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ABSTRACT

Investment taxes have a substantial impact on the performance of taxable mutual fund investors. Mutual funds can reduce the tax burdens of their shareholders by avoiding securities that are heavily taxed and by avoiding realizing capital gains that trigger higher tax burdens to the funds' investors. Such tax avoidance strategies constrain the investment opportunities of the mutual funds and might reduce their before-tax performance. Our paper empirically investigates the costs and benefits of tax-efficient asset management based on U.S. equity mutual funds. We find that mutual funds that follow tax-efficient asset management strategies generate superior after-tax returns. Surprisingly, more tax-efficient mutual funds do not underperform other funds before taxes, indicating that the constraints imposed by tax-efficient asset management do not have significant performance consequences.

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1 Introduction

Investment taxes have a substantial impact on the long-term performance of taxable mutual fund investors. U.S. mutual funds are required to distribute their dividend income and their realized capital gains to their shareholders at an annual frequency. Taxable mutual fund investors need to pay taxes on these mutual fund distributions even if they do not liquidate their mutual fund positions and continue to hold the funds for the long-term. Mutual funds can reduce the tax burdens of their shareholders by avoiding securities that are heavily taxed and by avoiding realizing capital gains that trigger higher tax burdens to the funds' investors. Such tax avoidance strategies, however, constrain the investment choices of the mutual funds and might reduce their before-tax performance. Our paper empirically investigates the costs and benefits of tax-efficient asset management based on U.S. equity mutual funds.

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. In addition, stocks with high dividend yields also face relatively high tax burdens, especially prior to the 2003 tax reforms, when dividends were taxed at substantially higher rates than long-term capital gains.

Mutual funds can reduce the tax burdens of their investors by avoiding stocks with high dividend yields, by avoiding the realization of capital gains, and by accelerating the realization of capital losses, as discussed by Bergstresser and Poterba (2002). However, it is not clear whether tax-efficient asset management substantially reduces before-tax performance. Tax avoidance strategies might be costly because they constrain funds' investment strategies and thereby reduce these funds' before-tax performance. On the other hand, tax-efficient

asset management strategies might not only reduce the tax burdens of investors, they might generate lower trading costs or superior investment performance before taxes. For example, tax-efficient investment strategies exhibit relatively low turnovers 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). Overall, on an after-tax basis, it is not clear whether tax efficiency leads to better or worse performance either. Our paper aims to investigate the implications of tax-efficient asset management on subsequent fund performance both before- and after adjusting for taxes.

To empirically address the costs and benefits of tax-efficient asset management, we use data on a comprehensive sample of U.S. equity mutual funds between 1990 and 2012. 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 1.12% of their investment value per year. This average tax burden is similar in size to fund expenses, which have recently received substantial attention (French (2008)). Furthermore, the variation in the tax burden differs substantially across funds. Large cross-sectional differences in tax burdens can have substantial impact on investment performance. For example, a $10,000 investment in 1990 in the most tax-efficient decile of domestic equity mutual funds would have accumulated to $48,818 in 2012 after taking into account taxes on dividend and capital gains distributions. On the other hand, an equal investment in the least tax-efficient decile of domestic equity funds would have accumulated to only $37,850 after taxes.

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

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

Due to the persistence of the tax burden, fund investors can increase their future *after-tax* performance by avoiding funds with high prior tax burdens. For example, funds in the lowest tax burden quintile over the previous three years exhibit excess returns of -0.19% over the subsequent year after taxes, whereas funds in the highest tax burden quintile exhibit excess returns of -2.29% after taxes. The after-tax performance results are not affected qualitatively if we adjust the returns for common factors or if we control for other fund characteristics.

Surprisingly, we do not find that the *before-tax* performance of funds deteriorates as they become more tax efficient. Indeed, funds in the lowest tax burden quintile over the previous three years outperform funds in the highest tax burden quintile by 0.91% in the subsequent year. Thus, our results indicate that tax-efficient asset management strategies, as practiced by U.S. equity mutual funds between 1990 and 2012, did not have negative performance consequences. This result can be explained primarily by the lower trading costs and by the superior investment ability of tax-efficient mutual funds.

Our paper is related to a small literature that investigates the tax implications of mutual fund management. Dickson and Shoven (1995) compare the rankings of mutual funds based on their before- and after-tax performance and argue that investment taxes should 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. 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 consequences of tax-efficient asset management.

The remainder of this paper is structured as follows. Section 2 summarizes the data sources, defines the tax burden, and reports summary statistics. Section 3 estimates the key determinants of the tax burdens of mutual funds. Section 4 investigates whether the tax efficiency of a mutual funds is related to the before- and after-tax performance of U.S. equity mutual funds.

2 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.

2.1 Data Sources

Our data covers U.S. equity mutual funds over the period between 1990 and 2012 based on the CRSP Survivorship Bias Free Mutual Fund database.[1] 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

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

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 414,393 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).[2]

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 (as of December 31st of the year prior to the survey date) 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).[3]

[2]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).

[3]We thank David Klein from *Pensions & Investments* for providing us with the survey data. 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 (2014).

2.2 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, $P_{f,t} - P_{f,t-1}$:

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

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 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:

$$\begin{aligned} R_{f,t}^{AT} &= (1 - \tau_t^{DIV})Y_{f,t}^{DIV} + (1 - \tau_t^{SCG})Y_{f,t}^{SCG} + (1 - \tau_t^{LCG})Y_{f,t}^{LCG} + Y_{f,t}^{UCG} \\ &= R_{f,t}^{BT} - \tau_t^{DIV}Y_{f,t}^{DIV} - \tau_t^{SCG}Y_{f,t}^{SCG} - \tau_t^{LCG}Y_{f,t}^{LCG}, \end{aligned} \tag{2}$$

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):

$$TB_{f,t} = R_{f,t}^{BT} - R_{f,t}^{AT} = \tau_t^{DIV}Y_{f,t}^{DIV} + \tau_t^{SCG}Y_{f,t}^{SCG} + \tau_t^{LCG}Y_{f,t}^{LCG}. \tag{3}$$

The tax burden corresponds to the tax cost of a mutual fund's distributions relative to the fund's net asset value.[4] 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).

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 more. Taxes are not taken into account for non-taxed returns of capital.[5] 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.[6]

Figure 1 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

[4]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 $R^{AT}_{f,t} = 0.17 - 0.3 \times 0.02 - 0.2 \times 0.05 = 15.4\%$. The tax burden of fund f in month t equals the difference between the before- and the after-tax returns: $TB = 0.3 \times 0.02 + 0.2 \times 0.05 = 1.6\%$.

[5]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.

[6]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).

Michaely (2003). Capital gains distributions are cyclical and are substantial in the late 1990s and the mid 2000s. Capital gains distributions are small in the early and late 2000s.

We use the NBER average marginal tax rates on dividends and short- and long-term capital gains to compute the tax burden. The tax rates are defined as the weighted averages of the marginal tax rates of investors in different income brackets, where the weights correspond to the declared amounts of dividends and capital gains. The tax rates include both federal and state taxes. Figure 2 summarizes the time-series variation in the average marginal dividend and capital gains tax rates since 1990. 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 to 15%.

Figure 3 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 3.90%.

2.3 Summary Statistics

Table 1 summarizes the distributions of the main variables. The mean tax burden over our sample equals 1.12% and ranges between 0.05% at the first quartile to 1.70% 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 (2014)). Furthermore, the standard deviation of the tax burden of 1.58% per year is substantially larger than the standard deviation of the expense ratio of 0.49%, 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 17% and 19% 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 1.21% and exhibit a turnover ratio of 88%. The median fund manages $210 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 ($R_{f,t}$):

$$FLOW_{f,t} = \frac{TNA_{f,t} - TNA_{f,t-1}(1 + R_{f,t})}{TNA_{f,t-1}(1 + R_{f,t})}. \tag{4}$$

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 0.81% per month. The average time-series standard deviation of the flow of a fund over the prior 12 months equals 2.84%.

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 lagged

one-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 1.80% and 10.27%, respectively.

2.4 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 around 1% and 5% 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 might exhibit lower portfolio turnover, since they 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 especially low for exchange-traded funds, which exhibit very low capital gains distributions.

Tax-managed and exchange-traded funds are recent financial innovations and their capital gains distributions are lower due to the fact that most of their observations are concentrated later in our sample when stock returns are relatively low. To address this concern we compare matched samples of funds over identical time periods. Tax-managed funds are matched to non-tax-managed funds in the same fund families by their size, value, and momentum scores. The average tax burden of tax-managed funds amounts to 0.27%, whereas the average tax burden of matched non-tax-managed funds amounts to 0.94%. On the other hand, the average before-tax return is very similar for tax-managed funds and non-tax-managed funds (0.27% vs. 0.26% per month). Whereas the differences in the tax burdens and the differences in the after-tax returns between matched fund pairs are statistically significant, the difference in before-tax returns between matched fund pairs is not statistically significantly.

Exchange-traded funds are matched to open-ended index funds that follow the same benchmark index. The average tax burden equals 0.34% for exchange-traded funds and 0.65% for matched open-ended index funds. The difference in the tax burden is statistically significant. On the other hand, the average before-tax return is not significantly different between exchange-traded funds and matched open-ended index funds (0.50% vs. 0.51% per month).

2.5 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 persistent 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. For example, 69% 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 until 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.[7]

[7]Harris, Hartzmark, and Solomon (2014) document that a small number of funds artificially increase their dividends by purchasing stocks before dividend payments to attract investor clienteles who demand high dividends. These strategies are costly since they create higher turnover and increased taxes for fund investors.

2.6 Relevance of Taxes

To illustrate the relevance of taxes for long-term fund investors, we compute the cumulative buy-and-hold returns before and after taxes for mutual funds with different average tax burdens over our whole time period (1990-2012). In a first step, we collect a time-series of fund histories for the sample of funds that existed at the beginning of 1990. If a fund existed for the whole time period, then we retain its whole history until 2012. If a fund is discontinued and its assets are merged into another fund, then we replace the missing observations with the observations of the acquiring fund. If a fund is discontinued and the remaining funds are distributed to the shareholders as a liquidating distribution, then we tax the distributions according to their specific type and reinvest the assets in a non-included fund that has the same objective code and the most similar prior tax burden to the defunct fund. In a second step, we compute the average tax burden for each mutual fund over the whole time period from 1990 to 2012. In a third step, we rank funds into deciles by their average tax burdens.

To compare the long-term tax costs of investing in different funds, we report in Panels A and B of Figure 4 the cumulative before- and after-tax buy-and-hold returns (BHR) of funds ranked in the highest and the lowest average tax burden deciles. 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 ($BHR^{BT}_{f,1989} = BHR^{AT}_{f,1989} = 1$):

$$BHR^{BT}_{f,t} = BHR^{BT}_{f,t-1}\left(1 + R^{BT}_{f,t}\right), \tag{5}$$

$$BHR^{AT}_{f,t} = BHR^{AT}_{f,t-1}\left(1 + R^{AT}_{f,t}\right). \tag{6}$$

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 ($(1-\tau_t^{DIV})Y_{f,t}^{DIV} + (1-\tau_t^{SCG})Y_{f,t}^{SCG} + (1-\tau_t^{LCG})Y_{f,t}^{LCG}$). 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.[8] The cumulative fund value after tax and liquidation BHR^{ATL} at time t captures the value of a fund investment that is held from the beginning of the sample and is liquidated at time t :

$$BHR^{ATL}_{f,t} = BHR^{AT}_{f,t} - \tau_t^{LCG}\left(BHR^{AT}_{f,t} - CB_{f,t}\right), \quad (7)$$

$$\begin{aligned} CB_{f,t} &= CB_{f,t-1} \\ &+ BHR^{AT}_{f,t-1}\left((1-\tau_t^{DIV})Y_{f,t}^{DIV} + (1-\tau_t^{SCG})Y_{f,t}^{SCG} + (1-\tau_t^{LCG})Y_{f,t}^{LCG}\right). \end{aligned} \quad (8)$$

Figure 4 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 similar for the two extreme deciles. A one dollar tax-exempt investment at the beginning of 1990 would have accumulated in December 2012 to \$5.89 for the most tax-efficient decile and to \$5.58 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 \$4.88 for the tax-efficient decile and to just \$3.78 for the tax-inefficient decile. 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 \$4.88 to \$4.48 and decreases the value of the

[8] In reality, 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.

tax-inefficient investment only slightly from $3.78 to $3.70. However, the overall performance difference remains economically substantial across the two extreme tax burden deciles. As a benchmark, we depict in Panel C of Figure 4 the cumulative return of an investment in Vanguard's S&P 500 Index Fund. This fund exhibits a higher before-tax performance and a lower tax burden than the funds in the extreme tax burden deciles.

This example illustrates the importance of taxes for long-term taxable investors. In the remaining of the paper we will analyze more systematically the benefits and costs of tax-efficient asset management.[9]

3 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 benchmark indices. Similarly, value funds and contrarian funds also need to liquidate stocks that exhibited high recent performance as the underlying stocks become growth stocks or momentum stocks. In addition, large-capitalization stocks and value stocks tend to have higher dividend yields, which increases 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

[9]This illustrative example does not represent an investable strategy since funds are ranked according to the average tax burden over the whole sample period. On the other hand, the results in Section 4 correspond to an investable strategy, since fund portfolios are formed solely based on prior information.

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.

To analyze the determinants of the tax burden, we run a panel regression of the tax burden or the fund distributions at time 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. The standard errors are clustered at the fund level. The regression specification is as follows:

$$\begin{aligned} TB_{f,t} &= \beta_1 SIZ_{f,t-1} + \beta_2 VAL_{f,t-1} + \beta_3 MOM_{f,t-1} + \beta_4 TURN_{f,t-1} \\ &+ \beta_5 EXP_{f,t-1} + \beta_6 LOG(TNA_{f,t-1}) + \beta_7 AGE_{f,t-1} + \beta_8 FLOW_{f,t-1} + \\ &+ \beta_9 FLOWVOL_{f,t-1} + \beta_9 SCGO_{f,t-1} + \beta_{10} LCGO_{f,t-1} + \beta_{0,t} + \epsilon_{f,t}. \end{aligned} \tag{9}$$

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 decreases the tax burden by between 0.08 and 0.11 percentage points, whereas a one-standard-deviation increase in the value score increases the tax burden by between 0.12 and 0.15 percentage points.

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

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 and a one-standard-deviation increase in the fund flow volatility increase the tax burdens by 0.29 and 0.05 percentage points, respectively.

Finally, the tax burden increases with the capital gains overhang, although the impact is relatively 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 0.50 percentage points, whereas a ten percentage point increase in the long-term capital gains overhang increases next year's tax burden by less than 0.05 percentage 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 in the future.

4 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 not significantly constrain investment decisions and might even 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 performance).

4.1 Tax Burden Portfolios

To investigage the relation between prior tax efficiency and subsequent before- and after-tax performance, we sort mutual funds in each month into five groups according to their average tax burdens over the prior one, three, and five years. The portfolios are formed monthly and weighted equally across funds. The portfolios are typically equally sized and correspond to quintile portfolios, except in periods where more than 20% of funds have zero tax burdens. In such periods we group the zero tax burden funds into the low tax burden portfolio and

divide the remaining mutual funds equally across the other four portfolios. Table 5 reports in the various panels the annualized before- and after-tax performance of mutual fund portfolios formed according to the average tax burden over the prior one, three, and five years. The tax burden column corresponds to the difference between the before- and after-tax returns.

We use two different measures of performance. The first measure is simply the average excess return of a quintile portfolio over the CRSP value-weighted market index. The second measure corresponds to the abnormal return α_f of a fund quintile portfolio over the whole sample period using the Fama-French-Carhart four-factor model:

$$\begin{aligned} R_{f,t} - R_{T,t} &= \alpha_f + \beta_f^M (R_{M,t} - R_{T,t}) + \beta_f^{SMB} (R_{S,t} - R_{B,t}) \\ &\quad + \beta_f^{HML} (R_{H,t} - R_{L,t}) + \beta_f^{UMD} (R_{U,t} - R_{D,t}) + \epsilon_{f,t}. \end{aligned} \tag{10}$$

The return of fund portfolio f during time period t is denoted by $R_{f,t}$. The index M corresponds to the market portfolio and the index T to the risk-free Treasury bill rate. Portfolios of small and large stocks are denoted by S and B, respectively; portfolios of stocks with high and low ratios between their book values and their market values are denoted by H and L, respectively; and portfolios of stocks with relatively high and low returns during the previous year are denoted by U and D, respectively. The Carhart (1997) model nests the CAPM model (which includes only the market factor) and the Fama and French (1993) model (which includes the size and the book-to-market factors in addition to the market factor).[10]

Table 5 indicates a strong inverse relation between prior tax burdens and subsequent after-tax performance regardless of the time horizon and the performance measures. For example, Panel B indicates that funds with the lowest tax burdens during the prior three years underperform the market by 0.19% per year after taxes. On the other hand, funds with the highest tax burdens during the prior three years underperform the market by 2.29% after-

[10]The results are not affected qualitatively if we report instead alphas based on the CAPM, the Fama and French (1993) model, or a five factor model that adds the liquidity factor of Pastor and Stambaugh (2003) as a fifth factor to the Carhart model.

tax. The difference in after-tax performance is 2.10%, which is statistically and economically significant. These results indicate that taxable investors should take into account the prior tax burdens when selecting mutual funds.

Surprisingly, before-tax returns are also negatively related to the prior tax burdens. The before-tax performance difference between the two extreme portfolios is economically significant and ranges between 0.51 and 0.97 percentage points per year, although the return differences are typically not statistically significant. Thus, funds that tend to exhibit low tax burdens do not underperform on a pre-tax basis funds with higher tax burdens. Finally, we also report the future tax burden of the portfolios formed according to the prior tax burdens. Consistent with Table 3 we find significant persistence in the tax burdens over the various horizons. Therefore, the overall underperformance of tax-inefficient funds after taxes is partly due to the underperformance in before-tax returns (43%) and partly due to high tax burdens (57%).

These results indicate that tax-efficient asset management, at least as practiced by U.S. equity mutual funds during the last decades, does not have significant negative performance implications before taxes.

4.2 Multivariate Performance Regressions

To analyze whether the prior tax burden predicts future before- and after-tax performance after controlling for various fund characteristics, we run the following panel regression:

$$\begin{aligned} PERF_{f,t} &= \beta_1 TB_{f,t-1} + \beta_2 PERF_{f,t-1} + \beta_3 EXP_{f,t-1} + \beta_4 LOG(TNA_{f,t-1}) \\ &+ \beta_5 AGE_{f,t-1} + \beta_6 TURN_{f,t-1} + \beta_7 FLOW_{f,t-1} + \beta_{0,t} + \epsilon_{f,t}, \end{aligned} \tag{11}$$

where $PERF$ is the monthly measure of fund performance, TB is the tax burden over the prior three years, EXP is the fund's expense ratio, TNA the fund size, AGE is the fund age, $TURN$ is the annual fund turnover, and $FLOW$ is the average monthly flow over the prior

12 months.

The fund performance $PERF$ is either defined as the excess fund return over the market return ($PERF_{f,t} = R_{f,t} - R_{M,t}$) or the fund return minus the fitted fund return based on the Fama-French-Carhart model ($PERF_{f,t} = R_{f,t} - R_{TB,t} - [\beta^{M}_{f,t-1}(R_{M,t} - R_{TB,t}) + \beta^{SMB}_{f,t-1}(R_{S,t} - R_{B,t}) + \beta^{HML}_{f,t-1}(R_{H,t} - R_{L,t}) + \beta^{UMD}_{f,t-1}(R_{U,t} - R_{D,t})]$). The factor loadings $\beta_{f,t-1}$ of a fund are estimated on a rolling basis over the prior 36 months. The regression includes time-fixed effects, style-fixed effects, and the standard errors are clustered by fund.

Consistent with the quintile portfolios in Table 5 we find that the after-tax return is negatively related to the prior tax burden. A one-standard-deviation increase in the tax burden of 1.58 percentage points decreases the after-tax return between 0.40 and 1.17 percentage points per year depending on whether we use excess or four-factor adjusted returns.

The relation between the prior tax burden and before-tax excess returns is significantly negative for excess returns. A one-standard-deviation increase in the tax burden decreases the before-tax excess return between 0.43 and 0.63 percentage points per year. The prior tax burden is not significantly related to the four-factor adjusted before-tax return, indicating that some of the before-tax performance difference is due to loadings on common factors.

The remaining coefficients are broadly consistent with the mutual fund literature. Mutual fund 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 (2014) among many others. We also find that the performance of funds decreases with the expense ratio, as discussed by Gil-Bazo and Ruiz-Verdu (2009), and decreases with the fund size, as shown by Chen, Hong, Huang, and Kubik (2004).

4.3 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. Panel A summarizes the portfolio results for long-term capital gains, Panel B for short-term capital gains, and Panel C for dividend distributions. We report the portfolios formed according to the distributions 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 outperform funds with higher prior long-term capital gains distributions on an after-tax basis. On the other hand, we do not obtain significant relations for after-tax performance for portfolios sorted according to short-term capital gains and dividend distributions, as shown in Panels B and C. This result likely occurs because average short-term capital gains distributions and dividend distributions are significantly smaller than long-term capital gains distributions. Furthermore, 51.2% of funds, on average, do not make any short-term capital gains distributions over the prior three years. Thus, the lowest short-term capital gains portfolio includes more than half of our observations, whereas the highest short-term capital gains portfolio includes only 12.2% of funds. The predictability of the tax burden does not derive 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.

The base-case results in Table 5 sort mutual funds according to the prior tax burden. We document in Section 3 that the tax burden also depends on the investment style, fund flows, capital gains overhangs, and other fund attributes. In an unreported robustness test we sort mutual funds into quintiles according to the fitted tax burden. The fitted tax burden in year t is obtained by regressing the tax burden on the lagged tax burden and on the other fund

characteristics from equation (9) using data over the prior ten years. The results are broadly consistent to the base-case results reported in Table 5: Tax-efficient funds tend to exhibit higher returns both before and after taxes. Surprisingly, we find that the cross-sectional differences in the future tax burdens are only slightly magnified using fitted values of the tax burden instead of simply using the lagged tax burdens. Whereas the difference in the future tax burdens amounts to 1.19% in our base-case specification in Panel B of Table 5 using the lagged 3-year tax burden, the corresponding difference amounts to 1.21% using the fitted value. Thus, the lagged tax burden provides a relatively accurate predictor of the future tax burden.

4.4 Decomposition of Fund Performance

Tax-efficient funds might perform worse as constraints imposed by tax management decrease stock selectivity and timing ability. On the other hand, tax-efficient funds might perform well, since tax efficiency could be an intended or even unintended consequence of profitable investment strategies. For example, following a low-turnover buy-and-hold strategy reduces at the same time taxes and trading costs. Furthermore, although momentum strategies exhibit high turnovers, they are relatively tax-efficient since they require to hold on to past winners and to liquidate past loser stocks (Bergstresser and Pontiff (2013) and Israel and Moskowitz (2011)).

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):

$$R^{BT}_{f,t} = RH_{f,t} - EXP_{f,t} + RG_{f,t}. \tag{12}$$

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 determined by 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.

Finally, 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:

$$TC_{f,t} = \frac{\sum_j P_{j,t} \left| N_{f,j,t} - N_{f,j,t-3} \right|}{\sum_j P_{j,t} N_{f,j,t}} \times ADJTV_{f,t} \times ADJTNA_{f,t} \times TCPU_{f,t}, \tag{13}$$

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 divided equally on the three months in a quarter to obtain monthly 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.[11]

Table 8 summarizes the results of this performance decomposition. We do not find any evidence that high tax burden funds exhibit superior selectivity or timing abilities, as would be expected from the fact that these funds are less constrained. These funds actually exhibit worse selectivity and timing abilities, although the return differences are not statistically significant. About half of the outperformance of low tax burden funds is explained by selectivity and style timing. The overall difference in the average style returns is small between the tax burden portfolios, as the momentum style advantages are offset to a large extend by the size and value style disadvantages. Low prior tax-burden funds tend to exhibit favorable exposures to momentum stocks, but unfavorable exposures to size and value stocks.[12]

Whereas expenses are negatively related to the prior tax burden, trading costs are positively related to the tax burden. Low tax burden funds are able to generate significantly lower trading costs, which might indicate that these managers are aware and capable of overall cost-efficient trading. On the other hand, the higher estimated trading costs of high tax burden funds are not offset by superior interim trading benefits, as suggested by the negative difference in the return gaps. Indeed, the difference in the return gap is actually slightly

[11]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.

[12]To determine the contribution of size, value, and momentum to the overall style return, we compute for each fund the mean return of style benchmarks based solely on size, value, and momentum quintiles. Low tax burden funds generate an excess return of 0.23 percentage points per year relative to high tax burden funds based on their exposure to momentum. Thus, around one-quarter of the before-tax performance difference between high- and low-tax funds can be attributed to different momentum exposures.

larger than the difference in the estimated trading costs, suggesting higher trading benefits by tax-efficient funds.[13] Overall, the superior performance of tax-efficient funds can be explained by their lower trading costs and by their superior investment ability.

4.5 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 might have 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 9 the before- and after-tax returns for different style portfolios. Panel A separates funds into terciles according to the size score of their most recent holdings. The size score of a fund corresponds to the average quintile number of firms' market values using NYSE cutoff levels. Panels B and C separate funds into terciles according to the corresponding value and momentum scores. We report the average before- and after-tax performance for the overall portfolios ("Average") and the difference between the high and low tax burden portfolios ("High-Low TB").

Panel A indicates that funds holding small-capitalization stocks tend to outperform funds holding large capitalization stocks before adjusting for the Carhart common factors. The tax burdens of different size score portfolios range between 1.28% for large-cap funds to 1.43% for small-cap funds. For all size groups, high TB funds underperform low TB funds both before

[13]Some of the negative effect of expenses is due to the fact that funds are allowed to subtract fund expenses from their dividend distributions, resulting in lower tax burdens for funds with higher expense ratios.

and after taxes.

Similarly, Panel B shows that funds holding value stocks tend to slightly outperform funds holding growth stocks. We find that the tax burden increases as a fund holds stocks with higher book-to-market ratios. For example, value funds have a tax burden of 1.53%, whereas growth funds have a tax burden of 1.25%.

The biggest difference in excess performance for the styles considered here occurs for momentum funds, as shown in Panel C. Funds that hold stocks with the highest recent performance generate, on average, annualized before-tax excess returns of 0.97%. On the other hand, funds that hold stocks with the lowest recent performance exhibit, on average, annualized before-tax excess returns of -1.20%. The performance differential between momentum and contrarian funds remains after adjusting for taxes, since both types of funds have similar tax burdens.

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 exhibited higher tax burdens over the prior three years will continue to exhibit high tax burdens. Furthermore, the after-tax returns are higher for funds that managed their tax burden over the previous years by reducing their dividend and capital gains distributions.

4.6 Tax Burden Effects by Capital Gains Overhang

Besides past fund distributions, the capital gains overhang also impacts future fund distributions. Funds with high capital gains overhang can make larger future distributions than funds with low capital gains overhang if they do not manage their tax burden efficiently.

To investigate whether the prior tax burden has a significant impact on our results, we sort mutual funds in each month into terciles according to their total capital gains overhang, which includes both short- and long-term capital gains. The capital gains overhang is estimated based on the disclosed fund holdings from Thomson-Reuters, as discussed in Section 2.3. In

addition, we divide the funds into five groups according to their tax burden over the prior three years. Panels A, B, and C of Table 10 summarize the results of funds in the lowest, middle or highest capital gains overhang terciles. The corresponding average capital gains overhangs equal 1.76% for the lowest tercile, 10.89% for the middle tercile, and 27.64% for the highest tercile.

Although the results on the before- and after-tax performance are consistent across capital gains overhang terciles, the performance results are more pronounced for funds with higher embedded capital gains. The average future tax burden difference based on the excess returns increases from 1.02% for the lowest capital gains overhang tercile to 1.44% for the highest tercile. However, the tax burden does not increase equally for the various tax burden portfolios. As we compare the two extreme capital gains overhang terciles, the future tax burden actually decreases from 0.76% to 0.69% for the lowest tax burden portfolio and increases from 1.77% to 2.13% for the highest tax burden portfolio. Thus, keeping track of the tax overhang is particularly important for funds with high previous tax burdens.

4.7 Tax Burden Effects by Prior Fund Performance

The tax burden might be affected by the contemporaneous fund return. Tax burdens might increase with the fund return because funds tend to realize larger capital gains during periods of high performance. A positive relation between past tax burdens and future before-tax fund performance could result if the before-tax performance is persistent. This concern is not economically significant for several reasons. First, our base case results in Tables 5 and 6 indicate an insignificantly negative relation between prior tax burdens and before-tax returns instead of a positive relation. Second, Table 6 shows that the tax burden coefficients do not change significantly after controlling for prior fund performance. Third, Table 11 indicates that the results are qualitatively unaffected if funds are sorted into three groups according to their prior three year performance. Thus, funds with lower prior tax burdens exhibit superior

performance regardless of the prior performance levels.

4.8 Assets in DC Pension Accounts

Mutual fund holdings in DC pension plans are an important segment of financial markets. 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 result in lower tax burdens than funds held primarily in tax-qualified accounts.[14]

To investigate whether our results differ across mutual funds with different tax clienteles, we sort funds into terciles according to their proportion of DC assets. The sample of funds decreases since we do not obtain DC assets for all funds over our sample period. Whereas funds in the bottom DC tercile only include 6.7% of DC assets, funds in the top DC tercile include 54.6% of DC assets. Table 12 indicates that the relation between the tax burden and the before-tax performance is more pronounced for funds with low- and medium-level DC assets.

4.9 Subperiods

Figure 2 shows that marginal tax rates on fund distributions have differed substantially over time. Based on this figure, we can identify three main tax regimes (1990-1997, 1998-2002, and 2003-2012). We observe a negative relation between past tax burdens and future after-tax returns for all three subperiods, as shown in Table 13. The results have weakened over the last tax regime due to relatively low marginal tax rates and due to relatively low fund distributions.

[14]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.

5 Conclusions

Many mutual funds attempt to create value for their investors through stock selection or market timing strategies. However, such active strategies often cause substantial trading costs that 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 by picking stocks or by timing markets, 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. Thus, both taxable and tax-exempt fund investors should take taxes on fund distributions into account when they make mutual fund investment decisions.

References

Allen, F. and R. Michaely (2003). Payout policy. In G. M. Constantinides, M. Harris, and R. M. Stulz (Eds.), *Handbook of the Economics of Finance Volume 1A Corporate Finance*, pp. 337–429. Amsterdam: Elsevier North-Holland.

Barclay, M. J., N. D. Pearson, and M. S. Weisbach (1998). Open-end mutual funds and capital-gains taxes. *Journal of Financial Economics 49*, 3–43.

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

Bergstresser, D. and J. Pontiff (2013). Investment taxation and portfolio performance. *Journal of Public Economics 97*, 245–257.

Bergstresser, D. and J. M. Poterba (2002). Do after-tax returns affect mutual fund inflows? *Journal of Financial Economics 63*, 381–414.

Berk, J. and J. H. Van Binsbergen (2014). Measuring managerial skill in the mutual fund industry. Forthcoming: *Journal of Financial Economics*.

Bollen, N. P. B. and J. A. Busse (2005). Short-term persistence in mutual fund performance. *Review of Financial Studies 18*, 569–597.

Brown, S. J. and W. N. Goetzmann (1995). Performance persistence. *Journal of Finance 50*, 853–873.

Carhart, M. M. (1997). On persistence in mutual fund performance. *Journal of Finance 52*(2), 57–82.

Chen, J., H. Hong, M. Huang, and J. Kubik (2004). Does fund size erode performance? Liquidity, organizational diseconomies and active money management. *American Economic Review 94*, 1276–1302.

Chen, Q., I. Goldstein, and W. Jiang (2010). Payoff complementarities and financial fragility: Evidence from mutual fund outflows. *Journal of Financial Economics 97*, 239–262.

Christoffersen, S., C. Geczy, D. Musto, and A. Reed (2006). Cross-border dividend taxation and the preferences of taxable and non-taxable investors: Evidence from Canada. *Journal of Financial Economics 78*, 121–144.

Christoffersen, S. and M. Simutin (2014). On the demand for high-beta stocks: Evidence from mutual funds. University of Toronto.

Christoffersen, S. E. K., R. Evans, and D. K. Musto (2013). What do consumers' fund flows maximize? Evidence from their brokers' incentives. *Journal of Finance 68*, 201–235.

Cici, G., A. Kempf, and C. Sorhage (2014). Do financial advisors provide tangible benefits for investors? Evidence from tax-motivated mutual fund flows. College of William and Mary and University of Cologne.

Daniel, K., M. Grinblatt, S. Titman, and R. Wermers (1997). Measuring mutual fund performance with characteristic-based benchmarks. *Journal of Finance 52*(3), 1035–1058.

Dickson, J. M. and J. B. Shoven (1995). Taxation and mutual funds: An investor perspective. *Tax Policy and the Economy 9*, 151–180.

Dickson, J. M., J. B. Shoven, and C. Sialm (2000). Tax externalities of equity mutual funds. *National Tax Journal 53*, 607–628.

Dimmock, S. G., W. C. Gerken, Z. Ivkovic, and S. J. Weisbenner (2014). Capital gains lock-in and governance choices. Nanyang Technological University, University of Kentucky, Michigan State University, and University of Illinois.

Edelen, R., R. Evans, and G. Kadlec (2013). Shedding light on "invisible" costs: Trading costs and mutual fund performance. *Financial Analysts Journal 69*, 33–44.

Edelen, R. M. (1999). Investor flows and the assessed performance of open-end fund managers. *Journal of Financial Economics 53*, 439–466.

Evans, R. B. (2010). Mutual fund incubation. *Journal of Finance 65*, 1581–1611.

Fama, E. F. and K. R. French (1993). Common risk factors in the return on bonds and stocks. *Journal of Financial Economics 33*, 3–53.

Fama, E. F. and J. D. MacBeth (1973). Risk, return, and equilibrium: Empirical tests. *Journal of Political Economy 81*, 607–636.

Feenberg, D. and E. Coutts (1993). An introduction to the taxsim model. *Journal of Policy Analysis and Management 12*, 189–194.

French, K. R. (2008). Presidential address: The cost of active investing. *Journal of Finance 63*, 1537–1573.

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

Grinblatt, M. and S. Titman (1992). The persistence of mutual fund performance. *Journal of Finance 42*, 393–416.

Harris, L. E., S. M. Hartzmark, and D. H. Solomon (2014). Juicing the dividend yield: Mutual funds and the demand for dividends. Forthcoming: *Journal of Financial Economics*.

Hendricks, D., J. Patel, and R. Zeckhauser (1993). Hot hands in mutual funds: Short-run persistence of performance, 1974-88. *Journal of Finance 48*, 93–130.

Israel, R. and T. J. Moskowitz (2011). How tax efficient are equity styles? University of Chicago.

Jegadeesh, N. and S. Titman (1993). Returns to buying winners and selling losers: Implications for stock market efficiency. *Journal of Finance 48*, 65–91.

Kacperczyk, M., C. Sialm, and L. Zheng (2008). Unobserved actions of equity mutual funds. *Review of Financial Studies 21*(6), 2379–2416.

Pastor, L. and R. F. Stambaugh (2003). Liquidity risk and expected stock returns. *Journal of Political Economy 111*(3), 642–685.

Poterba, J. M. and J. B. Shoven (2002). Exchange-traded funds: A new investment option for taxable investors. *American Economic Review: AEA Papers and Proceedings 92*, 422–427.

Sharpe, W. F. (1966). Mutual fund performance. *Journal of Business 39*, 119–138.

Sialm, C. (2009). Tax changes and asset pricing. *American Economic Review 99*, 1356–1383.

Sialm, C. and L. Starks (2012). Mutual fund tax clienteles. *Journal of Finance* (67), 1397–1422.

Sialm, C., L. Starks, and H. Zhang (2014). Defined contribution pension plans: Sticky or discerning money? Forthcoming: *Journal of Finance*.

Wermers, R. (2000). Mutual fund performance: An empirical decomposition into stock-picking talent, style, transactions costs, and expenses. *Journal of Finance 55*(4), 1655–1703.

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)	1.12	1.58	0.05	0.43	1.70
Before-Tax Return (in % per month)	0.66	5.42	−2.12	1.08	3.79
After-Tax Return (in % per month)	0.56	5.42	−2.24	0.97	3.72
Total Distributions (in % per year)	4.31	5.80	0.23	1.90	6.60
Dividend Yield (in % per year)	0.73	1.20	0.00	0.30	1.10
Short-Term Capital Gains (in % per year)	0.81	2.40	0.00	0.00	0.29
Long-Term Capital Gains (in % per year)	2.78	4.67	0.00	0.09	4.22
Expense Ratio (in % per year)	1.21	0.49	0.94	1.19	1.49
Turnover (in % per year)	88.10	130.07	31.00	62.00	109.00
TNA (in $M)	1,313.24	5,547.56	63.00	210.30	783.30
Age (in Years)	12.54	13.35	4.00	9.00	15.00
Flow (in % per month)	0.81	3.25	−1.05	0.01	1.75
12-Month Flow Std. Dev. (in % per month)	2.84	2.55	1.03	2.02	3.67
Size Score (Range [1,5])	4.12	0.95	3.50	4.54	4.88
Value Score (Range [1,5])	2.81	0.41	2.53	2.82	3.08
Momentum Score (Range [1,5])	3.12	0.44	2.81	3.09	3.39
Short-Term Capital Gains Overhang (in %)	1.80	5.57	−0.20	1.11	3.54
Long-Term Capital Gains Overhang (in %)	10.27	18.10	0.15	7.79	17.11
Number of Monthly Observations	414,393				

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)	1.14	0.27	0.77	0.34
Before-Tax Return (in % per month)	0.66	0.37	0.59	0.50
After-Tax Return (in % per month)	0.56	0.34	0.53	0.47
Before-Tax Market-Adjusted Return (in % per month)	−0.01	−0.02	0.03	0.04
After-Tax Market-Adjusted Return (in % per month)	−0.10	−0.04	−0.04	0.01
Total Distributions (in % per year)	4.38	1.25	3.19	1.74
Dividend Yield (in % per year)	0.69	0.57	1.31	1.67
Short-Term Gains (in % per year)	0.84	0.09	0.29	0.05
Long-Term Gains (in % per year)	2.85	0.59	1.59	0.02
Expense Ratio (in % per year)	1.26	1.16	0.45	0.30
Turnover (in % per year)	91.81	70.26	22.30	31.93
TNA (in $M)	1,194.37	495.32	3,365.52	3,257.74
Age (in Years)	12.79	6.10	8.37	5.14
Flow (in % per month)	0.79	0.92	1.15	3.24
Std. Dev. of Flow (in % per month)	2.85	2.54	2.73	8.45
Size Score (Range [1,5])	4.11	4.34	4.34	
Value Score (Range [1,5])	2.82	2.82	2.79	
Momentum Score (Range [1,5])	3.13	3.02	2.96	
Short-Term Gains Overhang (in %)	1.88	1.05	0.26	
Long-Term Gains Overhang (in %)	10.22	7.81	11.18	
Number of Monthly Observations	391,959	6,299	22,434	10,363

Table 3: **Persistence of Tax Burden**

This table presents the persistence of the tax burden (TB) quintiles and fund distribution quintiles. The standard errors of the differences 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	24.26	0.13	0.71	0.99	1.12	1.16	1.22
P2	18.93	0.56	0.97	1.14	1.24	1.25	1.28
P3	18.95	1.07	1.33	1.36	1.38	1.38	1.33
P4	18.95	1.70	1.61	1.53	1.48	1.47	1.43
High	18.91	3.26	2.05	1.82	1.71	1.63	1.49
High - Low TB			1.34***	0.82***	0.59***	0.47***	0.27***
			(0.17)	(0.12)	(0.10)	(0.08)	(0.07)

Panel B: Long-Term Capital Gains Distributions

Portfolio	Proportion	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Low	42.91	0.01	1.37	2.34	2.72	2.97	3.18
P2	14.24	0.80	2.52	2.92	3.24	3.40	3.50
P3	14.29	2.59	3.82	3.93	4.11	4.07	3.90
P4	14.30	4.94	4.87	4.72	4.46	4.49	4.28
High	14.27	10.58	6.44	5.61	5.30	4.76	4.40
High - Low TB			5.07***	3.27***	2.58***	1.79***	1.22***
			(0.55)	(0.46)	(0.45)	(0.33)	(0.35)

Panel C: Short-Term Capital Gains Distributions

Portfolio	Proportion	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Low	69.04	0.00	0.44	0.60	0.70	0.71	0.72
P2	7.71	0.21	0.58	0.77	0.71	0.87	0.77
P3	7.75	0.84	1.21	1.01	1.16	1.04	0.91
P4	7.78	1.97	1.67	1.51	1.51	1.57	1.17
High	7.72	6.09	2.93	2.70	2.07	1.86	1.74
High - Low TB			2.48***	2.10***	1.37***	1.15***	1.01***
			(0.35)	(0.41)	(0.25)	(0.27)	(0.27)

Panel D: Dividend Distributions

Portfolio	Proportion	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Low	34.97	0.03	0.13	0.13	0.14	0.16	0.17
P2	16.23	0.33	0.41	0.42	0.42	0.42	0.44
P3	16.27	0.84	0.82	0.76	0.73	0.71	0.69
P4	16.29	1.44	1.34	1.25	1.16	1.12	1.09
High	16.24	2.80	2.33	2.13	2.01	1.91	1.83
High - Low TB			2.20***	2.00***	1.87***	1.75***	1.66***
			(0.14)	(0.12)	(0.11)	(0.10)	(0.09)

Table 4: **Determinants of Tax Burden**

This table presents the determinants of taxable fund distributions. The regression includes 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	-0.08^{***}	-0.11^{***}	-0.22^{***}	-0.20^{***}	-0.54^{***}	-0.64^{***}
	(0.01)	(0.01)	(0.03)	(0.03)	(0.05)	(0.05)
Value Score	0.29^{***}	0.36^{***}	0.33^{***}	0.28^{***}	0.53^{***}	0.87^{***}
	(0.03)	(0.03)	(0.05)	(0.04)	(0.12)	(0.11)
Momentum Score	0.05^{*}	0.00	0.32^{***}	0.09	0.36^{***}	0.21^{**}
	(0.03)	(0.03)	(0.05)	(0.05)	(0.10)	(0.11)
Fund Flow		-0.09^{***}		-0.03^{***}		-0.37^{***}
		(0.00)		(0.01)		(0.02)
Fund Flow Std. Dev.		0.02^{***}		-0.01		0.10^{***}
		(0.01)		(0.01)		(0.02)
Fund Age		0.03^{*}		-0.02		0.10
		(0.02)		(0.03)		(0.06)
Log Fund Size		0.00		-0.00		0.02
		(0.01)		(0.01)		(0.03)
Turnover		0.04^{***}		0.30^{***}		0.02
		(0.02)		(0.05)		(0.05)
Expense Ratio		-0.19^{***}		-0.16^{***}		-0.20^{*}
		(0.03)		(0.04)		(0.11)
ST CG Overhang		0.05^{***}		0.08^{***}		0.16^{***}
		(0.00)		(0.01)		(0.01)
LT CG Overhang		0.00^{***}		-0.02^{***}		0.03^{***}
		(0.00)		(0.00)		(0.00)
Observations	28,011	27,063	28,011	27,063	28,011	27,063
R-squared	0.01	0.07	0.02	0.08	0.01	0.07

Table 5: **Performance of Tax Burden Portfolios**

This table presents the before-tax returns, the after-tax returns, and the tax burdens (TB) of mutual fund portfolios based on the prior fund tax burdens. The standard errors based on the time-series of the portfolio returns are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Funds Sorted by Tax Burden Over Prior Year

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.72	−0.04	0.76***	−0.27	−0.92	0.65***
	(1.01)	(1.00)	(0.13)	(0.85)	(0.86)	(0.13)
P2	−0.10	−1.08*	0.99***	−0.36	−1.21**	0.85***
	(0.54)	(0.56)	(0.15)	(0.48)	(0.51)	(0.14)
P3	−0.69	−2.01***	1.32***	−1.08***	−2.22***	1.14***
	(0.48)	(0.51)	(0.19)	(0.40)	(0.44)	(0.18)
P4	−0.51	−2.13***	1.62***	−1.03**	−2.42***	1.40***
	(0.53)	(0.58)	(0.22)	(0.46)	(0.53)	(0.21)
High	−0.25	−2.30***	2.05***	−0.80	−2.59***	1.79***
	(0.75)	(0.79)	(0.26)	(0.69)	(0.75)	(0.25)
High-Low TB	−0.97	−2.26***	1.29***	−0.53	−1.66**	1.13***
	(0.79)	(0.84)	(0.17)	(0.70)	(0.73)	(0.16)

Panel B: Funds Sorted by Tax Burden Over Prior 3 Years

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.56	−0.19	0.75***	−0.17	−0.81	0.64***
	(0.83)	(0.83)	(0.13)	(0.73)	(0.74)	(0.12)
P2	−0.50	−1.64***	1.14***	−1.05**	−2.04***	0.98***
	(0.58)	(0.59)	(0.18)	(0.52)	(0.55)	(0.17)
P3	−0.40	−1.78***	1.38***	−0.88**	−2.06***	1.18***
	(0.54)	(0.56)	(0.20)	(0.44)	(0.48)	(0.19)
P4	−0.31	−1.89***	1.58***	−0.79*	−2.16***	1.37***
	(0.55)	(0.59)	(0.23)	(0.46)	(0.52)	(0.22)
High	−0.34	−2.29***	1.94***	−0.94	−2.63***	1.69***
	(0.69)	(0.74)	(0.27)	(0.59)	(0.67)	(0.25)
High-Low TB	−0.91	−2.10***	1.19***	−0.77	−1.82***	1.05***
	(0.64)	(0.68)	(0.17)	(0.56)	(0.59)	(0.17)

Panel C: Funds Sorted by Tax Burden Over Prior 5 Years

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.11	−0.73	0.84***	−0.31	−1.03	0.72***
	(0.71)	(0.72)	(0.15)	(0.66)	(0.68)	(0.14)
P2	−0.08	−1.32**	1.24***	−0.55	−1.63***	1.07***
	(0.59)	(0.60)	(0.19)	(0.51)	(0.54)	(0.18)
P3	−0.42	−1.85***	1.43***	−0.86*	−2.09***	1.23***
	(0.54)	(0.57)	(0.21)	(0.45)	(0.50)	(0.20)
P4	−0.59	−2.22***	1.62***	−1.02**	−2.43***	1.41***
	(0.56)	(0.61)	(0.23)	(0.46)	(0.53)	(0.22)
High	−0.40	−2.25***	1.85***	−1.19**	−2.78***	1.59***
	(0.70)	(0.74)	(0.27)	(0.59)	(0.66)	(0.25)
High-Low TB	−0.51	−1.52**	1.01***	−0.88	−1.74***	0.87***
	(0.59)	(0.61)	(0.16)	(0.54)	(0.56)	(0.15)

Table 6: **Performance Predictability by Prior Tax Burden**
This table presents the before-tax returns, the after-tax returns, and the tax burdens (TB) of mutual fund portfolios based on the prior fund tax burdens. The regression includes time-fixed effects 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.

Panel A: Dependent Variable is Future Excess Return

	Before Tax		After Tax		Tax Burden	
Prior Tax Burden	-0.27^{***}	-0.40^{***}	-0.65^{***}	-0.74^{***}	0.37^{***}	0.35^{***}
	(0.10)	(0.10)	(0.09)	(0.09)	(0.02)	(0.02)
Prior Return		0.08^{***}		0.06^{***}		0.03^{***}
		(0.01)		(0.01)		(0.00)
Expense Ratio		-1.35^{***}		-1.24^{***}		-0.15^{***}
		(0.18)		(0.18)		(0.03)
Log(TNA)		-0.18^{***}		-0.18^{***}		-0.01^{**}
		(0.04)		(0.04)		(0.01)
Age		-0.00		0.05		-0.08^{***}
		(0.10)		(0.10)		(0.02)
Turnover		0.15		0.13		0.01
		(0.11)		(0.11)		(0.01)
Prior Flow		-0.22^{***}		-0.11^{***}		-0.12^{***}
		(0.03)		(0.03)		(0.01)
Observations	306,786	298,026	306,786	298,026	25,745	24,895
R-squared	0.00	0.00	0.00	0.00	0.07	0.13

Panel B: Dependent Variable is Future Carhart Alpha

	Before Tax		After Tax		Tax Burden	
Prior Tax Burden	-0.03	-0.06	-0.25^{***}	-0.25^{***}	0.20^{***}	0.19^{***}
	(0.08)	(0.07)	(0.08)	(0.08)	(0.03)	(0.03)
Prior Return		0.06^{***}		0.03^{***}		0.03^{***}
		(0.01)		(0.01)		(0.00)
Expense Ratio		-1.01^{***}		-0.92^{***}		-0.13^{***}
		(0.15)		(0.15)		(0.03)
Log(TNA)		-0.06^{*}		-0.05^{*}		-0.01^{**}
		(0.03)		(0.03)		(0.01)
Age		-0.21^{***}		-0.14^{*}		-0.12^{***}
		(0.08)		(0.08)		(0.02)
Turnover		0.02		0.01		0.01
		(0.08)		(0.08)		(0.01)
Prior Flow		-0.05^{*}		0.07^{**}		-0.13^{***}
		(0.03)		(0.03)		(0.01)
Observations	306,433	297,803	306,433	297,803	25,734	24,893
R-squared	0.00	0.00	0.00	0.00	0.02	0.08

Table 7: **Performance of Tax Burden Portfolios by Distribution Type**
This table presents the before-tax returns, the after-tax returns, and the tax burdens (TB) of mutual fund portfolios based on the the prior long-term capital gains distributions (LCG), the prior short-term capital gains distributions (SCG), and the prior dividend distributions (DIV). The standard errors based on the time-series of the portfolio returns are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Funds Sorted by Long-Term Capital Gains Distributions Over Prior 3 Years

	Excess Return			Carhart Alpha		
LCG Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.39	−0.48	0.86***	−0.31	−1.06	0.74***
	(0.72)	(0.72)	(0.14)	(0.65)	(0.66)	(0.14)
P2	−0.17	−1.41**	1.25***	−0.67	−1.75***	1.08***
	(0.59)	(0.61)	(0.16)	(0.53)	(0.55)	(0.16)
P3	−0.45	−1.92***	1.48***	−1.01**	−2.29***	1.28***
	(0.58)	(0.61)	(0.20)	(0.51)	(0.56)	(0.19)
P4	−0.38	−2.00***	1.62***	−0.88*	−2.28***	1.41***
	(0.60)	(0.64)	(0.22)	(0.49)	(0.55)	(0.21)
High	−0.13	−2.06***	1.92***	−0.80	−2.47***	1.68***
	(0.70)	(0.74)	(0.25)	(0.58)	(0.66)	(0.24)
High-Low TB	−0.52	−1.58**	1.06***	−0.48	−1.42**	0.93***
	(0.62)	(0.66)	(0.16)	(0.55)	(0.59)	(0.16)

Panel B: Funds Sorted by Short-Term Capital Gains Distributions Over Prior 3 Years

	Excess Return			Carhart Alpha		
SCG Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	−0.40	−1.63***	1.23***	−0.94*	−2.00***	1.06***
	(0.61)	(0.62)	(0.19)	(0.54)	(0.58)	(0.18)
P2	−0.63	−1.95***	1.32***	−0.74*	−1.90***	1.16***
	(0.49)	(0.53)	(0.16)	(0.43)	(0.47)	(0.16)
P3	0.20	−1.33**	1.53***	−0.42	−1.75***	1.33***
	(0.63)	(0.65)	(0.20)	(0.53)	(0.57)	(0.19)
P4	0.10	−1.52**	1.63***	−0.76	−2.16***	1.40***
	(0.74)	(0.77)	(0.22)	(0.65)	(0.70)	(0.20)
High	0.11	−1.63*	1.74***	−0.78	−2.28**	1.50***
	(0.96)	(0.98)	(0.25)	(0.87)	(0.92)	(0.23)
High-Low TB	0.51	−0.00	0.52***	0.16	−0.28	0.44***
	(0.61)	(0.63)	(0.13)	(0.59)	(0.62)	(0.13)

Panel C: Funds Sorted by Dividend Distributions Over Prior 3 Years

	Excess Return			Carhart Alpha		
DIV Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.51	−0.76	1.26***	−1.15	−2.22*	1.08***
	(1.59)	(1.58)	(0.22)	(1.29)	(1.31)	(0.21)
P2	−0.21	−1.54**	1.33***	−0.81	−1.95***	1.14***
	(0.70)	(0.72)	(0.20)	(0.60)	(0.65)	(0.19)
P3	−0.09	−1.50***	1.41***	−0.52	−1.73***	1.21***
	(0.52)	(0.56)	(0.20)	(0.44)	(0.49)	(0.19)
P4	−0.51	−1.96***	1.45***	−0.48	−1.75***	1.27***
	(0.66)	(0.71)	(0.19)	(0.45)	(0.51)	(0.18)
High	−0.71	−2.16**	1.45***	−0.20	−1.49**	1.29***
	(0.93)	(0.97)	(0.18)	(0.57)	(0.60)	(0.17)
High-Low TB	−1.22	−1.41	0.19*	0.94	0.73	0.21**
	(2.25)	(2.26)	(0.10)	(1.65)	(1.66)	(0.09)

Table 8: **Performance Decomposition by Tax Burden**
This table presents the before-tax fund returns, the Characteristic Selectivity, the Characteristic Timing, the Average Style, the Return Gap, the expense ratio, and the trading costs based on the fund tax burdens (TB) over the prior three years. The standard errors based on the time-series of the portfolio returns are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Portfolio	Before Tax Return	Characteristic Selectivity	Characteristic Timing	Average Style	Return Gap	Expense Ratio	Trading Costs
Low	10.31***	0.97*	0.41	10.60***	0.41	1.37***	1.88***
	(3.52)	(0.50)	(0.37)	(3.59)	(0.25)	(0.01)	(0.02)
P2	9.19***	0.55	0.41	10.22***	−0.16	1.18***	1.65***
	(3.36)	(0.38)	(0.32)	(3.51)	(0.16)	(0.01)	(0.02)
P3	9.29***	0.47	0.46	10.36***	−0.08	1.16***	1.63***
	(3.26)	(0.31)	(0.32)	(3.47)	(0.16)	(0.00)	(0.02)
P4	9.39***	0.53*	0.36	10.33***	0.06	1.11***	1.75***
	(3.26)	(0.32)	(0.33)	(3.48)	(0.15)	(0.01)	(0.02)
High	9.31***	0.50	0.26	10.54***	−0.05	1.17***	2.19***
	(3.42)	(0.39)	(0.33)	(3.56)	(0.17)	(0.01)	(0.02)
High-Low TB	−1.00	−0.48	−0.15	−0.06	−0.46**	−0.20***	0.31***
	(0.65)	(0.41)	(0.16)	(0.39)	(0.22)	(0.01)	(0.03)

Table 9: **Performance of Tax Burden Portfolios by Fund Style**
This table presents the before-tax returns, the after-tax returns, and the tax burdens (TB) of mutual fund portfolios based on the stock holdings of funds. The standard errors based on the time-series of the portfolio returns are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Funds Sorted into Terciles by Size Score

		Excess Return			Carhart Alpha		
		Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Small-Cap	Average	1.34	−0.09	1.43***	−0.66	−1.89	1.23***
		(1.49)	(1.48)	(0.20)	(1.14)	(1.16)	(0.19)
	High-Low TB	−1.53*	−2.65***	1.13***	−0.74	−1.75**	1.01***
		(0.84)	(0.88)	(0.18)	(0.76)	(0.79)	(0.17)
Medium-Cap	Average	−0.57	−1.99***	1.42***	−0.85*	−2.07***	1.22***
		(0.52)	(0.56)	(0.22)	(0.51)	(0.55)	(0.21)
	High-Low TB	−0.22	−1.37*	1.15***	−0.25	−1.23*	0.98***
		(0.69)	(0.70)	(0.19)	(0.64)	(0.65)	(0.18)
Large-Cap	Average	−1.45***	−2.73***	1.28***	−0.87**	−1.98***	1.11***
		(0.40)	(0.47)	(0.19)	(0.34)	(0.40)	(0.18)
	High-Low TB	−0.48	−1.61**	1.13***	−0.71	−1.68**	0.98***
		(0.71)	(0.73)	(0.15)	(0.68)	(0.70)	(0.15)

Panel B: Funds Sorted into Terciles by Value Score

		Excess Return			Carhart Alpha		
		Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Growth	Average	−0.31	−1.56	1.25***	−0.95	−2.01**	1.06***
		(1.13)	(1.13)	(0.21)	(0.92)	(0.95)	(0.20)
	High-Low TB	−0.34	−1.45**	1.11***	−0.31	−1.26*	0.95***
		(0.64)	(0.68)	(0.17)	(0.63)	(0.67)	(0.17)
Blend	Average	−0.36	−1.72***	1.36***	−0.90**	−2.07***	1.17***
		(0.51)	(0.53)	(0.20)	(0.45)	(0.49)	(0.19)
	High-Low TB	−0.85	−2.01**	1.16***	−0.99	−1.99**	1.00***
		(0.76)	(0.78)	(0.18)	(0.77)	(0.80)	(0.18)
Value	Average	−0.01	−1.54	1.53***	−0.51	−1.85***	1.34***
		(0.94)	(0.97)	(0.20)	(0.53)	(0.57)	(0.19)
	High-Low TB	−0.44	−1.48**	1.04***	0.06	−0.88	0.94***
		(0.58)	(0.61)	(0.15)	(0.54)	(0.56)	(0.15)

Panel C: Funds Sorted into Terciles by Momentum Score

		Excess Return			Carhart Alpha		
		Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Contrarian	Average	−1.20	−2.58***	1.38***	−0.77	−1.97***	1.21***
		(0.92)	(0.96)	(0.19)	(0.63)	(0.66)	(0.18)
	High-Low TB	−0.12	−1.27**	1.14***	−0.28	−1.30**	1.02***
		(0.62)	(0.64)	(0.17)	(0.58)	(0.60)	(0.16)
Neutral	Average	−0.47	−1.82***	1.34***	−0.93**	−2.09***	1.16***
		(0.50)	(0.53)	(0.19)	(0.42)	(0.46)	(0.18)
	High-Low TB	−0.52	−1.76**	1.24***	−0.71	−1.79***	1.09***
		(0.64)	(0.69)	(0.19)	(0.63)	(0.67)	(0.18)
Momentum	Average	0.97	−0.44	1.41***	−0.69	−1.88	1.19***
		(1.45)	(1.44)	(0.23)	(1.19)	(1.22)	(0.22)
	High-Low TB	−0.63	−1.80**	1.18***	−0.59	−1.60**	1.02***
		(0.72)	(0.77)	(0.20)	(0.68)	(0.72)	(0.19)

Table 10: **Performance of Tax Burden Portfolios by Capital Gains Overhang**
This table presents the before-tax returns, the after-tax returns, and the tax burdens (TB) of mutual fund portfolios based on the prior fund tax burdens. The standard errors based on the time-series of the portfolio returns are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Funds in the Lowest Capital Gains Overhang Tercile

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	1.12	0.36	0.76***	0.00	−0.64	0.64***
	(0.98)	(0.98)	(0.15)	(0.83)	(0.84)	(0.14)
P2	0.19	−0.94	1.13***	−0.49	−1.46**	0.97***
	(0.87)	(0.86)	(0.19)	(0.72)	(0.73)	(0.18)
P3	0.57	−0.72	1.29***	−0.03	−1.14*	1.11***
	(0.88)	(0.88)	(0.20)	(0.66)	(0.66)	(0.20)
P4	0.19	−1.29	1.48***	0.16	−1.11*	1.27***
	(0.85)	(0.87)	(0.23)	(0.63)	(0.65)	(0.22)
High	0.43	−1.34	1.77***	0.03	−1.52**	1.55***
	(0.82)	(0.84)	(0.26)	(0.66)	(0.68)	(0.25)
High-Low TB	−0.69	−1.71**	1.02***	0.03	−0.88	0.91***
	(0.77)	(0.79)	(0.16)	(0.69)	(0.70)	(0.16)

Panel B: Funds in the Middle Capital Gains Overhang Tercile

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.07	−0.77	0.84***	−0.91	−1.63**	0.72***
	(0.89)	(0.89)	(0.15)	(0.76)	(0.77)	(0.15)
P2	−0.37	−1.58**	1.21***	−1.32**	−2.36***	1.03***
	(0.68)	(0.68)	(0.19)	(0.61)	(0.63)	(0.18)
P3	−0.37	−1.74***	1.37***	−1.20**	−2.36***	1.17***
	(0.64)	(0.66)	(0.21)	(0.55)	(0.60)	(0.20)
P4	0.03	−1.57**	1.60***	−0.63	−2.02***	1.39***
	(0.59)	(0.62)	(0.23)	(0.48)	(0.54)	(0.22)
High	−0.42	−2.31***	1.89***	−1.16*	−2.81***	1.64***
	(0.69)	(0.74)	(0.28)	(0.61)	(0.69)	(0.27)
High-Low TB	−0.49	−1.54**	1.05***	−0.26	−1.18**	0.93***
	(0.68)	(0.72)	(0.18)	(0.56)	(0.60)	(0.17)

Panel C: Funds in the Highest Capital Gains Overhang Tercile

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.31	−0.39	0.69***	0.07	−0.53	0.60***
	(0.94)	(0.94)	(0.11)	(0.86)	(0.88)	(0.11)
P2	−0.92*	−2.07***	1.16***	−1.05*	−2.05***	1.01***
	(0.55)	(0.60)	(0.17)	(0.55)	(0.61)	(0.16)
P3	−0.95*	−2.43***	1.48***	−1.10**	−2.38***	1.28***
	(0.54)	(0.58)	(0.20)	(0.52)	(0.57)	(0.20)
P4	−0.97	−2.68***	1.71***	−1.52***	−3.02***	1.49***
	(0.61)	(0.67)	(0.23)	(0.59)	(0.67)	(0.22)
High	−0.99	−3.13***	2.13***	−1.65**	−3.49***	1.84***
	(0.74)	(0.82)	(0.27)	(0.70)	(0.81)	(0.27)
High-Low TB	−1.30	−2.74***	1.44***	−1.71**	−2.96***	1.25***
	(0.81)	(0.85)	(0.19)	(0.78)	(0.82)	(0.19)

Table 11: **Performance of Tax Burden Portfolios by Prior Return**
This table presents the before-tax returns, the after-tax returns, and the tax burdens (TB) of mutual fund portfolios based on the prior fund tax burdens. The standard errors based on the time-series of the portfolio returns are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Funds in the Lowest Prior 36-Month Return Tercile

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.16	−0.55	0.72***	−0.02	−0.64	0.62***
	(1.00)	(1.00)	(0.15)	(0.92)	(0.93)	(0.15)
P2	−0.66	−1.72*	1.06***	−0.66	−1.57**	0.91***
	(0.87)	(0.90)	(0.19)	(0.76)	(0.78)	(0.18)
P3	−0.87	−2.12**	1.25***	−0.80	−1.87**	1.07***
	(0.94)	(0.96)	(0.21)	(0.79)	(0.80)	(0.20)
P4	−1.18	−2.60***	1.42***	−0.66	−1.88**	1.22***
	(0.96)	(0.99)	(0.23)	(0.77)	(0.79)	(0.22)
High	−1.04	−2.67**	1.63***	−0.61	−2.04**	1.42***
	(1.03)	(1.07)	(0.24)	(0.83)	(0.86)	(0.23)
High-Low TB	−1.21	−2.12**	0.91***	−0.59	−1.39*	0.80***
	(0.83)	(0.86)	(0.15)	(0.75)	(0.77)	(0.15)

Panel B: Funds in the Middle Previous 36-Month Return Tercile

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.17	−0.67	0.84***	−0.21	−0.92	0.71***
	(0.82)	(0.83)	(0.15)	(0.79)	(0.81)	(0.14)
P2	−0.90*	−2.15***	1.25***	−1.04**	−2.13***	1.09***
	(0.47)	(0.50)	(0.20)	(0.42)	(0.46)	(0.19)
P3	−0.71	−2.17***	1.45***	−1.03***	−2.28***	1.25***
	(0.47)	(0.53)	(0.23)	(0.39)	(0.45)	(0.22)
P4	−0.69	−2.32***	1.63***	−0.96**	−2.40***	1.44***
	(0.50)	(0.55)	(0.24)	(0.40)	(0.47)	(0.23)
High	−0.64	−2.67***	2.03***	−0.77*	−2.53***	1.77***
	(0.54)	(0.64)	(0.30)	(0.46)	(0.57)	(0.28)
High-Low TB	−0.81	−2.00**	1.19***	−0.56	−1.62**	1.06***
	(0.77)	(0.80)	(0.18)	(0.74)	(0.76)	(0.17)

Panel C: Funds in the Highest Prior 36-Month Return Tercile

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.98	0.18	0.80***	−0.44	−1.12	0.69***
	(1.48)	(1.47)	(0.13)	(1.23)	(1.24)	(0.12)
P2	0.40	−0.82	1.22***	−1.19	−2.24**	1.05***
	(1.15)	(1.15)	(0.17)	(0.99)	(1.01)	(0.16)
P3	0.48	−0.97	1.45***	−0.93	−2.16**	1.24***
	(1.08)	(1.08)	(0.20)	(0.95)	(0.98)	(0.19)
P4	0.53	−1.20	1.73***	−1.03	−2.52**	1.49***
	(1.17)	(1.17)	(0.24)	(1.01)	(1.06)	(0.23)
High	0.41	−1.66	2.07***	−1.32	−3.10**	1.78***
	(1.30)	(1.30)	(0.30)	(1.16)	(1.21)	(0.28)
High-Low TB	−0.57	−1.84**	1.27***	−0.88	−1.98***	1.10***
	(0.78)	(0.81)	(0.22)	(0.73)	(0.75)	(0.21)

Table 12: **Performance of Tax Burden Portfolios by DC Proportion**
This table presents the before-tax returns, the after-tax returns, and the tax burdens (TB) of mutual fund portfolios based on the prior fund tax burdens. The standard errors based on the time-series of the portfolio returns are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: Funds in Lowest DC Tercile

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.68	0.20	0.48***	0.13	−0.29	0.43***
	(1.13)	(1.11)	(0.15)	(0.99)	(0.99)	(0.14)
P2	−0.61	−1.45	0.84***	−1.48	−2.21**	0.73***
	(1.10)	(1.09)	(0.22)	(1.06)	(1.07)	(0.21)
P3	−1.10	−2.13***	1.04***	−1.70***	−2.62***	0.92***
	(0.71)	(0.73)	(0.25)	(0.63)	(0.67)	(0.25)
P4	−0.23	−1.45*	1.22***	−0.58	−1.68**	1.10***
	(0.77)	(0.77)	(0.24)	(0.68)	(0.68)	(0.23)
High	0.55	−1.18	1.73***	−0.30	−1.78*	1.47***
	(0.90)	(0.98)	(0.44)	(0.84)	(0.96)	(0.41)
High-Low TB	−0.13	−1.38	1.25***	−0.44	−1.48	1.05***
	(0.94)	(1.04)	(0.34)	(0.85)	(0.95)	(0.31)

Panel B: Funds in Medium DC Tercile

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.68	0.21	0.43***	0.21	−0.18	0.40***
	(1.13)	(1.12)	(0.14)	(0.99)	(0.99)	(0.12)
P2	−1.34*	−2.20***	0.84***	−1.83**	−2.59***	0.76***
	(0.76)	(0.77)	(0.24)	(0.75)	(0.78)	(0.21)
P3	−1.09	−2.10***	1.02***	−1.59**	−2.47***	0.88***
	(0.73)	(0.75)	(0.24)	(0.62)	(0.63)	(0.22)
P4	0.01	−1.21	1.21***	−0.64	−1.70**	1.06***
	(0.74)	(0.74)	(0.31)	(0.67)	(0.68)	(0.27)
High	−0.62	−2.20**	1.64***	−1.16	−2.57**	1.42***
	(1.07)	(1.11)	(0.38)	(0.96)	(1.01)	(0.32)
High-Low TB	−1.30	−2.40**	1.20***	−1.37	−2.39**	1.02***
	(1.06)	(1.14)	(0.31)	(0.96)	(1.01)	(0.23)

Panel C: Funds in Highest DC Tercile

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	0.43	−0.03	0.46***	−0.21	−0.60	0.39***
	(0.95)	(0.95)	(0.11)	(0.90)	(0.91)	(0.11)
P2	−1.02	−1.91**	0.89***	−1.77**	−2.54***	0.77***
	(0.83)	(0.85)	(0.22)	(0.75)	(0.79)	(0.22)
P3	−0.39	−1.51*	1.12***	−1.12*	−2.10***	0.98***
	(0.78)	(0.81)	(0.24)	(0.63)	(0.68)	(0.24)
P4	0.44	−0.92	1.36***	−0.20	−1.40*	1.20***
	(0.81)	(0.82)	(0.30)	(0.71)	(0.74)	(0.30)
High	1.17	−0.57	1.74***	0.68	−0.89	1.57***
	(0.91)	(0.96)	(0.37)	(0.78)	(0.84)	(0.34)
High-Low TB	0.74	−0.54	1.28***	0.89	−0.29	1.17***
	(1.03)	(1.07)	(0.29)	(0.89)	(0.91)	(0.27)

Table 13: **Performance of Tax Burden Portfolios by Subperiod**
This table presents the before-tax returns, the after-tax returns, and the tax burdens (TB) of mutual fund portfolios based on the prior fund tax burdens. The standard errors based on the time-series of the portfolio returns are shown in parentheses. *, **, and *** represent statistical significance at the 10%, 5%, and 1% level, respectively.

Panel A: 1990-1997

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	−0.27	−1.59	1.33***	−0.17	−1.06	0.88***
	(1.32)	(1.36)	(0.14)	(0.79)	(0.89)	(0.15)
P2	−0.86	−2.78***	1.92***	−0.64	−1.97**	1.33***
	(0.92)	(1.03)	(0.14)	(0.59)	(0.79)	(0.17)
P3	−1.31*	−3.46***	2.15***	−0.80*	−2.22***	1.42***
	(0.75)	(0.89)	(0.17)	(0.46)	(0.70)	(0.23)
P4	−1.31*	−3.70***	2.38***	−0.66	−2.30***	1.64***
	(0.79)	(0.96)	(0.21)	(0.49)	(0.79)	(0.24)
High	−1.71*	−4.45***	2.74***	−1.11*	−3.02***	1.91***
	(0.88)	(1.10)	(0.28)	(0.59)	(0.95)	(0.32)
High-Low TB	−1.44	−2.85***	1.41***	−0.94	−1.96**	1.03***
	(0.99)	(1.04)	(0.19)	(0.86)	(0.93)	(0.20)

Panel B: 1998-2002

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	3.25*	2.34	0.91**	1.60	0.79	0.80*
	(1.90)	(1.78)	(0.28)	(1.64)	(1.60)	(0.37)
P2	0.17	−1.19	1.36**	−1.56	−2.78*	1.21*
	(1.83)	(1.76)	(0.43)	(1.54)	(1.52)	(0.53)
P3	0.43	−1.22	1.65**	−1.18	−2.64**	1.46*
	(1.80)	(1.73)	(0.53)	(1.33)	(1.25)	(0.66)
P4	0.33	−1.54	1.87**	−1.41	−3.07**	1.66*
	(1.78)	(1.74)	(0.60)	(1.42)	(1.42)	(0.75)
High	0.18	−1.99	2.17**	−0.76	−2.68	1.93
	(2.03)	(1.94)	(0.74)	(1.92)	(1.88)	(0.91)
High-Low TB	−3.07**	−4.33***	1.26*	−2.36**	−3.48***	1.12
	(1.32)	(1.43)	(0.46)	(1.16)	(1.21)	(0.55)

Panel C: 2003-2012

	Excess Return			Carhart Alpha		
TB Portfolio	Before Tax	After Tax	Tax Burden	Before Tax	After Tax	Tax Burden
Low	−0.12	−0.34	0.22***	−1.22	−1.44*	0.21***
	(1.28)	(1.28)	(0.04)	(0.81)	(0.81)	(0.04)
P2	−0.56	−0.96	0.40***	−1.23***	−1.62***	0.39***
	(0.64)	(0.64)	(0.08)	(0.46)	(0.47)	(0.08)
P3	−0.09	−0.71	0.62***	−0.82*	−1.44***	0.61***
	(0.62)	(0.64)	(0.17)	(0.46)	(0.48)	(0.16)
P4	0.18	−0.63	0.80***	−0.55	−1.35***	0.80***
	(0.64)	(0.69)	(0.23)	(0.45)	(0.50)	(0.21)
High	0.48	−0.71	1.19***	−0.84	−2.02***	1.18***
	(0.99)	(1.06)	(0.32)	(0.58)	(0.68)	(0.29)
High-Low TB	0.60	−0.37	0.97***	0.38	−0.59	0.97***
	(1.05)	(1.10)	(0.29)	(0.71)	(0.80)	(0.26)

Figure 1: **Average Fund Distributions**
The figure depicts the average distributions of dividends, short- and long-term capital gains by U.S. equity mutual funds.

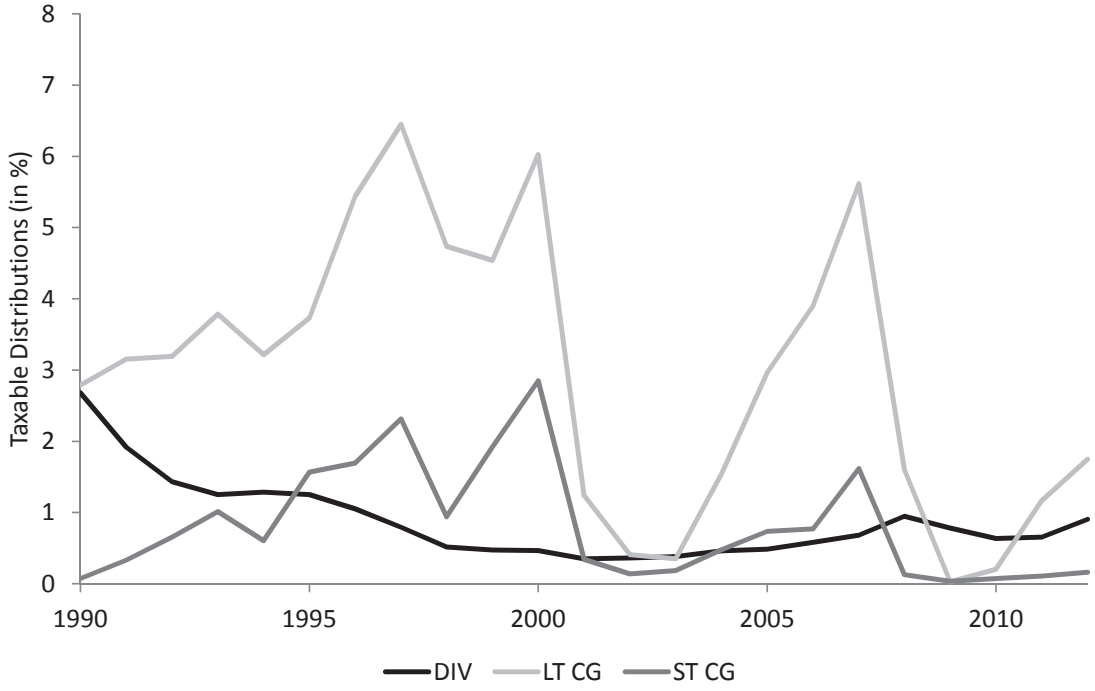


Figure 2: **Marginal Tax Rates**
The figure depicts the average marginal tax rates on qualified dividends, short-term capital gains, and long-term capital gains over our sample period. The data are obtained from the NBER Taxsim model.

Figure 3: **Tax Burdens**
The figure depicts the first quartile, the median, and the third quartile of the tax burdens over our sample period.

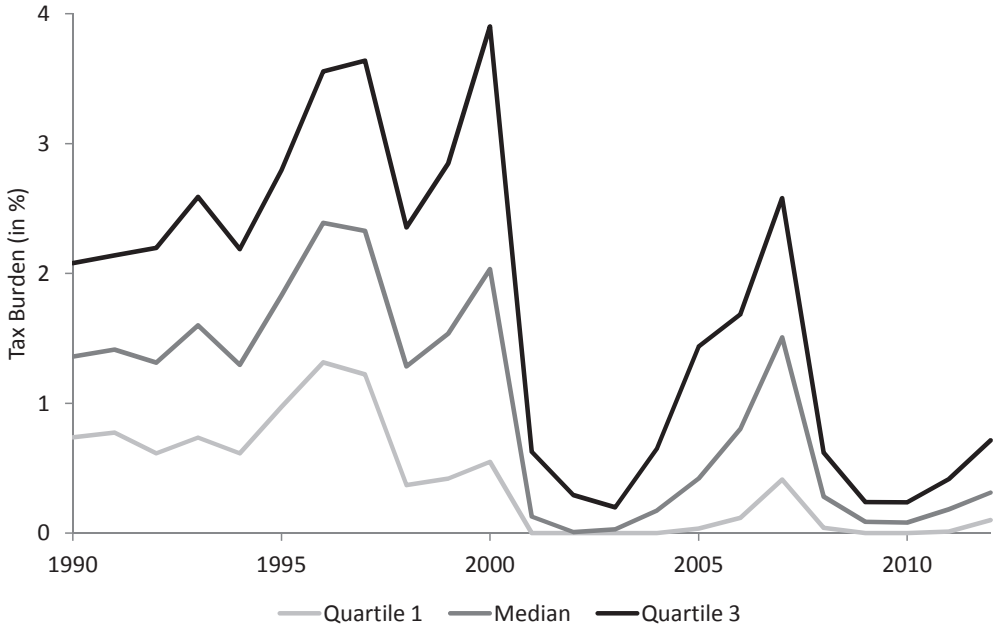
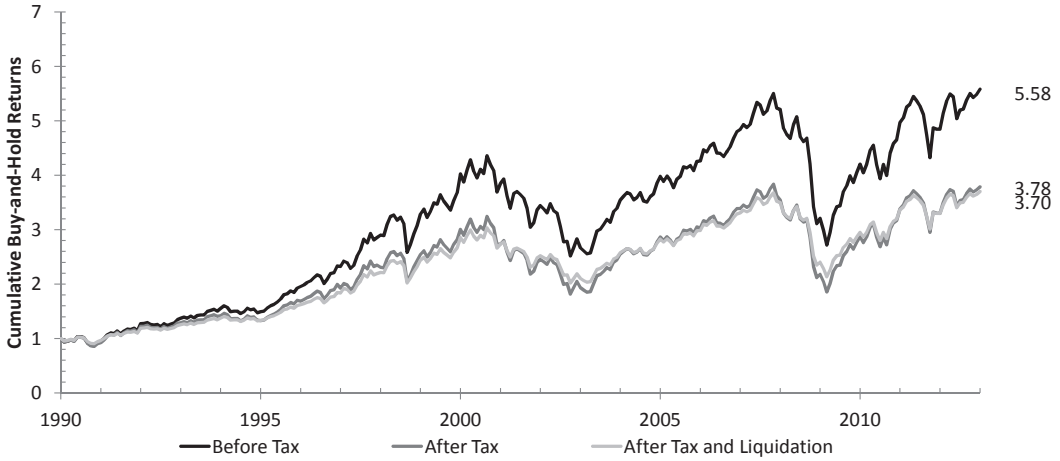
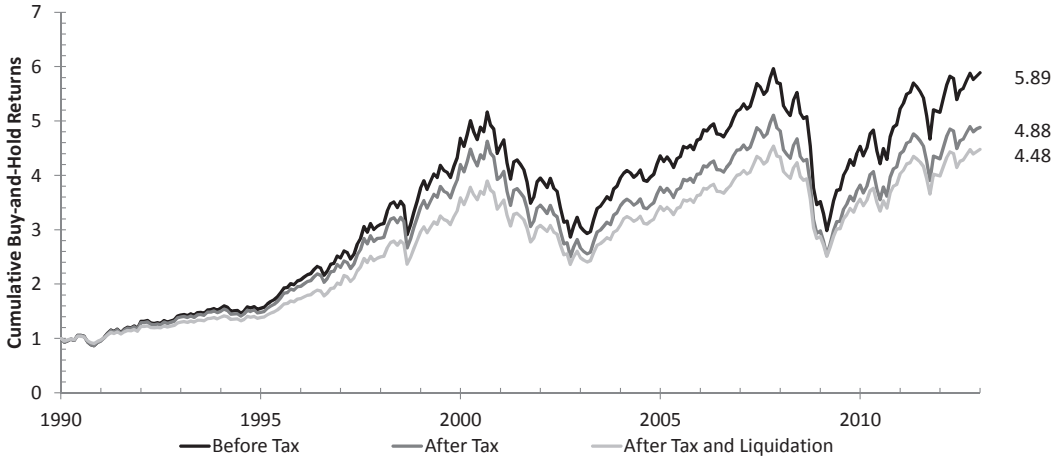


Figure 4: **Cumulative Buy-and-Hold Returns Before and After Taxes (1990-2012)** Panels A and B depict the cumulative buy-and-hold returns before and after taxes for funds in the highest and lowest average tax burden deciles over the whole sample period. Panel C depicts the corresponding returns for the Vanguard's S&P 500 Index fund

Panel A: Highest Average Tax Burden Decile



Panel B: Lowest Average Tax Burden Decile



Panel C: Vanguard S&P 500 Index Fund