# Should the government be paying investment fees on $3 trillion of tax-deferred retirement assets?*

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# Should the government be paying investment fees on $3 trillion of tax-deferred retirement assets?

**Abstract** – Governments incentivize retirement saving by allowing individuals to contribute to tax-advantaged accounts in which the returns to financial assets receive special tax treatment. In accounts with "back-loaded" taxation, the individual contributes pretax money and pays taxes when the money is withdrawn. In accounts with "front-loaded" taxation, the individual contributes aftertax money and pays no future taxes. Under some simplifying assumptions, a standard benchmark result is that each account type results in the same cash flows for the individual, and the same present value of tax revenue for the government, even though back-loaded taxation results in more assets under management (AUM). We add investment management fees to the benchmark model and show that the neutrality result breaks down. Assuming fees are fixed as a percent of AUM, we show that individuals are still indifferent to the timing of taxation but the government is not. Under back-loaded taxation, the government implicitly owns a share of all retirement accounts and is effectively paying investment fees on this share, something it avoids under front-loaded taxation. We estimate this to cost the U.S. government $17.3 billion per year, representing a subsidy to the asset management industry. We then ask whether this result holds in general equilibrium, where fees as a percent of AUM are allowed to vary. The answer depends both on the nature of the cost function for asset management services, and on the nature of market competition, but we find that the result will in general continue to hold: back-loaded taxation is more expensive for the government, and it produces a larger asset management industry. We also find that back-loaded taxation reduces social welfare in our model.

**Abstract (100 words)** – Under some simplifying assumptions, both individuals and the government are indifferent between traditional tax-deferred retirement accounts and "front-loaded" (Roth) accounts. We add investment fees to this standard benchmark and show that individuals are still indifferent but the government is not. We estimate that, by deferring tax revenue, the U.S. government pays $17.3 billion in excess annual investment fees. We also show that in general this result continues to hold when fees as a percent of AUM are allowed to vary. In our model, back-loaded taxation produces a larger asset management industry, lower tax revenue and lower social welfare.

# 1 Introduction

Retirement savings systems around the world incorporate tax incentives designed to increase saving and enhance retirement security. One dimension along which these incentive schemes vary is the timing of taxation. The traditional way to structure these incentives is through tax deferral—exempting contributions to retirement accounts from current income taxation and then taxing the principal and returns upon withdrawal. This "back-loading" of taxation benefits the investor, because asset returns (interest, dividends, and capital gains) can be earned on the deferred taxes, yielding a higher amount of resources during retirement than would occur in the absence of the tax deferral.

Although a large majority of assets is still held in traditional accounts, "front-loaded" schemes are becoming increasingly widespread. Under these schemes, contributions are made with after-tax income, but then neither the principal nor returns are taxed at any point in the future. In the U.S., the defined contribution retirement system began with the introduction of traditional accounts with back-loaded taxation, including both employer-based accounts ("401(k)s") and individual accounts ("IRAs"). Accounts with front-loaded taxation (named "Roth" accounts after the U.S. senator who originally proposed them) were made available as an additional option—via Roth IRAs in 1997 and Roth 401(k)s in 2001.[1] In the formulation of the recent U.S. tax reform, Congress considered including provisions for "Rothification", i.e., a shift away from traditional accounts in favor of front-loaded taxation (see, e.g., Tergesen and Rubin, 2017).[2] A similar pattern occurred in Canada and the U.K., who started with traditional accounts and later introduced front-loaded ones as an additional option. In 2015, the U.K. Treasury launched a formal consultation on whether one or the other scheme is preferable (Osborne, 2015; Buttonwood, 2015).

Much of the recent U.S. debate focused on the political economy aspects of the choice, i.e., whether front-loading tax revenue with a Roth scheme may encourage irresponsible fiscal policy. We abstract from this debate. Instead, our contribution is to highlight another important channel through which the timing of taxation affects welfare outcomes: record keepers, asset managers, and financial advisors charge fees for running retirement plans, managing assets, and advising clients. These fees are typically charged as a percentage of

[1] We follow the World Bank (Holzmann and Hinz, 2005) and Beshears et al. (2017) in using the terms "front-loaded" and "back-loaded" to refer to the timing of the *taxation*. A source of potential confusion is the earlier use of the terms "front-loaded" and "back-loaded" to refer to the timing of the *tax break*. Since the tax break for Roth accounts does not occur upfront, some of those involved in the discussion of the 1997 law that introduced Roth accounts referred to them as "back-loaded IRAs" (Committee on Finance of the U.S. Senate, 1997). Several authors including Thaler (1994) and Burman et al. (2001) follow this latter convention as well.

[2] Rothification was not included in the final tax reform text (Public Law 115-97 of 12/22/2017).

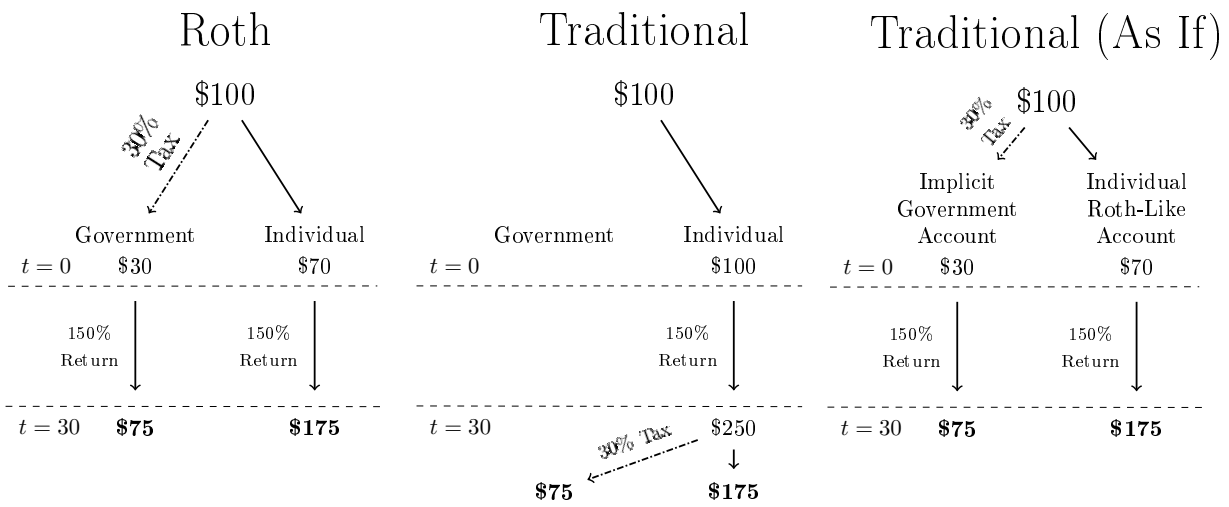


Figure 1: **Benchmark neutrality result.** Traditional is equivalent to a Roth account plus an implicit government account equal to the balance of deferred taxes. Without asset management fees, the two accounts yield the same cash flows for individuals, and the same future value of cash flows for the government. A 150% return is approximately equal to the total return on a 30-year Treasury bond (3.10% for 30 years).

assets under management (AUM). By deferring tax revenue with a traditional scheme, the government pays investment fees on the substantial amount of assets that sit in retirement accounts waiting to pay future taxes.

Under a few simplifying assumptions, including the constancy of the tax rate across working and retirement years, some basic math shows a standard benchmark neutrality result, shown in the first two panels of Fig. 1: in the absence of fees, (i) individuals are indifferent between Traditional and Roth accounts, which yield identical cash flow streams; and (ii) the timing of government cash flows differs across accounts, but the future (or present) value of tax revenue is constant.[3] This result can be intuitively understood by decomposing a Traditional account into a Roth-like individual account plus an implicit government account equal to the balance of deferred taxes, as in the third panel of Fig. 1.

We add fees to this benchmark model and show that, while individuals remain indifferent, the timing of taxation does affect the future value of government revenues. This is shown in Fig. 2. Because under Roth the government levies taxes upfront, the account size is smaller, and therefore total fees are also smaller. The third panel shows again the decomposition into a Roth-like account and an implicit government account, which also pays fees.

It is possible, of course, that the additional fees that the government pays on its implicit

[3]This benchmark result abstracts from differences that exist across Traditional and Roth in features such as contribution limits, withdrawal penalties and required minimum distributions. We briefly discuss these features in Section 2.

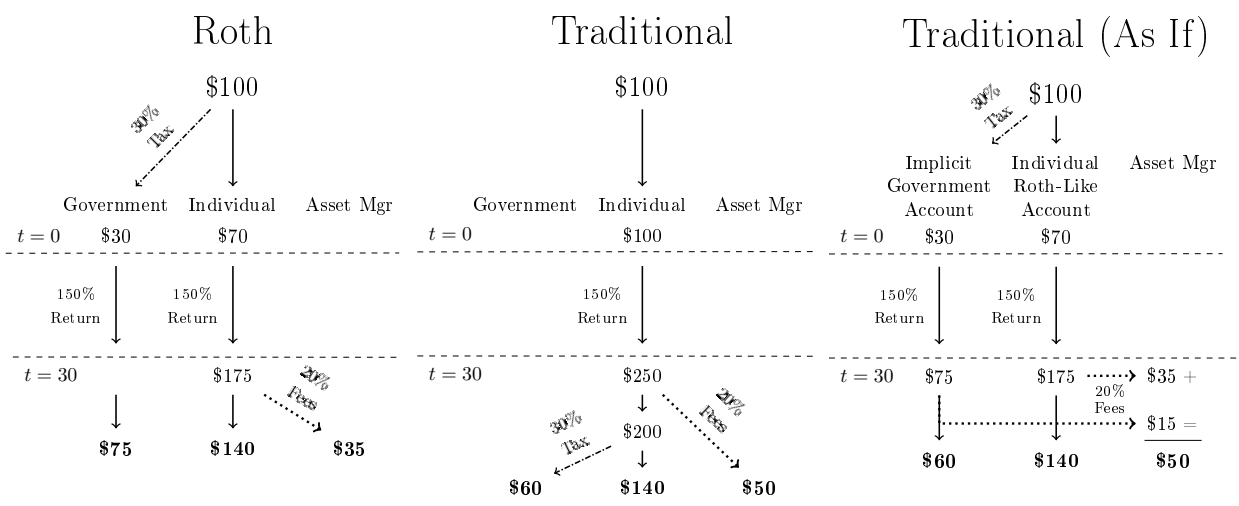


Figure 2: **Fee nonneutrality.** Traditional is equivalent to a Roth account plus an implicit government account equal to the balance of deferred taxes. With asset management fees, the two accounts yield the same cash flows for individuals, but the Roth account yields a superior future value for the government thanks to lower total fees. A 150% return is approximately equal to the total return on a 30-year Treasury bond (3.10% for 30 years); 20% fees are the future-value equivalent of 0.72%/year (the value we calibrate in this paper) for 30 years.

portfolio are compensation for services provided by asset managers, possibly including better performance. However, we deem it unlikely that the government captures these benefits because it implicitly holds a fraction of all retirement portfolios, and many of the potential benefits will cancel out in the aggregate. For example, some of the higher costs might be associated with creating customized funds or asset allocations, such as target-date retirement funds or industry funds. While this might create value for individuals, holding *all* target-date funds or industry funds will not create value to the government. A similar argument applies to active asset management, at least with regard to equity funds. In the words of Fama and French (2010), "The aggregate portfolio of actively managed U.S. equity mutual funds is close to the market portfolio, but the high costs of active management show up intact as lower returns to investors."

The U.S. government's implicit account is large. We estimate its size as the total amount of tax-deferred assets in DC plans and IRAs ($15.2 trillion) times 20%, a reasonable estimate of the average marginal tax rate in retirement, leading to our title figure of $3 trillion of retirement assets.[4] We conservatively estimate fees to be about 72 basis points (bps) based

[4]Our estimate of assets excludes the federal government's Thrift Savings Program (TSP), whose fees are negligible. It also excludes DB plans, although a parallel argument applies to these plans as well. Including corporate and state and local government DB plans would add $7.4 trillion of tax-deferred money, increasing our estimates of the implicit government account by 50% and the corresponding fees by 34%.

on the lowest asset-weighted figures available. We assume that 21% of fees paid by the government are recovered via corporate taxation of the asset managers. Multiplying \$3 trillion by $.72\% \times (1 - .21)$, we reach our estimate of \$17.3 billion per year—a cost for the government, and an annual subsidy to the asset management industry.

Our back-of-the-envelope calculation takes the supply side as given, i.e., it relies on the partial equilibrium assumption that fees as a percent of AUM remain the same if all Traditional accounts are converted to Roth. The extent to which this is true in general equilibrium depends on both the underlying cost structure and the competitive landscape of the asset management industry. If aggregate asset management costs are proportional to aggregate assets under management, then our partial equilibrium result will also hold exactly in general equilibrium.

In order to examine what happens if economies of scale are present, we examine an extreme alternative by assuming that all asset management costs are fixed and there are no variable costs. Intuitively, these economic assumptions would lead to a monopoly, which is inconsistent with the large observed number of asset management firms. We therefore introduce two additional realistic assumptions. First, consumers are not fully sensitive to the level of fees (see, e.g., Bergstresser et al., 2009; Henderson and Pearson, 2011; Gil-Bazo and Ruiz-Verdú, 2009), and second, entry is free. Specifically, we model competition among funds as spatial competition (Salop, 1979; Tirole, 1988, Ch.7) in a two-period, general equilibrium model in which each fund only needs a fixed amount of labor to operate. A switch from Roth to Traditional continues to increase assets under management. Despite the assumption that any fund could costlessly expand to manage the additional assets, the model generates increases in (i) the equilibrium number of funds, (ii) employment in the asset management industry, and (iii) the aggregate dollar fees collected. Our result is related to an extensive literature showing that the government may be able to borrow more efficiently than private agents (e.g., Barro, 1974; Aiyagari and McGrattan, 1998; Heathcote, 2005). Here we provide an example in which the government can *save* more efficiently.

Finally, we examine how the larger asset management industry that arises under Traditional accounts affects social welfare in our model, defined as the utility of the average individual. Consider the experiment of a shift from Roth to Traditional. If Roth were the social optimum, the shift would cause there to be too many funds. The total welfare loss would be relatively small, however, because we are departing from the optimum where the social welfare function is flat. Only if the equilibrium number of funds increased significantly would social welfare suffer serious consequences. Alternatively, if Roth had too few funds, a shift to Traditional would push society closer to the optimum. Finally, if Roth started with too many funds, the shift would be especially pernicious, as it would bring society even

farther from the optimum, starting at a point where the social welfare function is already steep. Under our assumptions, this third scenario prevails: we find that under Roth the equilibrium number of funds (and therefore, employment in the asset management industry) is already twice as large as the social optimum a rational planner would set. By showing an additional way in which the financial sector can become too large, we contribute to the recent literature on the optimal size of the financial services industry (Philippon and Reshef, 2012; Greenwood and Scharfstein, 2013; Malkiel, 2013; Bolton et al., 2016).

Our results have implications for public policy questions related to retirement saving. The primary question is whether the government should promote a shift towards Roth, and if so how aggressively. Our results point out one advantage of Roth accounts—higher present value of tax revenue. However, before taking a policy stance, one should recognize that there are potentially other important factors not captured by our model, including progressive taxation, behavioral biases, and political economy considerations, that could affect the relative desirability of the two types of account. Our analysis also raises the question whether the government should act to try to reduce the overall level of fees, either directly, by leveraging the bargaining power arising from its large implicit account, or indirectly, via stricter fiduciary standards for retirement savings accounts. We address these issues in the conclusion.

Our paper is structured as follows. Section 2 derives the basic result that the investor and the government are indifferent between Traditional and Roth in a benchmark partial-equilibrium model. In section 3, we introduce investment fees, and show that the basic indifference result still holds for the investor, but not for the government. In Section 4 we construct an asset-weighted estimate of total investment fees applicable to retirement accounts and use it to estimate total excess fees. Section 5 examines a simple general equilibrium model in which the size of the asset management industry and fees as a percent of AUM are determined endogenously. Section 6 briefly examines the implications for public policy and concludes.

# 2 Benchmark: indifference between front-loaded and back-loaded taxation

In this section we describe the standard result (e.g. Brady, 2012) that, assuming flat taxation and no time variation in the tax rate, optimizing individuals under Roth can and will choose the same consumption allocation (both during work life and during retirement) as they would under Traditional. In addition, the present value of government revenue is identical under

| Account type | Label | Type of taxation | Tax on initial contribution | Tax rate on investment returns | Tax on retirement payouts |
|---|---|---|---|---|---|
| Taxable | TTE | Front-loaded | $\tau_L$ | $\tau_I$ | 0 |
| Traditional | EET | Back-loaded | 0 | 0 | $\tau_R$ |
| Roth | TEE | Front-loaded | $\tau_L$ | 0 | 0 |

Table 1: **Different tax treatment of retirement savings.** Money earned and saved for retirement can be taxed at three points: when earned, when it earns returns on investment, and when paid out of the account in retirement. Each type of account is represented by a three-letter abbreviation. For instance, a common taxable account is "TTE" because earned income is taxable, investment returns are taxable, but account distributions in retirement are exempt.

Roth and Traditional. Together, these results imply that the economic equilibrium is the same under Roth and Traditional.

## 2.1 Base assumptions and notation

To begin, we assume that an individual's savings are held in an account and invested in the only one asset in positive supply, government bonds, paying a known return of $r$. We assume two constant tax rates, one for labor income ($\tau_L$) and one for retirement income ($\tau_R$). Neither tax rate varies with the level of income.[5] Table 1 compares three possible account types: Taxable, Traditional and Roth. Following convention, we label these accounts TTE, EET, and TEE, respectively.[6]

- *Taxable account* (TTE): all labor income is taxed at rate $\tau_L$ when earned. Intermediate investment returns are taxed at a rate $\tau_I > 0$. This scheme is referred to as TTE, because the earned income is taxable, investment returns are taxed, and account distributions in retirement are exempt.

- *Traditional retirement account* (EET): income tax on retirement account contributions is deferred until the time of retirement $T$, when the account is assumed to be liquidated and all the money is paid out as retirement income, taxed at a rate $\tau_R$. Intermediate

[5] In practice, the tax system does not have flat rates, but is instead progressive, with marginal tax rates increasing with income. This is our main motivation for having distinct tax rates: even if the tax rate schedule is constant over time, a lower level of income in retirement would imply $\tau_L > \tau_R$. Progressivity also introduces additional complications: when coupled with uncertain labor income or asset returns, marginal tax rates become stochastic. We briefly address these complications in the conclusion.

[6] This notation is standard in publications by the World Bank (Holzmann and Hinz, 2005; Whitehouse, 2007) and the OECD (Antolín et al., 2004; OECD, 2015a).

investment returns are not taxed. This scheme is referred to as EET because the earned income put into the account is exempt, the returns are exempt, and the full amount of the retirement account is taxed on withdrawal.

- *Roth retirement account* (TEE): all labor income is taxed at rate $\tau_L$ when earned. Intermediate investment returns are not taxed. This scheme is referred to as TEE because the earned income is taxable, the returns on investment are exempt, and account distributions in retirement are exempt.

We assume that individuals' initial consumption and the interest rate they earn on the assets in their retirement account are the same under Roth and Traditional. Later we will verify that these assumptions hold in the resulting equilibrium. We also assume that the individual has the same pretax labor earnings under either system, and we abstract for now from details such as contribution limits, withdrawal penalties, and required minimum distributions.[7] Together, these assumptions imply that the individual directs the same amount of pretax labor earnings to account contributions regardless of account type. We normalize this amount to \$1.

## 2.2 Benchmark neutrality result

Table 2 shows the initial and future cash flows for both the individual and the government. With a Traditional account, the government has no revenue upfront, and the individual's account balance is 1. At time 0, when the individual retires and the account is liquidated, the balance ($(1+r)^T$) is paid out and taxed. The individual receives $(1+r)^T(1-\tau_R)$ and the government receives $(1+r)^T\tau_R$. Conversely, with a Roth account, the government taxes the money upfront receiving $\tau_L$. The individual's starting balance is thus $1-\tau_L$. No additional taxation happens, and therefore at time 0 the individual can keep the entire balance $(1-\tau_L)(1+r)^T$.

It is immediate to see that if $\tau_R = \tau_L$, the individual's ending wealth is the same under both account types, and therefore a consumption plan that is feasible under Traditional is also feasible under Roth, and vice versa. Moreover, we assumed that initial wealth (i.e., pretax labor earnings) is the same under both accounts, and that the only price in the

[7] Our analysis makes a few simplifying assumptions for clarity of exposition. Some are immaterial, such as the assumption that the account is liquidated in a lump sum at time 0, instead of gradually to provide retirement income. Other simplifying assumptions let us abstract from features that may make one or the other account more attractive to the individual. However, these features result in a correspondingly higher cost for the government, and therefore they are immaterial for the purposes of our argument. For example, Roth (TEE) accounts have the same nominal contribution limits as Traditional (EET) accounts, allowing individuals to contribute a larger amount of after-tax income (Burman et al., 2001). Roth accounts also have fewer restrictions on withdrawals, as contributed principal can be withdrawn penalty-free at any time, and there are no required minimum distributions as long as the account owner is alive.

| Account | Individual | | | Government | | |
|---|---|---|---|---|---|---|
| | Initial balance | Future balance | Final payout | Initial revenue | Future revenue | PV @ $r$ |
| Traditional | 1 | $(1+r)^T$ | $(1+r)^T \cdot (1-\tau_R)$ | 0 | $(1+r)^T \cdot \tau_R$ | $\tau_R$ |
| Roth | $1-\tau_L$ | $(1-\tau_L) \cdot (1+r)^T$ | $(1-\tau_L) \cdot (1+r)^T$ | $\tau_L$ | 0 | $\tau_L$ |
| Traditional - Roth | $\tau_L$ | $\tau_L \cdot (1+r)^T$ | $(1+r)^T \cdot (\tau_L - \tau_R)$ | $-\tau_L$ | $(1+r)^T \cdot \tau_R$ | $\tau_R - \tau_L$ |
| If $\tau_R = \tau_L$ | | | 0 | | | 0 |

Table 2: **Benchmark cash flows under Traditional and Roth.** With flat taxes, and assuming that the tax rate on retirement income ($\tau_R$) is the same as the tax rate on labor income ($\tau_L$), the individual has the same retirement wealth both with a Traditional and a Roth account. Government revenue is also constant in present value, assuming that the government's discount rate is the same as the return on government debt ($r$).

economy, the interest rate, is also the same. With constant wealth and constant prices, the individual would choose the same consumption plan under Traditional as she would under Roth, i.e., the same consumption plan is optimal.[8]

The government's cash flow differs across plans—with Roth accounts revenue $\tau_L$ is received up front, whereas with Traditional accounts the revenue is deferred until the future, although it is larger ($(1+r)^T \tau_L$). But assuming that the government discount rate is equal to the interest rate on government bonds, the time-0 present value of revenue under Traditional is $(1+r)^{-T}(1+r)^T \tau_L = \tau_L$, i.e., the same as the immediate revenue under Roth. The government will therefore be indifferent (in a present value sense) between the accounts.

Up until now we have assumed that interest rates are the same under the two systems, but we now show the equilibrium result that a shift from Roth to Traditional does not affect equilibrium interest rates, because the sum of desired private saving and government saving is the same under each system. Under Traditional, the account balance is $\tau_L$ larger than the balance under Roth. Since the account is invested in government bonds, this creates additional demand for government bonds equal to $\tau_L$. At the same time, the government faces a revenue shortfall (relative to Roth) of $\tau_L$. Assuming for simplicity that government expenditure is exogenous, the government must issue an amount $\tau_L$ of new bonds, adding

[8]Even though the Traditional equilibrium is the same as the Roth equilibrium in a neoclassical sense, behavioral biases elicited by the different choice architecture may cause individuals to choose a suboptimal consumption plan under one or the other account. We discuss some of these factors in the conclusion.

to the existing supply. Thus, the increase in desired private saving is exactly offset by the decrease in government saving, leaving desired national savings and the equilibrium interest rate unchanged.

If $\tau_L \neq \tau_R$, a consumption plan that is optimal under Traditional would no longer be optimal under Roth. However, if we continue to assume that time-0 consumption is the same across the two types of account, the balance in a Traditional account at any time 0 can be decomposed into three virtual accounts as follows:

$$V_t^{EET} = (1+r)^t \left[ \begin{array}{ccccc} \underbrace{(1-\tau_L)} & + & \underbrace{(\tau_L - \tau_R)} & + & \underbrace{\tau_R} \\ \text{Individual} & & \text{Government} & & \text{Implicit} \\ \text{Roth-like} & & \text{Matching} & & \text{Government} \\ \text{Account} & & \text{Account} & & \text{Account} \end{array} \right]. \tag{1}$$

The first term is a "Roth-like" account of size $1 - \tau_L$, as if the individual had contributed to a Roth account. The second term is a "government matching account" of size $\tau_L - \tau_R$, which constitutes the true difference in final wealth between Traditional and Roth. This account is akin to an employer matching program—the government matches every dollar the individual saves with a grant $\tau_L - \tau_R$. This grant is not a consequence of inherent differences between Traditional and Roth, but rather of the difference in tax rates between labor income and retirement income, a result of separate policy choices. (Although often in practice $\tau_L - \tau_R > 0$, specific individuals may experience $\tau_L - \tau_R < 0$, resulting in a negative "match"). The last term is the "implicit government account" of size $\tau_R$. This account represents assets necessary to pay future taxes when the investor takes distributions from the account. Throughout the paper, we refer to this term as the government's implicit account.

## 2.3 Extended neutrality result: adding a risky asset

Now suppose that there are two assets: the government bond yielding $r$ and a risky asset (stocks) with expected return $r_s > r$. Assume an investor holds a percentage $\alpha$ of her retirement account in stocks. If $\tau_R = \tau_L$, the Roth account and the Traditional account would yield identical cash flows for the individual. Moreover, the present value of tax revenues would be the same, as long as the government discounts risky cash flows at the same rate $r_s$ under Traditional and Roth.

This result is self-evident for the investor, but somewhat less obvious for the government. Under Traditional, the *expected* future tax revenue is $\left[\alpha\left(1+r_s\right)^T + \left(1-\alpha\right)\left(1+r\right)^T\right]\tau_L$, which is more than in the basic scenario. Thus, a fraction $\alpha$ of the government's claim

on Traditional assets may be characterized as a levered investment in equity, as the government accepts to defer revenues (i.e., it borrows) in exchange for this claim. A casual observer may think that levered holdings of equities benefit the government, which pays a low interest rate on its debt while earning a high expected return on equities. However, future *realized* tax revenue is riskier than in the benchmark case, because it is proportional to realized stock returns. Because the government discounts risky cash flows at a rate $r_s$, the present value of government tax revenue is $\tau_L$, the same as the immediate tax revenue under Roth.

The assumption that both the government discounts risky cash flows at the same rate $r_s$ under both Traditional and Roth is a strong one. First, a (subtler) casual observer may claim that levered holdings of equities benefit the government because the equity premium outweighs the additional risk. Second, if *all* investors switch from Roth to Traditional, a fraction $\alpha$ of the government's newly created claim on Traditional assets is invested in equities. The resulting increase in demand for risky assets may affect the discount rate for risky cash flows (see, e.g., Romaniuk, 2013). However, both these objections imply that the government is constrained in its equity holdings, or else it could adjust its holdings until its discount rate for additional risky cash flows is the same as the investors'. Our assumption therefore is roughly equivalent to assuming that the government is unconstrained in its equity holdings.[9]

In practice, the government may well be constrained in its holdings of stocks, but the existence of Traditional accounts need not increase social welfare by easing a binding constraint. If the government already has too large an exposure to the stock market, Traditional accounts worsen the binding constraint by forcing it to hold even more stocks.

The literature on government exposure to the stock market highlights a number of motives for the government to demand positive or negative exposure to equities. For instance, if individuals are risk-neutral and the deadweight cost of taxation is convex, the government may benefit from hedging against cyclical fluctuations by taking a *short* position in the stock market (Bohn, 1990). However, if individuals are risk averse, equities' higher expected return means that taxes are on average lower, and the same convexity may cause the government to seek a *long* position in the stock market (Lucas and Zeldes, 2009). Further, constraints

[9]Even if the government is constrained, the benchmark neutrality result may still continue to hold because of a type of "Ricardian equivalence." If, under Traditional, the government is unable to reduce its stock position, infinitely lived and perfectly forward-looking individuals may realize that the government will have to change taxes in the future depending on realized stock returns up to then. Under some assumptions about how the government adjusts taxes in response to stock market returns, this amounts to an implicit long position in stocks because taxes will be lower if stocks have high returns, and vice versa. To offset this implicit position, individuals would reduce their own stock holdings today. Thus, demand and supply of stocks and bonds would remain in balance with no change in interest rates, stock expected returns, or household consumption.

may prevent households from holding equities, as argued in the literature on the costs and benefits of Social Security equity holdings (see, e.g. Geanakoplos et al., 1999; Abel, 2001; Diamond and Geanakoplos, 2003). Finally, it is worth noting that the government already has substantial exposure to equities through the tax system because tax revenue cash flows are correlated with stock market performance (Auerbach, 2004).

At the end of the next section, we discuss the implications of stockholding constraints for our main result.

# 3 The effect of asset management fees

## 3.1 Fee nonneutrality in our benchmark model

We now examine the effects of introducing asset management fees. At time 0, an asset management firm charges fees equal to a fixed proportion of account size, $f$. As in the basic case, we assume that individuals' initial pretax labor earnings, initial consumption, and the effective interest rate they obtain on the assets in their retirement account are the same under Roth and Traditional. Later we will discuss whether these assumptions hold in the resulting equilibrium. We begin by assuming $\tau_R = \tau_L$, a necessary condition for the benchmark neutrality result. For simplicity, we also assume that the government does not tax the corporate income of asset managers ($\tau_C = 0$).

Table 3 shows our results. The individual's final retirement wealth is lower, but still the same across Traditional and Roth. Both accounts grow at a net-of-fee rate of $(1+r)(1-f)-1$. The left panel of Table 3 calculates the final payouts for the individual. Under Traditional, the initial balance is 1, and the final aftertax distribution from the account is $(1+r)^T(1-f)^T(1-\tau_R) = (1+r)^T(1-f)^T(1-\tau_L)$. Under Roth, the initial balance is $1-\tau_L$, and the final distribution from the account is $(1-\tau_L)(1+r)^T(1-f)^T$. Thus, final wealth is the same, and therefore a consumption plan that is feasible under Traditional is also feasible under Roth. Moreover, with constant wealth and constant prices, a consumption plan that is optimal under Traditional is also optimal under Roth. The individual is still indifferent because a fraction $1-(1-f)^T$ of her final wealth is eroded by fees regardless of account type.

The right panel of Table 3 calculates the present value of tax revenue for the government. Even with fees, the government discounts cash flows at $r$, the interest rate it pays on outstanding debt. As in the benchmark case, the timing of tax revenue cash flows is different between Traditional and Roth. Unlike in the benchmark case, however, the present value of these cash flows is also different. The government has unambiguously lower present value of

| Account | Individual | | | Government | | |
|---|---|---|---|---|---|---|
| | Initial balance | Future balance | Final payout | Initial revenue | Future revenue | PV @ $r$ |
| Traditional | 1 | $(1+r)^T \cdot (1-f)^T$ | $(1+r)^T \cdot (1-f)^T \cdot (1-\tau_R)$ | 0 | $(1+r)^T \cdot (1-f)^T \cdot \tau_R$ | $(1-f)^T \cdot \tau_R$ |
| Roth | $1-\tau_L$ | $(1-\tau_L) \cdot (1+r)^T \cdot (1-f)^T$ | $(1-\tau_L) \cdot (1+r)^T \cdot (1-f)^T$ | $\tau_L$ | 0 | $\tau_L$ |
| Traditional - Roth | $\tau_L$ | $\tau_L \cdot (1+r)^T \cdot (1-f)^T$ | $(1+r)^T \cdot (1-f)^T \cdot (\tau_L - \tau_R)$ | $-\tau_L$ | $(1+r)^T \cdot (1-f)^T \cdot \tau_R$ | $-[\tau_L + -(1-f)^T \tau_R]$ |
| If $\tau_R = \tau_L$ | | | 0 | | | $-\tau_L \cdot [1 - (1-f)^T]$ |

Table 3: **Present value of tax revenue under Traditional and Roth with fees and no corporate taxes.** An asset manager charges proportional fees $f$ on the account. Assuming that the tax rate on retirement income ($\tau_R$) is the same as the tax rate on labor income ($\tau_L$), the individual has the same retirement wealth both with a Traditional and a Roth account. However, government revenue is lower with Traditional, assuming that the government's discount rate is the same as the return on government debt ($r$).

tax revenue under Traditional:

$$\mathbf{PV}\left(\mathbf{Tax\ Revenue}^{EET}\right) - \mathbf{PV}\left(\mathbf{Tax\ Revenue}^{TEE}\right) = -\tau_L[1-(1-f)^T] < 0. \quad (2)$$

This formula has an intuitive interpretation: $\tau_L$ is the initial size of the government's implicit account under Traditional, and $1-(1-f)^T$ is the fraction of the account that gets eroded by fees.

Generally speaking, in the resulting equilibrium with fees, the interest rate and the individual's final wealth need *not* remain the same under Traditional and Roth. If government expenditure follows an exogenous path, then to cover the loss of revenue under Traditional tax rates would have to be raised, reducing the individuals' wealth. Thus, a consumption plan that is feasible and optimal under Roth may not be feasible under Traditional. For the sake of exposition, we do not solve for the equilibrium consumption plan, and instead we continue to assume that the individuals' initial consumption stays constant.

Up to this point we have ignored corporate taxation. However, we show that taxing the income of asset managers at a rate $\tau_C$ can only ameliorate, but not eliminate the difference

in present value of government revenue between Traditional and Roth accounts. We assume conservatively that under Traditional every additional dollar of fee revenue equals profit for the asset manager.[10] Then, the government receives a stream of corporate tax revenues growing at a rate $(1+r)(1-f)-1$ (the same rate as the account balance), effectively recapturing a fraction $\tau_C$ of fees:[11]

$$\begin{aligned}\mathbf{PV}\left(\mathbf{Tax\ Revenue}^{EET}\right) - \mathbf{PV}\left(\mathbf{Tax\ Revenue}^{TEE}\right) = \\ = -\tau_L[1-(1-f)^T](1-\tau_C) < 0.\end{aligned} \tag{3}$$

Summarizing, when $\tau_R = \tau_L$, the investor is still indifferent between Traditional and Roth, but the government is not. For the individual, both Traditional and Roth are eroded by fees in equal proportions, whereas for the government, the present value of tax revenue is eroded only under Traditional. If the government were to shift from Traditional to Roth, it would receive the revenue upfront and take on lower debt. By leaving the money in its implicit account, the government keeps paying an interest rate $r$ on the outstanding debt, but receives a net-of-fees return $(1+r)(1-f)-1$.

The government's loss of tax revenue is not simply a consequence of the fact that in a Roth account fees are paid with after-tax money, whereas in a Traditional account fees are paid with pre-tax money, i.e., "deductible." To examine this possibility, in Section 1 of the Internet Appendix, along with Traditional and Roth accounts, we consider two alternative hypothetical accounts: a "deductible Roth", in which individuals receive a deduction for fees, and a "nondeductible Traditional", in which the government taxes the individual based on the gross-of-fees balance.[12] By comparing outcomes among these four account types we decompose the difference between Traditional and Roth into two components: fee deductibility, accounting for a fraction $1-\tau_R$ of the revenue loss, and the sheer existence of additional assets, accounting for the remainder.

If $\tau_R \neq \tau_L$, the individual is not indifferent between Traditional and Roth, as in the benchmark case. The Traditional account can be still decomposed into three virtual accounts:

[10] If the additional assets under Traditional result in additional costs, only a fraction of the revenue equals taxable profits directly for the asset manager. However, most additional costs would equal income indirectly for employees or other entities upstream in the supply chain. The overall result would be that a different fraction of asset manager revenue is recovered—somewhere between 0 (if the income somehow escapes taxation) and the top marginal tax rate.

[11] For a Traditional account, the present value of corporate tax revenues is equal to $\tau_C[1-(1-f)^T]$, i.e., the asset manager's one-period revenue flow $f(1+r)$, times the corporate tax rate $\tau_C$ (to obtain the government's one-period corporate tax revenue flow), times a growing annuity term $1/[f(1+r)]\cdot[1-(1-f)^T]$. Similarly, the present value of corporate tax revenues for a Roth is $(1-\tau_L)\tau_C[1-(1-f)^T]$, and therefore a Traditional yields an additional $\tau_L\cdot\tau_C[1-(1-f)^T]$ in corporate tax revenues. Adding this term to (2), we obtain (3).

[12] We thank Mariacristina DeNardi for bringing this possibility to our attention.

a Roth-like account, a government matching account, and the implicit government account. However, the existence of a government matching account does not create any additional inefficiency. The inefficiency is created because the government leaves an amount $\tau_L$ in the account at time 0, and how this amount is ultimately split between the government and the individual is inconsequential. The present value of the individual's retirement wealth simply increases by $(1-f)^T(\tau_L - \tau_R)$, and the present value of the government's tax revenue drops by the same amount:

$$\begin{aligned} &\mathbf{PV}\left(\mathbf{Tax\ Revenue}^{EET}\right) - \mathbf{PV}\left(\mathbf{Tax\ Revenue}^{TEE}\right) = \\ &= -(1-f)^T(\tau_L - \tau_R) - \tau_L[1-(1-f)^T](1-\tau_C). \end{aligned} \tag{4}$$

Thus, if $\tau_R \neq \tau_L$, the individual's relative preference for one or the other account does not change vis-à-vis the case with no fees, because the sign of the matching depends only on $\tau_L - \tau_R$ regardless of fees. From the government's point of view, the cost of the matching is unaffected by fees, because the amount of matching received by the individual is equal to the drop in present value of tax revenue.

Thus, the government's *virtual* account pays *real* fees. The fees are real because we assume that the same percentage fees are charged on a larger account size. Two natural questions arise. First, how important are fees? Second, would percentage fees really remain the same if the dollar size of accounts varied? We address these questions in the next two sections.

## 3.2 Fee nonneutrality with a risky asset

In order to understand whether our result continues to hold in the presence of a risky asset earning a risk premium, let us examine a hypothetical switch to Traditional starting from a Roth-only world. In Section 2.3 we argued that there are two necessary conditions for Traditional accounts to be welfare-improving. First, we must assume that the government is constrained in its equity holdings. This is not inconceivable because, although there are successful examples of governments holding large amounts of professionally managed risky investments (Ang et al., 2009), democracies are usually politically averse to direct government holdings of productive assets (see, e.g., Che and Qian, 1998), and ex post, liquidations of these assets are often controversial (Birdsall and Nellis, 2003). Second, we must assume that the government wishes to hold more equities than it currently does (i.e., the net effect of the factors summarized in Section 2.3 is positive).

With fees, these two conditions are necessary but not sufficient: for Traditional accounts to be welfare-improving, the benefit from stock holdings must still exceed the deadweight

loss from fees. Suppose that the government has positive demand for stocks: if it were to acquire an additional dollar of stock, it would value it using a discount rate $r_s'$ lower than the equilibrium discount rate $r_s$, for a net benefit equal to approximately $r_s - r_s'$. This benefit only applies to the first dollar; as the government increases its equity holdings, demand for equity increases ($r_s$ drops) and the government's own exposure to equity increases ($r_s'$ increases), resulting in diminishing marginal benefits. Moreover, if the government acquires exposure to equities via a claim on Traditional accounts, the entire balance pays fees at a rate $f$, but only a fraction $\alpha$ is invested in stocks. Thus, assuming that the entire additional fees on the government's implicit account represent a waste of resources, $\alpha\,(r_s - r_s') > f$ is required.[13] This is a difficult bar to clear: for instance, with fees equal to 0.72% (our asset-weighted estimate), $\alpha = 2/3$ (a value close to the actual asset allocation of U.S. retirement accounts) and a required return on stocks of 8%, the government's required return on the marginal dollar of stocks should be lower than 6.9% in order for Traditional accounts to be welfare-improving.

# 4 Calibration: excess fees under Traditional

Under a Traditional scheme, the government owns an implicit account of size $S \cdot \tau_R$, where $S$ is the aggregate amount of tax-deferred retirement savings, and $\tau_R$ is the effective tax rate on retirement payouts. This implicit account pays annual percentage fees at a rate $f$, and we assume that the government recovers a fraction $\tau_C$ of these fees via corporate taxation of the asset managers. Thus, a simple estimate of the annual ongoing flow of excess investment fees paid under a Traditional scheme, compared to a Roth scheme, can be calculated as:

$$\text{Excess investment fees} = S \cdot \tau_R \cdot f \cdot (1 - \tau_C)\,. \tag{5}$$

In the rest of this section, we calibrate the inputs to Equation (5). More detail on our estimates is provided in Section 2 of the Internet Appendix.

## 4.1 Estimating fees

In order to estimate the magnitude of fees $f$, we aim to obtain an asset-weighted estimate of total investment costs in DC plans and IRAs. Asset-weighted estimates are the relevant estimates for the purpose of assessing total fees paid by the government on its implicit

[13] If a part of the additional fees is a pure transfer to the asset managers, the consequences would be less negative, although paying for the transfer would still require higher taxes with the resulting distortions. A full welfare analysis is left for future research.

account. They are also typically substantially lower than equal-weighted estimates, because low-fee funds attract more customers, and therefore have larger assets under management (Hubbard et al., 2010).

An individual saving for retirement faces at least four types of costs: account fees, advisory fees, asset management fees, and trading costs. Account fees cover the cost of account maintenance. Advisory fees and "wrap" fees cover financial advice that comes with the account. Asset management fees are charged based on what financial products the account money is invested in. These fees cover the operating costs and profits of mutual funds sponsors and other providers. Finally, trading costs are incurred while buying and selling securities, either by the individual, or by a fund owned by the individual. In what follows, we include non-optional account fees, asset management fees, and trading costs, but we exclude fees for voluntary additional services such as robo-advisors or premium human advisors, a conservative assumption.

Two recent industry publications have attempted to provide an asset-weighted estimate of total fees for 401(k) accounts, a large fraction of overall DC plans. Deloitte (Rosshirt et al., 2014) estimates the "all-in fee" for 401(k) accounts at 58 bps of assets under management. BrightScope (2014) estimates "total plan costs" at 37 bps. Both estimates are done in partnership with the industry trade association, the Investment Company Institute. The Deloitte estimate is survey-based, providing a less precise but more representative estimate. The survey excludes plans with less than $1 million in assets and oversamples large plans, claiming representation of roughly 97% of the universe of plans filing Form 5500 with the Department of Labor. The BrightScope estimate is based on filings by audited plans, which generally means plans with 100 or more participants. As a consequence, the BrightScope study excludes about $1 trillion or 27% of total assets held in the smallest, and likely most expensive, plans. We construct an estimate of 50 bps for total account and asset-management costs by simply doing a rough average of these two estimates.

For IRAs, we estimate asset management fees alone to be at least 38 bps. About one-third of IRA assets is invested in individual securities without explicit fees.[14] However, most of the remaining assets is held in mutual funds whose fees (56 bps) are higher compared to collective investment products held in DC plans (37 bps).[15] We expect IRAs to be more

[14]For mutual funds held in IRAs, the ICI reports asset-weighted average fees of 65, 66 and 49 bps respectively for balanced, equity and bond funds. Having no data specifically on money market funds held in IRAs, we use the corresponding figure for DC plans (25 bps). Using ICI data on IRA holdings of mutual funds and EBRI data on overall asset allocation in IRAs, we estimate that 58.5% of IRA assets are held in mutual funds with asset-weighted average fees of 56 bps, 33.4% is held in individual securities (no fees) and the remaining 8.1% in other products like real estate funds, commodity funds, etc. (65 bps). The assumption of no fees for individual securities is conservative, because some of these securities may be structured products with implicit fees.

[15]In spite of this, there may still be scope for further reduction, as plan managers appear to choose

expensive also with respect to account fees and advisory fees. However, since to the best of our knowledge no comprehensive estimates of these fees are available, we conservatively assume total fees of 50 bps, the same as for DC plans.

These "all-in" estimates do not include trading costs, which nonetheless affect net returns. Because of the difficulty of finding asset-weighted estimates of trading costs—or any estimates at all, for bond funds—our estimate is based on the following approximation

$$\text{Annual trading costs} = \text{Trading costs per unit of volume} \times 2 \times \text{Annual turnover},$$

where "turnover" is defined as the lesser of a fund's gross purchases and sales of securities divided by the fund's average net assets, and therefore $2 \times$ Annual turnover is a lower bound to total volume of trading. We collect information from various sources on (i) trading costs of stocks and bonds and (ii) turnover of stock and bond funds, and we arrive at an asset-weighted estimate of trading costs of 22 bps.

Finally, as discussed in the introduction, we assume the government obtains no benefit from paying fees. Thus, based on asset management and account fees of 50 bps, implicit trading costs of 22 bps, and zero benefit, a conservative, asset-weighted estimate of "all-in" average fees is 72 bps, or $f = 0.72\%$.

## 4.2 Calibration

The aggregate amount of tax-deferred retirement savings, $S$, is estimated using data from the Investment Company Institute's Retirement Market Statistics (2017Q4). It is calculated as the sum of assets in individual retirement accounts and employer plans ($16.9 trillion), minus $1.1 trillion of assets in Roth plans and $0.6 trillion of assets in the federal government's Thrift Savings Plan (TSP), whose fees are negligible. This results in an estimated amount $S = \$15.2$ trillion.

The effective tax rate on retirement payouts, $\tau_R$, is estimated in a few different ways. An average marginal tax rate range of 20%–30% is deduced by reverse-engineering present-value tax expenditure estimates published by the federal government (Office of Management and Budget, 2014) or its employees (Lurie and Ramnath, 2011). Using data on retirement wealth reported in the Survey of Consumer Finances (SCF), we independently estimate that the average dollar paid out of a tax-deferred retirement account is currently taxed at a rate of approximately 26%.[16] We choose 20% as a conservative estimate. The size of the implicit

suboptimal menus of funds (Ayres and Curtis, 2015; Pool et al., 2016).

[16]For each SCF observation we calculate $W^T$, taxable wealth, and $W^{EET}$, tax-deferred retirement wealth. We assume baseline retirement income to be equal to taxable wealth times a constant return $r = 3\%$ ($Y_{Baseline} = W^T r$). In addition to this baseline income, we assume that the individual uses $W^{EET}$ to

government account is therefore $S \cdot \tau_R$ =\$3 trillion.

Finally, $\tau_C$, the corporate tax rate, is simply the top statutory corporate tax rate of 21%. Using all these inputs in Eq. (5), we obtain our estimate:

$$\begin{aligned} &\text{Excess investment fees} = S \cdot \tau_R \cdot f \cdot (1 - \tau_C) = \\ &= \$15.2 \times 20\% \times 0.72\% \times (1 - 21\%) = \$17.3 \text{ billion.} \end{aligned} \tag{6}$$

Our estimate of assets under management is also conservative, as it ignores another \$7.4 trillion of tax-deferred assets in state and local government and corporate defined-benefit pension plans. Although these assets do not belong to any individual in particular, they are subject to the exact same tax deferral benefit: the contribution is made with pretax money, and benefits are taxed not when the employee becomes entitled to them, but when they are actually paid out. Therefore, even defined-benefit plan assets can be decomposed into an employees' account and a government account earmarked to pay future taxes. While defined-benefit plans are likely to incur lower asset management costs than defined contribution plans or IRAs, they still incur a positive cost of managing the assets held in the government's virtual account. Accounting for these assets would increase our estimate of the size of the government's virtual account by another \$1.5 trillion. Assuming lower costs for DB plans (50 bps instead of 72 bps), the estimate of total government costs increases to \$23.2 billion.

In Table 4, we carry out the same back-of-the envelope calculation for the seven countries with the largest dollar amounts of tax-deferred assets. For each country, we obtain information on all existing types of tax-advantaged retirement plans and their tax treatment from OECD (2015a; 2015b). For Traditional plans and other plans with a tax-deferral feature, we obtain an estimate of the total assets in each type of plan from various sources. We then estimate the size of the implicit government account by multiplying total tax-deferred assets by the average tax rate on retirement payouts ($\tau_R$). We obtain information on average retirement income from each country's statistical office, and information on basic deductions and tax brackets from each country's tax authority. With this information, we estimate a lower bound to $\tau_R$ as the average tax rate faced by a person earning the average retirement income with no other income. Fees are estimated as the asset-weighted average of money market, equity and fixed-income mutual fund fees based on overall (not retirement-only) asset allocation in each country. Information on fees is collected from Morningstar (Alpert et al., 2013) and other sources. As before, $\tau_C$, the corporate tax rate, is simply the top statu-

purchase a constant annuity lasting $T = 20$ years, discounted using the same rate $r = 3\%$ ($Y_{Combined} = W^T r + W^{EET}/\{[1 - (1+r)^{-T}]/r\}$). We then calculate total dollar tax on the baseline income ($T_{Baseline}$) and on the combined total income ($T_{Combined}$) applying the U.S. tax brackets that were in force at the time of the survey, and calculate the average tax rate as $(T_{Combined} - T_{Baseline})/(Y_{Combined} - Y_{Baseline})$. Using both sampling weights and value weights, we arrive at an average tax rate of 25.8%.

tory corporate tax rate as reported by each country's tax authority.[17] We then aggregate the different types of plans up to the country level and convert to U.S. dollars using current exchange rates.

For consistency with our U.S. estimates, we exclude defined benefit (DB) pension plans from the calculation. With or without DB plans, the U.S. has the world's largest retirement assets, and therefore leads the list. However, other countries have substantial amounts of DB retirement assets (United Kingdom, Netherlands and Japan), and omitting DB leads to an important underestimate of the size of the implicit government account. In the case of United Kingdom and Netherlands, this underestimate meaningfully affects the estimated subsidy.

The average tax rate on retirement payouts ($\tau_R$) is another important factor. Although Switzerland, Australia and Japan have significant tax-deferred assets, the estimated subsidy is small simply because these countries expect relatively little future tax revenue from retirement accounts.

Finally, the level of fees is obviously an important determinant of the size of the subsidy. Although our non-U.S. fee estimates are not as precise as the U.S. estimates, greater accuracy is unlikely to change our findings. For instance, within these seven countries, Canada has the second-largest subsidy in dollar terms ($5.2 billion) and the largest as a fraction of GDP (0.34%). This is in part driven by the surprisingly large fees charged by Canadian funds (2.06%). We have no evidence that this figure is exaggerated, as two independent sources report numbers in the neighborhood of 2% (Alpert et al., 2013; Investor Economics, 2012). However, Canada would not drop in either dollar or percent rankings even using a fee estimate of 1%.

# 5 A simple general equilibrium model of retirement savings and asset management

In this section, we write down and solve a simple, two-sector general equilibrium model that includes an asset management industry. We use the model to examine whether a backloaded

[17] Unlike other countries, Australia's Superannuation Guarantee is taxed under a TTE scheme: contributions are taxed at favored flat rates (usually 15%) and returns are also taxed at favored rates (15% for interest and dividends, 10% for capital gains), while usually payouts are tax-exempt. Thus, compared to a pure Roth scheme in which all taxes are levied upfront, the Australian system entails some degree of tax deferral. In this case, we define $\tau_{TEE}$ as the tax rate that under a pure Roth scheme would raise the same present value of tax revenue as the actual revenue raised under the current scheme. Then, since the Australian government does levy a 15% upfront tax on contributions, the size of the government's implicit account is simply the remainder, $\tau_{TEE} - 15\%$.

| | Retirement Assets | | Govt. Acct. Size | | | | Subsidy | |
|---|---|---|---|---|---|---|---|---|
| Country | $b | % Deferred | $\tau_R$ | $b | Fees | $\tau_C$ | $b | % GDP |
| United States | 16,330 | 93% | 20% | 3,047 | 0.72% | 21% | 17.3 | 0.09% |
| Canada | 2,082 | 95% | 15% | 295 | 2.06% | 15% | 5.2 | 0.34% |
| United Kingdom | 950 | 32% | 20% | 41 | 1.45% | 20% | 0.7 | 0.02% |
| Netherlands | 108 | 100% | 39% | 41 | 1.41% | 25% | 0.4 | 0.06% |
| Switzerland | 945 | 100% | 4.0% | 38 | 1.29% | 18% | 0.4 | 0.06% |
| Australia | 1,797 | 55% | 3.4% | 34 | 1.10% | 30% | 0.3 | 0.02% |
| Japan | 112 | 100% | 2.6% | 3 | 1.47% | 30% | 0.0 | 0.00% |

Table 4: **Estimated subsidy to the asset management industry in seven countries with the largest Traditional retirement assets.** Fees are the asset-weighted average of money market, equity and fixed-income mutual fund fees based on overall (not retirement-only) asset allocation in that country. For each country, $\tau_R$ (the tax rate on retirement income, and therefore the fraction of Traditional assets that implicitly belong to the government) is calculated as the average tax rate faced by a person earning the average retirement income with no other income. $\tau_C$, the corporate tax rate, is simply the top statutory tax rate. Sources: see text.

system of taxation leads to a larger amount of resources devoted to asset management in equilibrium, and the resulting implications for social welfare.

The model yields predictions on several equilibrium quantities: the level of asset management fees $f$ (i.e., the price); total assets under management $S$ (i.e., the quantity produced); and total employment in the asset management industry $L$ (the resources used). Although it would be desirable to also study the equilibrium profits of asset managers, to simplify our task we assume that they are zero. Below, we describe the model and the resulting equilibrium. A full derivation of the equilibrium prices and quantities is provided in Section 4 of the Internet Appendix.

## 5.1 Demand: individuals

There is a unit continuum of individuals uniformly spread on the $[0, 1)$ circle. Individual $i \in [0, 1)$ begins with no endowment, lives two periods, and leaves no bequest. In the first period, $t = 0$, individuals work, save, and allocate the savings. Income from work is taxed at rate $\tau_L$. In period $t = 1$, the individual retires and depletes all the savings.

Individuals supply one unit of labor inelastically and they can choose to work in the consumption goods sector or in the asset management sector. For a given wage, individuals are indifferent between sectors. The production technology for the consumption goods is linear: for a given amount of labor $\ell$, production is $F(\ell) = \omega \cdot \ell$, so that the marginal product

of labor is $\omega$. In order to attract labor, therefore, firms producing asset management services (i.e., "funds") must pay a competitive wage $\omega$. We denote the equilibrium shares of labor going to the asset management sector and the consumption good sector as $L$ and $1 - L$, respectively.

### 5.1.1 Demand structure

There is abundant evidence that individual demand for financial services is imperfectly sensitive to the price. Although funds with lower fees tend to have higher market shares (Hubbard et al., 2010), many studies point to the continued existence of dominated funds. For instance, Hortacsu and Syverson found that in 2003 there existed 82 S&P 500 index fund share classes with large dispersion in fees (an interquartile range of about 90 bps). We update their analysis, and find that in 2015 there still existed 29 distinct funds (57 share classes) with an interquartile range of 107 bps. Gil-Bazo and Ruiz-Verdú (2009) find that "underperforming funds and funds faced with less performance-sensitive investors charge higher ... fees." Bergstresser et al. (2009) find that broker-sold funds are more costly *and* underperform, implying that the broker channel enables the survival of otherwise dominated funds.

Explanations proposed in the literature rely on search costs (Hortacsu and Syverson, 2004), shrouded prices of complex financial products (Gabaix and Laibson, 2006; Carlin, 2009; Henderson and Pearson, 2011), investors' inability to precisely observe either the quality of fund management (Gil-Bazo and Ruiz-Verdú, 2008), persistent reputation (Hubbard et al., 2010), or on investors' unwillingness to sever relationships with brokers or trusted advisors (Bergstresser et al., 2009; Gennaioli et al., 2015). Finally, Gârleanu and Pedersen (2015) model a financial market in which it is costly to find information about securities or money managers, and investors with high search costs choose to remain uninformed about manager quality.

To reflect this empirical evidence, we specify a model with limited price sensitivity in which funds face a downward-sloping demand function, i.e. if they raise their fees, their demand falls, but it does not fall to zero. Although all proposed explanations of limited price sensitivity point to information frictions or outright inertia, we take a view that is more conservative given what we aim to show. We use a model of spatial competition (Salop, 1979; Tirole, 1988, Ch.7), in which individuals have preferences for convenience, and every additional fund entering the market increases utility for the average individual because it reduces the average distance between an individual and their chosen fund. A low "distance" can be thought of as literally low physical distance from the nearest branch, but also ease of finding (e.g., the fund is recommended by the account administrator), availability (e.g., the fund is part of a small menu of preselected funds, as it is the case for many retirement

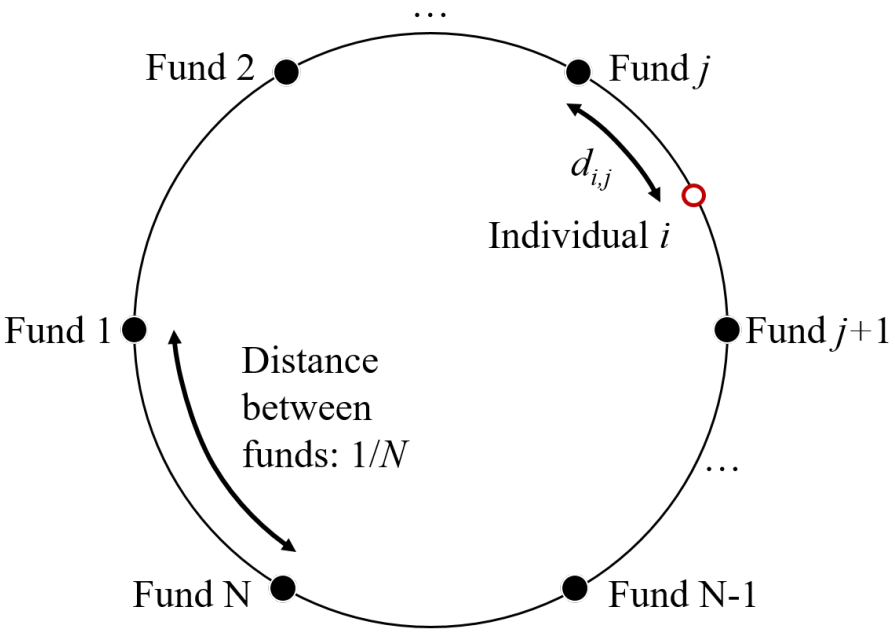


Figure 3: **Spatial competition**. $N$ funds are located at equal distances in a circular space of perimeter 1, as in Salop (1979). Individuals are distributed uniformly along the circle, and prefer funds located at a closer distance.

plans), trust, or even a preference for non-portfolio characteristics of funds, such as the level of customer service.

### 5.1.2 The individual's problem

The individual draws utility from current consumption ($C_0$) and from future consumption ($C_1$), discounted by a factor $\delta$. To finance future consumption, the individual saves and invests an amount $S$. All investment must be carried out via a chosen fund $j$ charging a proportional fee $f_j S$. The individual derives disutility from the distance between the location of the chosen fund $j$, denoted by $\iota_j \in [0, 1)$, and one's own location ($d_{i,j} \equiv |\iota_j - i|$). The distance between two points is calculated as the shortest arc distance, as shown in Figure 3. A fraction $a$ of the individual's savings is invested in government bonds paying a return $r$, and the remainder in an exogenous storage technology yielding a return $\rho$. Thus, the utility of individual $i$ is:

$$U_i = \max_{a,j} C_0 + \delta C_1 - \gamma d_{i,j}. \tag{7}$$

The government taxes labor income at a rate $\tau_L$, retirement income at a rate $\tau_R$, and grants the individual a deduction for savings at a rate $\tau_S$, resulting in the following budget con-

straints:

$$C_0 + S = \omega (1 - \tau_L) + S\tau_S, \tag{8}$$

$$C_1 = S (1 - f_j) [1 + ar + (1 - a) \rho] (1 - \tau_R). \tag{9}$$

At time 0, rather than deriving optimal consumption and savings as the result of an optimization problem, we simply assume that the individual allocates a fixed proportion of pretax earnings to consumption:

$$C_0 = \frac{1}{1 + \delta} \omega (1 - \tau_L). \tag{10}$$

Then, the individual's budget constraint (8) implies the following expression for savings:

$$S = \frac{\delta}{1 + \delta} \omega (1 - \tau_L) + S\tau_S = \frac{\delta}{1 + \delta} \omega \frac{1 - \tau_L}{1 - \tau_S}. \tag{11}$$

This specification of individual preferences implies that, while individual funds do face a downward-sloping demand curve, aggregate demand for asset management services is not affected by price. First, to the extent that individuals save, they must give their assets to a fund; moreover, because savings do not depend on the level of fees, high fees do not discourage individuals from saving.[18] This channel is potentially very important and could be in and of itself the source of social welfare losses if high fees cause individuals to save less. However, with respect to the specific question we are analyzing, any effect of the level of fees on the decision of how much to save would be a second-order feedback effect that would complicate the solution and exposition, without qualitatively altering our conclusions.

## 5.2 Supply: Funds

In our simple model we ignore the existence of multiple layers of financial intermediation (record keepers, asset managers, fund families, subadvisors, securities brokers, etc.). The unit of production of asset management services is the "fund", a generalist firm that produces asset management services. Individuals give their savings directly to funds who charge explicit fees. Funds do not rebate any of the fee revenue to distribution channels, and do not incur any trading costs.

[18] This result does not depend on the fact that savings are predetermined. The same expressions for $C_0$ and $S$, and therefore the same result, could be obtained endogenously if the individual had logarithmic utility. However, logarithmic utility makes the planner problem intractable.

### 5.2.1 Cost structure

At the fund level, the cost function for the production of asset management services could depend on several inputs, such as a fixed fund-level component, its assets under management $Q_j$, as well as the number of individuals that open accounts with the fund, denoted by $M_j$. For instance, a reasonably general form of this function may look like[19]

$$\ln \text{Cost}_j = c\left(Q_j, M_j\right) = \gamma_0\left(\omega\right) + \gamma_1\left(\omega\right) \cdot \ln Q_j + \gamma_2\left(\omega\right) \cdot \ln M_j, \tag{12}$$

where the $\gamma_n\left(\cdot\right)$ coefficients are possibly a function of the cost of labor $\omega$.

To restrict this general specification in a way that is appropriate for our problem, consider first the case in which all asset management costs are a linear function of the amount of assets under management ($\gamma_1 \approx 1$, $\gamma_2 = 0$). While this extreme case is implausible, the fact that fees are charged as a percentage of assets under management (as opposed to absolute dollar prices) suggests that the true cost function may have a variable cost component. However, the analysis of this case does not require solving a general equilibrium model. Upon a switch from Roth to Traditional, the amount of total assets under management would grow, and so would the amount of resources devoted to asset management at the expense of the production of real goods. In this case, the results we obtained in Section 3 would hold exactly because an increase in assets under management would not affect the equilibrium level of fees, $f^*$.

Next, consider the extreme in which asset management costs are only a function of the number of accounts. ($\gamma_1 = 0$, $\gamma_2 \approx 1$). Within our model, this case is not interesting because the aggregate number of accounts is fixed by assumption: the number of individuals is fixed, and each individual is required to put their assets in one and only one fund. Therefore, an increase in assets under management would not lead to an increase in resources used for asset management. Moreover, because of the zero profit assumption, an increase in assets under management would also not lead to an increase in asset management sector profits.

Finally, consider the extreme in which all asset management costs are fixed costs and none are variable ($\gamma_1 = \gamma_2 = 0$). In this case, while *at the fund level* taking on additional assets entails no additional costs, an increase in assets may affect the number of funds that,

[19] Latzko (1999) estimates a "translog" function which includes on the right-hand side not only the logarithm of fund assets, but also the square of the logarithm of fund assets. This specification is even more general and it is often used in economies of scale research. For the purposes of the current discussion, however, our specification is sufficiently general. Latzko also includes other variables such as fund style and fund family assets. Allowing fund family assets to affect total costs recognizes the existence of multiple layers of intermediation (and the possibility of having economies of scale on each layer). Allowing variables such as fund style or portfolio turnover to affect total costs recognizes an additional dimension of non-price product differentiation. Our model excludes these realistic features by design to focus on the most general and obvious cost drivers.

in equilibrium, are able to cover their fixed costs, and therefore the *aggregate* amount of resources devoted to asset management may still be a function of assets under management.

We believe the fixed-cost case is interesting and, as a stylized representation, intuitively plausible. Statements by industry insiders support this intuition: Kahn (2002) quotes Jeffrey S. Molitor, then director for portfolio review at Vanguard, as saying that the "marginal cost of managing increasing dollars is minimal." This statement refers specifically to *active* funds whose management Vanguard outsources to subadvisers; for passive funds, the economies of scale are obvious. Evidence of economies of scale on the cost side is also presented by several academic studies (Baumol et al., 1990; Latzko, 1999; Coates and Hubbard, 2007; Dyck and Pomorski, 2011). Gao and Livingston (2008) find that the "paperwork" part of mutual funds expenses (custodian fees, recordkeeping fees, etc.) does not vary meaningfully with fund size.[20]

To reflect this empirical evidence, and to focus on a simple but interesting case, we assume that every fund $j$ needs only a fixed amount of labor $\varphi$ to be able to operate. Total fund costs are therefore $\varphi \cdot \omega$, regardless of assets under management.

### 5.2.2 Competition

Because of product differentiation, the assumption of a large fixed cost component need not lead to a monopoly. Moreover, empirical evidence and casual observation suggest low barriers to entry or expansion in the mutual fund industry (Hubbard et al., 2010; Baumol et al., 1990). In 2014 alone, 654 new mutual funds and 69 new mutual fund sponsors entered the industry, for a net increase of 292 funds and 25 fund sponsors (ICI, 2015). A similar situation is reflected in the non-mutual fund segments of the asset management industry. For instance, in a 2016 survey sent by a leading industry publication to 1,070 known third-party retirement plan administrators, the majority of respondents were established in the past 25 years. To reflect this evidence, we assume that there is no entry cost, and $N$ funds enter the market until equilibrium profits are zero. For simplicity, $N$ is allowed to be noninteger.[21]

[20] This evidence is distinct from the literature on diseconomies of scale in fund performance (Berk and Green 2004; Pástor and Stambaugh 2012). *Performance* considerations do not directly affect the *resources* devoted to asset management. Moreover, the empirical evidence is mixed. Berk and van Binsbergen (2015) find in favor of diseconomies of scale, but Reuter and Zitzewitz (2015) present evidence of insignificant changes in performance using a change in Morningstar rating as a shock to assets under management. Dyck and Pomorski (2011) find that large pension plans are able to obtain superior returns through increased access to alternative investments. Pástor et al. (2015) show strong support of the industry-level decreasing returns to scale hypothesis (Pástor and Stambaugh, 2012): as the size of the active mutual fund industry increases, the ability of any given fund to outperform declines. For simplicity, we abstract from performance-related considerations, a conservative assumption.

[21] Requiring $N$ to be integer can lead to a situation in which with $N$ funds all funds make positive profits, and with $N+1$ funds all funds make negative profits. However, if $N$ is large enough, profits will be negligible.

### 5.2.3 The fund's problem

Following Salop (1979), we assume a symmetric equilibrium in which funds distribute themselves evenly around the circle ($\iota_1 = 0$, $\iota_2 = 1/N$, ... $\iota_N = (N-1)/N$), as shown in Figure 3. Thus, once the entry decision is made, fund $j \in \{1, 2, \ldots N\}$ can differentiate itself only by choosing the fees it charges, $f_j$. The fund chooses $f_j$ to maximize profit $\pi_j$, defined as fee revenue (percentage fees $f_j$ × market share $q_j$ × aggregate assets under management $S$) minus the fixed labor cost $\varphi\omega$. The fund takes into account that these choices will affect its market share $q_j$, but it takes competitors' choices as given. Thus, the fund's problem is:

$$\max_{f_j} \pi_j = f_j q_j S - \varphi\omega, \tag{13}$$

subject to the constraint $\pi_j \geq 0$. Fund profits are taxed at the same rate as other income. We do not keep track of fund profits, however, as they are zero because of free entry.

## 5.3 Government

The government spends an exogenously given amount $G$. This expenditure is inevitable and it does not affect the utility of agents. At time 0, the government taxes income at a rate $\tau_L$, and grants individuals a deduction for savings at a rate $\tau_S$. The government can also borrow an amount $B$ at the market interest rate $r$ to satisfy its time-0 budget constraint:

$$G = \tau_L \omega - S\tau_S + B. \tag{14}$$

At time 1, the government may tax retirement income at a rate $\tau_R$ to satisfy the time-1 budget constraint:

$$B(1+r) = \tau_R S(1-f)\left[1 + ar + (1-a)\rho\right], \tag{15}$$

where $f$ is the equilibrium level of fees.

The government has two policy options, Roth and Traditional incentive schemes. Under Roth, the government grants no deduction ($\tau_S = 0$) and does not tax retirement income ($\tau_R = 0$). Thus, it has no revenue at time 1, and therefore it cannot borrow ($B = 0$). This leaves no choice but to balance the budget at time 0 by setting the tax rate equal to the ratio between government expenditure and output ($\tau_L = G/\omega$). Under Traditional, the government grants a deduction for savings at the same rate as labor income ($\tau_S = \tau_L$). With three policy variables (the labor income tax rate $\tau_L$, the retirement income tax $\tau_R$, or the amount of borrowing $B$) and two budget constraints (at times 0 and 1), the government has

Our assumption is consistent with the preexisting literature (Salop, 1979; Tirole, 1988, Ch. 7).

one degree of freedom. To eliminate this source of indeterminacy, we assume the government takes $\tau_L^{EET} = \tau_L^{TEE} = G/\omega$ as given. In 5.6 below we discuss the case in which the government chooses $\tau_L$ optimally.

## 5.4 Market equilibrium

In this subsection we show our results for the equilibrium quantities of interest: $S$, aggregate assets under management; $N_M$, the number of funds; and $L_M$ $(= \varphi N_M)$, total employment in the asset management industry. The "$M$" subscript indicates that these quantities arise in the market solution; below we compare them with their counterparts chosen by a planner. A detailed derivation is provided in Section 4 of the Internet Appendix.

Aggregate assets under management (i.e., aggregate saving from equation 11) are higher with a Traditional scheme ($\tau_S = \tau_L$) than they are with a Roth scheme ($\tau_S = 0$):

$$S = \frac{\delta}{1+\delta}\omega\frac{1-\tau_L}{1-\tau_S}. \tag{16}$$

The number of funds is also higher under a Traditional scheme ($\tau_R > 0$) than under a Roth scheme ($\tau_R = 0$):

$$N_M = \sqrt{\frac{\gamma}{\varphi\omega\delta\left(1+\rho\right)\left(1-\tau_R\right)}}. \tag{17}$$

Thus, employment in the asset management industry is higher under Traditional than under Roth:

$$L_M^{EET} = \sqrt{\frac{\gamma\varphi}{\omega\delta\left(1+\rho\right)\left(1-\tau_R^{EET}\right)}} \geq L_M^{TEE} = \sqrt{\frac{\gamma\varphi}{\omega\delta\left(1+\rho\right)}}. \tag{18}$$

Finally, the equilibrium level of fees is a decreasing function of the number of funds and of assets under management:

$$f = \frac{1}{N_M} \cdot \frac{\gamma}{\delta S\left(1+\rho\right)\left(1-\tau_R\right)}. \tag{19}$$

Under our assumption that $\tau_L^{EET} = G/\omega$ (and under any other reasonable alternative assumptions), percent fees are lower under Traditional, because of the greater number of funds and the resulting higher competition.

## 5.5 Planner solution

We compare the market equilibrium with the socially optimal solution chosen by a rational planner. As in the market solution, we simply assume that time-0 savings and consumption

are in fixed proportions ($S = \delta C$). The planner takes $G$ as exogenously given, and chooses the number of funds ($N$) directly to maximize the utility of the average individual:

$$U = \max_{N} C_0 + \delta C_1 - \gamma \bar{d}, \tag{20}$$

where $\bar{d}$ indicates the *average* distance between an investor and the closest fund. The planner is subject to the following resource constraints:

$$C_0 + S = \omega - G; \tag{21}$$

$$C_1 = (S - \varphi N)(1 + \rho). \tag{22}$$

Under these assumptions, we recover the standard result that the market generates too many funds (Tirole, 1988, Ch. 7).

$$L^* = \varphi N^* = \frac{1}{2}\sqrt{\frac{\gamma\varphi}{\delta\omega(1+\rho)}} = \frac{1}{2}L_M^{TEE}. \tag{23}$$

Thus, in our simplified setup, the socially optimal level of employment in the asset management industry is half as much as the level prevailing under a market solution with a Roth system, which in turn is lower than the level under a Traditional system:

$$L^* < L_M^{TEE} < L_M^{EET}. \tag{24}$$

## 5.6 Optimal taxation under a Traditional scheme

Under Roth, the government has no choice but to set $\tau_L = G/\omega$. So far, we have derived our results under the assumption that $\tau_L$ under Traditional is the same as under Roth. However, the government has one degree of freedom: for instance, it can choose $\tau_R$ and then set $B$ and $\tau_L$ to satisfy its two budget constraints (14) and (15).

What is the optimal way for the government to exercise its one degree of freedom? From (18), it is evident that if the government sets $\tau_R^{EET} = 0$, the equilibrium employment in asset management (and number of funds) under Traditional is the same as under Roth.[22] The resulting $\tau_L$ is:

$$\tau_L^* = {}^{G}\!/_{\omega}\,(1 + \delta) > {}^{G}\!/_{\omega}. \tag{25}$$

Importantly, (16) implies that aggregate savings (i.e., total assets under management)

[22] As discussed in 4.2 above, this appears to be the policy chosen by countries such as Switzerland, Australia and Japan, who expect relatively little future tax revenue from retirement accounts.

are larger under Traditional than under Roth, regardless of the chosen $\tau_L^{EET}$. If the number of funds is the same, and total assets $S$ are higher, the zero-profit condition implies that $f$ must be lower. In other words, setting $\tau_R = 0$ makes the individuals fully sensitive to fees. This represents another way for the government to eliminate its virtual retirement account, and with it, the source of the inefficiency.

It is crucial to notice that in our stylized model a Traditional policy with $\tau_R = 0$ implies a very high $\tau_L$, leading to a drastic decrease in time-0 consumption compared to a Roth policy. In a richer model in which individuals optimally choose consumption, savings, and labor supply, the high $\tau_L$ has two consequences. On one hand, a large tax differential between work life and retirement ($\tau_L \gg \tau_R = 0$) increases the subsidy for retirement savings. On the other hand, the time-0 marginal tax rate on labor income is much higher than its counterpart under Roth, reducing the incentive to work for those who save less than the optimal amount. We leave the study of this potential tradeoff to future research.

## 5.7 Discussion

The model's main insight is that an increase in assets causes an increase in resources devoted to asset management unless strict conditions are verified. These conditions require that the cost of producing asset management services at the firm level should neither depend on the amount of assets under management, nor have a fixed component. Because neither assumption is likely to hold in reality, intuition suggests that in general equilibrium the subsidy would almost certainly result in a transfer to the asset management industry, and this transfer is likely to result in excess real resources devoted to asset management. Moreover, the substantial evidence of imperfect price sensitivity suggests that resources devoted to the asset management industry would likely be already too high under a Roth-only system, and therefore the excess resources diverted to asset management under a Traditional system would be damaging for social welfare as defined in our model.

While our model abstracts from the specific causes of limited price sensitivity, it conservatively assumes that every additional fund improves the utility of the average individual. It would have been possible, consistent with the prevailing empirical evidence, to write a model with captive demand and shrouded fees. In such a model, back-loaded taxation would still cause an increase in the resources devoted to asset management, and welfare consequences would be undoubtedly more severe.

Our model contributes to the literature on limited price sensitivity in retail financial markets by examining the effect of a government subsidy within a model of spatial competition in which individuals already have limited price sensitivity. Although the subsidy does not

affect investors' sensitivity to *percent* fees, it reduces their sensitivity to *dollar* fees. As a result, in the presence of fixed costs, investors are subsidized in seeking more variety.

More in general, this result is related to a recent literature on the optimal size of the financial services industry. Greenwood and Scharfstein (2013) note that the U.S. financial services industry (encompassing insurance, securities and credit intermediation) as a share of GDP doubled in size in the last 50 years, going from 4% to 8%. Half of this 4 percentage point increase (1.5–2 percentage points) is due to growth of the asset management industry, which has managed to keep its revenue a relatively stable fraction of the stock market. Malkiel (2013) argues that in spite of a more than 100-fold increase in assets under management, the benefits from the vast economies of scale inherent to the asset management industry have accrued to industry insiders, because fees (as a percentage of assets under management) have not fallen proportionately. French (2008) and Fama and French (2010) attempt to quantify the amount of resources spent in the zero-sum game of attempting to beat the market. Philippon and Reshef (2012) find empirically that financial deregulation is associated with greater skill intensity, increased job complexity, and higher wages for finance employees. Bolton et al. (2016) show in theory that it is possible for the financial industry to extract excessively high rents for the provision of financial services, thus attracting too much talent. Our study features another mechanism by which, because of search frictions, the financial industry attracts too much labor, and points out that under reasonable assumptions this mechanism not only exists, but it is magnified by government policy.

# 6 Conclusion

A standard benchmark model yields a neutrality result between front-loaded (Roth) and back-loaded (Traditional) taxation of retirement savings. Individuals obtain the same consumption in every period, and the present value of government tax revenues is the same under the two systems. The timing of taxation is different: back-loaded taxation leads to higher outstanding government debt and a correspondingly greater amount of retirement assets. These additional assets represent an implicit government portfolio, i.e., resources earmarked to pay future taxes when the money is distributed from the account. In this paper, we add one crucial bit of realism to the benchmark model: asset management fees. We show that the indifference result breaks down because the government is paying an estimated $17.3 billion a year in fees on its large implicit portfolio. In a stylized general equilibrium model, we also show that back-loading taxation inefficiently increases the amount of resources spent on asset management, thus reducing welfare.

Our results raise the policy issue of whether governments should encourage or possibly

mandate wider adoption of Roth. Our model, taken literally, would imply that it should. However, both the benchmark model and our model abstract from other potential drivers of the policy choice between front-loaded and back-loaded taxation of retirement savings.

First, most real-world tax systems are progressive. With progressive taxation, lifetime taxes are more aligned with lifetime income under Traditional than under Roth. For example, consider two workers with the same lifetime income: one with high annual earning and a short work life (e.g. a firefighter), and another with lower annual earnings but a longer work life (e.g. a municipal clerk). Under Roth, the firefighter would pay more lifetime taxes than the clerk. Under Traditional, the gap between the lifetime taxes paid by the two workers will shrink and potentially disappear. In addition, if a worker's lifetime income is not known in advance, Traditional may work as "insurance" because the average tax rate on distributions is higher when the account balance is higher.

The effect of progressive taxation has contingent consequences as well. A switch to Roth for new contributions ("Rothification") has been discussed as part of the recent U.S. debate on tax reform, although it was ultimately not enacted. Such a switch would not affect all individuals equally. Individuals with high labor income but no expected income in retirement would be disproportionately affected, as their current marginal tax rate is high and their tax rate in retirement is low.[23]

Second, behavioral biases that cause people to save too little are a frequently-cited motive for the provision of retirement saving incentives. Behavioral arguments exist in favor of either taxation scheme. During an individual's work life, back-loaded taxation could induce individuals to underestimate the future "tax bite" and still save too little (Iwry and John, 2009). However, back-loaded taxation could also provide a more powerful behavioral response because of the "instant gratification" of an immediate tax benefit (Feenberg and Skinner, 1989; Bernheim, 2002), or simply because individuals don't fully understand that Traditional balances are subject to taxation in the future. Beshears et al. (2017) find empirically that Roth induces individuals to save more, and argue that this is because individuals focus on nominal contributions and savings and underweight future taxes.[24] In addition, during

[23] As part of the debate, industry sources argued that a shift to Roth would endanger retirement security because Traditional provides more resources for retirement under progressive taxation. That argument, which focuses on the overall level of taxation, is distinct from ours, which focuses on distribution. If that argument is correct, under a Roth system the government could use the additional tax revenue to provide additional resources for retirees. Our model allows for differential tax rates during work life and retirement, which we consider to be a separate policy choice.

[24] Our results rely on the assumption that individuals are rational savers and therefore under our benchmark model contribute enough extra dollars into a Traditional plan relative to what they would contribute under a Roth plan to ensure that retirement consumption would be the same under the two plans. Beshears et al. (2017) provide evidence that individuals do not adjust their retirement savings in this way, but instead find that contributions under a Roth 401(k) plan are similar to those under a traditional 401(k) plan,

the individual's retirement, under progressive taxation a Traditional system penalizes bulk withdrawals with higher tax rates. As part of the recent British debate, an Economist editorial claims that this feature "is actually quite useful in that it stops people blowing their pension pot in a spending spree at 65" (Buttonwood, 2015). Of course, the other side of the coin is that Traditional penalizes individuals who withdraw funds in bulk for legitimate reasons such as hardship or investment. We are not aware of any systematic study of this tradeoff.

Third, there are political economy considerations that are important to the debate over a shift from Traditional to Roth. U.S. budget rules make it more cumbersome to pass bills that increase the total budget deficit over a five- or ten-year window. A transition from Traditional to Roth generates more cash flow upfront and less when the relevant workers retire, thus bringing more revenue into the budget window, resulting in a temporary deficit reduction and easing the passage of other legislation that involves lower taxes or higher spending.[25] This additional short-run fiscal flexibility may or may not be considered desirable, but it certainly makes Roth attractive to many real-world policymakers. Indeed, one of the purported motivations for originally proposing Roth accounts in the U.S. was to help "fund" cuts in the capital gains tax (Pine, 1989).

Our analysis raises some additional policy issues. The $17.3 billion cost to the government exists because the government owns an implicit account that incurs substantial investment fees. One way to reduce this cost is to shrink or eliminate this account. This can be accomplished either by switching to Roth, as discussed throughout the paper, or by simply not taxing retirement savings, as briefly discussed in Section 5.6. An alternative approach would be to leave the size of the account unchanged, but to reduce investment fees to a more acceptable level. The U.S. Department of Labor fiduciary rule implemented in June 2017 and recently struck down by the courts could also have helped reduce fees on the government account. One of the stated motivations for the rule was protecting retail investors from aggressive marketing of high-fee products—especially senior investors that prepare to roll over their employer plan savings into an individual retirement account. If a fiduciary rule had the effect of reducing fees incurred by individual investors, our results suggest that it

implying a higher retirement consumption under a Roth plan. If these findings generalized to the policy experiments we consider, they may complicate our welfare analysis, but the gist of our argument would still be valid. Roth is more cost effective than Traditional. If the total amount of assets is constant under Traditional and Roth, then Roth delivers a larger savings subsidy for the same cost to the government. At the other extreme, if, as in our paper, the total amount of retirement consumption is constant, then Roth delivers the same savings subsidy for a lower cost to the government.

[25] The effectiveness of this approach is complicated by the "Byrd rule," which requires a supermajority to approve a deficit increase beyond the period covered by the budget resolution (Committee for a Responsible Federal Budget, 2016).

would also protect the government's future revenue from being eroded by high fees, providing a possible additional rationale for implementing the rule itself.

# References


Abel, A. B., 2001. The effects of investing Social Security funds in the stock market when fixed costs prevent some households from holding stocks. American Economic Review 91 (1), 128–148.

Aiyagari, S. R., McGrattan, E. R., 1998. The optimum quantity of debt. Journal of Monetary Economics 42, 447–469.

Alpert, B. N., Rekenthaler, J., Suh, S., 2013. Global fund investor experience 2013 report. Tech. rep., Morningstar Fund Research.

Ang, A., Goetzmann, W. N., Schaefer, S. M., 2009. Evaluation of active management of the Norwegian Government Pension Fund – Global, dcember 14, 2009.

Antolín, P., de Serres, A., de la Maisonneuve, C., 2004. Long-term budgetary implications of tax- favoured retirement plans, oECD Economics Department Working Papers, No. 393, OECD Publishing.

Auerbach, A., 2004. How much equity does the government hold? American Economic Review 94 (2), 155–160.

Ayres, I., Curtis, Q., 2015. Beyond diversification: The pervasive problem of excessive fees and 'dominated funds' in 401(k) plans. Yale Law Journal 124 (5), 1346–1835.

Barro, R. J., 1974. Are government bonds net wealth? Journal of Political Economy 82 (6), 1095–1117.

Baumol, W. J., Goldfeld, S. M., Gordon, L. A., Koehn, M. F., 1990. The Economics of Mutual Fund Markets: Competition Versus Regulation. Rochester Studies in Managerial Economics and Policy. Kluwer Academic Publishers.

Bergstresser, D., Chalmers, J. M. R., Tufano, P., 2009. Assessing the costs and benefits of brokers in the mutual fund industry. Review of Financial Studies 22 (10), 4129–4156.

Berk, J., van Binsbergen, J., 2015. Measuring skill in the mutual fund industry. Journal of Financial Economics.

Berk, J. B., Green, R. C., 2004. Mutual fund flows and performance in rational markets. Journal of Political Economy 112 (6), 1269–1295.

Bernheim, D., 2002. Handbook of Public Economics. Elsevier Science B.V., Ch. 18. Taxation and Savings, pp. 1173–1249.

Beshears, J., Choi, J. J., Laibson, D., Madrian, B. C., 2017. Does front-loading taxation increase savings? evidence from Roth 401(k) introductions. Journal of Public Economics 151, 84–95.

Birdsall, N., Nellis, J., 2003. Winners and losers: Assessing the distributional impact of privatization. World Development 31 (10), 1617–1633.

Bohn, H., 1990. Tax smoothing with financial instruments. The American Economic Review 80 (5), 1217–1230.

Bolton, P., Santos, T., Scheinkman, J. A., 2016. Cream-skimming in financial markets. Journal of Finance 71 (2), 709–736.

Brady, P., 2012. The tax benefits and revenue costs of tax deferral, investment Company Institute, Washington, DC.

BrightScope, Investment Company Institute, 2014. The BrightScope/ICI defined contribution plan profile: A close look at 401(k) plans. Tech. rep.

Burman, L., Gale, W. G., Weiner, D., 2001. The taxation of retirement saving: Choosing between front-loaded and back-loaded options. National Tax Journal 54 (3), 689–702.

Buttonwood, 5 Aug. 2015. EET your TEE, George. The Economist.

Carlin, B. I., 2009. Strategic price complexity in retail financial markets. Journal of Financial Economics 91, 278–287.

Che, J., Qian, Y., 1998. Insecure property rights and government ownership of firms. The Quarterly Journal of Economics 113 (2), 467–496.

Coates, J. C., Hubbard, R. G., 2007. Competition in the mutual fund industry: evidence and implications for policy, Harvard John M. Olin Discussion Paper No. 592, available at http://ssrn.com/abstract=1005426.

Committee for a Responsible Federal Budget, Dec. 2016. Reconciliation 101, retrieved on 17/12/2017 at http://www.crfb.org/papers/reconciliation-101.

Committee on Finance of the U.S. Senate, 1997. Expanding IRA's. U.S. Government Printing Office.

Diamond, P., Geanakoplos, J., 2003. Social security investment in equities. American Economic Review 93 (4), 1047–1074.

Dyck, A., Pomorski, L., 2011. Is bigger better? size and performance in pension plan management, Rotman School of Management Working Paper No. 1690724, available at http://ssrn.com/abstract=1690724.

Fama, E. F., French, K. R., 2010. Luck versus skill in the cross-section of mutual fund returns. The Journal of Finance 65 (5), 1915–1947.

Feenberg, D. R., Skinner, J., 1989. Sources of IRA saving. Tax Policy and the Economy 3, 25–46.

French, K. R., 2008. Presidential address: The cost of investing. The Journal of Finance 53 (4), 1537–1573.

Gabaix, X., Laibson, D., 2006. Shrouded attributes, consumer myopia, and information suppression in competitive markets. Quarterly Journal of Economics 121 (2), 505–540.

Gao, X., Livingston, M., 2008. The components of mutual fund fees. Financial Markets, Institutions and Instruments 17 (3), 197–223.

Gârleanu, N. B., Pedersen, L. H., 2015. Efficiently inefficient markets for assets and asset management, NBER Working Paper 21563, available at http://www.nber.org/papers/w21563.

Geanakoplos, J., Mitchell, O., Zeldes, S. P., 1999. Social Security Money's Worth. Prospects for Social Security Reform. Pension Research Council, University of Pennsylvania Press, Ch. 5, pp. 79–151.

Gennaioli, N., Shleifer, A., Vishny, R., 2015. Money doctors. Journal of Finance 70 (1), 91–114.

Gil-Bazo, J., Ruiz-Verdú, P., 2008. When cheaper is better: Fee determination in the market for equity mutual funds. Journal of Economic Behavior and Organization 67, 871–885.

Gil-Bazo, J., Ruiz-Verdú, P., 2009. The relation between price and performance in the mutual fund industry. The Journal of Finance 64 (5), 2153–2183.

Greenwood, R., Scharfstein, D., 2013. The growth of finance. Journal of Economic Perspectives 27 (2), 3–28.

Heathcote, J., 2005. Fiscal policy with heterogeneous agents and incomplete markets. Review of Economic Studies 72, 161–188.

Henderson, B. J., Pearson, N. D., 2011. The dark side of financial innovation: A case study of the pricing of a retail financial product. Journal of Financial Economics 100, 227–247.

Holzmann, R., Hinz, R., 2005. Old Age Income Support in the 21st Century. The World Bank.

Hortacsu, A., Syverson, C., May 2004. Product differentiation, search costs, and competition in the mutual fund industry: A case study of S&P 500 index funds. Quarterly Journal of Economics, 403–456.

Hubbard, R. G., Koehn, M. F., Ornstein, S. I., Audenrode, M. V., Royer, J., 2010. The Mutual Fund Industry: Competition and Investor Welfare. Columbia Business School Publishing.

ICI, 2015. 2015 Investment Company Fact Book. Investment Company Institute.

Investor Economics, 2012. Mutual fund MERs and cost to customer in Canada: Measurement, trends and changing perspectives, retrieved on 2017/12/17 at https://www.ific.ca/wp-content/uploads/2013/08/Canadian-Study-Mutual-Fund-MERs-and-Cost-to-Customer-in-Canada-September-2012.pdf/1655/.

Iwry, J. M., John, D. C., 2009. Pursuing universal retirement security through automatic IRAs, brookings Institution, Retirement Security Project, Research Report 2009-3.

Kahn, V. M., 14 July 2002. Investing; mutual fund expertise, for rent. The New York Times.

Latzko, D. A., 1999. Economies of scale in mutual fund administration. Journal of Financial Research 22 (3), 331–339.

Lucas, D. J., Zeldes, S. P., 2009. How should public pension plans invest? American Economic Review 99 (2), 527–532.

Lurie, I. Z., Ramnath, S. P., December 2011. Long-run changes in tax expenditures on 401(k)-type retirement plans. National Tax Journal 64 (4), 1025–1038.

Malkiel, B. G., 2013. Asset management fees and the growth of finance. Journal of Economic Perspectives 27 (2), 97–108.

OECD, 2015a. Stocktaking of the tax treatment of funded private pension plans in OECD and EU countries.

OECD, 2015b. The tax treatment of funded private pension plans - OECD and EU country profiles.

Office of Management and Budget, February 2014. Budget of the U.S. Government. Analytical perspectives. Fiscal Year 2015. Tech. rep., United States Government.

Osborne, G., July 2015. Strengthening the incentive to save: a consultation on pensions tax relief, Her Majesty's Treasury Cm 9102.

Pástor, L., Stambaugh, R. F., 2012. On the size of the active management industry. Journal of Political Economy.

Pástor, L., Stambaugh, R. F., Taylor, L. A., 2015. Scale and skill in active management. Journal of Financial Economics 116, 23–45.

Philippon, T., Reshef, A., 2012. Wages and human capital in the U.S. financial industry: 1909–2006. Quarterly Journal of Economics 127 (4), 1551–1609.

Pine, A., October 20 1989. GOP senators offer capital gains cut, new type of IRA. Los Angeles Times. Retrieved online on 10/19/2016.

Pool, V. K., Sialm, C., Stefanescu, I., Aug. 2016. It pays to set the menu: Mutual fund investment options in 401(k) plans. Journal of Finance 71 (4), 1779–1812.

Reuter, J., Zitzewitz, E., 2015. How much does size erode mutual fund performance? a regression discontinuity approach, working paper, available at http://ssrn.com/abstract=1661447.

Romaniuk, K., 2013. Pension fund taxation and risk-taking: should we switch from the EET to the TEE regime? Annals of Finance 9 (4), 573–588.

Rosshirt, D. E., Parker, S. A., Pitts, D. A., 2014. Inside the structure of defined contribution/401(k) plan fees, 2013: A study assessing the mechanics of the 'all-in' fee. Tech. rep., Deloitte Consulting LLP.

Salop, S. C., 1979. Monopolistic competition with outside goods. Bell Journal of Economics 10 (1), 141–156.

Tergesen, A., Rubin, R., 2017. Talk of retirement savings cap rattles financial industry. Wall Street Journal10/21/2017.

Thaler, R. H., 1994. Psychology and savings policies. The American Economic Review, Papers and Proceedings of the Hundred and Sixth Annual Meeting of the American Economic Association 84 (2), 186–192.

Tirole, J., 1988. The Theory of Industrial Organization. MIT Press.

Whitehouse, E., 2007. Pensions Panorama—Retirement-Income Systems in 53 Countries. The World Bank.