	0.598	0.610
20	0.787	0.780	0.760	0.689	0.684	0.655	0.628	0.627	0.604	0.618	0.637	0.649
30	0.817	0.809	0.787	0.743	0.735	0.700	0.688	0.685	0.657	0.647	0.665	0.675
40	0.911	0.917	0.918	0.923	0.939	0.944	0.856	0.871	0.876	0.672	0.690	0.697
50	0.942	0.946	0.947	0.984	0.997	1.000	0.927	0.940	0.943	0.696	0.712	0.719

Source: Author's calculations as described in the text.

Table 3: Age Distribution of Tax-Deferred Account Ownership, 1998 SCF

Age of Household Head	Percentage of Tax-Deferred Account Holders	Percentage of Assets Held in Tax-Deferred Accounts
< 25	5.1	0.6
25-29	8.9	1.9
30-34	9.3	4.9
35-39	11.5	7.0
40-44	11.8	11.4
45-49	10.2	11.6
50-54	9.0	13.5
55-59	7.7	12.8
60-64	5.2	10.1
65-69	5.9	8.8
70-74	5.4	7.8
75 +	10.2	9.7

Source: Author's tabulation based on data in the 1998 Survey of Consumer Finances.

Table 4: Asset Allocation in Taxable and Tax-Deferred Accounts, 1998 SCF

Percentage of Tax-Deferred Assets Held in Stocks	Percentage of Tax-Deferred Account Holders	Percentage of Assets Held in Tax-Deferred Accounts
< 20%	25.4%	20.2%
20-40	3.6%	4.6%
40-60	23.5%	17.1%
60-80	2.5%	3.1%
80 +	45.0%	55.0%

Source: Author's tabulations from the 1998 Survey of Consumer Finances. All calculations are based on the universe of households with at least some assets in a tax-deferred account (TDA).

Table 5: Distribution of TDA Holders by Marginal Tax Rates, 1998 SCF

Marginal Tax Rate on Interest Income (First Dollar Rate)	Percentage of Tax-Deferred Account Holders	Percentage of Assets Held in Tax-Deferred Accounts
< 15%	10.0%	6.8%
15	33.9	8.3
15-27	9.1	14.2
28-30	35.7	32.1
31-38	6.2	14.5
39-41	3.1	11.1
> 41	2.1	12.9

Source: Author's tabulations from the 1998 Survey of Consumer Finances. All calculations are based on the universe of households with at least some assets in a tax-deferred account (TDA).

Table 6: Weighted Average Equivalent Wealth in Taxable vs. Tax-Deferred Accounts, 1998 SCF

Age Subcategory	Bond Return = .06, Stock Return = .09, Dividend Yield = .02		Bond Return = .04, Stock Return = .09, Dividend Yield = .02	
	Participant-weighted	Weighted by TDA Assets	Participant-Weighted	Weighted by TDA Assets
Assuming Ordinary Income Tax Rate Applies to Interest Income, Dividend Income, and Withdrawals from Tax-Deferred Account; Capital Gains Rate = .15				
	Asset Withdrawal at Age 70			
< 35	1.116	1.107	1.054	1.044
35-44	1.043	1.023	0.992	0.971
45-54	0.951	0.915	0.919	0.889
55-64	0.883	0.802	0.866	0.788
> 65	0.858	0.754	0.854	0.750
All Age Groups	0.997	0.936	0.957	0.902
	Asset Withdrawal at Age 80			
< 35	1.200	1.207	1.113	1.115
35-44	1.136	1.131	1.059	1.050
45-54	1.045	1.013	0.991	0.968
55-64	0.970	0.907	0.934	0.873
> 65	0.921	0.846	0.907	0.834
All Age Groups	1.075	1.024	1.016	0.970
Assuming Ordinary Income Tax Rate Applies to Interest Income and Withdrawals from Tax-Deferred Account; Dividends and Capital Gains Taxed at 15 Percent				
	Asset Withdrawal at Age 70			
< 35	1.081	1.039	1.018	0.976
35-44	1.004	0.958	0.953	0.906
45-54	0.915	0.865	0.883	0.839
55-64	0.869	0.778	0.852	0.763
> 65	0.857	0.748	0.853	0.744
All Age Groups	0.966	0.888	0.926	0.854
	Asset Withdrawal at Age 80			
< 35	1.155	1.121	1.068	1.029
35-44	1.083	1.043	1.006	0.962
45-54	0.992	0.938	0.938	0.892
55-64	0.945	0.857	0.909	0.823
> 65	0.916	0.827	0.903	0.814
All Age Groups	1.034	0.957	0.975	0.903

Source: Authors' calculations as described in text.

Table 7: Minimum Distribution Requirements and Mortality Distributions

Age	Minimum Distribution Requirement (Percent of Account Balance)	Survival Probability (Given Reached Age 70)		Percent of Individuals Reaching Age 70 Who Die at This Age	
		Men	Women	Men	Women
71	0.038	1	1	0%	0%
72	0.040	0.9697	0.9803	3.03	1.97
73	0.041	0.9383	0.9595	3.14	2.08
74	0.043	0.9058	0.9375	3.25	2.2
75	0.044	0.8719	0.9142	3.39	2.33
76	0.046	0.8366	0.8894	3.53	2.48
77	0.048	0.7998	0.8631	3.68	2.63
78	0.050	0.7614	0.8351	3.84	2.8
79	0.052	0.7214	0.8056	4	2.95
80	0.054	0.6797	0.7745	4.17	3.11
81	0.057	0.6365	0.742	4.32	3.25
82	0.060	0.592	0.7079	4.45	3.41
83	0.063	0.5464	0.6722	4.56	3.57
84	0.065	0.5003	0.6349	4.61	3.73
85	0.069	0.4538	0.5961	4.65	3.88
86	0.072	0.4076	0.5558	4.62	4.03
87	0.076	0.3621	0.5141	4.55	4.17
88	0.081	0.3178	0.4712	4.43	4.29
89	0.085	0.2754	0.4275	4.24	4.37
90	0.090	0.2354	0.3835	4	4.4
91	0.095	0.1983	0.3396	3.71	4.39
92	0.101	0.1644	0.2965	3.39	4.31
93	0.106	0.1341	0.255	3.03	4.15
94	0.114	0.1075	0.2157	2.66	3.93
95	0.120	0.0846	0.1791	2.29	3.66
96	0.128	0.0653	0.1164	1.93	6.27
97	0.137	0.0494	0.091	1.59	2.54
98	0.145	0.0366	0.0698	1.28	2.12
99	0.154	0.0267	0.0525	0.99	1.73
100	0.164	0.019	0.0388	0.77	1.37
101	0.175	0.0133	0.0281	0.57	1.07
102	0.189	0.0091	0.02	0.42	0.81
103	0.200	0.0062	0.0139	0.29	0.61
104	0.213	0.0041	0.0094	0.21	0.45
105	0.227	0.0026	0.0062	0.15	0.32

Source: Minimum distribution shares are calculated from IRS tables. Mortality statistics are drawn from Social Security Office of the Actuary publications.

Table 8: Duration of Distributions from Individual Retirement Account, Assuming No Distributions Prior to Age 70 ½

	Rate of Return on IRA Assets		
	R = .04	R = .06	R = .08
Male Account Holder, Account Liquidation at Death	80.03	80.51	80.94
Male Account Holder, Account Liquidation at Death + 4 Years	82.22	82.83	83.37
Female Account Holder, Account Liquidation at Death	81.30	81.97	82.55
Female Account Holder, Account Liquidation at Death + 4 Years	83.20	84.00	84.72

Source: Author's calculations as described in the text.