Tax-Efficient Asset Management: Evidence from Equity Mutual Funds*

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February 28, 2018

Abstract

Investment taxes have a substantial impact on the performance of taxable mutual fund investors. Our paper investigates the before- and after-tax performance of mutual funds from both a theoretical and empirical perspective. The theoretical model introduces heterogeneous tax clienteles in a model where the performance of mutual funds is subject to decreasing returns to scale. We find that the equilibrium performance before taxes is not necessarily equalized across mutual funds and depends on the size of the tax clienteles. Our empirical results show that the before- and after-tax performance of U.S. equity mutual funds is related to their tax burdens. We find that tax-efficient funds do not just exhibit superior after-tax performance, they also exhibit superior before-tax performance due to lower trading costs, favorable factor exposures, and superior stock selectivity.

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1 Introduction

Investment taxes have a substantial impact on the long-term performance of taxable mutual fund investors. Our paper investigates the before- and after-tax performance of U.S. equity mutual funds with different tax management strategies and thereby sheds light on the costs and benefits of tax-efficient asset management.

Mutual funds in the U.S. are required to distribute their dividend income and their realized capital gains to their shareholders at an annual frequency. The U.S. taxes different income sources to mutual fund investors at different rates. Short-term capital gains distributions, generated by the liquidation of fund positions held for less than one year, are typically taxed at substantially higher rates than long-term capital gains distributions. On the other hand, unrealized capital gains remain untaxed until the securities are liquidated or can completely be avoided due to the "step-up of the cost basis at death" if the investment passes through an estate.

Mutual funds can reduce the tax burdens of their shareholders by deferring the realization of capital gains, by accelerating the realization of capital losses, and by avoiding securities with high dividend yields, as discussed by Bergstresser and Poterba (2002). Such tax management strategies, however, constrain the investment choices of the mutual funds and might reduce their before-tax performance. The resulting deterioration in the pre-tax performance might more than offset the tax savings of tax-efficient funds.

On the other hand, tax-efficient investment strategies might be associated with superior before-tax performance. For example, tax-efficient investment strategies exhibit relatively low turnover generating lower trading costs. In addition, liquidating stock positions with embedded capital losses and holding on to positions with capital gains can generate superior before-tax returns due to the momentum effect of Jegadeesh and Titman (1993). Finally, fund managers who are sufficiently savvy to avoid taxes might exhibit superior investment abilities

in other dimensions. Our paper aims to investigate the implications of tax management on subsequent fund performance both before and after taxes.

To better understand the equilibrium relation between before- and after-tax returns across mutual funds, we present a stylized model with different investment strategies and heterogeneous tax clienteles. Investors have access to investment opportunities that face differential taxation and that are subject to decreasing returns to scale, as proposed by Berk and Green (2004). The model enables us to answer whether before- or after-tax returns are equalized in equilibrium.

The model shows that the returns of the different investment strategies depend on the distribution of tax clienteles. If the proportion of tax-exempt investors is relatively high, then tax-exempt investors are the marginal investors and before-tax returns are equalized across the strategies. On the other hand, after-tax returns are equalized if taxable investors are dominant. At intermediate distribution levels, neither before- nor after-tax returns are equilibrated in contrast to the predictions of the model by Berk and Green (2004).

To empirically test the predictions of the theoretical model, we use data on a comprehensive sample of U.S. equity mutual funds between 1990 and 2016. We find that taxes have a significant impact on the performance of taxable fund investors. On average, taxable fund shareholders are estimated to pay investment taxes amounting to 1.08% of their investment value per year. The tax burden is similar in size to fund expenses, which have received substantial attention (French (2008)). Furthermore, the variation in the tax burden differs substantially across funds.

We find that the tax burden is persistent and can be predicted by the investment style, by the flows of fund investors, and by the capital gains overhang. Tax burdens tend to be higher for funds that focus on small-capitalization and value portfolios, as these investment styles trigger relatively high realizations of capital gains. Tax burdens increase as funds experience

redemptions by fund investors or volatile investor flows. Finally, tax burdens of funds are positively related to the turnover, the age, and the capital gains overhang.

Fund investors can increase their future *after-tax* performance by avoiding funds with high prior tax burdens. For example, a one-standard-deviation increase in the tax burden over the prior three years (which equals 1.18 percentage points) is associated with a decrease in the after-tax excess return of a fund over the next year of 0.87 percentage points. The after-tax performance results are not affected materially if we control for other fund characteristics. Around half of the after-tax predictability can be explained by the persistence in the tax burden and the other half by differences in the before-tax performance of funds with different prior tax burdens.

Surprisingly, we do not find that the *before-tax* performance of funds is negatively associated with the tax efficiency. A one-standard-deviation increase in the tax burden over the prior three years is associated with a decrease in the before-tax excess return of a fund over the next year of between 0.39 and 0.55 percentage points. The superior pre-tax performance of tax-efficient funds can be explained by lower trading costs, by favorable style exposures, and by superior selectivity. Thus, our results indicate that tax-efficient asset management strategies, as practiced by U.S. equity mutual funds between 1990 and 2016, exhibit favorable returns after and also before taxes.

Mutual funds might be tax-efficient not because these funds deliberately minimize the tax burden, but because these funds' strategies unintentionally generate relatively low tax burdens. For example, a low-turnover fund that invests in large capitalization stocks will tend to be relatively tax efficient since this fund infrequently liquidates stock positions and since liquidations are concentrated among poorly-performing stocks which are excluded from the benchmark portfolio of large capitalization stocks. To address this question we also study the performance of mutual funds that explicitly classify themselves as tax-managed funds. We

find that self-designated tax-efficient funds significantly outperform after taxes similar funds without an explicit tax objective. Furthermore, the self-designated tax-efficient funds do not underperform other funds before taxes, indicating that the constraints imposed by tax-efficient asset management do not have evident performance consequences.

Our paper is related to a small literature that investigates the tax implications of mutual fund management. Jeffrey and Arnott (1993) and Dickson and Shoven (1995) show that investment taxes play an important role for mutual fund investors. Barclay, Pearson, and Weisbach (1998) discuss the conflict that mutual fund managers face in determining their capital gains distribution policy, arguing that managers have an incentive to realize some capital gains and thereby reduce the capital gains overhang in order to attract prospective investors. Bergstresser and Poterba (2002) explore the relation between the after-tax returns that taxable investors earn on equity mutual funds and the subsequent cash inflows to these funds. They also analyze the determinants of mutual funds' tax burdens. Gibson, Safieddine, and Titman (2000) find evidence of mutual fund managers engaging in tax loss selling at the end of the tax year. Christoffersen, Geczy, Musto, and Reed (2006) find that managers decisions with respect to cross-border dividend payments differ according to the proportion of DC assets in their funds. Sialm and Starks (2012) investigate whether the characteristics, investment strategies, and performance differ for mutual funds held by different clienteles. They find that funds held primarily by taxable investors choose investment strategies that result in lower tax burdens than funds held primarily in tax-qualified accounts. Our paper adds to this literature by analyzing the performance of tax-efficient equity mutual funds.

The remainder of this paper is structured as follows. Section 3 summarizes the data sources, defines the tax burden, and reports summary statistics. Section 4 estimates the key determinants of the tax burdens of mutual funds. Section 5 investigates whether the tax efficiency of a mutual funds is related to the before- and after-tax performance of U.S. equity

mutual funds. Section 6 studies the subsample of mutual funds, which designate themselves as tax managed.

2 Model

This section presents an extension of the Berk and Green (2004) model with heterogenous tax clienteles. Investors have access to investment opportunities that face differential taxation and that are subject to decreasing returns to scale. The model enables us to answer whether before- or after-tax returns are equalized in equilibrium.

2.1 Model Assumptions

Investors in the stylized model have access to two investment strategies $s \in \{L, H\}$ that are subject to decreasing returns to scale. The proportion invested in each of the two strategies equals w_H and w_L, respectively. The aggregate wealth that is investable in the two strategies is normalized to 1. The expected return of each strategy $r_s > 0$ decreases monotonically with the amount invested in the two strategies (i.e., $f' < 0$):

$$r_H = f^H(w_H), \tag{1}$$

$$r_L = f^L(w_L). \tag{2}$$

The model includes two types of investors with differential tax treatment $i \in \{X, T\}$. Returns of tax-exempt investors, abbreviated as X, are not taxed, whereas returns of taxable investors, abbreviated as T, are taxed at a flat rate τ_s, which depends on the investment strategy. Tax-exempt assets are held by tax-exempt institutions or charities or in tax-qualified retirement accounts (e.g., 401(k), 403(b), IRAs). Taxable assets are held in regular taxable financial accounts.

Investment taxes are symmetric between capital gains and capital losses and do not explicitly allow for tax deferral. Strategy H exhibits a higher tax burden than strategy L, either

because it invests in assets that are more highly taxed or because it has a higher propensity to realize capital gains. Thus, $\tau_H > \tau_L > 0$.

The proportion of wealth held by tax-exempt investors amounts to $\lambda \in [0, 1]$. The remaining assets are held by taxable investors.

Both types of investors are risk-neutral and cannot hold short positions or incur debt ($w_s^i \geq 0$). Short-selling constraints are necessary with risk-neutral agents, since otherwise agents will take infinitely large short and long positions in the two investment strategies to take advantage of the differential tax treatment. Investors avoid such tax arbitrage strategies at moderate levels of risk aversion.[1]

2.2 Equilibrium with Only Tax-Exempt Investors ($\lambda = 1$)

Panel A of Figure 1 depicts the before-tax returns of the two investment strategies in an environment with only tax-exempt investors.[2] The horizontal axis shows the allocation of the assets across the two investment options. The amount invested in the high-tax asset w_H is measured from the left to the right, whereas the amount invested in the low-tax asset $w_L = 1 - w_H$ is measured from the right to the left.

The declining curve labeled r_H depicts how the return of the high-tax strategy decreases as the assets invested in this strategy increase. The highest return of $r_H = f^H(0)$ (i.e., intercept on the left vertical axis) occurs if no funds are invested in this strategy and the lowest return $r_H = f^H(1)$ (i.e., intercept on the right vertical axis) occurs if all funds are investment in this strategy. The increasing curve labeled r_L depicts how the return of the low-tax strategy increases as the assets invested in this strategy decrease. The intercept on the left vertical

[1] An extension of the model introduces risk aversion. The results are qualitatively unaffected at low levels of risk aversion. At higher levels of risk-averse investors have a desire to diversify across the two investment options reducing the tax clientele effects. Furthermore, the attractiveness of the high-tax asset increases for highly risk-averse taxable investors since it exhibits a lower standard deviation.

[2] The figure uses the following return function: $f^s(w_s) = 2 * \underline{\mu}_s - \overline{\mu}_s + 2(\overline{\mu}_s - \underline{\mu}_s)/(1 + w_s)$, where $\underline{\mu}_s = f^s(1)$ and $\overline{\mu}_s = f^s(0)$ for $s \in \{H, L\}$. In the figure $\overline{\mu}_H > \overline{\mu}_L$ and $\underline{\mu}_H = \underline{\mu}_L$.

axis shows the return of the low-tax strategy if all funds are invested in this strategy (i.e., $f^L(1)$) and the intercept on the right vertical axis shows the return of the low-tax strategy if no funds are invested in this strategy (i.e., $f^L(0) > f^L(1)$).

An optimal portfolio allocation for tax-exempt investors occurs where the returns of the two investment strategies are equalized, which is depicted as the intersection of the two curves in Panel A.[3] Thus, at the allocation of $w_H = \overline{\lambda}$ and $w_L = 1-\overline{\lambda}$, the returns of the two investment strategies will be equalized: $r_H = f^H(\overline{\lambda}) = f^L(1-\overline{\lambda}) = r_L$. Other allocations are sub-optimal since they generate lower expected portfolio returns.

2.3 Equilibrium with Only Taxable Investors ($\lambda = 0$)

Taxable investors allocate their portfolios according to the after-tax returns of the strategies. The after-tax returns are $(1-\tau_H)r_H$ for the high-tax strategy and $(1-\tau_L)r_L$ for the low-tax strategy. Panel B of Figure 1 depicts the after-tax returns of the two investment strategies using dashed curves.

An optimal portfolio allocation for taxable investors occurs where the after-tax returns of the two investment strategies are equalized, as depicted in Panel B.[4] At the allocation of $w_H = \underline{\lambda}$ and $w_L = 1-\underline{\lambda}$, the after-tax returns of the two investment strategies will be equalized: $(1-\tau_H)r_H = (1-\tau_H)f^H(\underline{\lambda}) = (1-\tau_L)f^L(1-\underline{\lambda}) = (1-\tau_L)r_L$. Other allocations are sub-optimal since they generate lower expected portfolio returns after taxes.

[3]We assume that $f^L(0) > f^H(1)$ and $f^H(0) > f^L(1)$. In this case, an optimal allocation includes positive allocations to both strategies. If $f^L(0) < f^H(1)$, then investors will invest all their funds solely in strategy H and if $f^H(0) < f^L(1)$, then investors will invest all their funds solely in strategy L.

[4]We assume that $(1-\tau_L)f^L(0) > (1-\tau_H)f^H(1)$ and $(1-\tau_H)f^H(0) > (1-\tau_L)f^L(1)$. In this case, an optimal allocation includes positive allocations to both strategies. If $(1-\tau_L)f^L(0) < (1-\tau_H)f^H(1)$, then investors will invest all their funds solely in strategy H and if $(1-\tau_H)f^H(0) < (1-\tau_L)f^L(1)$, then investors will invest all their funds solely in strategy L.

2.4 Equilibrium with Mixed Clienteles ($0 < \lambda < 1$)

Equity holdings in the United States are held by both taxable and tax-exempt investor types. For example, the Investment Company Institute mutual funds held in DC plans and IRAs accounted for 56percent of household long-term mutual funds. The remaining funds are held primarily by taxable investors.[5] Thus, it is plausible to look at environments which include both taxable and tax-exempt investors (i.e., $0 < \lambda < 1$). In this case, the portfolio allocation differs across the two clienteles. We have to distinguish between three cases depending on whether the proportion of tax-exempt investors is relatively low (i.e., $\lambda \leq \underline{\lambda}$), intermediate (i.e., $\underline{\lambda} < \lambda < \overline{\lambda}$), or relatively high (i.e., $\lambda \geq \overline{\lambda}$).

2.4.1 Relatively Few Tax-Exempt Investors ($\lambda \leq \underline{\lambda}$)

In the first case, the proportion of tax-exempt investors is relatively low (i.e., $\lambda \leq \underline{\lambda}$). In this case, taxable investors are the marginal investors and they hold both investment strategies in equilibrium. To make them indifferent between investing in strategies, the after-tax returns of the two strategies need to be equalized (i.e., $(1-\tau_H)r_H = (1-\tau_L)r_L$). The minority of tax-exempt investors will find it optimal to invest all their wealth in the high-tax strategy since it offers a higher before-tax return than the low-tax strategy. Thus, the tax-exempt investors will put all their wealth in the high-tax strategy $w_H^X = 1$ and nothing in the low-tax strategy $w_L^X = 0$. The taxable investors will allocate their wealth to equilibrate the after-tax returns. Their allocation to the high-tax strategy amounts to $w_H^T = (\underline{\lambda} - \lambda)/(1-\lambda) \geq 0$. The total amount invested in the high-tax strategy is $w_H = \lambda w_H^X + (1-\lambda)w_H^T = \lambda + (\underline{\lambda} - \lambda) = \underline{\lambda}$ and the total amount invested in the low-tax strategy is $w_L = 1 - \underline{\lambda}$. At these allocations, the after-tax returns of the two strategies are equilibrated ($(1-\tau_H)r_H = (1-\tau_H)f^H(\underline{\lambda}) = (1-\tau_L)f^L(1-\underline{\lambda}) = (1-\tau_L)r_L$) and the before-tax returns of the high-tax strategy exceed

[5] 2017 Investment Company Factbook, p. 124.

the before-tax returns of the low-tax strategy ($r_H = f^H(\underline{\lambda}) > f^L(1-\underline{\lambda}) = r_L$). Thus, neither taxable nor tax-exempt investors have an incentive to deviate from the allocations given above.

The equilibrium allocations and returns are depicted in Figure 2. Panel A shows the portfolio allocations of the two clienteles. The horizontal axis shows the proportion of tax-exempt investors λ. The vertical axis shows the portfolio weights invested in the high-tax asset by taxable investors (w_H^T), by tax-exempt investors (w_H^X), and by all investors ($w_H = \lambda w_H^X + (1-\lambda) w_H^T$). The weights allocated to the low-tax assets amount to $1 - w_H^i$. At low proportions of tax-exempt investors (i.e., $\lambda < \underline{\lambda}$), tax-exempt investors will put all their wealth in the high-tax strategy (i.e., $w_H^X = 1$), whereas the taxable investors will hold both strategies and invest $w_H^T = (\underline{\lambda} - \lambda)/(1-\lambda)$ in the high-tax strategy. The aggregate weight in the high-tax asset in this case is constant and amounts to: $w_H = \lambda \times 1 + (1-\lambda) \times w_H^T = \underline{\lambda}$.

Panel B of Figure 2 reports the before- and after-tax returns of the two investment strategies at different wealth distribution levels. If the proportion of tax-exempt investors is relatively small (i.e., $\lambda < \underline{\lambda}$) the high-return strategy offers higher expected returns before taxes than the low-return strategy, but the two strategies offer identical after-tax returns.

2.4.2 Intermediate Proportion of Tax-Exempt Investors ($\underline{\lambda} < \lambda < \overline{\lambda}$)

In the second case, the proportion of tax-exempt investors is intermediate (i.e., $\underline{\lambda} < \lambda < \overline{\lambda}$). In this case, it is optimal for investors to fully concentrate in one investment strategy: taxable investors will allocate all their wealth to the low-tax strategy (i.e., $w_H^T = 0$ and $w_L^T = 1$) whereas tax-exempt investors will allocate all their wealth to the high-tax strategy (i.e., $w_H^X = 1$ and $w_H^X = 0$). Tax-exempt investors do not have an incentive to deviate from this strategy since the before-tax return of the high-tax strategy is higher than the before-tax return of the low-tax strategy: $r_H = f^H(\lambda) > f^L(1-\lambda) = r_L$. Similarly, taxable investors also do not have an incentive to deviate since the after-tax return of the low-tax strategy is

higher than the after-tax return of the high-tax strategy: $(1-\tau_L)r_L = (1-\tau_L)f^L(1-\lambda) > (1-\tau_H)f^H(\lambda) = (1-\tau_H)r_H$, as can be seen from Panel B of Figure 1.

Panel A of Figure 2 shows that portfolio allocations are fully separated across the two clienteles at intermediate levels of λ: Taxable investors invest only in the low-tax asset and tax-exempt investors invest only in the high-tax asset. Panel B shows that in this case, both the before- and after-tax returns of the investment options are not equalized across the investment options. This differs from the Berk and Green (2004) model, where investment returns are equalized in a competitive market with decreasing returns to scale. Investors in an environment with mixed clienteles do not have an incentive to equalize the returns across investment strategies.

2.4.3 Relatively Many Tax-Exempt Investors ($\lambda \geq \overline{\lambda}$)

In the third case, the proportion of tax-exempt investors is relatively high (i.e., $\lambda \geq \overline{\lambda}$). In this case, tax-exempt investors are the marginal investors and they hold both investment strategies in equilibrium. To make them indifferent between investing in strategies, the before-tax returns of the two strategies need to be equalized (i.e., $r_H = r_L$). The taxable investors will invest all their wealth in the low-tax strategy since it offers a higher after-tax return. Thus, the taxable investors will put all their wealth in the low-tax strategy $w_L^T = 1$ and nothing in the high-tax strategy $w_H^T = 0$. The tax-exempt investors will allocate their wealth to equilibrate the before-tax returns since they are the marginal investors. Their allocation to the high-tax strategy amounts to $w_H^X = \overline{\lambda}/\lambda > 0$. The total amount invested in the high-tax strategy is $w_H = \lambda w_H^X + (1-\lambda)w_H^T = \overline{\lambda}$. At these allocations, the before-tax returns of the two strategies are equilibrated ($r_H = f^H(\overline{\lambda}) = f^L(1-\overline{\lambda}) = r_L$) and the after-tax returns of the low-tax strategy exceed the after-tax returns of the high-tax strategy ($(1-\tau_L)r_L = (1-\tau_L)f^L(1-\overline{\lambda}) > (1-\tau_H)f^H(\overline{\lambda}) = (1-\tau_H)r_H$). Thus, neither taxable nor

tax-exempt investors have an incentive to deviate from the allocations given above.

With a relatively high proportion of tax-exempt investors, the before-tax returns are equalized across the two strategies, but the after-tax returns differ across the two strategies, as depicted in Figure 2.

2.5 Model Conclusions

The stylized model makes two main predictions. First, investors tend to tilt their portfolios towards the investment strategies that correspond to their tax preferences: tax-exempt investors tend to tilt their portfolios towards investment strategies that are more heavily taxed, whereas taxable investors tend to tilt their portfolios towards strategies that exhibit lower tax burdens. The extent of the tilting depends on the distribution of investor types. A perfect separation into two different tax clienteles occurs if clienteles are fairly equally distributed. Second, the returns of the different strategies depend on the distribution of tax clienteles. If the proportion of tax-exempt investors is relatively high, then tax-exempt investors are the marginal investors and before-tax returns are equalized across the strategies. On the other hand, after-tax returns are equalized if taxable investors are relatively abundant. At intermediate distribution levels, neither before- nor after-tax returns are equilibrated in contrast to the predictions of the model by Berk and Green (2004). In the stylized model the equilibrium before-tax returns on the high-tax strategy are at least as high as the equilibrium returns on the low-tax strategy.[6] In the remainder of the paper, we study empirically whether before- or after-tax returns are equilibrated using a sample of domestic equity mutual funds.

[6]The fact that $\overline{\mu}_H > \overline{\mu}_L$ is not driving the result that the equilibrium before-tax returns on the high-tax strategy are at least as high as the equilibrium returns on the low-tax strategy.

3 Data and Summary Statistics

This section summarizes our data sources, defines the tax burden of equity mutual funds, and reports summary statistics of our main variables.

3.1 Data Sources

Our data covers U.S. equity mutual funds over the period between 1990 and 2016 based on the CRSP Survivorship Bias Free Mutual Fund database.[7] The CRSP database includes mutual fund characteristics such as fund returns, fund dividend and capital gains distributions, total net assets, fees, flows, and investment objectives. We exclude balanced, bond, international, and money market funds, as well as funds that, on average, hold less than 80% of their assets in common stock. To avoid the incubation bias identified by Evans (2010), we also exclude funds which in the previous month manage less than $10 million, funds with missing fund names in the CRSP database, and funds where the year for the observation is in the same year or in an earlier year than the reported fund starting year. Mutual fund share classes are aggregated at the fund level. Our sample includes 570,207 monthly fund observations.

We merge the CRSP mutual fund database with the Thomson-Reuters Mutual Fund Holdings database and the CRSP Stock Database using the MFLINKS file based on Wermers (2000) and available through the Wharton Research Data Services (WRDS). The Thomson-Reuters data include the equity holdings of mutual funds on specific disclosure dates, which allow us to determine the style of the stocks being held and the capital gains overhangs.

We obtain data on the tax rates on dividend, short-term, and long-term capital gains from the National Bureau of Economic Research (NBER).[8]

[7] We focus on this time period because the CRSP mutual fund database does not typically classify the term of the capital gain before 1990.

[8] We thank Daniel Feenberg for computing these time series. The time series can be downloaded from http://www.nber.org/~ taxsim and additional information on the TAXSIM model is given in Feenberg and Coutts (1993).

Finally, we obtain the proportion of Defined Contribution (DC) assets in mutual funds between 1997 and 2012 from the surveys conducted by *Pensions & Investments*. In these surveys the mutual fund management companies are asked to report the dollar amount of the mutual fund assets held in DC retirement accounts for the mutual funds most used by DC plans in broad investment categories (Domestic Equity Funds, Domestic Fixed Income Funds, International Equity Funds, Balanced Funds, Money Market Funds).[9]

3.2 Tax Burden

Although mutual funds are considered corporations in the U.S., there is usually no double taxation of their income because mutual funds registered under the Investment Company Act of 1940 can pass through their dividend and capital gains income to fund shareholders on an annual basis. Thus, an investment company distributing all of its realized income to its shareholders has no direct tax liability. However, these distributions are taxable to mutual fund shareholders who hold the mutual fund in a taxable account. Thus, when funds realize capital gains, they accelerate the payment of taxes for their current shareholders.

The before-tax total return of fund f at time t, $R_{f,t}^{BT}$, depends on the dividend distributions, DIV, the short- and long-term capital gains distributions, SCG and LCG, and the price appreciation of the fund, $P_{f,t} - P_{f,t-1}$:

$$\begin{aligned} R_{f,t}^{BT} &= \frac{DIV_{f,t} + SCG_{f,t} + LCG_{f,t} + P_{f,t} - P_{f,t-1}}{P_{f,t-1}} \\ &= Y_{f,t}^{DIV} + Y_{f,t}^{SCG} + Y_{f,t}^{LCG} + Y_{f,t}^{UCG}, \end{aligned} \tag{3}$$

where Y^{DIV}, Y^{SCG}, Y^{LCG}, and Y^{UCG} are the fund's dividend yield, the short- and long-term capital gains yield, and the unrealized capital gains yield. The unrealized capital gain equals

[9]Additional information about the survey can be obtained from the website at http://www.pionline.com. Surveys from the same data source have been used previously by Christoffersen, Geczy, Musto, and Reed (2006), Sialm and Starks (2012), Christoffersen and Simutin (2014), Dimmock, Gerken, Ivkovic, and Weisbenner (2014), and Sialm, Starks, and Zhang (2015).

the price appreciation of the fund after the various distributions have been made.

The after-tax return of fund f at time t $R_{f,t}^{AT}$ depends on the before-tax return of the fund $R_{f,t}^{BT}$ net of the dividend and capital gains taxes:

$$\begin{aligned} R_{f,t}^{AT} &= (1-\tau_t^{DIV})Y_{f,t}^{DIV} + (1-\tau_t^{SCG})Y_{f,t}^{SCG} + (1-\tau_t^{LCG})Y_{f,t}^{LCG} + Y_{f,t}^{UCG} \\ &= R_{f,t}^{BT} - \tau_t^{DIV}Y_{f,t}^{DIV} - \tau_t^{SCG}Y_{f,t}^{SCG} - \tau_t^{LCG}Y_{f,t}^{LCG}, \end{aligned} \tag{4}$$

where τ^{DIV}, τ^{SCG}, τ^{LCG} are the tax rates on dividends and short- and long-term capital gains.

To measure the overall tax costs of an equity mutual fund, we define the tax burden (TB):

$$TB_{f,t} = R_{f,t}^{BT} - R_{f,t}^{AT} = \tau_t^{DIV}Y_{f,t}^{DIV} + \tau_t^{SCG}Y_{f,t}^{SCG} + \tau_t^{LCG}Y_{f,t}^{LCG}. \tag{5}$$

The tax burden corresponds to the tax cost of a mutual fund's distributions relative to the fund's net asset value.[10] A fund investor might incur additional capital gains taxes when the investor liquidates the fund position. The liquidation taxes depend on the net realized capital gain (i.e., the difference between the liquidation value and the cost basis of the fund investment).[11]

The dividend and capital gains distributions of mutual funds are obtained from the CRSP mutual fund database. Short-term gains typically are for investments that are held for less than a year and long-term gains are typically for investments that are held for one year or

[10]The following example illustrates the definition of the tax burden. Suppose a mutual fund with an initial share price of \$100 makes at the end of month t a dividend distribution of \$2 and a long-term capital gains distribution of \$5. In addition, the fund appreciates by 10% after these distributions have been made. This fund has a dividend yield of $Y^{DIV} = 2\%$, a long-term capital gains yield of $Y^{LCG} = 5\%$, and an unrealized capital gain of $Y^{UCG} = 10\%$. The total before-tax return of this fund in month t equals $R^{BT} = 2\% + 5\% + 10\% = 17\%$. If the dividend tax rate is 30% and the long-term capital gains tax rate is 20%, then the investor needs to pay \$0.60 in dividend taxes and \$1 in capital gains taxes. Thus, the after-tax return equals $R_{f,t}^{AT} = 0.17 - 0.3 \times 0.02 - 0.2 \times 0.05 = 15.4\%$. The tax burden of fund f in month t equals the difference between the before- and the after-tax returns: $TB = 0.3 \times 0.02 + 0.2 \times 0.05 = 1.6\%$.

[11]If the investor liquidates the mutual fund position in month t at a capital gain, then the investor needs to pay an additional tax on the net realized capital gain. If the investor liquidates the fund at a loss, then the investor can subtract the net loss from the ordinary income up to a certain annual limit, which currently equals \$3,000. The losses exceeding the annual deduction need to be carried forward to future years and can offset future realized capital gains or ordinary income.

more. Taxes are not taken into account for non-taxed returns of capital.[12] Dividend taxes are not charged for untaxed or tax-exempt dividends. Mutual funds are only required to distribute dividends that exceed their fund expenses. Thus, dividend distributions of mutual funds tend to be significantly smaller than dividends paid by the corporations they hold.[13]

A substantial fraction of dividend and capital-gains distributions occur in December. It is therefore important to aggregate the tax burdens and the fund distributions over annual time periods.

Figure 3 summarizes the time-series variation in the average dividend and capital gains distributions by domestic equity mutual funds. Dividend distributions have gradually declined as companies have replaced dividends with share repurchases as discussed by Allen and Michaely (2003). Capital gains distributions are cyclical and are substantial in the 1990s and the mid 2000s. Capital gains distributions are small in the early and late 2000s.

We use the top federal marginal tax rates on dividends and short- and long-term capital gains to compute the tax burden. Figure 4 summarizes the time-series variation in the average marginal dividend and capital gains tax rates. Over our sample period there were two major tax reforms. The Taxpayer Relief Act of 1997 reduced the top federal long-term capital gains tax rate from 28% to 20% and the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) of 2003 reduced the marginal federal tax rate on qualified dividends and long-term capital gains

[12] If the term of the capital gain is not specified, we assume that gains correspond to long-term capital gains. During a short time interval there was a medium-term classification for investments held for more than one year but less than 18 months and a super-long-term for investments held for more than five years. The proportions of these medium- and super-long-term capital gains are very small and we classify these gains as long-term gains since we do not have available tax rates for these gains.

[13] After the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA), dividend distributions are divided into qualified and non-qualified distributions depending on the investor's holding period and on the identity of the corporation that pays the dividends. Non-qualified dividends are taxed at the ordinary income tax rate, whereas qualified dividends are taxed at a lower tax rate to reduce the impact of the double taxation of dividend payments. Since 2003, more than 90% of mutual fund dividend distributions are classified as qualified distributions. Additional information on the taxation of capital gains and dividend distributions can be obtained from historical versions of Publication 550 of the IRS (http://www.irs.gov/publications/p550/index.html).

to 15%.

Figure 5 depicts the cross-sectional distribution of tax burdens over our sample period based on funds' dividend and capital gains distributions and on the average marginal tax rates. We observe a substantial cross-sectional variation in fund distributions and tax burdens. For example, in 2000, funds in the first quartile exhibit annual tax burdens below 0.55% and funds in the fourth quartile exhibit annual tax burdens above 3.55%.

3.3 Summary Statistics

Table 1 summarizes the distributions of the main variables. The mean tax burden over our sample equals 1.08% and ranges between 0.07% at the first quartile to 1.60% at the third quartile. The average tax burden is similar in magnitude to the average expense ratio, which has obtained a lot of attention in the mutual fund literature (Carhart (1997), Wermers (2000), French (2008), Gil-Bazo and Ruiz-Verdu (2009), and Berk and Van Binsbergen (2015)). Furthermore, the standard deviation of the tax burden of 1.55% per year is substantially larger than the standard deviation of the expense ratio of 0.50%, indicating that there is substantial variation in tax burdens across funds and across time.

Around two-thirds of fund distributions are characterized as long-term capital gains, whereas dividend and short-term capital gains account for 18% and 16% of fund distributions. The cross-sectional distribution indicates that short-term capital gains distributions are highly concentrated on a few funds during a few time periods.

The fund returns, the expense ratios, the turnover ratios, the total net assets (TNA), and the ages of funds are obtained from the CRSP mutual fund database. We aggregate the returns, the fund distributions, the expense ratio, the turnover ratio by asset-weighting the corresponding characteristics of the individual share classes. The TNA of the fund is aggregated by summing the TNAs of the individual share classes and the fund age is obtained by the age of the oldest share class. Funds in our sample have an average expense ratio of

1.14% and exhibit a turnover ratio of 83%. The median fund manages $230 million and is nine years old.

Based on the CRSP data, we compute the fund flow ($FLOW$), which is defined as the growth rate of the assets under management after adjusting for the appreciation of the mutual fund's assets ($R_{f,t}$):

$$FLOW_{f,t} = \frac{TNA_{f,t} - TNA_{f,t-1}(1 + R_{f,t})}{TNA_{f,t-1}(1 + R_{f,t})}. \tag{6}$$

Since estimated fund flows exhibit substantial outliers, we winsorize both the top and the bottom parts of the distribution at the 2.5% level. Funds in our sample have an average flow of 0.72% per month. The average time-series standard deviation of the flow of a fund over the prior 12 months equals 3.15%.

The style scores and the unrealized capital gains overhangs are obtained from the Thomson-Reuters mutual fund holdings data. Following Daniel, Grinblatt, Titman, and Wermers (1997), we group each stock listed in CRSP into respective quintiles according to its market value (using NYSE cutoff levels), its industry-adjusted book-to-market ratio, and its prior-year return. Using the quintile information of stocks held by a mutual fund, we compute the value-weighted size, value, and momentum scores for each fund in each period. For example, a mutual fund that invests one-half of its value in stocks in the largest size quintile and the other half in stocks in the second largest size quintile has a size score of 4.5. Mutual funds in our sample tend to hold stocks in the largest size quintile and have slight biases towards growth and momentum stocks.

Using the equity holdings from Thomson-Reuters, we obtain a measure of the short- and long-term capital gains overhang of a mutual fund following Sialm and Starks (2012). The capital gains overhang reflects investors' future potential tax burden. Specifically, at the end of every quarter we compute for each equity position the unrealized capital gain as the percentage difference between the current price of the position and the price of the position

on the last trading day in the quarter the position was acquired. If the current position was acquired across multiple quarters, then we compute the weighted average capital gain of the different lots. An unrealized capital gain is classified as short term if the position has been held for less than four quarters. The unrealized short and long-term capital gains are then aggregated over all stock positions of a fund. We find that the average short- and long-term capital gain overhangs equal 1.61% and 11.39%, respectively.

Finally, the average proportion of DC assets based on the surveys by *Pensions & Investments* equals 27.26% with a standard deviation of 23.44%.

3.4 Summary Statistics by Mutual Fund Type

The tax burdens differ significantly by the type of mutual funds, as illustrated in Table 2. We divide our sample into actively-managed, tax-managed, and passively-managed funds. Passively- and tax-managed funds are identified by their names. Tax-managed and passively-managed funds account for 1.4% and 7.1% of the observations in our sample. For comparison we also include the characteristics of exchange-traded funds (ETFs). Exchange-traded funds are investment funds that allow authorized participants to create and redeem investment units. Exchange-traded funds are governed by the same tax rules as open-ended mutual funds, but they use "redemptions in kind" to substantially reduce their distributions of realized capital gains, as discussed by Poterba and Shoven (2002). In addition, exchange-traded funds are not directly exposed to flows by fund investors which force fund managers to liquidate some of their positions and realize capital gains, as discussed by Barclay, Pearson, and Weisbach (1998) and Dickson, Shoven, and Sialm (2000). Table 2 indicates that tax-managed and passively-managed funds tend to exhibit lower tax burdens than actively-managed funds. The tax burdens are also low for exchange-traded funds, which exhibit very low capital gains distributions.

Not surprisingly, the DC ratio of tax-managed funds is small (2.54%) compared to index

mutual funds (40.15%).

3.5 Persistence of Tax Burden

Since our main analysis relies on lagged tax burdens, it is important to analyze whether the tax burdens are persistent. Ex-ante it is not clear whether tax burdens are persistent or not. On one hand, investment strategies of mutual funds are persistent resulting in persistent distributions and tax burdens. On the other hand, funds that distribute in the current period a larger capital gain will have a lower unrealized capital gains overhang which will tend to reduce future fund distributions.

To analyze the persistence of tax burdens and fund distributions, we sort mutual funds annually into five groups according to their tax burdens and their distributions in year zero. We report the average tax burdens and distributions of the groups of funds over the subsequent five years in Table 3. As shown in the first column, the fund groups are not equally large. This occurs because in some years more than 20% of funds exhibit zero distributions and therefore a zero tax burden. Furthermore, 67% of mutual funds on average have zero short-term capital gains distributions.

Our results indicate that tax burdens and fund distributions are highly persistent. Although we observe some reversion to the mean, funds in the highest tax burden group continue to exhibit significantly higher tax burdens than funds in the lowest tax burden group for at least five years after the portfolio formation. The standard errors of the differences are reported in parentheses and are computed based on the time-series variation of the tax burdens as in Fama and MacBeth (1973). The persistence in the tax burdens is not just due to the persistence in dividend distributions, as shown in Panel D, but also due to the persistence in short- and long-term capital gains.[14]

[14]Harris, Hartzmark, and Solomon (2015) document that a small number of funds artificially increase their dividends by purchasing stocks before dividend payments to attract investor clienteles who demand high

4 Determinants of Tax Burden

The tax burden of a mutual fund depends on both the investment style of the fund, on the trading behavior of the fund investors, and on the market conditions. The role of the investment style of a fund has been discussed by Bergstresser and Pontiff (2013) and Israel and Moskowitz (2011), who simulate the long-term tax burdens of various investment styles. Funds that tend to hold assets for shorter time periods and exhibit higher portfolio turnovers will typically incur higher tax burdens because short-term gains are more heavily taxed than long-term gains. Funds that tend to focus on small-capitalization stocks need to liquidate stocks that appreciate in value and exit the small-capitalization benchmarks. Similarly, value funds and contrarian funds also need to liquidate stocks that exhibited high recent performance as the underlying stocks become growth or momentum stocks. In addition, large-capitalization stocks and value stocks tend to have higher dividend yields, which increase the tax burden, especially in tax regimes without a preferential tax treatment of dividends.

The tax burden also depends on the trading behavior of fund investors, as discussed by Dickson, Shoven, and Sialm (2000). Redemptions of fund investors may force the mutual fund to sell some of its equity positions in order to pay off the liquidating investors. As a result, the fund may be forced to distribute taxable capital gains to its shareholders. On the other hand, new investors convey a positive externality upon existing investors by diluting the unrealized capital gain position of the fund. Thus, taxes correspond to an additional source of strategic complementarities across investors in open-ended funds besides the liquidity-based externalities discussed by Edelen (1999) and Chen, Goldstein, and Jiang (2010).

Finally, the tax burden also depends on the market conditions. For example, capital gains distributions tend to be larger after bull markets and for funds that accumulated more substantial unrealized capital gains overhangs.

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dividends. These strategies are costly since they create higher turnover and increased taxes for fund investors.

To analyze the determinants of the tax burden, we run a panel regression of the tax burden or the fund distributions in year t on the prior fund characteristics. The size, value, and momentum scores (SIZ, VAL, and MOM) based on the fund holdings are used to capture the main investment styles of the funds. In addition, fund turnover ($TURN$), fund expenses (EXP), fund size (TNA), and fund age (AGE) might also capture additional facets of the investment strategy and the style of the mutual fund. The behavior of fund investors is captured by last year's average monthly flow ($FLOW$) and by the standard deviation of the monthly flows over the last year ($FLOWVOL$). Finally, market conditions are captured by the time-fixed effects and by the short- and long-term capital gains overhangs ($SCGO$ and $LCGO$)). The regression is performed at an annual frequency since most fund distributions occur in December. The standard errors are clustered at the fund level. The regression specification is as follows:

$$\begin{aligned} TB_{f,t} &= \beta_1 SIZ_{f,t-1} + \beta_2 VAL_{f,t-1} + \beta_3 MOM_{f,t-1} \\ &+ \beta_4 FLOW_{f,t-1} + \beta_5 FLOWVOL_{f,t-1} + \beta_6 AGE_{f,t-1} + \beta_7 LOG(TNA_{f,t-1}) \\ &+ \beta_8 TURN_{f,t-1} + \beta_9 EXP_{f,t-1} + \beta_{10} SCGO_{f,t-1} + \beta_{11} LCGO_{f,t-1} + \beta_{0,t} + \epsilon_{f,t}. \quad (7) \end{aligned}$$

Table 4 indicates that the investment style plays an important role in determining the tax burden. Funds that hold companies with smaller market capitalizations and with higher book-to-market ratios tend to exhibit higher capital gains distributions and tax burdens. For example, a one-standard-deviation increase in the size score (which is equal to 0.95 units) decreases the tax burden by between 0.09 and 0.10 percentage points, whereas a one-standard-deviation increase in the value score (which is equal to 0.41 units) increases the tax burden by between 0.08 and 0.10 percentage points. Changes in the momentum scores have an economically smaller and statistically less significant impact on the tax burden.

We find that funds that experience negative or volatile new money growth over the prior year tend to distribute higher capital gains over the subsequent year since these funds are more

likely to sell shares and recognize capital gains. The impact of investor behavior is also economically significant. For example, a one-standard-deviation decline in the fund flow (which amounts to 3.15%) and a one-standard-deviation increase in the fund flow volatility (which amounts to 2.56%) increase the tax burdens by 0.28 and 0.04 percentage points, respectively.

The tax burden increases with the fund turnover, as increased turnover raises short-term capital gains distributions. The tax burden decreases with the expense ratio, primarily because fund expenses can be subtracted from funds' distributions.

Finally, the tax burden increases with the short-term capital gains overhang, although the impact is very small for the long-term capital gains overhang. For example, a ten percentage point increase in the short-term capital gains overhang increases next year's tax burden by 40 basis points. A large capital gains overhang indicates on one hand that the fund might make large distributions in the near future as it will be forced to realize these gains, as suggested by Barclay, Pearson, and Weisbach (1998). On the other hand, funds with large embedded capital gains might continue deferring the realization of capital gains into the future.

5 Mutual Fund Performance

This section analyzes whether the before- and after-tax performance of equity mutual funds depends on the prior tax efficiency of mutual funds. Answering this question helps us to determine whether investors should take into account prior tax efficiency when selecting mutual funds. It also informs us about the economic costs of investment constraints imposed by tax-efficient asset management.

Although we have shown in Table 3 that tax burdens are persistent over time, it is not necessarily the case that funds with lower tax burdens exhibit higher subsequent after-tax performance. Tax-efficient asset management could be sufficiently costly and reduce the before-tax performance by more than the decline in the tax burden. Funds with low prior tax burdens

might underperform funds with high tax burdens before or even after taxes. Furthermore, taxes could be capitalized into equity prices (Sialm (2009)), as assets facing lower tax burdens might offer lower before-tax returns. On the other hand, tax efficient asset management might improve before-tax returns if tax-efficient investment strategies exhibit lower trading costs (e.g., due to lower portfolio turnover or overall awareness of efficient trading strategies) or higher investment returns (e.g., due to superior investment ability or superior style exposure).

5.1 Methodology

To investigate the relation between prior tax efficiency and subsequent before- and after-tax performance, we run the following panel regression:

$$\begin{aligned} PERF_{f,t} &= \beta_1 TB_{f,t-1} + \beta_2 RET_{f,t-1} + \beta_3 EXP_{f,t-1} + \beta_4 LOG(TNA_{f,t-1}) \\ &+ \beta_5 AGE_{f,t-1} + \beta_6 TURN_{f,t-1} + \beta_7 FLOW_{f,t-1} + \beta_{0,t} + \epsilon_{f,t}, \end{aligned} \tag{8}$$

where $PERF$ is either the before-tax excess return, the after-tax excess return, or the tax burden, TB is the average tax burden over the prior three years, RET is the excess return over the prior year, EXP is the fund's lagged expense ratio, TNA is the lagged fund size, AGE is the fund's lagged age, $TURN$ is the lagged annual fund turnover, and $FLOW$ is the average monthly flow over the prior 12 months. The regressions are taken at an annual frequency because most mutual funds make their dividend and capital gains distributions only in December.[15] The excess return is measured relative to the market return. In Sections 5.4 and 5.5 we study alternative holdings- or factor-based performance measures. Although the dependent variable for the return regressions corresponds to the performance of a fund over one year, our specification captures a longer-term predictability since the independent tax burden variable is measured over the prior three years.

[15] Our results are not affected qualitatively if we run the return specifications at a monthly frequency instead.

The regression includes year-fixed effects, style-fixed effects, and the standard errors are clustered by fund. The nine different fund equity styles are based on the holdings of the mutual funds and are obtained by dividing funds in each time period into three equal-sized groups by the size score (i.e., market capitalization of their holdings) and into three equal-sized groups by the value score (i.e., the book-to-market ratio of their holdings).

5.2 Predictability by Tax Burden

Table 5 indicates a strong inverse relation between prior tax burdens and subsequent after-tax performance. A one-standard-deviation increase in the average tax burden over the past three years of 1.18 percentage points decreases the after-tax excess return between 0.87 and 0.99 percentage points per year depending on whether we control for other fund characteristics. The predictability of after-tax excess returns by the prior tax burden is both statistically and economically significant. Thus, taxable investors should take into account the prior tax burdens when selecting mutual funds.

Surprisingly, before-tax excess returns are also negatively related to the prior tax burdens. A one-standard-deviation increase in the tax burden decreases the before-tax excess return between 0.39 and 0.55 percentage points per year. Thus, funds that tend to exhibit prior low tax burdens do not underperform on a pre-tax basis funds with higher tax burdens as one would expect if the higher tax efficiency would substantially constrain optimal asset management. Thus, around half of the after-tax performance effect is due to pre-tax performance and the other half is due to the persistence in the tax burden, as shown in the last two columns.

The remaining coefficients are broadly consistent with the mutual fund literature. Mutual fund pre-tax performance is persistent, as shown previously by Sharpe (1966), Grinblatt and Titman (1992), Hendricks, Patel, and Zeckhauser (1993), Brown and Goetzmann (1995), Carhart (1997), Bollen and Busse (2005), and Berk and Van Binsbergen (2015) among many

others. We also find that the pre-tax performance of funds decreases with the expense ratio (e.g., Gil-Bazo and Ruiz-Verdu (2009)), decreases with the fund size (e.g., Chen, Hong, Huang, and Kubik (2004)), and decreases with fund flows (e.g., Frazzini and Lamont (2009)).

The well-known difficulty of predicting mutual fund returns is apparent from the small R-squares of the return regressions. Fund characteristics, time-fixed effects, and style-fixed effects can explain only around 3% of the variation in before-tax excess returns. On the other hand, we find that around 12% of the variability of the tax burden can be explained by the factors considered here. This provides evidence that taxable mutual fund investors should carefully consider the determinants of the future tax burdens of funds, since it is more difficult to predict before-tax performance than tax burdens.

Whereas Table 5 reports the performance predictability using the tax burden over the prior three years, Table 6 summarizes the results using the tax burden over the prior one or five years. The first specification using the tax burden over the prior year does not use overlapping observations for the independent variables. The results over these alternative horizons are consistent with the results in Table 5.

Our measure of the tax burden depends on the distributions of the funds and on the historical tax rates on the different types of distributions. Our results are qualitatively unaffected if we evaluate the tax burden using weighted-average marginal tax rates following Sialm (2009), the average tax rates over the whole time period, or the tax rates in 2016.

5.3 Decomposition of Tax Burden

The tax burden depends on the distributions of dividends and short- and long-term capital gains. Table 7 decomposes the tax burden into the different types of distributions to analyze whether the results are driven by capital gains or dividend distributions. The distributions are measured over the prior three years.

The results for long-term capital gains closely correspond to the base case results reported

in Table 5. Funds with lower prior long-term capital gains distributions exhibit higher excess returns before and after taxes. Similarly, we also find a negative relation between prior dividend distributions and before- and after-tax excess returns. On the other hand, we do not obtain significant relations for before-tax excess returns for short-term capital gains. As summarized in Table 1, long-term capital gains account for most of the fund distributions and dividend and short-term capital gains distributions are relatively small. The last two columns of Table 7 show that the future tax burden is positively related with all three types of distributions.

These results indicate that the predictability of the tax burden does not come entirely from the type of stocks funds hold. Instead, it comes mainly from the conscious and consistent trading decisions of fund managers regarding their capital gains realizations.

5.4 Decomposition of Fund Performance

The relation between the prior tax burden and subsequent performance is not necessarily an intentional consequence of the fund management. Indeed it is unlikely that imposing tax constraints on the portfolio optimization enhances investment opportunities. However, the positive relation between tax-efficiency and pre-tax performance could be due to the fact that tax efficient funds might incur lower trading costs, might benefit from favorable factor exposures, and might select more highly skilled fund managers who exhibit superior investment abilities in many different investment dimensions (e.g., tax management, trading costs, selectivity, timing, style exposures). We discuss in this section possible drivers for the positive relation between tax efficiency and pre-tax performance.

To better understand the drivers of the before-tax fund performance, we decompose fund returns into stock selection, style timing, style selection, expenses, and trading costs. Kacperczyk, Sialm, and Zheng (2008) decompose the net fund return (R^{BT}) into the gross holdings

return (RH), fund expenses (EXP), and the return gap (RG):

$$R_{f,t}^{BT} = RH_{f,t} - EXP_{f,t} + RG_{f,t}. \tag{9}$$

The gross holdings return, RH, is defined as the value-weighted return of the previously disclosed fund holdings, R, where the weights correspond to the relative value of each fund position at the end of the previous month. The return gap RG captures the impact of unobserved actions on fund returns. It is composed of the incurred trading costs and the interim trading benefits. Funds where the trading costs exceed the interim trading benefits will exhibit negative return gaps.

Following Daniel, Grinblatt, Titman, and Wermers (1997) we can further divide the gross holdings return into a "Characteristic Selectivity" measure, CS, a "Characteristic Timing" measure, CT, and an "Average Style" measure, AS. To form the benchmark portfolios, we group the universe of common stocks listed on the NYSE, NASDAQ, and AMEX into quintiles along the dimensions of size (market value of equity), industry-adjusted book-to-market ratio, and momentum (the return of a stock in the previous year). This sequential sorting results in 125 passive portfolios.

The variable CS denotes a measure of stock selection ability and uses as a benchmark the return of a portfolio of stocks that is matched to each of the funds stock holdings every quarter along the dimensions of size, book-to-market, and momentum. The variable CT denotes a measure of style-timing ability, which examines whether fund managers can generate additional performance by exploiting time-varying expected returns of the size, book-to-market, or momentum benchmark portfolios. Finally, the AS measure captures the returns due to a fund's tendency to hold stocks with certain style characteristics.

To estimate the trading costs of a mutual fund using holdings data, we follow Edelen,

Evans, and Kadlec (2013). The percentage trading costs in each quarter are defined as follows:

$$TC_{f,t} = \frac{\sum_j P_{j,t} \left| N_{f,j,t} - N_{f,j,t-3} \right|}{\sum_j P_{j,t} N_{f,j,t}} \times ADJTV_{f,t} \times ADJTNA_{f,t} \times TCPU_{f,t}, \tag{10}$$

where $N_{f,j,t}$ is the split-adjusted number of shares of stock j held by fund f at time t, P is the corresponding price of shares of stock j, $ADJTV_{f,t}$ is the adjustment factor for interim trading, $ADJTNA_{f,t}$ is the adjustment factor for fund size, and $TCPU_{f,t}$ is the per-unit trading cost. These quarterly trading costs are aggregated across a year to obtain annual trading costs.

Based on Edelen, Evans, and Kadlec (2013), we calibrate the interim trading adjustment factor $ADJTV$ to equal 1.2 for quarterly disclosers and the size-adjustment factor $ADJTNA$ to equal $0.98/0.8 = 1.225$ for above-median TNA funds and $0.62/0.8 = 0.775$ for below-median TNA funds. Finally, the per-unit trading costs $TCPU$ depend on the style of the funds according to Table 2 of Edelen, Evans, and Kadlec (2013). For example, the per unit trading cost equals 1.64% for a fund holding stocks in the lowest market-capitalization tercile and the highest book-to-market tercile (i.e., small-value fund) and 0.48% for a fund holding stocks in the highest market-capitalization tercile and the lowest book-to-market tercile (i.e., large-growth fund). The style of the funds is determined using the size and value scores from the fund holdings.[16]

Table 8 summarizes the performance regressions using the various performance components as dependent variables. We find that the prior tax burden is negatively related with the ability to select securities and with the ability to time styles. These performance results likely provide evidence of selection effects: Tax-efficient fund managers tend to exhibit superior investment ability in many different dimensions.

[16]For funds with holdings disclosures at different frequencies than quarterly, we adjust the formula accordingly and compute the trading costs of the corresponding time periods. For example, for semi-annual disclosures we compute the trading costs over a 6-month time period.

We also find a significant relation between the prior tax burden and trading costs. Low tax burden funds generate significantly lower trading costs, which indicates that these funds are capable of overall cost-efficient trading. Expenses are on the other hand negatively related to the tax burden in the univariate specification. This relation occurs primarily because funds are allowed to subtract fund expenses from their dividend distributions, resulting in lower tax burdens for funds with higher expense ratios.

Overall, the superior performance of tax-efficient funds can be explained by their lower trading costs, their favorable style exposures, and their superior selectivity. We do not find support for the hypothesis that the constraints imposed by tax efficiency prevent mutual funds from taking advantage of their stock selection and style timing abilities.

5.5 Adjusted Performance

Whereas Table 5 and Table 8 study the associations of the prior tax burden with excess fund returns and various holdings-based performance measures, Table 9 studies the relation between the prior tax burden and various factor-adjusted abnormal returns. We report the results using the CAPM, the three-factor model of Fama and French (1993), the four-factor model of Carhart (1997), the Fama and French (2015) five-factor model, and the Berk and Van Binsbergen (2015) measures of excess performance (i.e., return of fund before fees minus return of composite index fund benchmark) and value added (i.e., excess performance multiplied by the lagged asset size).[17]

The fund performance $PERF$ for the factor-based measures is computed as the intercept of time-series regression using daily return data estimated separately in each calendar year. For example, the abnormal return of fund f in year t for the CAPM ($\alpha_{f,t}^{CAPM}$) is the intercept from the following regression $R_{f,t} - R_{TB,t} = \alpha_{f,t}^{CAPM} + \beta_{f,t}^{CAPM}(R_{M,t} - R_{TB,t}) + \epsilon_{f,t}^{CAPM}$, where

[17]We thank Ken French for providing data on the various return factors.

$R_{f,t}$ denotes the return of fund f during month t, $R_{M,t}$ denotes the market portfolio return, and $R_{TB,t}$ the Treasury bill rate. The difference between the before-tax and the after-tax alpha can be interpreted as a factor-adjusted tax burden and is summarized in the last two columns. The Berk-Binsbergen measures are also estimated using daily return data. Since daily returns are only available in CRSP since 1999, we focus this analysis on the subsample between 1999 and 2016.

The relation between the prior tax burden and the after-tax alphas and the adjusted tax burden is similar to the results reported in Table 5. However, the pre-tax relation weakens after adjusting for common factors. These results are consistent with the decomposition in Table 8, which indicated that a significant portion of the pre-tax effect can be explained by the style timing (CT) and by the average style exposure (AS). Both of these return components are absorbed by the exposures to common factors. Thus, low-tax burden funds generate superior pre-tax excess returns because they load favorably on common factors. However, the prior tax burden remains an important predictor for the after-tax alpha and for the tax burden adjusted for common factors.

5.6 Style Performance Effects

The tax burden of mutual funds depends on the style of the investments, as discussed by Bergstresser and Pontiff (2013) and Israel and Moskowitz (2011). First, dividend yields differ across mutual fund styles. Large capitalization stocks and value stocks tend to pay higher dividend yields than small capitalization stocks and growth stocks. Second, the capital gains distributions can also depend on the investment style. Funds that focus on small capitalization stocks or value stocks tend to sell stocks that recently appreciated in value to maintain their style exposures. Thus, small capitalization and value funds might realize more capital gains.

To analyze differences in tax burdens across different styles, we report in Table 10 the

before- and after-tax returns for different style portfolios. The size score of a fund corresponds to the average quintile number of firms' market values using NYSE cutoff levels. The value and momentum scores are defined correspondingly based on the average quintile number of the book-to-market ratio and the prior-year return of the holdings of a mutual fund.

Table 10 indicates that mutual funds holding small-capitalization stocks and value stocks tend to outperform before taxes. This outperformance is primarily driven by the superior performance of the corresponding styles over our sample period. The outperforance remains after adjusting the returns for taxes. The results also show that the tax burden effect remains consistent after controlling for the style scores of the funds: the tax burden is negatively related with the before- and the after-tax excess return and positively related with the after-tax return. The interaction effects between the tax burden and the style scores are generally insignificant for before-tax returns, indicating that the tax burden is not differentially related to pre-tax fund performance across different styles.

Overall, we find that the prior tax burden is an important consideration when selecting mutual funds even after conditioning on different investment styles. Funds that exhibit higher tax burdens over the prior three years will continue to exhibit high tax burdens.

5.7 Assets in DC Pension Accounts

Mutual fund holdings in DC pension plans are an important segment of financial markets. For example, mutual fund holdings in DC pension plans constituted more than half of mutual fund assets in 2015 according to the Investment Company Institute (ICI).[18] Whereas taxable fund investors care about the tax burdens of mutual funds, fund investors in tax-qualified accounts are not affected by the taxable distributions of their investments. Sialm and Starks (2012) find that funds held primarily by taxable investors choose investment strategies that

[18] 2016 Investment Company Handbook, p. 251.

result in lower tax burdens than funds held primarily in tax-qualified accounts.[19]

To investigate whether our results differ across mutual funds with different tax clienteles, we control for the DC ratio and the interaction of the DC ratio with the prior tax burden. The number of observations decreases substantially since the DC ratio is only available for the sub-period from 1997-2012 and for a subset of funds. Table 11 indicates that the relation between the tax burden and performance is qualitatively unaffected using this subsample after controlling for the DC ratio.

5.8 Subperiods

Figure 4 shows that marginal tax rates on fund distributions have differed substantially over time. To investigate whether the results differ across time, we divide our sample into two subperiods that have approximately equal length (1990-2002, 2003-2016). Taxes were higher during the first subperiod. Furthermore, equity returns were also higher during the first subsample. Despite these differences, we find consistent results across the two subsamples, as summarized in Table 12.

5.9 Relevance of Taxes

This section illustrates the importance of taxes for long-term investors. We compute the cumulative buy-and-hold returns before taxes, after taxes, and after taxes and liquidation. Liquidation taxes can be incurred when investors sell their fund holdings, which reduce the benefits of tax management because tax-managed mutual fund investments will exhibit higher unrealized capital gains.

[19]The involvement of financial advisors might also lead to tax clienteles, as suggested by Cici, Kempf, and Sorhage (2014). They provide evidence that U.S. mutual fund investors receive valuable tax-management advice from financial advisors. This result contrasts with the recent evidence by Bergstresser, Chalmers, and Tufano (2009) and Christoffersen, Evans, and Musto (2013), who document agency problems by brokers in the mutual fund industry.

To analyze the importance of liquidation taxes, we compute the cumulative buy-and-hold returns before and after taxes for mutual funds with different average tax burdens over our time period (1990-2016). In each month we sort mutual funds into quintiles according to their tax burdens over the prior 36 months. We only consider mutual funds with a complete return history over these prior 36 months. We form equal-weighted portfolios of the funds in the highest and the lowest tax burden quintiles. In each month we compute then the before- and the after-tax return of the extreme tax burden portfolios.

To compare the long-term tax costs of investing in different funds, we report in Panels A and B of Figure 6 the cumulative before- and after-tax buy-and-hold returns (BHR) of funds ranked in the highest and the lowest average tax burden quintiles. We assume that the total distributions are reinvested into the fund for the before-tax portfolio and that the after-tax distributions are reinvested into the fund immediately after the distributions are made for the after-tax portfolio. The initial values are set equal to one ($BHR^{BT}_{f,1989} = BHR^{AT}_{f,1989} = 1$):

$$BHR^{BT}_{f,t} = BHR^{BT}_{f,t-1}\left(1 + R^{BT}_{f,t}\right), \tag{11}$$

$$BHR^{AT}_{f,t} = BHR^{AT}_{f,t-1}\left(1 + R^{AT}_{f,t}\right). \tag{12}$$

We also compute a time series that takes into account the capital gains taxes incurred if the fund position is liquidated at any time. The realized capital gains equal to the difference between the cumulative after-tax fund value BHR^{AT} and the cost basis CB. The initial cost basis equals the initial investment ($CB_{f,1989} = BHR^{AT}_{f,1989} = 1$) and the cost basis increases every year until liquidation by the fund reinvestments, which equal to the after-tax fund distributions ($(1-\tau^{DIV}_t)Y^{DIV}_{f,t} + (1-\tau^{SCG}_t)Y^{SCG}_{f,t} + (1-\tau^{LCG}_t)Y^{LCG}_{f,t}$). If the cost basis exceeds the after-tax fund value, then we assume that the investor will obtain a tax refund in the year of liquidation.[20] The cumulative fund value after tax and liquidation BHR^{ATL} at time

[20]In practice, individuals can deduct up to \$3,000 of realized capital losses from their ordinary taxable incomes after offsetting realized capital losses with realized capital gains. The remaining losses need to be carried forward to future years.

t captures the value of a fund investment that is held from the beginning of the sample and is liquidated at time t :

$$BHR_{f,t}^{ATL} = BHR_{f,t}^{AT} - \tau_t^{LCG}\left(BHR_{f,t}^{AT} - CB_{f,t}\right), \tag{13}$$

$$\begin{aligned} CB_{f,t} &= CB_{f,t-1} \\ &+ BHR_{f,t-1}^{AT}\left((1-\tau_t^{DIV})Y_{f,t}^{DIV} + (1-\tau_t^{SCG})Y_{f,t}^{SCG} + (1-\tau_t^{LCG})Y_{f,t}^{LCG}\right). \end{aligned} \tag{14}$$

Figure 6 plots the buy-and-hold portfolio values for three different tax scenarios. The first scenario is before taxes and corresponds to the cumulative investment value if the fund is held in a tax-qualified retirement account. The before-tax performance is higher for the low-tax burden portfolio, consistent with the base-case results reported in Table 5. A one dollar tax-exempt investment at the beginning of 1990 would have accumulated in December 2016 to \$10.48 for the most tax-efficient quintile and to \$9.20 for the least tax-efficient decile.

The accumulated values differ significantly in the second scenario that takes into account taxes on fund distributions. A one dollar investment would have increased after taxes to \$8.62 for the tax-efficient quintile and to just \$5.41 for the tax-inefficient decile. These accumulated values correspond to the values of mutual fund portfolios that pass through an estate since no liquidation tax needs to be paid due to the step-up of the cost basis at death.[21]

The difference in the accumulative account values shrinks slightly in the third scenario that also takes into account taxes on the realized capital gains from the funds' liquidations. Since the tax-efficient funds have a larger embedded capital gain than the tax-inefficient funds, the liquidation tax reduces the value of the tax-efficient investment from \$8.62 to \$7.28 and actually increases the value of the tax-inefficient investment slightly from \$5.41 to \$5.48. However, the overall performance difference remains economically substantial across the two

[21]These calculations do not incorporate taxes that occur due to the rebalancing of mutual fund holdings in the portfolios.

extreme tax burden deciles.[22]

6 Self-Designated Tax-Managed Funds

Some mutual funds might be tax-efficient not because these funds deliberately minimize the tax burden, but because these funds use investment strategies that unintentionally generate relatively low tax burdens. We study in this section the performance of mutual funds that explicitly classify themselves as tax-managed funds. Funds that include "tax-aware," "tax-efficient," "tax-managed," or similar terms are classified as self-designated tax-managed funds.

Overall, our sample includes 79 funds that are self-designated tax-managed funds. Thus, the number of self-designated tax-managed funds is substantially smaller than the number of mutual funds.

Table 13 reports the average annual excess returns of tax-managed funds and matched funds that do not explicitly manage their taxes. The standard errors are computed by clustering by fund.

Panel A matches each self-designated tax-efficient funds to another fund in the same family, where the name only differs by omitting the designation as a tax-efficient fund. For example, the "J.P. Morgan Tax Aware Large Cap Growth Fund" is matched to the "J.P. Morgan Large Cap Growth Fund." Fund families set up such twin funds to cater to different tax clienteles. We can only find twin funds for 28 tax-efficient funds. The tax-efficient funds outperform the matched funds by 0.33 percentage points per year before taxes. However, the before-tax return differences are not statistically significant due to the very small number of tax-managed funds with valid matches. Consistent with our base-case results in Table 5, we find that the after-tax returns and the tax burdens are significantly different across the two types of funds:

[22]The after-tax monthly returns before and after liquidation are significantly different between the two extreme tax burden deciles at a five percent significance level. On the other hand, the before-tax returns are not significantly between the two extreme tax burden deciles.

Tax-efficient funds outperform matched funds by 1.95 percentage points per year after tax. The tax burden of tax-efficient funds is 1.61 percentage points lower than the burden of matched funds.

Panel B broadens the sample of valid fund pairs by matching a self-designated tax-efficient fund to another fund in the same family that has the closest style based on the fund holdings. For each mutual fund we compute the size, value, and momentum scores, as described in Section 3.3. We can find matches for 73 tax-efficent funds. For each potential pair of funds we compute the average difference in the three style scores. The matched fund corresponds to the fund with the smallest average squared style score difference. We find that the tax-efficient funds outperform the matched funds only marginally before taxes. This performance difference is not even close to being statistically significant. Consistent with Panel A, we find statistically and economically significant differences in the after-tax returns and in the tax burdens. Tax-efficient funds outperform matched funds by 0.81 percentage points per year after tax. The tax burden of tax-efficient funds is 0.78 percentage points lower than the burden of matched funds.

Panel C also incorporates fund size as a matching criteria. We obtain the closest match by minimizing the average squared difference between the standardized logarithm of the TNA and the three standardized style scores. In this sample we have 70 pairs of matched funds. The results are similar to the results in Panel B.

Overall, we find that self-designated tax-efficient funds significantly outperform after taxes similar funds without an explicit tax objective. Furthermore, the self-designated tax-efficient funds do not underperform other funds before taxes, indicating that the constraints imposed by tax-efficient asset management do not have evident performance consequences.

The insignificant pre-tax performance difference is an indication that the performance differences in our base-case analysis is due to different styles or fund-family effects.

7 Conclusions

Many mutual funds attempt to create value for their investors through active trading strategies, which often cause substantial trading costs and make it difficult for actively managed mutual funds to persistently generate superior performance for their investors, as discussed by French (2008). An additional cost of active fund management, which has often been ignored both in academia and in practice, is the tax imposed on fund investors. Whereas it is difficult for fund managers to create superior investment performance relying purely on picking stocks or market timing, it is relatively easy to avoid destroying value for taxable fund investors by managing investment taxes.

Our paper shows that investment taxes are of similar importance as fund expenses. Surprisingly, we find that mutual funds that impose higher tax burdens on their investors do not offset these tax costs with superior before-tax performance. Rather, tax-efficient funds seem to outperform tax-inefficient funds before and after taxes through superior investment ability, lower trading costs, and careful tax management. Our results indicate that the ability to manage taxes is positively related with the ability to control trading costs and to select securities.

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Table 1: **Summary Statistics of Mutual Funds**
This table presents summary statistics for the equity funds in our sample.

	Mean	Std.Dev.	Quartile 1	Median	Quartile 3
Tax Burden (in % per year)	1.08	1.55	0.07	0.44	1.60
Before-Tax Return (in % per month)	0.70	5.16	−1.96	1.09	3.71
After-Tax Return (in % per month)	0.61	5.17	−2.07	0.98	3.66
Total Distributions (in % per year)	4.44	5.90	0.39	2.08	6.68
Dividend Yield (in % per year)	0.78	1.30	0.00	0.39	1.21
Short-Term Capital Gains Yield (in % per year)	0.73	2.26	0.00	0.00	0.25
Long-Term Capital Gains Yield (in % per year)	2.93	4.86	0.00	0.17	4.48
Expense Ratio (in % per year)	1.14	0.50	0.86	1.13	1.42
Turnover (in % per year)	82.65	125.63	28.00	57.00	101.00
TNA (in $M)	1,552.98	7,583.47	67.40	229.80	874.10
Age (in Years)	12.77	13.00	4.00	9.00	16.00
Flow (in % per month)	0.72	3.15	−1.04	−0.05	1.61
Std. Dev. of Flow (in % per month)	2.84	2.56	1.00	2.02	3.71
Size Score	4.13	0.95	3.50	4.55	4.88
Value Score	2.84	0.41	2.55	2.85	3.11
Momentum Score	3.12	0.42	2.83	3.10	3.38
Short-Term Capital Gains Overhang (in %)	1.61	5.39	−0.11	0.95	3.22
Long -Term Capital Gains Overhang (in %)	11.39	18.37	0.47	8.53	18.48
DC Ratio (in % of TNA)	27.26	23.44	9.10	21.09	38.80
Number of Monthly Observation	570,207				

Table 2: **Tax Burden by Mutual Fund Type**
This table presents the tax burden and other fund characteristics by type of mutual fund.

	Actively-Managed Mutual Funds	Tax-Managed Funds	Index Mutual Funds	Exchange-Traded Funds
Tax Burden (in % per year)	1.11	0.32	0.66	0.35
Before-Tax Return (in % per month)	0.70	0.47	0.66	0.78
After-Tax Return (in % per month)	0.61	0.45	0.61	0.76
Before-Tax Market-Adjusted Return (in % per month)	−0.04	−0.02	0.03	0.02
After-Tax Market-Adjusted Return (in % per month)	−0.13	−0.05	−0.02	−0.01
Total Distributions (in % per year)	4.54	1.51	3.01	1.75
Dividend Yield (in % per year)	0.74	0.55	1.37	1.65
Short-Term Capital Gains Yield (in % per year)	0.77	0.08	0.22	0.05
Long-Term Capital Gains Yield (in % per year)	3.03	0.88	1.43	0.05
Expense Ratio (in % per year)	1.19	1.10	0.40	0.34
Turnover (in % per year)	86.80	62.38	21.86	48.95
TNA (in $M)	1360.15	748.10	4242.58	2823.62
Age (in Years)	13.06	8.18	8.71	5.19
Flow (in % per month)	0.68	0.83	1.16	2.58
Std. Dev. of Flow (in % per month)	2.83	2.31	3.02	6.87
Size Score (Range [1,5])	4.12	4.30	4.27	
Value Score	2.84	2.83	2.83	
Momentum Score	3.13	3.06	2.98	
Short-Term Capital Gains Overhang (in %)	1.71	1.25	0.25	
Long -Term Capital Gains Overhang (in %)	11.26	11.26	13.15	
DC Ratio (in % of TNA)	26.18	2.54	40.15	
Number of Monthly Observations	532,508	7,656	37,699	26,624

Table 3: **Persistence of Tax Burden**

This table presents the average tax burden and fund distributions over a five-year period for fund portfolios sorted into quintiles in year zero. The standard errors of the differences are computed based on the time-series variation as in Fama and MacBeth (1973) and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Tax Burden

Portfolio	Proportion	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Low	23.65	0.15	0.72	1.00	1.13	1.17	1.21
P2	19.09	0.56	0.98	1.13	1.25	1.22	1.25
P3	19.10	1.05	1.32	1.33	1.34	1.31	1.28
P4	19.10	1.64	1.60	1.50	1.40	1.35	1.31
High	19.06	3.18	2.12	1.82	1.67	1.51	1.37
High - Low		3.03	1.40***	0.82***	0.54***	0.33***	0.16*
			(0.16)	(0.11)	(0.09)	(0.10)	(0.09)

Panel B: Long-Term Capital Gains Distributions

Portfolio	Proportion	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Low TB	42.93	0.01	1.36	2.36	2.86	3.12	3.34
P2	14.24	0.84	2.73	3.29	3.60	3.68	3.72
P3	14.28	2.68	4.10	4.25	4.49	4.37	4.18
P4	14.30	5.08	5.25	5.07	4.88	4.77	4.47
High TB	14.25	11.01	6.99	6.06	5.71	5.09	4.64
High - Low		11.00	5.63***	3.70***	2.85***	1.97***	1.31***
			(0.57)	(0.47)	(0.44)	(0.31)	(0.30)

Panel C: Short-Term Capital Gains Distributions

Portfolio	Proportion	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Low TB	67.20	0.00	0.44	0.59	0.67	0.67	0.70
P2	8.17	0.16	0.58	0.73	0.62	0.65	0.63
P3	8.21	0.72	1.06	0.97	1.05	0.82	0.81
P4	8.23	1.79	1.63	1.39	1.24	1.18	1.01
High TB	8.19	5.62	2.90	2.33	1.97	1.61	1.43
High - Low		5.62	2.46***	1.74***	1.30***	0.94***	0.72***
			(0.33)	(0.27)	(0.22)	(0.19)	(0.19)

Panel D: Dividend Distributions

Portfolio	Proportion	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Low TB	32.88	0.02	0.12	0.13	0.15	0.18	0.18
P2	16.76	0.29	0.38	0.39	0.41	0.45	0.45
P3	16.79	0.79	0.79	0.78	0.75	0.73	0.71
P4	16.80	1.38	1.29	1.23	1.16	1.14	1.10
High TB	16.77	2.72	2.26	2.10	2.01	1.91	1.83
High - Low		2.71	2.15***	1.97***	1.85***	1.73***	1.65***
			(0.11)	(0.10)	(0.10)	(0.08)	(0.08)

Table 4: **Determinants of Tax Burden**

This table presents the determinants of the tax burden and the short- and long-term capital gains distributions. The regressions include time-fixed effects. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Tax Burden		Short-Term Capital Gains		Long-Term Capital Gains	
Size Score	−0.0911***	−0.1017***	−0.1938***	−0.1618***	−0.3828***	−0.4556***
	(0.0120)	(0.0121)	(0.0217)	(0.0210)	(0.0412)	(0.0400)
Value Score	0.1852***	0.2436***	0.3039***	0.2554***	−0.2619***	0.1606*
	(0.0266)	(0.0259)	(0.0396)	(0.0361)	(0.1005)	(0.0954)
Momentum Score	0.0223	−0.0074	0.2937***	0.0808*	−0.0026	0.1387
	(0.0258)	(0.0264)	(0.0453)	(0.0476)	(0.0893)	(0.0891)
Fund Flow		−0.0895***		−0.0294***		−0.3672***
		(0.0041)		(0.0063)		(0.0140)
Fund Flow Std. Dev.		0.0173***		−0.0061		0.0869***
		(0.0044)		(0.0075)		(0.0143)
Fund Age		0.0223		−0.0289		0.1330***
		(0.0141)		(0.0243)		(0.0500)
Log Fund Size		0.0115*		0.0019		0.0579**
		(0.0067)		(0.0089)		(0.0259)
Turnover		0.0456***		0.2562***		−0.2764***
		(0.0129)		(0.0391)		(0.0333)
Expense Ratio		−0.1046***		−0.0792**		0.3019***
		(0.0234)		(0.0354)		(0.0852)
ST CG Overhang		0.0402***		0.0721***		0.0721***
		(0.0038)		(0.0076)		(0.0073)
LT CG Overhang		0.0000		−0.0146***		0.0351***
		(0.0008)		(0.0011)		(0.0044)
Constant	0.8950***	0.7784***	−0.2569	0.4522*	5.5275***	2.8930***
	(0.1489)	(0.1541)	(0.2316)	(0.2463)	(0.5469)	(0.5396)
Observations	38,867	37,119	38,867	37,119	38,867	37,119
R-squared	0.0071	0.0534	0.0141	0.0691	0.0066	0.0731

Table 5: **Performance Predictability by Prior Tax Burden**

The table presents annual regressions of before-tax returns, after-tax returns, and tax burdens on the average tax burden over the prior three years and on additional lagged control variables. The returns are measured in excess of the market return. The regressions include time- and style-fixed effects. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Before Tax Return		After Tax Return		Tax Burden	
Tax Burden	-0.3347^{***}	-0.4701^{***}	-0.7364^{***}	-0.8393^{***}	0.4017^{***}	0.3692^{***}
	(0.0909)	(0.0933)	(0.0843)	(0.0866)	(0.0205)	(0.0206)
Return		0.0757^{***}		0.0576^{***}		0.0181^{***}
		(0.0091)		(0.0087)		(0.0016)
Expense Ratio		-1.2867^{***}		-1.2707^{***}		-0.0160
		(0.1338)		(0.1319)		(0.0181)
Log(TNA)		-0.1561^{***}		-0.1708^{***}		0.0147^{***}
		(0.0320)		(0.0321)		(0.0047)
Age		-0.1321		-0.0501		-0.0820^{***}
		(0.0871)		(0.0849)		(0.0124)
Turnover		-0.0228		-0.0432		0.0204^{**}
		(0.1226)		(0.1183)		(0.0096)
Flow		-0.3168^{***}		-0.2361^{***}		-0.0807^{***}
		(0.0260)		(0.0262)		(0.0035)
Constant	11.2417^{***}	13.4104^{***}	10.4130^{***}	12.5802^{***}	0.8288^{***}	0.8302^{***}
	(0.2216)	(0.3633)	(0.2178)	(0.3535)	(0.0300)	(0.0527)
Observations	37,427	35,412	37,427	35,412	37,427	35,412
R-squared	0.0147	0.0315	0.0158	0.0276	0.0795	0.1216

Table 6: **Performance Predictability by Prior Tax Burden at Different Horizons**
The table presents annual regressions of before-tax returns, after-tax returns, and tax burdens on the average tax burden over the prior one and five years and on additional lagged control variables. The returns are measured in excess of the market return. The regressions include time- and style-fixed effects. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Before Tax Return		After Tax Return		Tax Burden	
Tax Burden Prior Year	−0.3775***		−0.3775***		0.3055***	
	(0.0591)		(0.0591)		(0.0170)	
Tax Burden Prior 5 Years		−0.4634***		−0.8334***		0.3700***
		(0.0883)		(0.0876)		(0.0220)
Return	0.0822***	0.0717***	0.0822***	0.0538***	0.0153***	0.0179***
	(0.0079)	(0.0077)	(0.0079)	(0.0078)	(0.0015)	(0.0016)
Expense Ratio	−1.1966***	−1.2595***	−1.1966***	−1.2644***	−0.0299	0.0050
	(0.1286)	(0.1295)	(0.1286)	(0.1277)	(0.0185)	(0.0207)
Log(TNA)	−0.1478***	−0.1101***	−0.1478***	−0.1307***	0.0096**	0.0207***
	(0.0318)	(0.0313)	(0.0318)	(0.0314)	(0.0048)	(0.0052)
Age	−0.2532***	−0.1195	−0.2532***	−0.0395	−0.0349***	−0.0801***
	(0.0808)	(0.0886)	(0.0808)	(0.0869)	(0.0114)	(0.0148)
Turnover	−0.0324	−0.1293	−0.0324	−0.1456	0.0382**	0.0162
	(0.1144)	(0.1280)	(0.1144)	(0.1213)	(0.0171)	(0.0104)
Flow	−0.2925***	−0.2762***	−0.2925***	−0.1796***	−0.0634***	−0.0965***
	(0.0252)	(0.0263)	(0.0252)	(0.0265)	(0.0034)	(0.0041)
Constant	13.3182***	9.6810***	13.3182***	9.1788***	0.8446***	0.5022***
	(0.3524)	(0.3030)	(0.3524)	(0.3011)	(0.0518)	(0.0546)
Observations	36,666	31,084	36,666	31,084	36,666	31,084
R-squared	0.0311	0.0283	0.0311	0.0241	0.1369	0.1024

Table 7: **Performance Predictability by Prior Distribution Type**

The table presents annual regressions of before-tax returns, after-tax returns, and tax burdens on the average long-term gains, the short-term gains, and the dividend distributions over the prior three years and on additional lagged control variables. The returns are measured in excess of the market return. The regressions include time- and style-fixed effects. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Before Tax Return		After Tax Return		Tax Burden	
Long-Term Gains	-0.1337^{***}	-0.1717^{***}	-0.2382^{***}	-0.2688^{***}	0.1045^{***}	0.0971^{***}
	(0.0212)	(0.0195)	(0.0208)	(0.0193)	(0.0034)	(0.0035)
Short-Term Gains	0.0097	-0.0069	-0.0956	-0.1012^{*}	0.1052^{***}	0.0943^{***}
	(0.0695)	(0.0691)	(0.0585)	(0.0589)	(0.0186)	(0.0177)
Dividends	-0.1421^{**}	-0.3801^{***}	-0.2537^{***}	-0.4889^{***}	0.1116^{***}	0.1087^{***}
	(0.0711)	(0.0676)	(0.0700)	(0.0636)	(0.0154)	(0.0169)
Return		0.0741^{***}		0.0556^{***}		0.0185^{***}
		(0.0089)		(0.0086)		(0.0016)
Expense Ratio		-1.4513^{***}		-1.4413^{***}		-0.0101
		(0.1368)		(0.1347)		(0.0202)
Log(TNA)		-0.1617^{***}		-0.1760^{***}		0.0143^{***}
		(0.0320)		(0.0321)		(0.0046)
Age		-0.0662		0.0293		-0.0955^{***}
		(0.0829)		(0.0822)		(0.0117)
Turnover		-0.0870		-0.1263		0.0392^{***}
		(0.1132)		(0.1066)		(0.0130)
Flow		-0.3326^{***}		-0.2561^{***}		-0.0765^{***}
		(0.0260)		(0.0260)		(0.0035)
Constant	10.3419^{***}	12.6934^{***}	9.5771^{***}	11.9951^{***}	0.7648^{***}	0.6983^{***}
	(0.2050)	(0.3665)	(0.2028)	(0.3577)	(0.0337)	(0.0574)
Observations	37,427	35,412	37,427	35,412	37,427	35,412
R-squared	0.0155	0.0331	0.0172	0.0299	0.0826	0.1247

Table 8: **Performance Decomposition by Tax Burden**

The table presents annual regressions of the Characteristic Selectivity (CS), the Characteristic Timing (CT), the Average Style (AS), the Expense Ratio (EXP), the Return Gap (RG), and Trading Costs (TC) on the average tax burden over the prior three years and on additional lagged control variables. The CS, CT, and AS measures are based on Daniel, Grinblatt, Titman, and Wermers (1997), the RG measure is based on Kacperczyk, Sialm, and Zheng (2008), and the TC measure is estimated following Edelen, Evans, and Kadlec (2013). The various performance measures are annualized. The regressions include time- and style-fixed effects. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Portfolio	Characteristic Selectivity		Characteristic Timing		Average Style		Expense Ratio		Return Gap		Trading Costs	
Tax Burden	−0.2011***	−0.2887***	−0.0604*	−0.0729**	−0.0555	−0.1065*	−0.0223***	−0.0002	−0.0005	0.0054	0.1852***	0.1337***
	(0.0560)	(0.0570)	(0.0331)	(0.0340)	(0.0591)	(0.0589)	(0.0049)	(0.0009)	(0.0588)	(0.0586)	(0.0123)	(0.0139)
Return		0.0565***		0.0174***		0.0097**		−0.0008***		−0.0140**		−0.0034***
		(0.0075)		(0.0034)		(0.0049)		(0.0001)		(0.0058)		(0.0007)
Expense Ratio		−0.0165		−0.1655***		−0.1109		0.9425***		0.0332		0.2720***
		(0.0959)		(0.0529)		(0.0783)		(0.0059)		(0.0752)		(0.0328)
Log(TNA)		−0.0734***		−0.0106		−0.0255		−0.0054***		0.0178		0.1129***
		(0.0238)		(0.0147)		(0.0207)		(0.0005)		(0.0181)		(0.0079)
Age		0.0286		−0.0013		−0.0929*		0.0067***		−0.0850*		−0.0940***
		(0.0602)		(0.0375)		(0.0535)		(0.0014)		(0.0462)		(0.0177)
Turnover		0.1815***		0.0900**		0.0437		0.0084***		−0.0378		0.4844***
		(0.0542)		(0.0369)		(0.0370)		(0.0018)		(0.0704)		(0.0474)
Flow		−0.1105***		−0.0223**		−0.1161***		−0.0045***		−0.0123		−0.0067**
		(0.0184)		(0.0096)		(0.0168)		(0.0004)		(0.0146)		(0.0032)
Constant	1.5464***	0.0751	0.3362***	0.3449***	11.6530***	9.3127***	0.9085***	0.0801***	−0.1108	0.0466	2.4425***	−0.4301***
	(0.1465)	(0.2080)	(0.0781)	(0.1278)	(0.1499)	(0.1812)	(0.0239)	(0.0088)	(0.0854)	(0.2137)	(0.0527)	(0.0672)
Observations	36,913	34,562	36,913	34,562	36,913	34,562	36,061	34,560	34,421	33,220	36,913	34,562
R-squared	0.0037	0.0118	0.0073	0.0116	0.0261	0.0406	0.0730	0.9348	0.0018	0.0032	0.3582	0.4837

Table 9: **Abnormal Performance Predictability by Prior Tax Burden**

The table presents annual regressions of before-tax alphas, after-tax alphas, and tax burden alphas on the average tax burden over the prior three years and on additional lagged control variables. The alphas are based on the CAPM, the three-factor model of Fama and French (1993), the four-factor model of Carhart (1997), the five-factor model of Fama and French (2015), and the excess return and the value added of Berk and Van Binsbergen (2015). The abnormal returns are estimated as the regression intercepts at an annual frequency using daily data. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Before Tax Alpha		After Tax Alpha		Difference	
Raw Returns	-0.3347^{***}	-0.4701^{***}	-0.7364^{***}	-0.8393^{***}	0.4017^{***}	0.3692^{***}
	(0.0909)	(0.0933)	(0.0843)	(0.0866)	(0.0205)	(0.0206)
CAPM	-0.3473^{***}	-0.4477^{***}	-0.7313^{***}	-0.8095^{***}	0.3841^{***}	0.3618^{***}
	(0.0918)	(0.0902)	(0.0841)	(0.0829)	(0.0258)	(0.0251)
Fama-French 3 Factor	-0.2583^{***}	-0.3419^{***}	-0.6205^{***}	-0.6845^{***}	0.3623^{***}	0.3426^{***}
	(0.0831)	(0.0754)	(0.0745)	(0.0673)	(0.0214)	(0.0206)
Carhart 4 Factor	-0.2897^{***}	-0.3673^{***}	-0.6448^{***}	-0.7031^{***}	0.3551^{***}	0.3358^{***}
	(0.0814)	(0.0763)	(0.0731)	(0.0687)	(0.0206)	(0.0196)
Fama-French 5 Factor	-0.1444^{*}	-0.2013^{***}	-0.5063^{***}	-0.5431^{***}	0.3618^{***}	0.3418^{***}
	(0.0871)	(0.0768)	(0.0791)	(0.0712)	(0.0219)	(0.0211)
Berk-Binsbergen Alpha	-0.2392^{***}	-0.2776^{***}	-0.5993^{***}	-0.6223^{***}	0.3600^{***}	0.3447^{***}
	(0.0850)	(0.0756)	(0.0731)	(0.0656)	(0.0249)	(0.0240)
Berk-Binsbergen Value Added	-2.4186^{**}	-3.1901^{***}	-4.8163^{***}	-4.0616^{***}	2.3977^{***}	0.8716^{**}
	(1.0347)	(1.0179)	(1.0925)	(1.0334)	(0.4486)	(0.3575)
Controls	No	Yes	No	Yes	No	Yes

Table 10: **Performance Predictability by Prior Tax Burden and Fund Style**

The table presents annual regressions of before-tax returns, after-tax returns, and tax burdens on the average tax burden over the prior three years, the lagged style scores, and on additional lagged control variables. The style scores are based on quintile scores of the market capitalization, the book-to-market ratio, and the prior-year return of the holdings of the funds. The returns are measured in excess of the market return. The regressions include time-fixed effects. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Before Tax Return			After Tax Return			Tax Burden		
Tax Burden	−0.3525***	−0.3532***	−0.4830***	−0.7660***	−0.7656***	−0.8592***	0.4135***	0.4125***	0.3763***
	(0.0876)	(0.0813)	(0.0894)	(0.0808)	(0.0771)	(0.0859)	(0.0200)	(0.0171)	(0.0171)
Size Score	−1.2290***	−1.2136***	−1.2306***	−1.1642***	−1.1274***	−1.1664***	−0.0648***	−0.0862***	−0.0642**
	(0.0554)	(0.1134)	(0.1167)	(0.0539)	(0.0970)	(0.0998)	(0.0085)	(0.0272)	(0.0276)
Value Score	1.2469***	1.3283***	1.3738***	1.1557***	1.3222***	1.3647***	0.0912***	0.0061	0.0091
	(0.1395)	(0.1848)	(0.1937)	(0.1389)	(0.1862)	(0.1940)	(0.0195)	(0.0274)	(0.0291)
Momentum Score	−0.3271**	−0.2798	−0.2992	−0.3575**	−0.2417	−0.2277	0.0305*	−0.0381	−0.0715***
	(0.1628)	(0.2119)	(0.2283)	(0.1612)	(0.2102)	(0.2257)	(0.0177)	(0.0238)	(0.0263)
TB x Size		−0.0132	−0.0282		−0.0310	−0.0373		0.0178	0.0091
		(0.1045)	(0.1014)		(0.0847)	(0.0832)		(0.0262)	(0.0250)
TB x Value		−0.0762	−0.1355		−0.1567	−0.2090		0.0805***	0.0735***
		(0.1395)	(0.1385)		(0.1392)	(0.1384)		(0.0225)	(0.0224)
TB x Momentum		−0.0431	−0.0901		−0.1034	−0.1466		0.0603***	0.0566***
		(0.1208)	(0.1214)		(0.1202)	(0.1206)		(0.0205)	(0.0195)
Return			0.0753***			0.0573***			0.0181***
			(0.0092)			(0.0089)			(0.0017)
Expense Ratio			−1.2131***			−1.2092***			−0.0040
			(0.1283)			(0.1264)			(0.0174)
Log(TNA)			−0.1454***			−0.1608***			0.0155***
			(0.0314)			(0.0316)			(0.0046)
Age			−0.1379			−0.0628			−0.0751***
			(0.0875)			(0.0862)			(0.0111)
Turnover			−0.0172			−0.0365			0.0193*
			(0.1406)			(0.1354)			(0.0102)
Flow			−0.3011***			−0.2215***			−0.0796***
			(0.0255)			(0.0257)			(0.0035)
Constant	9.0982***	9.1014***	11.1723***	8.4282***	8.4334***	10.5244***	0.6700***	0.6679***	0.6479***
	(0.1037)	(0.1005)	(0.3092)	(0.0983)	(0.0963)	(0.2975)	(0.0217)	(0.0201)	(0.0487)
Observations	36,681	36,681	35,108	36,681	36,681	35,108	36,681	36,681	35,108
R-squared	0.0191	0.0191	0.0340	0.0204	0.0205	0.0303	0.0942	0.0953	0.1312

Table 11: **Performance Predictability by Prior Tax Burden and DC Ratio**
The table presents annual regressions of before-tax returns, after-tax returns, and tax burdens on the average tax burden over the prior three years, the lagged DC ratio, and on additional lagged control variables. The DC ratio captures the proportion of assets held in Defined Contribution (DC) plans according to the surveys by *Pensions & Investments*. The returns are measured in excess of the market return. The regressions include time- and style-fixed effects. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Before Tax Return		After Tax Return		Tax Burden	
Tax Burden	−0.3399	−0.4278	−0.6990***	−0.7515***	0.3592***	0.3237***
	(0.2618)	(0.2644)	(0.2624)	(0.2661)	(0.0458)	(0.0423)
DC Ratio	0.2531	0.2578	0.2769	0.2669	−0.0237	−0.0090
	(0.2983)	(0.2961)	(0.2982)	(0.2994)	(0.0690)	(0.0657)
TB x DC Ratio	−0.1203	−0.0493	−0.1503	−0.0351	0.0300	−0.0142
	(0.3541)	(0.3552)	(0.3509)	(0.3549)	(0.0658)	(0.0619)
Return		0.0695***		0.0460**		0.0234***
		(0.0185)		(0.0193)		(0.0041)
Expense Ratio		−0.9121**		−0.7718**		−0.1403**
		(0.3741)		(0.3718)		(0.0607)
Log(TNA)		−0.4101***		−0.4078***		−0.0023
		(0.0967)		(0.0969)		(0.0126)
Age		−0.1572		−0.1097		−0.0475**
		(0.2324)		(0.2335)		(0.0241)
Turnover		−0.3274		−0.3141		−0.0133
		(0.3039)		(0.3143)		(0.0288)
Flow		−0.3949***		−0.3020***		−0.0929***
		(0.0727)		(0.0720)		(0.0107)
Observations	5,500	5,456	5,500	5,456	5,500	5,456
R-squared	0.0230	0.0380	0.0200	0.0292	0.0925	0.1539

Table 12: **Performance of Tax Burden Portfolios by Subperiod**

The table presents annual regressions of before-tax returns, after-tax returns, and tax burdens on the average tax burden over the prior three years and on additional lagged control variables for two subperiods (1990-2002 and 2003-2016). The returns are measured in excess of the market return. The regressions include time- and style-fixed effects. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

	Before Tax Return		After Tax Return		Tax Burden	
	1990-2002	2003-2016	1990-2002	2003-2016	1990-2002	2003-2016
Tax Burden	−0.6462***	−0.3386***	−0.9018***	−0.8190***	0.2556***	0.4804***
	(0.1476)	(0.0828)	(0.1346)	(0.0862)	(0.0333)	(0.0168)
Return	0.1599***	−0.0936***	0.1360***	−0.1019***	0.0239***	0.0084***
	(0.0128)	(0.0088)	(0.0122)	(0.0087)	(0.0023)	(0.0010)
Expense Ratio	−1.4538***	−1.1130***	−1.3178***	−1.1678***	−0.1360***	0.0548***
	(0.2774)	(0.1334)	(0.2765)	(0.1342)	(0.0405)	(0.0178)
Log(TNA)	−0.5128***	0.0328	−0.5063***	0.0065	−0.0065	0.0263***
	(0.0781)	(0.0312)	(0.0778)	(0.0315)	(0.0097)	(0.0050)
Age	−0.1135	0.0286	−0.0431	0.0989	−0.0704***	−0.0703***
	(0.1564)	(0.0858)	(0.1520)	(0.0863)	(0.0254)	(0.0118)
Turnover	0.0513	−0.0538	−0.0466	−0.0490	0.0979***	−0.0047
	(0.2248)	(0.1391)	(0.2310)	(0.1392)	(0.0291)	(0.0054)
Flow	−0.6686***	−0.0315	−0.5305***	0.0078	−0.1381***	−0.0393***
	(0.0541)	(0.0228)	(0.0544)	(0.0231)	(0.0066)	(0.0032)
Constant	12.5957***	10.0286***	11.2224***	9.7163***	1.3732***	0.3123***
	(0.8229)	(0.2902)	(0.8091)	(0.2915)	(0.1283)	(0.0407)
Observations	11,751	23,661	11,751	23,661	11,751	23,661
R-squared	0.0647	0.0376	0.0534	0.0386	0.1373	0.1357

Table 13: **Performance of Self-Designated Tax-Efficient Funds**

This table presents the average annualized before-tax returns, after-tax returns, and tax burdens of self-designated tax-efficient funds and other funds matched by name or by fund characteristics. The standard errors are clustered by fund and are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Funds Matched to Funds in Same Family with Similar Name

	Before Tax Return	After Tax Return	Tax Burden
Tax-Efficient Funds	0.2794	−0.2307	0.5048***
	(0.7086)	(0.7110)	(0.1080)
Matched Funds	−0.0489	−2.1782*	2.1106***
	(0.9845)	(1.1733)	(0.6640)
Difference	0.3283	1.9475**	−1.6059**
	(0.5263)	(0.9201)	(0.6688)

Panel B: Funds Matched to Funds in Same Family with Most Similar Style

	Before Tax Return	After Tax Return	Tax Burden
Tax-Efficient Funds	−0.2875	−0.5927	0.3052***
	(0.4676)	(0.4587)	(0.0425)
Matched Funds	−0.3148	−1.3990***	1.0842***
	(0.4564)	(0.4196)	(0.1175)
Difference	0.0273	0.8063***	−0.7790***
	(0.2450)	(0.2576)	(0.1002)

Panel C: Funds Matched to Funds in Same Family with Most Similar Size and Style

	Before Tax Return	After Tax Return	Tax Burden
Tax-Efficient Funds	−0.0010	−0.3238	0.3228***
	(0.4749)	(0.4687)	(0.0445)
Matched Funds	−0.0597	−1.1703***	1.1106***
	(0.4367)	(0.4310)	(0.1568)
Difference	0.0587	0.8464***	−0.7877***
	(0.2358)	(0.3095)	(0.1483)

Figure 1: **Before- and After-Tax Returns**
The figure depicts the before- and after-tax returns of the two investment options at different aggregate portfolio allocation levels.

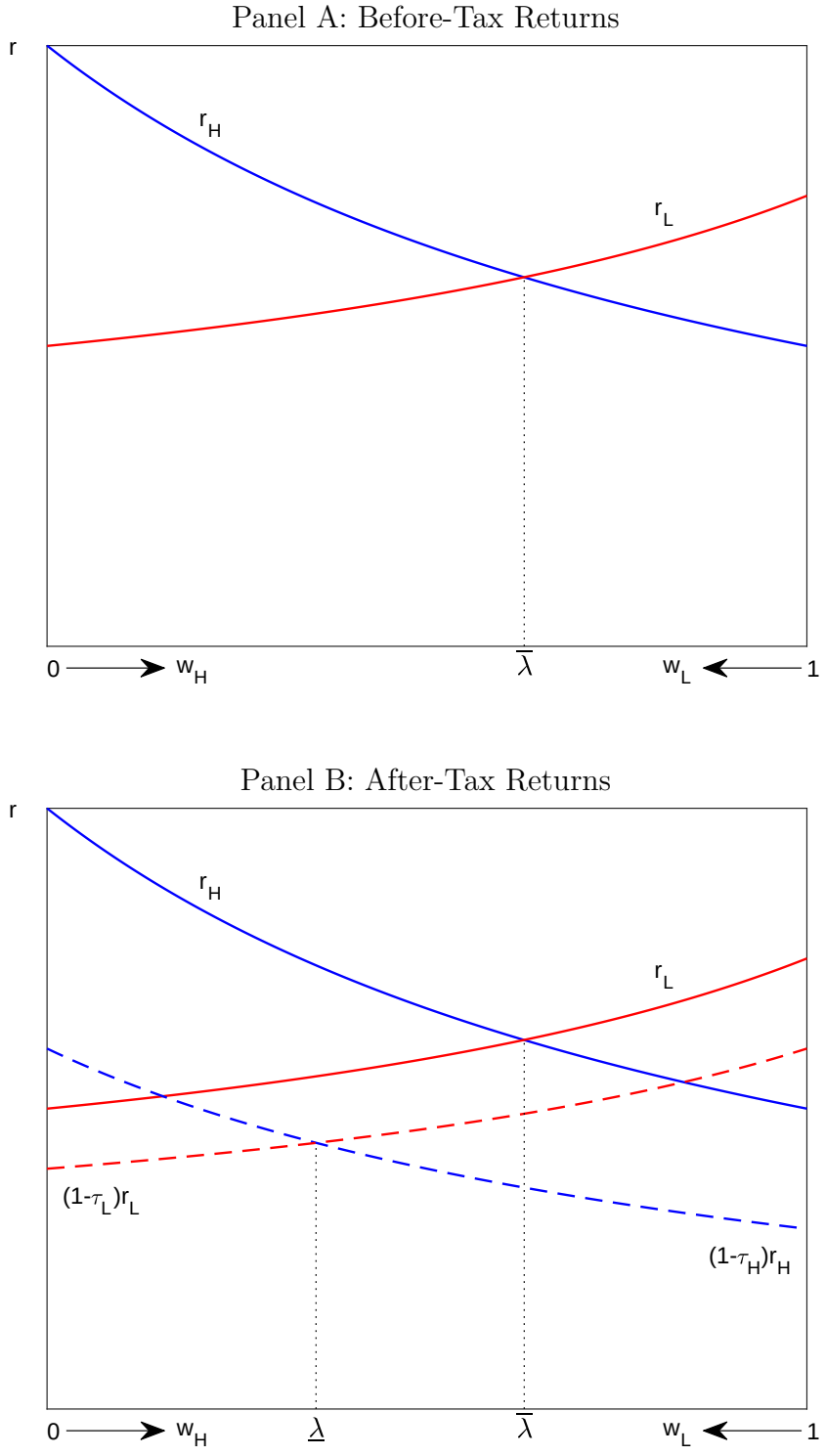
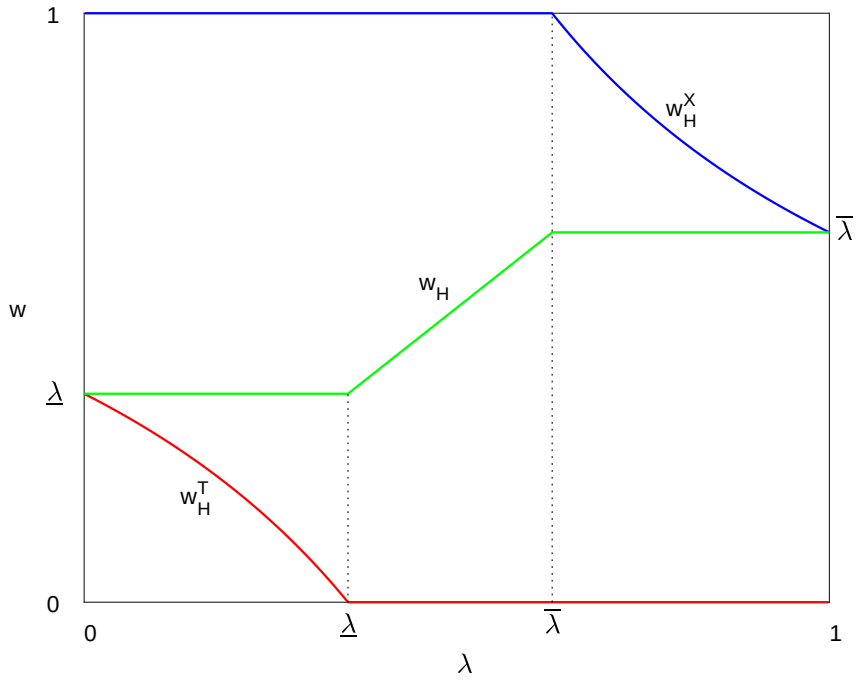


Figure 2: **Equilibrium Portfolio Allocations and Returns**
The figure depicts the equilibrium portfolio allocations and the equilibrium before- and after-tax returns at different distributions of tax clienteles.

Panel A: Equilibrium Portfolio Allocations



Panel B: Equilibrium Before- and After-Tax Returns

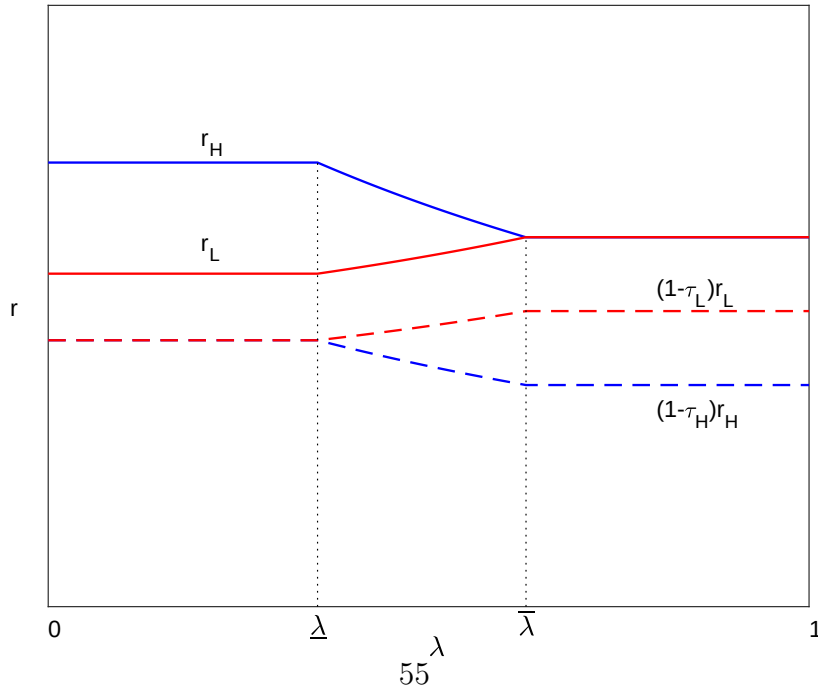


Figure 3: **Average Fund Distributions**
The figure depicts the average distributions of dividends, short- and long-term capital gains by U.S. equity mutual funds.

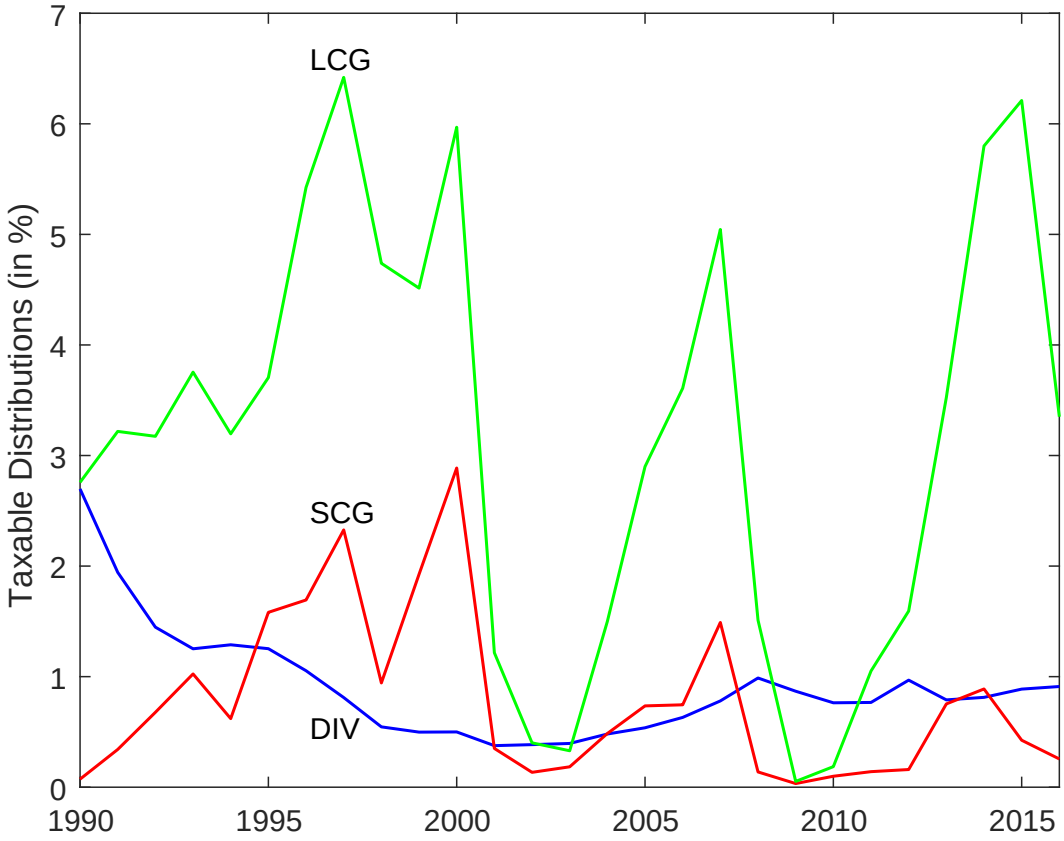


Figure 4: **Marginal Tax Rates**
The figure depicts the top marginal tax rates on qualified dividends, short-term capital gains, and long-term capital gains over our sample period.

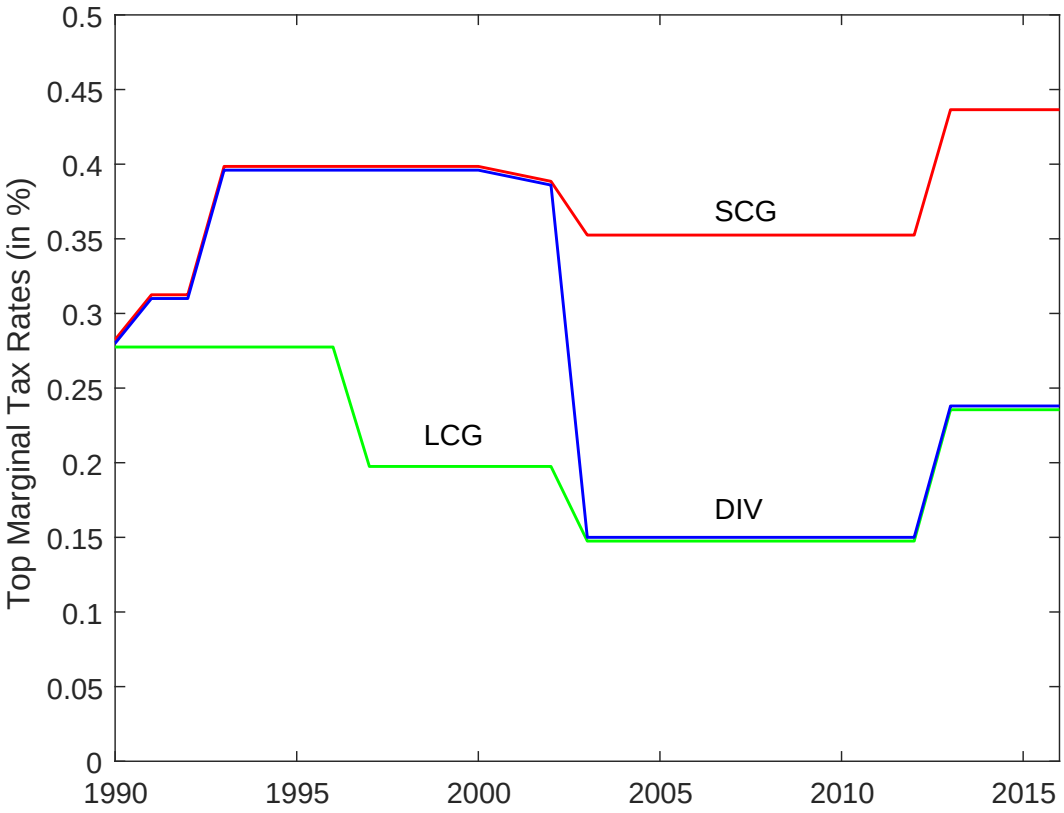


Figure 5: **Tax Burdens**
The figure depicts the first quartile, the median, and the third quartile of the tax burdens over our sample period.

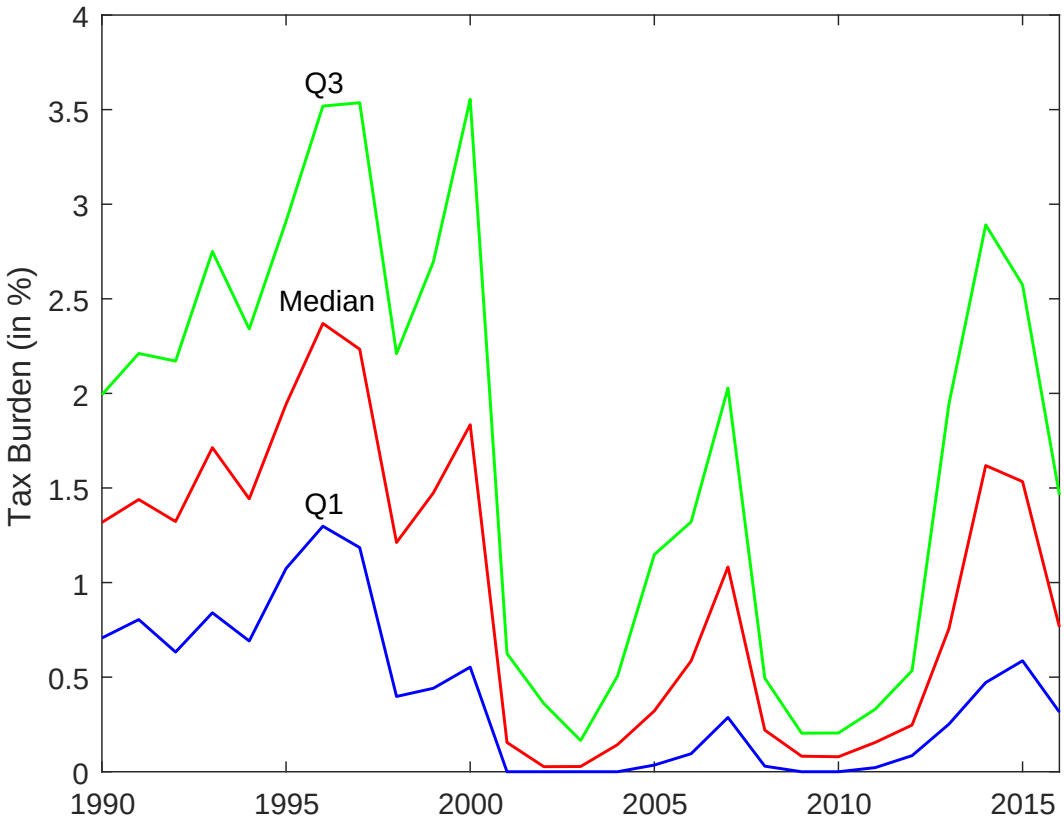


Figure 6: **Cumulative Buy-and-Hold Returns Before and After Taxes (1990-2012)** Panels A and B depict the cumulative buy-and-hold returns before and after taxes for funds in the highest and lowest average tax burden quintiles over the whole sample period.