ETF Heartbeat Trades, Tax Efficiencies, and Clienteles:
The Role of Taxes in the Flow Migration from Active Mutual Funds to ETFs

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Abstract

We study the use of "heartbeat trades" by ETFs in explaining their superior tax efficiency. By relying on the in-kind-redemption exemption rule, authorized participants help ETFs avoid distributing realized capital gains and reduce their tax overhang. In recent years, ETFs end up with 0.92% lower tax burden per year compared with active mutual funds, partly due to heartbeat trades. Challenged by ETFs' tax efficiencies, mutual funds exhibit higher flow-tax sensitivity than flow-fee sensitivity. Active mutual funds with relatively higher tax burdens had more outflows from tax-sensitive investors at the same time when ETFs with similar investment styles experienced stronger inflows. Using holdings data of institutions with high net-worth clients, we find that investment advisors with tax-sensitive investors allocate four times more assets to ETFs than other institutions, representing an important driver behind the overall surge in ETF flows, especially after the increase of capital gains tax rate in 2013. We conclude that the migration of flows from active mutual funds to ETFs is driven primarily by tax considerations.

Keywords: ETFs, Mutual Funds, Capital Gains, Tax Deferral, Fund Flows, Heartbeats, High-Net-Worth Investors, Step-up Basis

JEL Classification: G12, G11

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I. Introduction

On November 24, 2020, the first conversion of a mutual fund into an exchange traded fund (ETF) was announced to be near completion, ushering in a new era of ETF growth and representing a watershed moment for the mutual fund industry.[1] The conversion of mutual fund assets into ETFs has been accelerating in recent months to include well-known fund families, such as Dimensional Fund Advisors, Vanguard, and Fidelity.[2] This recent migration of investor assets from mutual funds into ETFs comes after a challenging decade for mutual funds where $1 trillion of investors' capital left active fund portfolios and a similar amount flowed into ETFs during that period (Figure I.C; Dannhauser & Pontiff (2019)). ETF asset growth and dominance seem unrelenting. In this paper, we argue that ETFs' tax advantage, the likely driver of this recent wave of fund conversions, is the main catalyst behind the massive flow migration from active mutual funds to ETFs over the last two decades. We present evidence that tax sensitivity is the main determinant of outflows from mutual funds, especially in recent years, and is as important and in some instances stronger than other determinants of flows, such as relative performance and fund fees. During the same period when mutual funds exhibited the most outflows by tax-sensitive investors, we find that institutional advisors with the most tax-sensitive investors had the largest allocations to ETFs, both relative to their total portfolios and proportional to overall ETF assets.

The success of ETFs is attributed to several factors, among which are lower transaction costs, less cash drag, intraday liquidity, lower expense ratios, and fewer capital gains distributions than index mutual funds (Kostovetsky (2003); Ben-David, Franzoni, & Moussawi (2017)). Consequently, the flow migration from active mutual funds to ETFs could be due to a variety of reasons. First, active mutual funds' lack of outperformance net of fees could be an important reason behind the trend. Second, ETFs are attractive because of their lower expense ratios, which allows them to compete for investor flows not only with open-end mutual funds but even with futures and

[1] Guiness Atkinson expects the completion of the first mutual fund industry transformation of a fund into an ETF by the end of 2020: https://www.ft.com/content/9eb2fbba-51f6-4c43-982b-98844d1f1bc0.

[2] Dimensional Fund Advisors announced in November 2020 the conversion of some of their mutual funds into ETFs: https://www.ft.com/content/7a6da469-b2d7-4ad4-b857-b3049752efb6. Fidelity Magellan fund announced in September 2020 that it will be repackaging the fund into an ETF: https://www.cnbc.com/2020/10/02/fidelity-magellan-mutual-fund-moves-to-etf-format-what-may-be-next.html. As of October 2020, Vanguard has recorded $148 of inflows into its ETFs, partly because of $22.8 billion of conversion of some of its mutual fund clients to ETF shares of the same funds: https://www.bloomberg.com/news/articles/2020-10-27/world-s-biggest-etf-is-losing-cash-faster-than-any-of-its-peers.

other index products.[3] Indeed, recent media reports claim that ETF fee efficiency is the primary reason for the decline in the average expense ratio of mutual funds (Figure II).[4] Third, differences in tax efficiencies may have spurred the flow migration to ETFs especially by tax-sensitive investors. So far, there is little research on the role that taxes play to that effect.

In this paper, we show that ETFs are attractive to "high net worth" and other tax-sensitive investors primarily because they allow investors to defer capital gains taxes by avoiding the distributions of realized capital gains. This is attributed to ETFs' unique security design. In the U.S., compared with other pooled investment vehicles, ETFs are tax efficient because redemptions from ETFs are often made in-kind (that is, by delivering certain assets from the ETF's portfolio, rather than cash), thereby avoiding the need to directly sell assets which potentially triggers a taxable event.[5] Open-end funds are required, under the Investment Company Act of 1940, to pass through and distribute any realized capital gains and dividends to investors on an annual basis. However, the Tax Reform Act of 1969 introduced an exemption that allowed funds to forgo capital gains distributions by delivering appreciated stocks "in-kind" to redeeming investors, which avoids triggering a tax event. Furthermore, several ETFs aim to maximize this tax benefit provided by the in-kind redemption process, using a mechanism called "heartbeat" trades. Heartbeat trades, a term coined by Kashner (2017) since the plot of daily ETF flows resembles an ECG graph (Figure III.C), are typically executed around ETF rebalancing dates and consist of large ETF inflows followed by in-kind outflows a few days later. They are specifically designed to syphon away realized capital gains of departing ETF constituents through the in-kind redemption process, rather than requiring the fund to directly sell these securities.

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[3] Some ETFs arguably have lower fees than the annualized futures roll costs. Futures contracts incur roll costs because they have an expiration date, and the position must be rolled into a new position every time the futures expire. Joe Rennison, "Low-cost ETF challengers eat into derivatives market," *Financial Times*, September 11, 2016. Rochelle Toplensky, "Investors replace futures with ETFs," *Financial Times*, March 23, 2016.

[4] See for example: Wigglesworth, 2019, "Asset managers slash expenses as 'feemageddon' bites" https://www.ft.com/content/1dc6b618-4b1c-11e9-8b7f-d49067e0f50d. Flood, 2018, "Fund fees forecast to fall by a fifth" https://www.ft.com/content/941cdfc1-5c26-3834-890d-a53139252484. Zweig and Krouse, 2016, "Fees on Mutual Funds and ETFs Tumble toward Zero" https://www.wsj.com/articles/fees-on-mutual-funds-and-etfs-tumble-toward-zero-1453858966. Lim, 2019, "Index Funds Are the New Kings of Wall Street" https://www.wsj.com/articles/index-funds-are-the-new-kings-of-wall-street-11568799004

[5] The differential treatment of ETFs and mutual funds under the tax code appears to be absent in most other countries. In their study on regulation and taxation across 26 markets, Morningstar (2020) observes that the "U.S. and Australia are notable exceptions where taxes are due on capital gains incurred by the fund, regardless of whether an investor has sold the fund or not" (quote from press release).

Deferring capital gains taxes represents a valuable optionality for tax-sensitive investors due to multiple reasons. Unlike mutual funds, most ETFs can avoid annual capital gains distributions and their tax consequences for investors who hold these ETFs in taxable investment accounts. The unique in-kind redemption feature allows ETFs to convert all realized capital gains at the fund level into unrealized long-term capital gains at the investor level. Investors can decide to sell ETF shares when it is most optimal for their tax purposes. Additionally, further tax savings are obtained from the ability of ETFs to "convert short-term gains at the fund level into long-term gains at the shareholder level" (Colon (2017)). Furthermore, if ETF shares are transferred at the investor's death to her heirs, a "step-up" in basis to the fair market value at the time of transfer is applied, which readjusts appreciated assets for tax purposes.[6] For these reasons, high-net-worth individuals are likely attracted by ETFs' tax efficiencies as they are more sensitive to tax considerations. In this paper, we provide novel evidence on the behavior of this group of tax-sensitive investors by focusing on institutions that manage the assets of high-net-worth individuals. We use the change of capital gains tax rate due to the Affordable Care Act of 2010, which targets high income earners by increasing their marginal capital gains tax rates, as a quasi-natural experiment in order to better identify the role of tax considerations in explaining the wave of outflows from active mutual funds and the surge in inflows into ETFs when the rule became effective after 2012.

We use an exhaustive sample of all U.S. mutual funds and ETFs from the CRSP Mutual Fund Database merged with hand-collected data from Form N-SAR on realized and unrealized capital gains and distributions during the period between 1993 and 2017. We follow Sialm (2009) and use corresponding marginal tax rates for dividends, short-term, and long-term capital gains distributions to estimate the overall tax burden as a percentage of the prior year's total asset value for investors in ETFs and mutual funds, when held in taxable accounts by investors taxed at the highest rates. During our sample period (the last five years), we find that index mutual funds experience an average tax drag between 0.73% (0.98%) per year and active mutual funds have a tax drag of 0.96% (1.28%) per year. On the other hand, ETFs have the lowest tax burden during each of the years in our sample, with an average of 0.42% (0.36%) per year primarily due to

[6] The step-up in basis is defined in the Internal Revenue Code, Section 1014(a) as follows: "the basis of property in the hands of a person acquiring the property from a decedent or to whom the property passed from a decedent shall, if not sold, exchanged, or otherwise disposed of before the decedent's death by such person, be the fair market value of the property at the date of the decedent's death." https://www.law.cornell.edu/uscode/text/26/1014.

dividend distributions during the sample period (the last five years).[7] The overall ETF tax burden savings relative to active mutual funds is 0.92% on average in the last five years. When comparing investments across styles, we find that large-cap ETFs save investors around 0.91% in after-tax return per year in recent years, while small- and mid-cap ETFs have the highest average reduction in tax burden of 1.05% relative to active mutual funds. This represents a positive alpha that ETF investors experience on an after-tax, net return basis, and is more pronounced in styles that experience higher realizations of capital gains.

The superior tax efficiency of ETFs is clear in their near-zero capital gains distributions. While ETFs and mutual funds with similar characteristics and investment styles all *realize* capital gains (3.89% for ETFs, 3.86% for index mutual funds, and 5.88% for active mutual funds), ETFs *distribute* almost no capital gains at all (0.1%), in contrast to the average capital gains distribution yield of 3.44% (1.76%) for active (index) mutual funds. ETFs are likely able to avoid distributing capital gains by taking advantage of regular outflows when sufficiently available, and by employing "heartbeat" trades, which could be initiated, when needed, with the help of an ETF market maker (and/or authorized participant). As a result of these trades, ETF capital gains are *realized* without being distributed to investors. They can also help ETFs increase the cost basis of the shares that remain in the portfolio. We document that in any given year, between 5% and 30% of ETFs make use of heartbeat trades, performing 1 to 2 heartbeat trades per year on average. The fraction of ETFs that rely on heartbeat trades has steadily increased after 2010, along with the capital gains growth of underlying portfolios and increased ownership by tax-sensitive clienteles (Figures IV and VII).

To better understand the differences between the tax burden of mutual funds and ETFs, we first examine what drives realized capital gains and distributions, such as recent performance, portfolio turnover, and investors' outflows. While ETFs are not discernibly different than mutual funds in how performance, turnover, and outflows affect realized capital gains yields, we notice that outflows have the opposite effect for ETFs compared with mutual funds when it comes to distributions and unrealized capital gains. While mutual fund outflows trigger taxable events resulting in higher distributions at the end of the year, ETF outflows during the year substantially reduce capital gains distributions. This also affects the cost bases of the remaining stocks in ETF portfolios resulting in lower tax overhang. We present results that are consistent with the fact that

[7] Also, not all ETFs have a custom redemption basket exemption, which makes it more difficult for those ETFs to use heartbeat trades to wash away all capital gains.

ETFs, unlike mutual funds, strategically use outflows to allocate stocks from lots with the lowest cost bases to redemption baskets, taking advantage of the capital gains distribution exemption, and leaving the fund with shares that have higher cost bases on average. As a result, there is a stark difference between active mutual funds and ETFs regarding the effect of outflows on distributed and unrealized capital gains due to the differential tax implications of the in-kind redemption process.

After establishing the effect of ETF outflows, we include a proxy of heartbeat trades to isolate the effect of those outflows specifically designed to wash away realized capital gains. Heartbeat trades significantly reduce capital gains distributions and are more powerful than outflows in reducing both the short-term and long-term distributions. Our results show that ETFs are more likely to employ heartbeat trades when an ETF has a higher portfolio turnover ratio that results in higher realized capital gains, has a large number of portfolio constituents, and when outflows during the year are not sufficiently large to flush away the bulk of realized capital gains through in-kind redemptions. As a result, ETFs end up with significantly lower tax burdens compared with mutual funds: for example, an ETF with *two* heartbeat trades per year ends up, on average, with 0.86% lower tax burden than a comparable mutual fund with a similar style, after controlling for various fund characteristics.

ETF tax efficiency seems especially appealing to tax-sensitive investors who migrate out of active mutual funds for tax consideration. We test this clientele effect and whether tax-sensitive investors did indeed reallocate capital into tax-efficient ETFs in four steps. First, we run a horse race of fund flow sensitivities with performance, fees, and tax burden. Flows from mutual funds to ETFs could be explained by the underperformance of active mutual funds relative to passive funds (index funds and ETFs) in general, especially in the last two decades, and by the fee efficiency of index funds and ETFs. However, tax efficiency is unique for ETFs due to their lower tax burdens than index and active mutual funds. We find that flow-tax sensitivity is a stronger determinant, statistically and economically, of active mutual fund outflows than flow-fee sensitivity and is as meaningful as, and sometimes stronger, than flow-performance sensitivity. Second, we focus on investors' fund outflows measured during the period between when realized capital gains are publicly reported and before they are distributed. As a result, we confirm the evidence that the expected tax burden emerges as the strongest determinant of subsequent mutual funds outflows in anticipation of capital gains distributions. These results suggest that tax-sensitive investors were the leading driver of outflows from active mutual funds during our sample period. Third, we sort

active funds by their realized capital gains yields and find that indeed it is those mutual funds with the largest gains that experience the largest outflows, while ETFs of similar investment styles exhibit relatively higher inflows than other ETFs, suggesting a migration of flows from active mutual funds to ETFs by tax-sensitive investors in order to take advantage of ETFs' superior tax efficiencies.

Finally, as a direct test of the clientele effect and to confirm that the flows into ETFs are driven by tax efficiencies, we explore portfolio allocations by investment advisors with the type of clients who are most sensitive to tax considerations. Following Blouin, Bushee, & Sikes (2017), we identify institutions that manage the investment accounts for tax-sensitive investors using client information in Form ADV, and directly use their holdings data to explore ETF allocations. We find that investment advisors with high-net-worth clients are likely to be the most attuned to the tax efficiency needs of their clients, as they have been increasingly allocating more assets to ETFs. In 2017, for example, allocations to ETFs by investment advisors with high-net-worth clients made up 21% of their overall portfolio, compared to 5% for other investment advisors, and this allocation has increased significantly after 2012, when short term and long term capital gains tax rates increased, which disproportionally affected high-net-worth clienteles. These regulatory changes in capital gains tax rates present a quasi-natural experiment that help us better identify the observed flow migration due to tax reasons.

High-net-worth clients can benefit especially from the optionality that ETFs provide on when to realize capital gains for optimal tax purposes and the ability to indefinitely defer capital gains allowing future heirs to forgo capital gains taxes using step-up in basis. Even though investment advisors of high-net-worth individuals represent a smaller asset base, their ETF ownership and flows into ETFs relative to the total ETF assets are the largest across institutional advisors, and they constitute most of the ETF flows by investment advisors in recent years. The migration of active fund flows to ETFs is most visible when examining the portfolio of investment advisors with high-net-worth clients, where we document an overwhelming trend in allocation and flows into ETFs relative to advisors with lower fractions of tax-sensitive clientele, which accelerated with the increase in capital gains tax rates after 2012. Our evidence points to the dominant role of ETF tax efficiencies behind the dramatic surge of flows into ETFs in recent years.

Overall, we establish that ETFs are hardwired to take advantage of special capital gains distribution exemptions, allowing them to generate significant tax savings that are appealing to tax-sensitive investors. We show that this tax efficiency has propelled the growth and popularity of

ETFs in recent years as tax-sensitive investors, such as high-net-worth investors, gradually switched from mutual funds to ETFs over the last decade. Our findings are related to the conclusions of other researchers regarding the competition between mutual funds and ETFs. Guedj & Huang (2010) develop an equilibrium model and find that open-end mutual funds and ETFs can coexist in equilibrium because they attract different liquidity clienteles. They find that ETFs are better suited for long-term investors, which is in line with our findings regarding the optimal use of ETFs to defer capital gains taxes. Agapova (2011) concludes that index mutual funds and ETFs are imperfect substitutes, and they can coexist due to liquidity or tax-driven clientele effects. Our study further highlights the importance of heartbeat trades for ETFs to realize their superior tax efficiencies, and pinpoints the tax clientele effect on flows using holdings data from institutional advisors with high-net-worth clients.

Our study proceeds as follows. Section II reviews the literature and discusses ETF heartbeat trades and the unique security design that gives rise to the superior ETF tax efficiency. Section III provides the sample construction details followed by descriptive statistics. Section IV documents a wedge between realized capital gains and distributions for ETFs giving rise to tax efficiency. Section V discusses tax burden and identifies the potential tax "alpha" for ETFs resulting from the reduction in the tax burden of ETFs due to near-zero distributions. After quantifying ETF tax efficiency, we run a horse race between the flow sensitivity of relative performance, fees, and taxes of active mutual funds to assess the comparative effects of each of these determinants of flows, and specifically outflows from active funds in Section VI. Section VII provides direct evidence on ETF allocation by tax-sensitive investors using holdings data. Section VIII concludes.

II. ETF Security Design and Tax Efficiency

Exchange traded funds (ETFs) have exhibited unprecedented growth since their launch in 1993 and have become a popular investment vehicle by institutions and retail investors alike. As illustrated in Figure I.A, around 1,100 domestic equity-focused ETFs trade publicly in the US as of December 2019, with aggregate assets under management (AUM) of around $2.4 trillion.[8] In contrast, open-end active (index) equity mutual fund assets represent about $5.8 trillion ($3.2

[8] The total ETF assets in the US surpassed $4 trillion in 2019 according to the Investment Company Institute: https://www.ici.org/research/stats/etf/etfs_10_19; out of which US equity ETFs consists of $2.4 trillion, matching our ETF sample statistics in Figure I.

trillion) owned by over 3,750 actively-managed mutual funds (around 600 index funds). The success of ETFs is attributed to several factors, among which are lower transaction costs, less cash drag, intraday liquidity, lower expense ratios, and fewer capital gains distributions than index mutual funds (Kostovetsky (2003); Ben-David, Franzoni, & Moussawi (2017)).

The tax efficiency of ETFs lies on an exemption, originally designed for open-end mutual funds, which allows them to forgo distributing realized capital gains to investors. When faced with outflows or rotating into new positions, mutual funds are often forced to sell stocks in their portfolios, thereby realizing capital gains for appreciated stocks. This causes externalities on remaining fund investors (Dickson, Shoven, & Sialm (2000)). Under the Investment Company Act of 1940, and to avoid double taxation, funds are required to pass through and distribute their dividends and realized capital gains to investors on an annual basis, which will be taxed at the shareholder level. However, since the inception of Tax Reform Act (TRA) of 1969[9], open-end funds have enjoyed an exemption to forgo capital gains distributions by handing over appreciated stocks "in-kind" to redeeming investors without the recognition of gain under the in-kind redemption exemption rule 852(b)(6) which avoids triggering a tax event.[10]

Essentially, this exemption allows ETFs and mutual funds to defer both short-term and long-term capital gains until investors sell their own shares in the fund, which enhances the tax-timing option of taxable investors. While we could identify only 798 instances in which 320 mutual funds issued in-kind redemptions to investors (mostly due to liquidity reasons),[11] ETFs are hardwired to actively take advantage of this exemption, resulting, on average, in near-zero short- and long-term capital gains distributions in recent years. We will survey the mutual fund tax literature next, before discussing the ETF security design and the heartbeat mechanism in the following subsections.

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[9] Colon (2017) provides a detailed discussion of the taxation of in-kind redemption and the 852(b)(6) exemption rule. For reference, see U.S. Tax Code 852: Taxation of Regulated Investment Companies and their Shareholders https://www.law.cornell.edu/uscode/text/26/852, Section (b)6, following Section 311(b) of the Tax Reform Act of 1969, https://www.pgdc.com/files/generalexplanati00jcs1670_bw.pdf, December 3, 1970. Based on this rule, ETFs and mutual funds can deliver appreciated stocks to investors instead of handing over cash, and therefore realize the capital gains without triggering a capital gains distribution event.

[10] For a registered investment company, there are only two ways to avoid distributions. One way is to offset net realized capital gains by loss carryovers. Another is through redemption-in-kind transactions where a pro-rata or a custom basket of portfolio assets, rather than cash, are delivered to redeeming shareholders. The realized gains through redemption-in-kind transactions will be reclassified as paid-in capital and not subject to federal taxation. See the Notes to Financial Statements section on significant accounting policies related to in-kind redemptions in iShares' Annual Report: https://www.ishares.com/us/literature/annual-report/ar-ishares-evolved-us-sectors-etfs-07-31.pdf

[11] The 1940 Act allows for redemption-in-kind to alleviate instances when the fund must meet very large redemptions, or the underlying shares are very illiquid (Section 2(a) 32).

A. Mutual Fund Taxes, Flows, and Clienteles

Capital gains taxes represent an important concern for long term investors that own mutual funds in taxable investment accounts. Mutual fund returns are reported net of management fees but on a pre-tax basis. After-tax returns are generally lower depending on the type of mutual fund account (taxable vs. tax-advantaged retirement account), investor tax bracket, and the taxable distributions of the fund which are a function of the fund's investment style and turnover (short term vs. long term capital gains, dividends). In 2018, mutual funds distributed $511 billion in capital gains to shareholders (ICI Fact Book). For investors in the highest tax bracket, short-term (long-term) capital gains would be taxed federally at 40.8% (23.8%). Longmeier & Wotherspoon (2006) find that this type of investor lost on average 1.84% per year due to taxes during the period 1995-2005, while Peterson, Pietranico, Riepe, & Xu (2002) found a similar effect of 2.2% during 1981-1998. Overall, Sialm & Starks (2012) find that the average annual tax burden is of a magnitude similar to the expense ratio at around 1% of the fund's value. The distribution of capital gains is taxable and incurs a cost to tax-sensitive mutual fund investors. At the same time, net capital losses are not passed through to shareholders but are carried forward to offset future capital gains (Longmeier & Wotherspoon (2006)).[12]

There is evidence that investors are paying attention to the effect of taxes on their returns. For example, Bergstresser & Poterba (2002) find that after-tax returns better explain inflows to mutual funds than before-tax returns. Additionally, they find that investors avoid funds with high unrealized capital gains overhangs, which is consistent with Barclay, Pearson, & Weisbach (1998), who argue that managers have an incentive to reduce capital gains overhangs to attract new investors. Christoffersen, Geczy, Musto, & Reed (2005) document a clientele effect in international equity funds resulting in differential dividend arbitrage strategies to take advantage of tax credit when non-retirement accounts are the majority. More recently, Sialm & Starks (2012) find that mutual funds choose investment strategies that reduce tax burdens when they are held primarily by taxable investors, for example employing strategies that reduce capital gains distributions.

Blouin, Bushee, & Sikes (2017) use 13-F and Form ADV filings to classify institutional investors as tax-sensitive or tax-insensitive in order to evaluate portfolio characteristics and trading

[12] Before 2011, mutual funds could carry forward capital losses for up to eight years. https://www.wsj.com/articles/SB10001424052748704893604576200921149587458

behavior. They find that tax-sensitive investors earn lower pre-tax returns on average, likely due to tax reduction practices. Arnott, Kalesnik, & Schuesler (2018) note that many tax deference strategies (such as loss harvesting, wash sale management, and holding period management, among others) are still underused by funds, causing most active funds to have difficulty delivering alpha in excess of their fees and taxes. Bergstresser & Pontiff (2013) show that investment style is an important driver of tax burden, documenting that value and size risk premia are reduced after taxes are taken into account. Moreover, Peterson, Pietranico, Riepe, & Xu (2002) find that past pretax performance, expenses, risk, past tax efficiency, and large recent redemptions significantly affect after-tax performance for mutual funds as well. Additionally, Beggs & Liu (2020) find that mutual funds that are managed side-by-side with tax-exempt separate account clients incur higher tax burdens.

B. ETF Security Design

There are costs and benefits to investing in exchange traded funds (Ben-David, Franzoni, & Moussawi (2017)). ETF investors do incur brokerage transaction fees and bid-ask spreads, but these costs have decreased over time. ETF investors may also incur a price difference between the price of the ETF and the net asset value (NAV) of its basket. Among the costs are also various effects on the securities in the underlying basket, such as increased volatility (Ben-David, Franzoni, & Moussawi (2018)), decreased liquidity (Hamm (2014)), reduced informational efficiency (Israeli, Lee, & Sridharan (2017)), increased return comovement (Da & Shive (2017)) and increased liquidity comovement (Agarwal, Hanouna, Moussawi, & Stahel (2019)). Benefits of ETFs include lower costs, the ease with which one can obtain a diversified portfolio, less cash drag, as well as tax efficiencies (Gastineau (2001)). In this paper, we further explore the tax efficiencies of ETFs and what effects they have on fund flows.

Several advantages of ETFs over mutual funds arise from the in-kind creation and redemption transactions that ETFs heavily use. The innovation of ETFs lies in the ability of ETF sponsors and authorized participants (and/or market makers)[13] to engage in the primary market of

[13] We refer interchangeably to authorized participants (APs) and market makers (MMs), but not all APs are market makers and vice versa. An AP is typically a market maker or large institutional investor that has a legal agreement with the ETF to create and redeem shares of the fund. Many. Evans, Moussawi, Pagano, & Sedunov (2019) discuss this issue in more details and reports that an ETF usually has several APs that are active registered market makers with

ETF shares, incentivized by arbitrage profits, typically engage in the creation/redemption process in order to satisfy demand for ETF shares in secondary markets, which keeps the ETF price in line with the net asset value of the underlying basket (Evans, Moussawi, Pagano, & Sedunov (2019)). This process allows authorized participants to exchange baskets of securities or cash for ETF shares, and vice versa.

C. ETF Tax Efficiencies, and Heartbeats

Given the 1969 exemption, ETF fund managers are incentivized to exchange securities from tax lots with the lowest cost basis and highest unrealized gains (Poterba & Shoven (2002), Kostovetsky (2003), Colon (2017)). This can be employed whenever ETF shares are being redeemed to meet investors' outflows in ETF primary or secondary markets, or as part of the ETF arbitrage process. As a result, the remaining shares of underlying securities in the ETF have a higher cost basis and most capital gains can be deferred. Going forward, investors may not even incur capital gains during portfolio rebalancing as a result of the adjusted cost bases. Mutual funds do not usually have similar opportunities to take advantage of the in-kind redemption mechanism, and predominantly use it to accommodate large redemption requests (Agarwal, Ren, Shen, & Zhao (2020)).[14]

This benefit is not limited to ETF shareholders. Colon (2017) documents that Vanguard and Eaton Vance have started to offer mutual funds with ETF share classes, which in turn help the fund reduce its unrealized capital gains through the in-kind redemption process.[15] In a recent Bloomberg investigative article, Mider, Massa, & Cannon (2019) document that Vanguard was able to syphon away realized capital gains for $130 billions of their appreciated assets between 2000 and 2018 from both their ETFs and open-end mutual funds due to their patented ETF-Mutual Fund hybrid structure.

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obligations to provide continuous buy and sell quotes for ETF shares on secondary markets. We assume that an ETF market maker is also an authorized participant or has an agent with an AP agreement with the ETF sponsor, and so we refer to such a market maker interchangeably in the paper as AP or MM.

[14] Section 270.18f-1 of the Investment Company Act of 1940 allows a registered open-end investment company to redeem in kind if a redemption request is over $250,000 or more than 1% of the AUM.

[15] Bloomberg provides examples of various cases where Vanguard funds stopped distributing taxable capital gains after the introduction of the ETF share class in its funds as documented by Mider, Massa and Cannon in their article from May 1, 2019: https://www.bloomberg.com/graphics/2019-vanguard-mutual-fund-tax-dodge/

Many ETFs aim to maximize the benefit from the in-kind redemption process to avoid realization of capital gains, using a mechanism called "heartbeat" trades.[16] A heartbeat trade, a term coined by Kashner (2017), as the plot of daily ETF flows resembles an ECG graph (Figure III.C), is initiated by the ETF with the help of a market maker (and/or authorized participants). The process relies on a large inflow to the ETF where the market maker provides a short-term loan to the ETF and creates new ETF shares. This is followed by a large outflow where the same market maker redeems ETF shares equal in size to the creation order from days earlier, which marks the return of the capital. The outflow trade occurs a few days later and is aimed specifically to use appreciated securities in the in-kind redemption basket, thereby washing away all capital gains that would have to be realized and distributed otherwise.[17] This trade effectively defers the taxation of capital gains until an investor sells their shares in the ETF and thereby "can convert short-term gains at the fund level into long-term gains at the shareholder level" (Colon (2017)). Furthermore, if ETF shares are transferred at death to an investor's heirs, a "step-up" in basis to the fair market value at the time of transfer is applied, which readjusts the cost basis of appreciated assets for tax purposes.[18] Mider, Evans, Wilson, & Cannon (2019) estimate that over 400 U.S. equity ETFs together deferred taxes on more than $211 billion in gains in 2018 alone. While the flexibility and control around the timing of tax payments are valuable benefits to ETF investors, the reduced application of short-term (and in some cases long-term) capital gains tax rates are foregone income for tax agencies.

III. Sample Construction and Data Description

To construct our sample, we first identify an exhaustive list of US Equity ETFs and mutual funds since 1993, and then map this data with various data sources for capital gains information,

[16] Heartbeats are also called friendlies or tax kickers. (Loder (2019))

[17] Heartbeat trades are operationally easier to implement for certain ETFs that qualify for the custom basket exemption, as the redemption basket would consist only of the appreciated securities leaving the fund, thus reducing the size and costs of the overall heartbeat trades. On September 26, 2019, the SEC made it easier for ETFs to seek custom basket exemptions through Rule 6c-11. According to this rule, an ETF "will be permitted to use baskets that do not reflect a pro-rata representation of the fund's portfolio or that differ from the initial basket used in transactions on the same business day ('custom baskets') if the ETF adopts written policies and procedures setting forth detailed parameters for the construction and acceptance of custom baskets that are in the best interests of the ETF and its shareholders." See Rule 6c-11 for more information: https://www.sec.gov/news/press-release/2019-190, and https://www.sec.gov/rules/final/2019/33-10695.pdf.

[18] This is described by Ryan Kirlin in the Alpha Architect podcast from October 12, 2019. https://alphaarchitect.com/2019/10/02/etfs-vs-mutual-funds-who-wins-investors-ryan-kirlin/, but the heir would still be subject to estate and/or inheritance taxes.

ETF heartbeat trades, and institutional ownership by advisors with high-net-worth clienteles. Our sample ends in 2017 which is the last year with complete Form N-SAR data that represents the source of our realized, distributed, and unrealized capital gains information.

A. Fund Sample

We construct three fund samples: ETFs, index funds, and actively managed mutual funds. All three samples are from the CRSP Mutual Fund Database. We use the *et_flag* and *index_fund_flag* variables to identify ETFs and index funds. We use the Lipper Class (*lipper_class*) and *crsp_obj_cd* variables to filter out any non-equity funds.[19] For all investment style analyses and variables constructed at the fund style level, we rely on Lipper Class information which is inferred by Lipper from holdings, while CRSP Objective code and Lipper Objective code are typically self-reported fund style/objective codes.[20]

Table I Panel A reports the overall sample of US Equity ETFs, index funds, and active mutual funds over the years using statistics at the share class and portfolio levels. All three groups have witnessed exponential growth from a combined 1,834 fund share classes at the end of 1993 to 15,920 share classes at the end of 2017. In terms of unique fund portfolios, the fund industry has seen a change from 1,438 to 4,793 portfolios during our sample period.

US Equity ETFs have grown from 28 funds at the end of 1998 to 1,029 at the end of 2017, an almost 37-fold increase (excluding years 1993-1998 where there are less than 10 ETFs). There

[19] To identify US equity funds, we require the first two text character to be 'ED' in the *crsp_obj_cd* column. We also exclude short and hedge ETFs from this list (objective codes 'EDYS' and 'EDYH', as well as ETFs that do not have US equity holdings (that hold commodities, swaps, and other instruments). ETFs that invest in derivatives (instead of physical securities) are not likely to engage in in-kind redemptions which are essential to take advantage of the capital gains distribution exemption.

[20] CRSP Objective Codes (CRSP_OBJ_CD), which are based on Lipper Objective codes, are self-reported and assigned "based on the language that the fund uses in its prospectus to describe how it intends to invest." However, they can be misleading in many instances. For example, the *SPDR S&P 500 Value ETF* (*SPYV*) is classified by CRSP Objective Code as a US Equity Growth fund (EDYG) and similarly by Lipper Objective Code as a Growth (G) fund. Lipper Class (or Classification) code, on the hand, more accurately classifies *SPYV* as a Large-Cap Value Fund (LCVE) based on its holdings. Lipper Class codes are more reliable because they are assigned by Lipper after running the actual holdings of the fund through their internal classification model. See: http://www.crsp.org/products/documentation/lipper-objective-and-classification-codes. These classification mismatches are pervasive in the data as there are more than 100,000 quarterly observations in CRSP FUND_SUMMARY2 dataset with funds having "VALUE" in their names or Lipper Class codes, while being classified as growth funds by Lipper or CRSP.

is a similar growth trend in passive index mutual funds as well. There were 58 index mutual funds at the end of 1993 and 1,007 share classes at the end of 2017, a 17-fold increase. Active mutual funds, on the other hand, reached a high at the end of 2015 with 14,225 share classes being offered. With growing competition for investor money from ETFs and index funds, active mutual funds have seen a slowing growth rate in recent years.

B. N-SAR Data

Our data on funds' realized capital gains and distributions, as well as monthly inflows and outflows, are extracted from the SEC's N-SAR filings. Form N-SAR is short for "Form N, Semi-Annual Report". During each fiscal year, a registered investment company must file the Form N-SAR twice. Form N-SARA covers a fund's operations for the first six months of its fiscal year, while form N-SARB covers the entire fiscal year. These filings are available electronically at the SEC's EDGAR database. SEC's recent Investment Company Reporting Modernization Rules[21] mandated that Form N-CEN would replace Form N-SAR effective on June 1, 2018. Therefore, our sample period ends at the end of 2017.

Each N-SAR filing is at the registrant level identified by a Central Identification Key (CIK). A registrant usually is not a registered investment company (a fund) but represents a group of funds that belong to the same fund family. In each N-SAR filing, a registrant can report up to 99 funds due to organizational limitations of the form.[22] Item 7C in the N-SAR form reports the list of funds and assigns each fund a series ID that could be used to identify the same fund in past and future filings.[23] We use this series ID to build a historical record for each reported fund.

From the N-SAR filings, we collect funds' realized capital gains and distributions during each fiscal year. Realized capital gains (item 72AA) and realized capital losses (item 72BB) are reported as an aggregate dollar amount, while distributions are reported as both aggregated dollar amounts (item 72EE) and per-share amount (item 73B). We compute net realized capital gains as the difference between realized gains and losses. A fund could report non-zero net realized capital

[21] https://www.sec.gov/divisions/investment/guidance/secg-investment-company-reporting-modernization-rules.htm

[22] For example, ProShares Trust (CIK 1174610), which exceeded the 99 fund limit, listed sixty additional funds in an addendum to its N-SAR filings. https://www.sec.gov/Archives/edgar/data/1174610/000117152018000350/ex99-77q1_7c.htm. No data was reported for these additional funds exceeding the 99 fund limit in ProShares N-SAR filings.

[23] Because management companies are instructed not to reuse fund series identifiers, often data on fewer than 99 funds can be obtained from each form N-SAR.

gains but zero distributions. Possible explanations would be that the fund had loss carryovers that offset the realized capital gains, or the fund realized the gains through redemption-in-kind that were reclassified as paid-in capital (Agarwal, Ren, Shen, & Zhao (2020)).

N-SAR filings are not the only data source on funds' distributions. In the CRSP mutual fund database, the *Fund_Summary* and *Dividends* datasets supply data on capital gains distributions on per-share basis and various types of distributions as well. The data on realized and unrealized capital gains is mostly missing in CRSP, and for this reason we rely primarily on the N-SAR data to collect the total realized and unrealized capital gains/losses at the end of each fiscal year, which are important to understand the effectiveness of heartbeat trades in washing away realized capital gains.[24]

We also use N-SAR data to construct accurate monthly flow measures for mutual funds and ETFs. Net Flows are first constructed from CRSP following Carhart (1997) by inferring monthly flows from total net assets and monthly returns. For more accurate inflow and outflow information, we rely on the monthly new sales (inflows) and redemptions (repurchases or outflows) information in item 28 on NSAR filings, which we supplement using the NSAR-based data in CRSP on monthly fund redemptions and new subscriptions. Various flow variables are measured over one year and scaled by total net assets at the beginning of the year.[25]

C. Comparison of N-SAR and CRSP Coverages

To link the funds reported in N-SAR filings to the CRSP fund samples, we take the following steps. First, we use ticker symbols. Starting from 2006, the SEC requires each fund to report its ticker symbol if available and assigns a unique series ID to each fund. If a fund's ticker symbol is not available, we use its series ID to map with the CRSP fund samples.[26] If neither is available, we resort to name matching.

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[24] We compare distributions data from N-SAR filings with the CRSP Dividends dataset. Un-tabulated results show that 63% of the realized capital gains distributions are identical between N-SAR data and the CRSP *Dividends* data table. 25% of the realized capital gains distributions are within a difference of 5 cents per share between the two data sources. And the average difference is 0.003 cents per share.

[25] Net flows variable is theoretically equal to new sales minus redemptions plus other flows due to reinvestment of dividends and distributions. The NSAR's redemptions and new sales information is reported at the portfolio level, and both variables are scaled with the total portfolio assets at the beginning of the period, then matched to individual share classes of ETFs and mutual funds.

[26] The *crsp_cik_map* table maps the series ID in N-SAR filings with the *crsp_fundno* column in the CRSP mutual fund database for mutual funds that are currently active.

In Table I Panel A, we report the number of funds in our sample that we are able to link to their N-SAR filings. Coverage improved substantially after 1995, and in recent years there is more than 70% match rate for ETFs and more than 65% for mutual funds.[27] Table I Panel B presents the total assets of the funds in our matched sample along with the breakdown of matched mutual fund portfolios into index and active mutual funds, showing a match rate for index funds of about 80%.[28] Table I Panel B also reports the growth of total assets under management (AUMs) for our samples of US Equity ETFs, index funds and active mutual funds. ETFs show a significant growth trajectory since 1996 from having just $1 billion in AUM to close to $1.8 trillion at the end of 2017. Index funds also exhibit a fast growth trend since 1996 from $63 billion in AUM to $2,186 billion at the end of 2017. Compared to ETFs and index funds, the growth of active mutual funds is more subdued. Combined, the active mutual funds in our sample grew from $1.1 trillion in AUM at the end of 1996 to $4.1 trillion at the end of 2017. The Wall Street Journal reported that passive investment vehicles surpassed their active rivals in terms of AUM in September 2019 for the first time in history.[29] The asset growth in our samples which are also depicted in Figure I corroborate this overall trend. Panel C of Figure I is uniquely interesting, as it illustrates the massive outflows after 2004 from active mutual funds exceeding $1 trillion vis-à-vis ETFs which experience inflows of similar magnitude during the same period.

D. ETF Heartbeat Trades

ETFs that have lower portfolio turnover and receive a lot of routine creation and redemption requests are better situated to wash away their capital gains during regular operations. Other larger ETFs that would like to avoid selling stocks with embedded capital gains may make use of heartbeat trades to wash away their capital gains. Common reasons for the need to sell stocks are rebalancing

[27] For example, at the end of 2017, there are 717 out of 1,029 ETFs linked with N-SAR filings, while 7,359 out of 13,884 active mutual fund share classes are linked with N-SAR filings. At the end of 2017, 807 out of 1,007 index fund share classes find matches in N-SAR filings, corresponding to 3,116 portfolios out of which there 317 index fund portfolios and 2,122 active mutual fund portfolios. AUM-weighted match rate average is much higher and exceeds 90% in recent years.

[28] Capital gains data is also collected from N-SAR-U filings for ETFs organized as Unit Investment Trusts report. E.g. SPY https://www.sec.gov/cgi-bin/browse-edgar?action=getcompany&CIK=0000884394&type=NSAR-U and QQQ https://www.sec.gov/cgi-bin/browse-edgar?action=getcompany&CIK=0001067839&type=NSAR). Between 1993 and 1998, capital gains data for SPDR ETFs is collected from form N-30D, for Annual and Semi-Annual reports mailed to shareholders of investment companies.

[29] See for more illustration: https://www.wsj.com/articles/index-funds-are-the-new-kings-of-wall-street-11568799004

and reconstitution events. Other reasons include active management, expired derivative contracts, and forced selling due to downgrades or the redemption of convertible bonds as equity (Kashner (2017)).

Heartbeat trades are characterized by a large inflow followed by a large outflow several days later. In order to detect heartbeats in ETF flows, we build on the procedure by Mider, Evans, Wilson, & Cannon (2019). We start by looking for large inflows, defined as flows that have a magnitude of at least 1% relative to total shares outstanding. We exclude flows that are equal to 25,000 or 50,000 shares, which are typical sizes of one creation unit, as these flows likely belong to infrequently traded ETFs and are liquidity driven. To determine whether large flows are part of a heartbeat trade, we compare them to the largest flows in the surrounding days. A heartbeat trade is characterized by flows that are at least three times in magnitude as the maximum percentage flow observed in the surrounding 30 trading days, ignoring any outflows during the 7 trading days after the observed large inflow. Additionally, an inflow needs to be followed by outflows during the subsequent 7 trading days that together offset at least 75% of the magnitude of the inflow.[30] Daily shares outstanding are obtained from Bloomberg using unique shares outstanding tickers for each ETF.[31,32] We carefully adjust share counts for splits when necessary. Figure III Panel A provides the timeline that illustrates the windows used to identify heartbeat trades. Panel B shows an example from our sample of detected heartbeat trades using a times series of shares outstanding of the VanEck Vectors Morningstar Wide Moat ETF (MOAT), and Panel C illustrates the corresponding "heartbeat" flow chart for MOAT constructed as the time series plot of changes in shares outstanding.

The number of heartbeat trades has been steadily increasing in recent years with both the growth in ETF assets and market returns. Figure IV shows the number of heartbeats detected during

[30] It may be the case that some of these creation and redemption trades have taken place all on the same day in the past, making them unobservable to researchers. Currently, funds' understanding of the tax law in ensuring that transactions are legitimate is to keep the inflows for at least 48 hours. (Mider, Evans, Wilson, & Cannon (2019))

[31] If a percentage change in shares outstanding was missing (6% of observations), we substituted values based on Bloomberg's shares outstanding variable EQY_SH_OUT, followed by Morningstar (Shares_Outstanding), and FactSet measures (P_COM_SHS_OUT or ETP_SHS_OUT).

[32] A Bloomberg representative confirmed the accuracy of the recording date of shares outstanding figures. Other databases at times are subject to delays that are likely due to T+1 accounting (Tufano, Quinn, & Taliaferro (2012)).

each month across all ETFs in our sample, which illustrates how the use of heartbeats has been steadily increasing over time, approaching the level of 80 heartbeat trades per month in 2018.[33]

E. Descriptive Statistics

Table II presents summary statistics for the main variables used in this paper. On average, the sample consists of 88% US Equity actively managed mutual funds, 8% index mutual funds, and 4% ETFs during the sample period. Although the average pretax and net-of-fees return over the last twelve months is 8.54%, the Fama-French-Carhart four factor alpha is -1.45%, which is consistent with prior studies that document a lack of outperformance for the average mutual fund. Expenses take up 1.35% per year, on average, during our sample period, but there is an overall decline for most funds over time. The funds in our sample have an average annual turnover ratio of 86% and hold, on average, 167 stocks in their portfolios.[34]

In order to study the differences in capital gains distributions between mutual funds and ETFs, we create several variables. First, we create a dummy variable that equals to 1 when a fund reports any capital gains distributions during the year. On average, capital gains distributions take place in 37% of the fund-year observations in our sample. Furthermore, to get a sense of the magnitude of the distribution, we scale the capital gains distribution by the net realized capital gains of the fund as reported on N-SAR. The average capital gains distribution is around 3% relative to total net assets and represents about half of the net realized capital gains in an average year, possibly due to the offsetting effect for the realized losses and loss carryovers.

We also keep track of the funds' realized and unrealized capital gains and losses, as reported on form N-SAR. Realized capital gains represent 8.4% of fund assets, while net realized capital gains (realized capital gains minus realized capital losses) make up 2.8% of fund assets. If we restrict the measure to positive net realized capital gains only, which have the potential to get distributed, this measure is equal to 5.8% of total net assets. Unrealized capital gains are of similar magnitude at 6.1% of assets, on average.

[33] If heartbeat trades were performed during the span of one business day, particularly in the earlier part of the sample, we would not be able to detect those trades. However, such transactions are unlikely as they are more predisposed to a challenge from the IRS (Colon (2017)).

[34] The number of observations is lower for this variable because it is measured at the fund level instead of the share class level.

Investors in a fund typically receive three types of distributions from the fund: dividends, short-term, and long-term capital gains distributions. On average, long-term capital gains distributions represent the largest value component for fund investors, since the long-term capital gains yield is 2.3%. This is followed by the dividend yield of 0.61% and the short-term capital gains yield of 0.59%. Following Sialm & Zhang (2019), we compute the tax burden for each fund and report that the return of an investor in the highest tax bracket is reduced by 0.82%, on average, due to taxes on dividends, short-term and long-term capital gains distributions.

In analyzing the flow migration caused by tax-related motives, we study inflows and outflows separately in addition to net flows. Because outflows can cause funds to sell positions and realize capital gains, these are particularly relevant in explaining funds' tax burdens. On average, funds experience net flows of $90,000 over the last 12 months, and outflows equal to $293,000 during the same time period.

IV. The Gap between Realized Capital Gains and Distributions

A. Tax efficiency: Gap difference between open-end Mutual Funds and ETFs

We start by examining the difference in capital gains distributions between ETFs, index mutual funds, and active mutual funds. If active mutual fund managers are tax conscious, they may trade in a way that is optimal for their investors and reduces capital gains distributions. On the other hand, if active mutual funds incur higher turnover by trading more, they may generate higher capital gains distributions. Starting in this table, we report net realized capital gains as the difference between realized capital gains and realized capital losses as reported on form N-SAR, scaled by total fund assets at the portfolio level. We set negative values of this measure to zero since net capital losses are not passed through and distributed to shareholders but instead are carried forward to offset future capital gains. Since we don't know the exact timing when these carried forward capital losses are being used to offset future capital gains, we exclude them from our analysis going forward.

In Table III Panel A, we document that index mutual funds (*IMF*) and active mutual funds (*AMF*) distribute capital gains significantly more often than ETFs. We report the distribution patterns by year to capture the evolution over the sample period, and notice that in each year after 2002, the fraction of funds that distributes capital gains is in the order of ten times larger than that of ETFs. Furthermore, even when ETFs distribute capital gains, the amount distributed is merely a

tiny fraction of the net realized capital gains. On the other hand, index and active mutual funds distribute a much larger portion of their net realized capital gains (up to 70% in certain years) while they are the lowest after big market downturn likely due to loss carryover effect (e.g. 2009-2011). Since asset-weighted average capital gains distributions are a bit larger than equal-weighted average capital gains distributions, we can also infer that larger active mutual funds distribute more capital gains to their investors (more than 85% in certain instances). These trends in capital gains distributions are also illustrated in Figure V.

In years following significant market downturns, funds may be able to offset realized capital gains by carrying forward capital losses incurred in prior years. Table III Panel B and Figure V indeed document substantial reductions in the capital gains distributions as a proportion of net realized capital gains for several years following the downturns in 2002 and 2009. Overall, these findings are consistent with Elton, Gruber, & de Souza (2019).

B. ETF Heartbeats and the gap between realized capital gains and distributions

To avoid distributing capital gains to investors, ETFs can coordinate with authorized participants and/or market makers to manufacture in-kind creations and redemptions and time them around rebalancing dates in order to get rid of the lower-cost basis securities that are leaving the ETF portfolio without triggering a tax event. In doing so, the capital gains are *realized* without requiring the ETF to distribute them to investors. Panel A of Table III shows that in any given year, 5 to 30% of the ETFs make use of these heartbeat trades, and 1 to 2 heartbeat trades are performed per ETF, which makes sense because ETFs resort to these transactions mainly on portfolio rebalancing dates and only when the positions of securities scheduled to leave the portfolio could not be absorbed by ordinary in-kind redemptions between rebalancing dates. The fraction of ETFs that rely on heartbeat trades has increased substantially after 2010.

In Panel B of Table III, we measure the capital gains distribution yield, measured as a percentage of total fund assets, and compare it to the net realized and unrealized capital gains yields. We can clearly see the superior tax efficiency of ETFs from the near-zero capital gains distributions yield, below 20bps in most years. In contrast, mutual funds distributed capital gains of, on average, several percentage points higher than ETFs over the last 25 years, with index mutual funds distributing less than active mutual funds in most years, consistent with index funds having lower portfolio turnover. Interestingly, the difference in distributions does not originate from the

difference in net realized capital gains. ETFs and mutual funds realize capital gains of the same order of magnitude. Net unrealized capital gains are also quite similar between ETFs and mutual funds.

Although the funds that are reported on N-SAR forms are only a subset of the CRSP mutual fund database, we are confident that the N-SAR data is of high quality. In Panel C of Table III, we show all but one U.S. equity ETF in CRSP can be matched to ETFs reported on N-SAR forms. Furthermore, the combined short-term and long-term capital gains distribution yields from CRSP closely match with the capital gains distribution yields from the N-SAR filings, for all types of funds. This reassures us of our inferences based on the realized capital gains figures from N-SAR, which are not available in CRSP.

V. Tax Burden and Tax Efficiency Gains

After establishing that ETFs have been consistently distributing significantly fewer capital gains than mutual funds, we now present a measure that quantifies the reduction in ETF tax drag. This reduction in tax drag, or tax burden as we define it in the next subsection, is expected to represent an important component, a tax "alpha", in the investors' net after-tax returns.

A. Tax Burden

Table IV shows that long-term capital gains distributions are often the largest source of distributions for active mutual funds. For index mutual funds, long-term capital gains and dividend distributions are the largest of the three distributions, although they vary in magnitude from year to year. For ETFs, dividends are the largest form of distributions made by the fund. Active mutual funds seem to have a lower exposure to dividend-paying stocks. On the other hand, ETFs have, on average during the period between 1993 and 2017, much lower short-term (0.07%) and long-term (0.03%) capital gains distributions than index funds (0.41% and 1.39%) and active mutual funds (0.71% and 2.48%, respectively). Using the prevailing marginal tax rates in 2017 of 43.4% for short term capital gains and 23.8% for long term capital gains, ETF investors in high tax brackets are deferring on average 0.64% in short term capital gains and 2.45% in long term capital gains relative to active mutual funds, which translates into an average saving of 0.86% in annual taxes.[35] This tax

[35] 0.86% = 43.4%*(0.71%-0.07%) + 23.8%*(2.48%-0.03%).

"alpha" increased to 1.12% in the last five years of our sample period (between 2013 and 2017) coinciding with increases in tax rates due to regulatory changes as well as increases in capital gains distributions, which we will discuss in Section VIII.[36]

To measure the overall tax costs that a fund imposes on a long-term investor in the fund, we compute the total tax burden as defined by Sialm & Zhang (2019), using data on dividend and short- and long-term capital gains distributions from CRSP and top federal marginal tax rates:

$$TB_{f,t} = \tau_t^{DIV} Y_{f,t}^{DIV} + \tau_t^{SCG} Y_{f,t}^{SCG} + \tau_t^{LCG} Y_{f,t}^{LCG}$$

where $TB_{f,t}$ is the tax burden of fund f in year t, τ_t^{DIV}, τ_t^{SCG}, and τ_t^{LCG} are the tax rates on dividends, short-term capital gains, and long-term capital gains, and $Y_{f,t}^{DIV}$, $Y_{f,t}^{SCG}$, and $Y_{f,t}^{LCG}$ are the fund's dividend, short-term, and long-term capital gains yields, respectively.

Table IV shows that index and active mutual funds experience substantial tax burdens. ETFs have the lowest tax burden amongst all three fund types, in most years. Figure VI shows the trends in tax burden for ETFs, active, and index mutual funds. The tax burden ranges between 0.17 and 0.48% for ETFs (excluding years 1993-1998 where there are less than 10 ETFs), while index mutual funds experience tax burdens between 0.22 and 1.37% during the same time period and active mutual funds have tax burdens between 0.18 and 1.85%. These figures are consistent with the findings of Arnott, Kalesnik, & Schuesler (2018) who estimate an average tax burden over 1993-2017 of 1.1% and 0.3% for mutual funds and ETFs, respectively, resulting in a net 0.8% reduction of tax drag for ETFs compared to mutual funds. ETFs cannot entirely eliminate tax burdens, because dividends still have to be distributed to investors.[37] Despite that, in the last 5 years of our sample period, ETFs have a tax burden that is on average 0.92% (0.62%) lower than active mutual funds (index funds). The tax burden difference, which translates directly into investors' net after-tax return, is the largest in 2015, consisting of 1.46% between ETFs and active funds and 0.98% between ETFs and index funds. To interpret the magnitude of these figures, we also report average yearly expense ratios for all fund types. Between 2013 and 2017, ETFs have an average expense ratio of 0.48%, which is 0.79% lower than active funds (with average expense ratio of 1.27%). This shows that the tax efficiency of ETFs relative to active mutual funds is of similar economic

[36] 1.12% = 43.4%*(0.54%-0.06%) + 23.8%*(3.86%-0.04%).

[37] Furthermore, some ETFs did not have custom redemption basket exemptions, which makes it difficult for those funds to use heartbeat trades to wash away capital gains.

magnitude, if not larger, to the relative ETF fee efficiency. Moreover, these tax savings would add to the savings from ETFs' lower expense ratios.

Table V reports how the tax burden varies with investment style in the last five years of our sample period. While realized and unrealized capital gains yields are shown to be similar for funds that follow the same style, the tax burden for ETFs is generally the lowest of the three fund types. Mutual funds have a higher tax burden relative to ETFs in all styles, with the highest level being in the small and mid-cap fund category where the average tax burden difference amounts to 1.05%. For all investment styles, ETFs distribute less than 0.14% in capital gains, a trivial amount compared to mutual funds.

B. Determinants of Capital Gains Distributions: The Effects of Outflows and Heartbeat Trades

After quantifying the significant savings in the form of a reduced tax burden that ETFs provide to investors, we now explore the mechanism through which they deliver these savings. To do that, we first examine what drives the difference in tax burden between ETFs and active mutual funds by identifying what factors drive capital gains and their distributions for each fund type. In Table VI Panel A, we report results from the regressions of realized capital gains yields and distributions on the various plausible determinants, including lagged fund size, portfolio turnover, annual returns, and outflows, which we each interact with an ETF dummy to capture any differential effects for ETFs. Specifications 1 and 2 show that higher performance, turnover, and expense ratio are all significant positive drivers for capital gains realizations, as expected. Furthermore, mutual funds have higher capital gains realizations when they experience higher outflows, because they may have to sell securities with unrealized capital gains, which represents an unwelcome side-effect for the remaining fund investors. Interestingly, the evidence from specification 2 indicates that, there is no significant differential effect of outflows on capital gains between mutual funds and ETFs. The only difference in capital gains yield determinants is with regard to expenses, perhaps due to the fact that, while ETFs in general have low expense ratios, more active ETFs with higher trading activity are typically associated with higher expense ratios (e.g. smart beta ETFs, thematic ETFs etc.). For additional robustness, we add style fixed effects in specifications 5 and 6 and the results are unchanged.

The effect of outflows on capital gains distributions diverges significantly between ETFs and mutual funds. While outflows, measured using N-SAR monthly redemptions over a 12-month

period, are associated with higher distributions for mutual funds, due to the realization of capital gains associated with flow-motivated sales, they have the opposite effect for ETFs. ETF outflows have a negative effect on capital gains distributions due to the in-kind redemption mechanism that leads to the deferral of realized capital gains. These results are similar whether we control for date (specifications 3-4), or date and style fixed effects (specifications 7-8), and confirm in-kind redemptions as the mechanism behind ETF tax efficiency. Additionally, specifications 9 and 10 show that there is a positive relation between capital gains realizations and their distributions among mutual funds, suggesting that mutual funds, on average and after controlling for all other factors, distribute slightly more than 25% of their capital gains realizations. This may be due to the netting effect of losses and loss carryovers. Interestingly, this relation is completely reversed for ETFs, as the negative coefficient on the ETF dummy nearly offsets the coefficient on the realized capital gains. As expected, ETFs do not experience a clear relationship between realized capital gains and their distributions, because ETFs distribute very little capital gains overall.

After confirming redemption-in-kind as the mechanism through which ETFs reduce their distributions, we explore the effects of heartbeat trades on the capital gains distribution yield. We build on the analysis from Panel A and regress realized capital gains, the overall capital gains distribution yield and its components (the short-term and long-term capital gains distribution yield), as well as the overall tax burden on the same set of independent variables plus the number of heartbeat trades in the last 12 months (transformed by taking the natural logarithm) as an additional explanatory variable. As described earlier, ETFs can make use of in-kind redemptions prompted by outflows or heartbeat trades to avoid distributing capital gains to their investors.

Panel B of Table VI shows that in all specifications, heartbeat trades appear to be significant in reducing capital gains distributions and tax burden. Notably, heartbeats trades seem the reduce the short-term capital gains distribution yield more strongly than outflows do, which are insignificant. This is consistent with the fact that an ETF sponsor cannot time the outflows to offset capital gains realized over shorter periods, but they can manufacture the heartbeat's in-kind redemptions on-demand for these short-term capital gains. After controlling for heartbeat trades, outflows are still significant in reducing the more predictable long-term capital gains distributions, and in reducing the overall tax burden.

Overall, the results show that an ETF with an average of two heartbeat trades per year ends up, on average, with an additional reduction in its tax burden equal to 0.86%, compared to a mutual fund (or ETF without in-kind redemptions) with a similar style, after controlling for various fund

characteristics. It is worth noting here that from specifications 1 and 6, we infer that outflows do not differentially affect ETFs' realized capital gains yields overall. We can conclude that the heartbeat trades indeed help to reduce the tax burden of the fund and does that decisively by significantly flushing away both short-term and long-term capital gains.

C. Determinants of Heartbeat Trades

Table VI Panel C explores the determinants of the use of heartbeat trades by ETFs. Using various proxies for heartbeat trade usage, we examine their relationship to fund size, turnover, and performance over the last twelve months. The results confirm our priors that larger ETFs with higher turnover and better performance during the year are expected to realize larger capital gains which necessitate more in-kind redemptions during the span of the year. We also document a substitution effect between ETF outflows and heartbeat trades: when ETFs have sufficient ordinary outflows to distribute appreciated assets through in-kind redemption baskets, they are less likely to employ heartbeat trades. As expected, we find that ETFs with higher realized capital gains are more likely to make use of heartbeat trades. Furthermore, ETFs that hold more stocks, and thus are more likely to be affected by potential rebalancing due to index reconstitution leading to higher capital gains realizations, tend to use heartbeat trades more.

We include specifications with family and fund fixed effects to acknowledge the role of fund families in facilitating these large transactions with the family broker networks. We also expect heartbeat trades to be more prevalent in certain ETFs than in others (Mider, Massa, & Cannon (2019)). The increase in explanatory power between specifications 1-2, 3-4, and 5-6 by adding family and fund fixed effects shows that the use of heartbeats differs by ETF and ETF family. When including ETF fixed effects in specifications 5 and 6, which absorb fund level factors, it appears that funds mainly use heartbeat trades more in years when they incur higher realized capital gains and have higher portfolio turnover.

D. Tax Externalities of Outflows

ETFs achieve their tax efficiencies through the in-kind redemption process and the use of heartbeat trades which help ETFs offload low-basis stocks, resulting in lower unrealized capital gains and tax overhang for the remaining stocks in the ETF portfolio. On the other hand, redemptions by mutual fund investors can present a negative externality on remaining longer-term

investors, who may receive additional distributions if the fund was forced to sell appreciated assets (Dickson, Shoven, & Sialm (2000)). Therefore, we expect a differential effect of outflows on tax overhang and test that directly in Table VI Panel D. While mutual funds may want to dampen the impact of outflows on their remaining investors by avoiding the sale of appreciated shares, ETFs can see the redemption requests as an opportunity to offload shares with the lowest cost basis, and as a result be left with lower unrealized capital gains. ETF investors benefit from this in-kind redemption mechanism if they stay invested with the fund.

To further study the differential effect of outflows on the fund's composition, we analyze the determinants of funds' unrealized capital gains yields. The results are reported in Table VI Panel D. Specification (1) shows that, for an average fund, unrealized capital gains are increasing in expense ratios, returns, and outflows, and decreasing in turnover. We add interactions with the ETF dummy in specification (2), which illustrates that there is no differential effect between mutual fund and ETF characteristics on unrealized capital gains yields, except for outflows. Outflows are associated with significant increases in unrealized capital gains for mutual funds, while the effect is reduced for ETFs. Outflows are even negatively related to unrealized capital gains for ETFs when we add style fixed effects, and this pattern is also robust when we control for fund and date fixed effects, representing a stark difference with active mutual funds. Heartbeat trades do not appear to be a significant determinant however, which is consistent with the fact that they are the mechanism of last resort against large impending capital gains that are about to be distributed to investors. Additionally, heartbeat trades of ETFs with custom redemption baskets are expected to contain only appreciated stocks that are leaving the portfolio, and therefore have no effect on the remaining stocks in the ETF portfolio. Overall, the results are consistent with the fact that ETFs strategically use ordinary outflows to allocate lower cost basis stocks in redemption baskets, taking advantage of the capital gains distribution exemption, and leaving the fund with lower unrealized capital gains.

VI. ETF Flows: Expenses or Tax Burden

After documenting that ETFs are significantly more tax efficient than mutual funds, and establishing the mechanism of such tax efficiency, we now explore the importance of taxes and their effect on mutual fund flows. Building on Sirri & Tufano (1998) and Dannhauser & Pontiff (2019) who document *performance* and *expense ratio* as the primary determinants for mutual fund and ETF flows, we include *tax burden* to the list of flow drivers and run a horse race between these

three determinants. Flows from mutual funds to ETFs could be explained by the underperformance of active mutual funds relative to index funds and ETFs of the same investment style, especially in the last two decades, and by the fee efficiency of index funds and ETFs (See Figure II). However, in the United States, tax efficiency is unique to ETFs, and as we document in prior sections, ETFs have significantly lower tax burdens than both index and active mutual funds. Therefore, we interpret the evidence on the importance of tax considerations in explaining outflows from active mutual funds as a likely indication of the flow migration to the tax-efficient ETFs. Effectively, we will confirm the second leg of this migration more directly in the next section when we look at the ETF holdings of tax-sensitive investors.

A. Baseline Model: Flow Sensitivity Horse Race between Performance, Fees, and Taxes

To run the horse race between the three main drivers of mutual fund flows, performance, fees, and taxes, we follow the framework from Sirri & Tufano (1998). Table VII Panel A provides the baseline results of the determinants of active mutual fund flows using various robustness specifications. We use panel regressions in specifications (1) to (8) and Fama-MacBeth regressions with a Newey-West correction in specifications (9) to (12). Specifications (1) to (4) use rolling monthly observations with clustering of standard errors by fund and date, while specifications (5) to (8) use only annual data observed in December, with the same clustering. We use piecewise linear regressions based on funds' relative performance rank within its investment style following Sirri & Tufano (1998) to account for the flow-performance relationship. Next, we compute the expense ratio and tax burden variables as the difference between the fund level and the investment style average including ETFs. We then introduce reduced form specifications with performance quintile dummies, performance rank, and a continuous performance variable. We control for fund size and age to account for returns to scale effects, style flows, return volatility, and different intercepts for each style and date. A retail dummy is included to capture differences in tax-sensitivity across share classes, where tax-advantaged retirement accounts often have access to institutional share classes.

The results show that performance, expense ratio, and tax burden are all significant determinants of active mutual fund flows, and their economic and statistical significance is comparable and consistent across various specifications. We observe the non-linear flow-performance relationship documented in the literature, where funds in the highest performance

quintile experience relatively higher net flows than similar-sized performance differences among the lowest performing funds. Examining the coefficients on the fee gap and tax burden gap variables, which measure the difference between a mutual fund's expense ratio or tax burden from the average level across all active and passive funds with the same style, we observe that both variables are negatively related to fund flows. There is also evidence of a decreasing returns to scale effect, and younger funds tend to have higher inflows. The results are robust across different specifications and estimation methods.

B. Active Fund Outflow Sensitivities: Sensitivity to Taxes is Stronger than Fees and Returns

To better understand the relative economic importance of the fee gap and tax gap variables on fund flows, we standardize the various performance, fees, and tax variables to have zero mean and unit standard deviation in Table VII Panels B and C. In Panel B, we dive deeper into the flow-fee and flow-tax sensitivities, compare them to the flow-performance sensitivity, and zoom in on the active fund annual outflows, measured using N-SAR monthly outflows data. We expect that tax-sensitive investors may be inclined to withdraw their investment from a fund when the fund experiences a high tax burden. In specification (1), we find that a one standard deviation increase in the tax burden gap (fee gap) is associated with a 5.7% (5.0%) decrease in net fund flows. When looking at total outflows separately, we see that a one standard deviation increase in the tax burden gap (fee gap) increases outflows by 1.9% (0.6%). A one standard deviation decrease in performance is attributed to a 1.5% increase in outflows. Tax considerations seem to be stronger than the effect of performance and three times more powerful than fees in influencing active mutual fund outflows.

In various specifications, tax burden appears to be the strongest determinant of mutual fund outflows suggesting that tax-sensitive investors were responsible for the substantial outflows that active mutual funds experience during the sample period. To better understand the impact of taxes on outflows, we decompose tax burden into its various components. From specifications (3) and (4), we learn that the (standardized) realized capital gains yield is the strongest driver for fund outflows compared to other components of tax burden, with a coefficient of 5.1%. We also find that retail share classes, which are more likely to be used by tax-sensitive investors, are associated with higher fund outflows. Looking at the subsample of retail funds in particular, as in specifications (5) and (6), there is no relationship between fees and outflows, while the relationship between tax burden and outflows remains strong, again driven by the realized capital gains yield. The results

confirm the role of tax-sensitive investors in explaining outflows from active mutual funds over the last two decades.

The remaining specifications indicate that for funds that experience significant outflows (specification 8) or have above median tax burden (specification 10), there is a stronger positive relationship between the fund's tax burden gap and the magnitude of the fund outflows, relative to funds with less significant outflows and lower tax burden. The economic significance of the relationship between fees and outflows is also much weaker when the tax burden influence is stronger.

C. Focusing on Outflows between Fiscal Period Ends and Distribution Dates

To better identify the influence of taxes on outflows, we exploit the timing difference between when realized capital gains are reported to investors, usually around a mutual fund's fiscal year-end, and when these gains are distributed, typically at calendar year-end. The objective is to focus on investors' outflows after realized capital gains are reported to investors, and before these realized gains are distributed, as these outflows are more likely to be motivated by tax considerations. Investors in mutual funds with high realized capital gains may want to withdraw their capital from a fund before the capital gains are distributed to avoid the tax repercussions.

Gibson, Safieddine, & Titman (2000) document that the Tax Reform Act of 1986 mandated October 31 as a tax year-end for all funds and required funds to distribute "at least 98% of ordinary income and net capital gains to avoid paying an excise tax." Consistent with this, we document in our sample that 96.2% of funds with capital gains distributions have their distributions in December, with 73.70% of funds have distributions only in December. [38]

Knowing that realized capital gains are typically reported on a quarterly basis to shareholders, through Forms N-CSR, N-CSRS, and N-Q, and every six months through Form N-SAR, we focus on the sample of funds that have fiscal period end before December of each year.[39] Then, since 62.4% of funds in our sample have a fiscal period end on or before October 31, we

[38] Some of the capital gains distributions occurring in earlier months are due to fund closures and merger events. According to Morningstar, "capital gains distributions are usually paid out once per year, typically in December. You can find information about estimated fund distributions, including the total amount, percentage of NAV (if provided), and scheduled payout date on the fund company's website usually starting in November and December." https://www.morningstar.com/articles/720873/what-you-need-to-know-about-capital-gains-distributions.

[39] Around 29.25% of funds have fiscal year-ends in December.

assume that the realized capital gains information reported in fiscal year-end reports to investors are likely to be a good proxy for the realized capital gains reported for tax reasons as of October 31. We focus on this subsample of funds to compute the cumulative outflows between the fiscal year-end month and the calendar year-end month and regress those outflows on the realized capital gains reported in fiscal year-end filings.

Table VII Panel C provides the results on whether a higher expected tax burden gap is associated with increased redemptions between the fiscal year-end, when the realized capital gains are reported, and the calendar year-end, when they are distributed. This analysis is intended to further narrow down the timing of the flows and solidify the argument regarding the effect of tax considerations on flows. The results confirm earlier findings, and the tax burden gap again emerges as the strongest and most significant determinant, statistically and economically, of mutual fund outflows measured over the months between when expected realized capital gains are observed by investors and when they are distributed. Additionally, specifications (4)-(6) show that the driver behind this effect is the realized capital gains yield. These specifications confirm that tax burden considerations dominate both fee efficiency and, surprisingly, performance as the main driver of active mutual fund outflows.

This evidence supports our conjecture that tax considerations are very significant in explaining the flow migration from active mutual funds. In the next section, we show that tax-sensitive investors also represent a significant driver of inflows into ETFs, around the same time when active fund outflows are observed.

VII. Clientele Effects: The Role of Tax-Sensitive Investors

So far, our evidence strongly suggests that the flow-tax sensitivity is a stronger determinant, statistically and economically, of active mutual fund outflows than flow-fee sensitivity, and it is as meaningful as, and sometimes stronger, than flow-performance sensitivity, especially when focusing on active mutual fund outflows. The tax efficiency of ETFs, evident in the fact that ETFs realize similar capital gains as do mutual funds but distribute near zero amounts due to the in-kind redemption exemption that is boosted by the use of heartbeat trades, seems very appealing to tax-sensitive investors who may migrate out of active mutual funds for tax consideration. In this section, we provide further evidence that tax-sensitive investors did indeed reallocate capital into the more tax efficient ETFs. We first present evidence that mutual funds with high realized capital gains

experience more outflows than other active funds, at the same time when similar ETFs from the same investment styles experienced relatively higher inflows. Then, we identify the institutions that manage the investment accounts for tax-sensitive investors and explore the patterns of ETF investments during that period. Finally, we use the increase in capital gains taxes after 2012 due to regulatory changes as a quasi-natural experiment to better identify the observed flow migration due to tax reasons.

A. Flow Migration from Active Mutual Funds into similar ETFs

We start by directly measuring the flows from active mutual funds to ETFs within the same investment style. We expect that investors that are concerned about their tax burden will move capital from mutual funds to ETFs that follow the same investment style.[40] To test whether there is a tax-sensitive clientele effect driving flows into ETFs, we compare net flows as a percentage of assets under management across quintiles based on realized capital gains yields. Table VIII shows the results.

We sort active mutual funds into quintiles by their realized capital gains every year and then compare the flow patterns with other similar funds including ETFs. For each fund, we construct a value-weighted benchmark of all funds with the same investment style, categorized by active mutual funds, index funds, and ETFs. The table reports value-weighted averages of total net flows, realized capital gains, and distributions by quintile of active mutual funds sorted on their realized capital gains yields. We use Lipper Class codes for the investment style information as it is computed by Lipper using the holdings of the fund (as opposed to being self-reported), and we keep only styles to which more than one ETF belongs.

As expected, funds with higher realized capital gains exhibited, on average, higher outflows, amounting to -22.76% per year for the funds in quintile 5. The benchmark group of other active mutual funds matched to the sorted funds by style also exhibits a pattern of increasing outflows by quintile, suggesting that style-related reasons are behind the higher capital gains realizations. On the other hand, index mutual funds and ETFs both exhibit inflows in all buckets, consistent with the overall trends. More interestingly, however, ETFs that follow the same styles as the ranked

[40] Anecdotal evidence of this can be read in the following article describing changes made recently in the portfolio managed by MSD Capital, Michael Dell's $16 billion family office: https://www.wsj.com/articles/michael-dells-money-managers-change-how-his-wealth-is-invested-11575628204 (WSJ, December 6, 2019)

active funds exhibit relatively higher inflows in quintiles 4 and 5, while index funds exhibited the highest inflows in quintile 1. The results suggest that while active funds with higher realized capital gains were bleeding outflows driven by tax-sensitive investors, ETFs with the same investment styles witnessed relatively higher inflows in the same period compared to other ETFs.

The results suggest that tax-sensitive investors are migrating from active funds to ETFs in similar investment styles when they are expecting to face a higher tax bill due to realized and distributed capital gains. To confirm that matching ETFs distribute much fewer capital gains, we report the average realized capital gains and distributions for the ranked active mutual funds as well as their benchmarks. The results confirm that while both matching active and index funds exhibit increased realized and distributed capital gains in the highest quintiles, ETF distributions were the lowest in higher quintiles, despite the ETFs and index funds having similar realized capital gains. This result is another indication supporting the premise that tax-sensitive investors, such as high-net-worth individuals who likely face higher tax burdens, are actively reallocating from active funds into ETFs in order to take advantage of the superior tax efficiency unique to ETFs under U.S. laws. This tax-related flow migration is not an active to passive phenomenon, but strictly a flow migration into ETFs.

B. ETF Usage by High-Net-Worth Individuals

The optionality that ETFs provide on when to realize capital gains for optimal tax purposes and the ability to indefinitely defer capital gains allowing future heirs to forgo capital gains taxes using the step-up in basis are especially valuable for high-net-worth individuals. High-net-worth investors, faced with the highest marginal income and capital gains tax rates, are expected to be among the most tax-sensitive investors. We resort to institutional ownership data to identify institutions with tax-sensitive clients and explore their allocations to ETFs during the same period when active mutual funds were experiencing the largest outflows. To do that, we follow Blouin, Bushee, & Sikes (2017) and identify institutions that advise high-net-worth individuals, based on the client type disclosures of investment advisors that file Form ADV.[41]

[41] Form ADV provides 'Clients' information under question D of "Item 5 Information About Your Advisory Business - Employees, Clients, and Compensation", which describes the types of clients of investment advisors including: high-net-worth individuals, banking or thrift institutions, trusts, investment companies, pension plans, charitable organizations, insurance companies, government entities (including government pension plans), sovereign wealth

Our methodology proceeds as follows. First, to examine the use of ETFs by high-net-worth individuals more directly, we explore 13F institutional ownership data provided by the Thomson-Reuters Global Ownership database (also known as the Thomson OP database). Thomson-Reuters Global Ownership database classifies 13F institutions into different categories (as determined by Thomson's OwnerType variable), but we focus on investment advisors registered with the SEC who manage assets for private clients and other institutions. Investment advisor type is the most common institution type found in Thomson 13F data and it consists of buy-side institutions who invest on behalf of their clients as they have discretionary power over assets under management.

Investment advisors make separate Form ADV filings with the SEC detailing their client types, including pensions, endowments, and high-net-worth individuals. Pensions, endowments, and investment advisors with the majority of their clientele consisting of tax-exempt entities are clearly classified as tax-insensitive. Following Blouin, Bushee, & Sikes (2017), we classify institutions as tax-sensitive only for those institutions and investment advisors with a substantial fraction of assets managed on behalf of high-net-worth clients.[42] We exclude from our tax-sensitive classification all institutions, including banks, insurance companies, hedge funds, and investment advisors without majority tax-sensitive clienteles.

We link the Thomson 13F entities to their investment advisors from Form ADV filings by using CIK, phone numbers, addresses and name information.[43] We use question 5D of Form ADV to determine which investment advisors have a high exposure to tax-sensitive investors, with at least 25% of total assets under management coming from the accounts of high-net-worth individuals.[44]

To confirm that flows into ETFs are driven by tax efficiencies, we explore the portfolio allocations by investment advisors that are likely to be most attuned to the tax efficiency needs of

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funds, corporations, other pooled investment vehicles (e.g. hedge funds), and other individuals (other than high-net-worth individuals). Form ADV can be publicly accessed in this page: https://advisorinfo.sec.gov/IAPD/Default.aspx. Historical ADV data can be obtained in the FOIA section of the SEC website: https://www.sec.gov/foia/docs/form-adv-archive-data.htm.

[42] According to the SEC, a "High Net Worth" client of a fund advisory service is defined as individual with at least $750,000 managed by the advisor, or whose net worth your firm reasonably believes exceeds $1,500,000, or who is a "qualified purchaser" as defined in section 2(a)(51)(A) of the Investment Company Act of 1940. The net worth of an individual may include assets held jointly with his or her spouse.

[43] Our mapping results in 5,913 Thomson 13F institutional managers (OwnerCode) mapped to Form ADV entities (CRD).

[44] We use the number of clients by each client type in earlier years when the fraction of assets under management by client type was not available.

their clients, which would be reflected in their investment patterns. Table IX reports the detailed results, and Figure VII shows graphically that investment advisors of high-net-worth clients have significantly higher allocations to ETFs relative to the total assets managed by advisors across all asset classes.

Table IX Panel A shows the aggregate amount of 13F assets (U.S. exchange listed stocks and ETFs) held by each group of investment advisors.[45] We indeed find that the allocations to ETFs by investment advisors of high-net-worth clients are nearly four times more than investment advisors with low or no high-net-worth clients and have reached 32.4% of the overall 13F assets managed by these advisors in 2017, compared to less than 9% for other investment advisors, respectively. After scaling with the total assets reported on Form ADV, because 13F assets do not include mutual funds and other non-13F qualified investments, we find that ETFs make up 21% of the overall portfolios of these tax-sensitive investors, compared with 5% of other investment advisors' portfolios, and this allocation has increased significantly since 2012. Figure VII illustrates the magnitude of this increase in ETF allocations which we will explore further in the next subsection.

Next, we break down the aggregate institutional ownership of ETFs by investment advisor type, focusing on their overall ETF ownership as a fraction of the overall ETF market. Panel B of Table IX reports that institutional ownership of ETFs has increased from 31% to 59% between 2000 and 2017 as the ETFs industry grew in size. ETF ownership by investment advisors overall grew from 11% to 30% during this time, which represents half of the ETF ownership by all institutions. Additionally, in our sample of investment advisors matched to form ADV data, we document that in the most recent five years of the sample, investment advisors with high exposures to high-net-worth clients, the most tax-sensitive investors, account for the largest share of ETF ownership by advisors.[46] This is remarkable because this group accounts for the least amount of assets under management overall as shown in Panel A.

Finally, we document the trends in ETF flows across different types of institutions and advisors with varying levels of high-net-worth clients. Our test aims to provide evidence that flows

[45] It is important to note that the advisors with the highest exposure to high-net-worth clients represents a smaller group in terms of assets than the groups with low or no exposure to high-net-worth clients ($0.94 trillion vs. $2.3 trillion and $2.5 trillion for low and no high-net-worth client groups, respectively.

[46] This shift lines up with the adjustments to form ADV in 2011 to add fields requiring advisors to disclose the assets managed for each client type in addition to the number of clients in each group that was being reported before.

by investment advisors with tax-sensitive client base are relatively larger during years when active mutual funds experience higher realized capital gains. Panel C of Table IX shows that ETF flows were the highest in the earliest years of the sample, when the ETF industry was still relatively small. On average, ETF flows have grown 15% per year during the sample period. Twelve percentage points of this growth in flows are driven by demand from institutions, half of which are from investment advisors (6%), while retail investors likely account for the remaining 3% of flow growth each year. Overall, we find that 1.85% of the growth comes from advisors that manage the most assets for tax-sensitive clients during the entire sample period, despite the fact that the total assets managed by this group is the lowest. This is followed by advisors with some exposure to high-net-worth individuals at 1.55%. Investment advisors that do not have high-net-worth clients add 1% to the ETF asset base on average each year.

In particular, we notice a trend in ETF flows that is in parallel with capital gains realized by active mutual funds, especially after 2012. During the sample period, years when realized capital gains yields of active mutual funds spiked up coincided with a relatively high proportion of ETF allocations by advisors with a high exposure to tax-sensitive clients. For a more direct test, we use the increase in the capital gains tax rates for high earners in 2013 as a quasi-natural experiment to provide more quantitative insights on ETF usage and the flows into ETFs by tax-sensitive clientele.

C. ETF Allocations and the Increases in Capital Gains Tax Rates in 2013

Two major changes to the tax code in 2013, the American Taxpayer Relief Act of 2012 (ATRA) and the Affordable Care Act (ACA) of 2010, significantly increased capital gains tax rates for high-income taxpayers. The ATRA was proposed to address the expiration of the favorable tax rates set by the Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (Perez Cavazos & Silva (2019)). The ATRA raised the ordinary income rate from 35% to 39.6%, and the dividend and long-term capital gains rate from 15% to 20% on top earners ($450,000 for married joint filers and $400,000 for single filers). The ACA also introduced a 3.8% income tax on passive investment income for taxpayers with income above $250,000 if filing jointly and $200,000 if filing single. Overall, the ATRA and ACA jointly raised the maximum tax rate on high-income taxpayers. As a result, taxes on short-term capital gains, based on ordinary income rates, increased from 35% to 43.4%, and taxes on long-

term capital gains increased from 15% before 2012 to 23.8% afterwards.[47] Extant literature found that these reforms had significant effects on capital gains realizations in 2012 (Perez Cavazos & Silva (2019), and Auten, Splinter, & Nelson (2016)).

We follow Beggs & Liu (2020) and use the enactment of the ATRA and ACA as a quasi-natural experiment to study how these increases in tax rates affect advisors' allocations to ETFs on behalf of their most tax-sensitive investors: their high-net-worth clients. We hypothesize that advisors with more high-net-worth clients have increased incentive to allocate their clients' assets to ETFs from 2012 on, anticipating the enactment of ATRA and the ACA.[48] The tax efficiencies of ETFs would enable fewer capital gains distributions, deferring more taxes for high-net-worth clients due to the increased maximum marginal rates.

To test this, we implement a difference-in-difference test using advisors' allocations to ETFs as the dependent variable:

$$ETF\ Allocation_{i,t} = \beta_0 + \beta_1 HNW_{i,t} + \beta_2 2012 * HWN_{i,t} + \beta_3 Log(AUM_{i,t}) + FE + \epsilon_{i,t} \ ,$$

where the $ETF\ Allocation_{i,t}$ is the percentage of AUM allocated to ETFs for advisor i in year t. The independent variable $HNW_{i,t}$ is an indicator variable equal to one if an advisor has high-net-worth clients and zero otherwise, in order separate our treatment group from remaining tax-insensitive advisors, which include advisors with pension clients, government, insurance companies, charitable institutions, etc. In some specifications, we further strengthen our treatment group by specifically focusing on those institutions with the majority of their assets (>=75%) corresponding to their high-net-worth clients, as they are expected to be the most sensitive to the capital gains tax increase. We then interact the high-net-worth investor indicator variable with an indicator variable that is equal to one for the years 2012 and after, and zero otherwise. If those most tax-sensitive institutions allocated more to ETFs due to the tax reforms, we expect the interaction term to be positive and statistically significant.

The results are presented in Table X Panel A. All specifications use quarter fixed effects and standard errors are clustered by institution and date. The first three specifications report the main effect using, respectively, ETF allocations as fraction of 13F AUM, ETF allocations as a

[47] The Tax Cuts and Jobs Act (TCJA) of 2017 reduced tax rates for high earners on short-term and long-term capital gains but was effective in 2018 after the end of our sample period.

[48] Another reason was the rush by wealthy investors in 2012 to complete transactions before the end of the calendar year when the estate tax exemption was scheduled to drop in 2013. See: https://www.bloomberg.com/news/articles/2020-12-21/wealthy-americans-fearing-higher-taxes-hurry-to-move-money-now.

fraction of all advisor assets reported on form ADV, and the quarterly percentage change in ETF flows. Advisors with high-net-worth clients tend to have higher allocations to ETFs overall and explain part of the flow into ETFs as well.

We add the 2012 capital gains tax rate increase dummy starting in specification 4. The results show that the allocation to ETFs has increased significantly after 2012. Although the significance of this result declines a bit when we include institution fixed effects in specifications 6 and 7, the interaction effect remains positive and statistically significant for the institutions that have the greatest exposure to high-net-worth clients (specifications 8 through 10). The results confirm our prior findings that advisors with high-net-worth clients were incentivized and did in fact allocate more of their assets to ETFs after 2012, which are more tax efficient than other assets.

The migration of active fund flows to ETFs is visible when we examine the change in ETF allocation by investment advisors of high-net-worth individuals who are most sensitive to tax considerations, where we document an overwhelming increase in allocations and flows into ETFs relative to advisors with lower fractions of high-net-worth clients especially after the increase in capital gains tax rates after 2012. We also explore the effect of this tax increase on mutual fund outflows and their sensitivities to tax burden. Panel B shows that the relationship between fund outflows and tax burden gap also strengthens after 2012, while fee gap remains less important in explaining fund outflows. Overall, the results in Table X provide strong support for our hypothesis that clientele effects and tax efficiency play an important role in explaining the flows to ETFs. Overall, our evidence points to the dominant role of ETF tax efficiencies behind the massive outflows from active mutual funds and the dramatic surge of flows into ETFs in recent years.

VIII. Conclusion

The popularity of ETFs among long-term investors is to a large extent driven by their fee and tax efficiencies. ETFs achieve their tax efficiency through the in-kind redemption process and the use of heartbeat trades, which constitute a short-term loan that helps ETFs offload low-basis stocks without triggering a taxable event. This feature of ETFs is particularly appealing to high-net-worth individuals and other tax-sensitive investors that face higher marginal capital gains tax rates. Our evidence implies that inflows into ETFs relative to open-end funds are driven more by their higher tax efficiencies than their lower expenses. Our paper emphasizes the importance of the heartbeat trades and the in-kind redemption exemption for ETFs to realize their superior tax

efficiencies and pinpoints the tax clientele effect by using the holdings of investment advisors of high-net-worth individuals.

Our empirical evidence first documents that open-end mutual funds distribute capital gains significantly more often and in larger magnitudes than ETFs. In many years, the fraction of mutual funds that distribute capital gains is in the order of ten times higher than that of ETFs. Furthermore, even when ETFs distribute capital gains, the amount distributed (close to 4bps in recent years) is merely a small fraction of the net realized capital gains. ETFs are able to avoid distributing capital gains by taking advantage of regular outflows when sufficiently available, and by employing the mechanism known as "heartbeat" trades, which we describe in section II.B. As a result of these trades, ETF capital gains are *realized* without being required to be distributed to investors. We document that in any given year, between 5% and 33% of the ETFs make use of heartbeat trades, performing 1 to 2 heartbeat trades per ETF on average, typically coinciding with major rebalancing events of the ETF's underlying indexes. The fraction of ETFs that rely on heartbeat trades has steadily increased after 2010, along with the capital gain growth of underlying portfolios. Equally interesting, the majority of ETFs, even those that did not appear to make use of heartbeat trades, did not distribute capital gains during the last years of our sample period either because they did not realize any, or because they had sufficient outflows to distribute securities with the highest unrealized capital gains. In our regressions, ETF outflows indeed emerge as an important and significant substitute for heartbeat trades for ETFs with unrealized capital gains.

Overall, we establish that ETFs are hardwired to take advantage of capital gains tax exemptions in the US, which is appealing to tax-sensitive investors. Using holdings data of institutions with high-net-worth clients, we find that their ETF allocations are nearly four times higher compared with investment advisors with low or no high-net-worth individuals, reaching 32.4% of the overall 13F-reported assets managed by these advisors in 2017. We use the increase of capital gains tax after 2012 as a quasi-natural experiment and find that the migration of active fund flows from tax-sensitive investors is more visible, with a higher sensitivity of outflows to tax burdens and a sharper increase in ETF allocations mainly by the investment advisors of high-net-worth clients.

The optionality on when to realize capital gains for optimal tax purposes and indefinitely defer capital gains taxes, which allows future heirs to forgo capital gains taxes using step-up in basis, is especially valuable for high-net-worth individuals. We find that these types of investors have in turn pursued investments in ETFs to lower their present tax bills and defer them to the

future. We argue that this tax efficiency is among the predominant reasons that propelled the growth and popularity of ETFs in recent years. As ETFs can avoid capital gains distributions and most short-term capital gains taxes and defer long-term capital gain taxes, this leads to externalities on other investors and taxpayers.

Mider, Evans, Wilson, & Cannon (2019) estimate that over 400 U.S. equity ETFs together deferred taxes on more than $211 billion in gains in 2018 alone. If US equity ETFs were to distribute capital gains, these distributions would amount to somewhere between 2% to 3.4% per year which represent the 10-year average distribution yields for index and active mutual funds respectively (Table III). Given that the existing US equity ETF industry is currently slightly less than $2 trillion in size, it is reasonable to assume that US equity ETFs would contribute to a deferral of at least $400 billion and up to $679 billion in short- and long-term capital gains distributions in the next decade. These projections will be much higher if we incorporate additional ETFs traded in the US (other equity and fixed income ETFs, estimated to be more than $2 trillion in size), as well as future investors flows into ETFs. Furthermore, investors will end up paying taxes on the accumulated capital gains only if they sell their future shares and before they bestow them, which would enable the step-up in basis rule to kick in, erasing the capital gains for tax purposes.

The shift from active to passive, and specifically to ETFs, is expected to have monumental consequences on market efficiency and capital formation (Wermers (2020)). For these reasons, policymakers may want to further study who bears the costs of ETF tax efficiency, especially since it presents an unequitable treatment of different investors regarding the flexibility and control of the timing of tax payments. Additionally, the reduced application of short-term capital gains taxes, and in some cases long-term capital gains taxes due to step-up in basis, represents a foregone income for tax agencies which creates a more profound challenge to the existing tax code and taxation philosophy (Colon (2017)). Without a doubt, the tax efficiency of ETFs is likely to continue exacerbating the active-to-ETF flow migration and inevitably lead to more mutual fund conversions for tax purposes.

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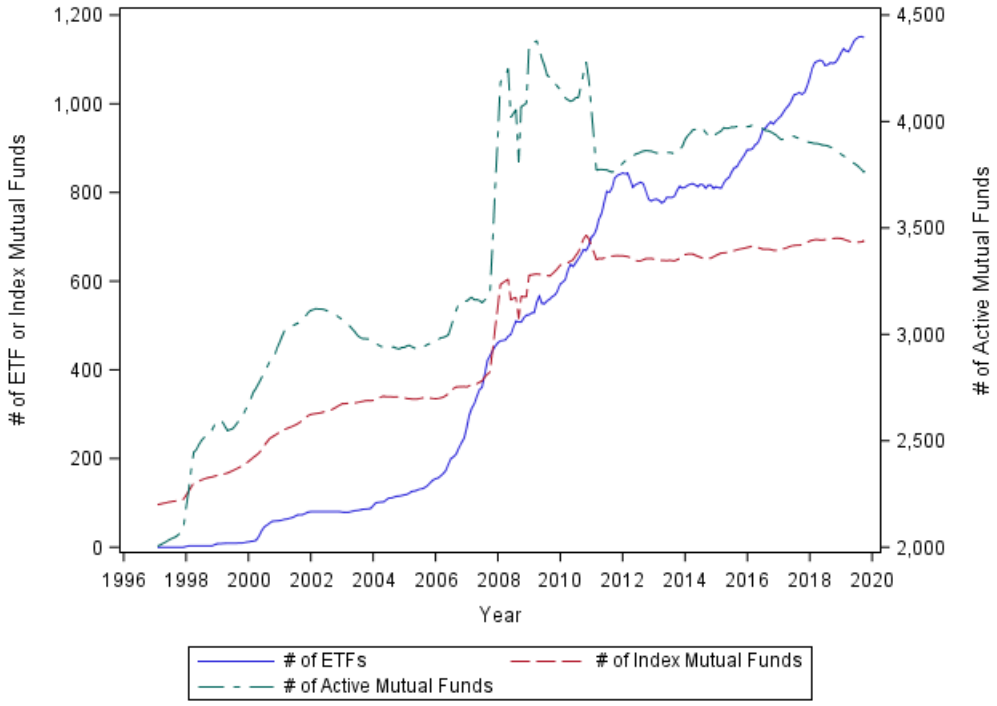
Figure I: ETFs and Mutual Funds: AUM, Flows, and # of Funds

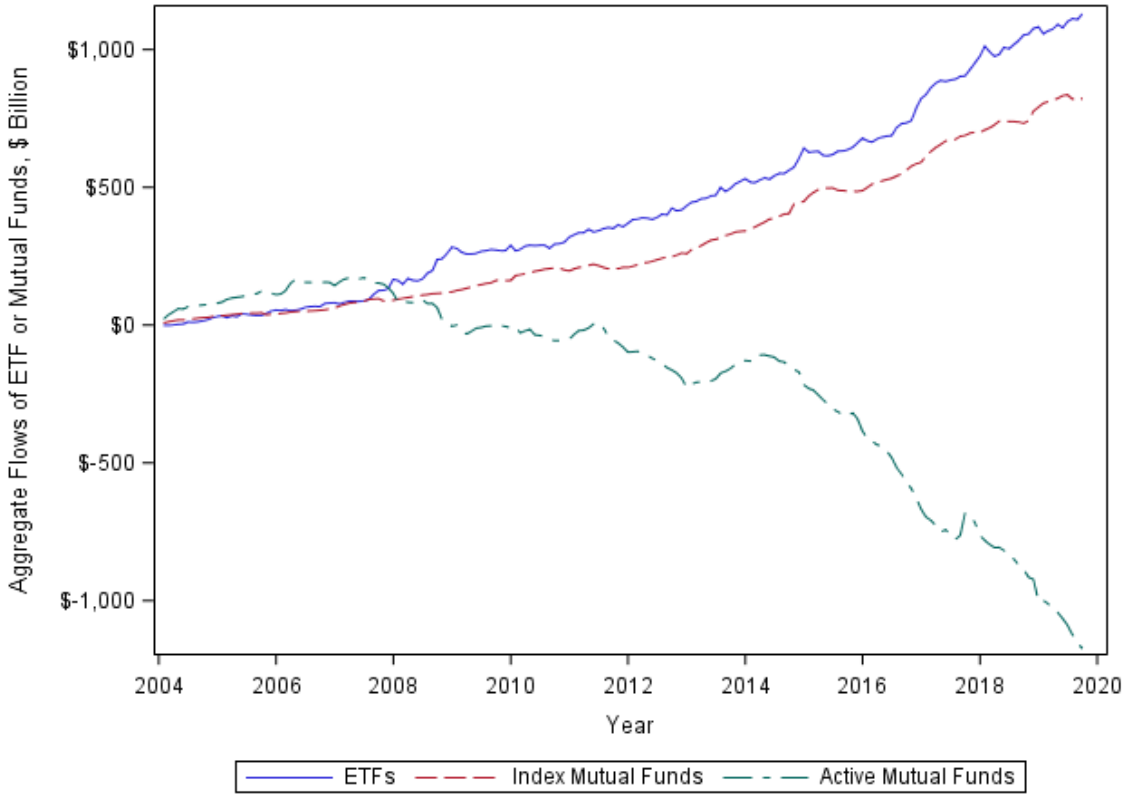
The first two figures illustrate the growth in the number of portfolios, and AUM of ETFs, Index Mutual Funds, and Active Mutual Funds during our sample period using CRSP Mutual Fund Database. The third figure represents the cumulative net flows by each type of funds. The fourth figure represents the growth in the number of fund share classes (CRSP_FUNDNO) as a robustness for the first chart. CRSP portfolio identifiers, CRSP_PORTNO and CRSP_CL_GRP, exhibit changes and inconsistencies in the period between 2008 to 2010 due to CRSP transition to different data providers.

Panel A: Number of US Equity Fund Portfolios (CRSP Universe)



Panel B: Assets under management by US Equity Funds (CRSP Universe)

Panel C: Cumulative Net Flows of US Equity Funds since 2004 (CRSP Universe)



Panel D: Number of US Equity Fund Share Classes (CRSP Universe)

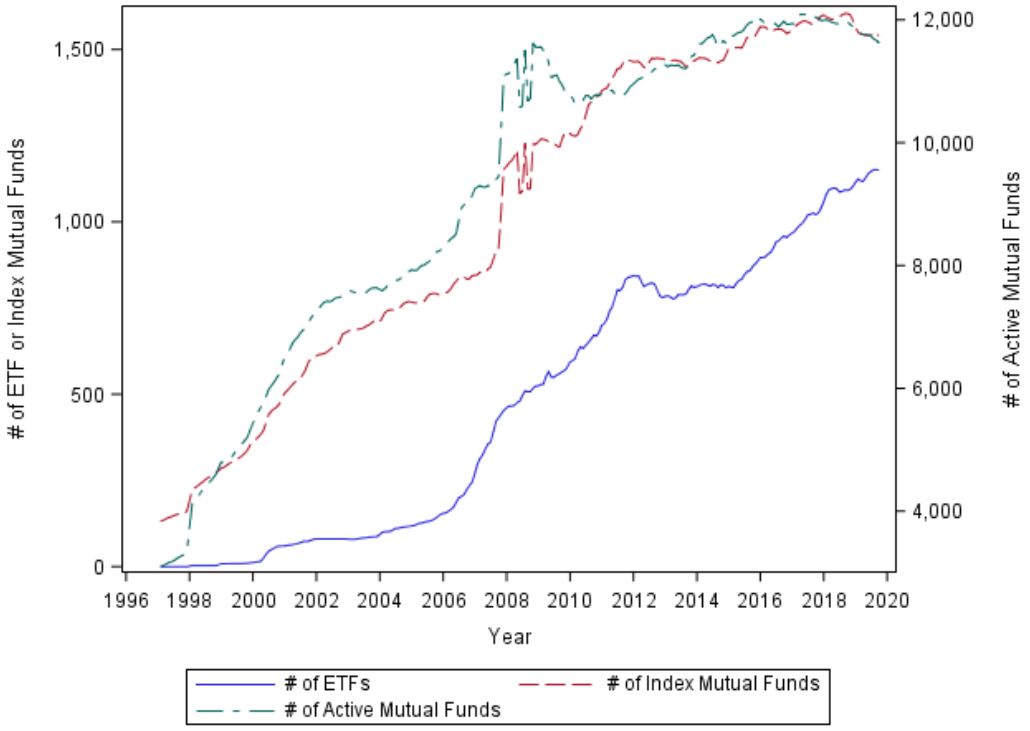
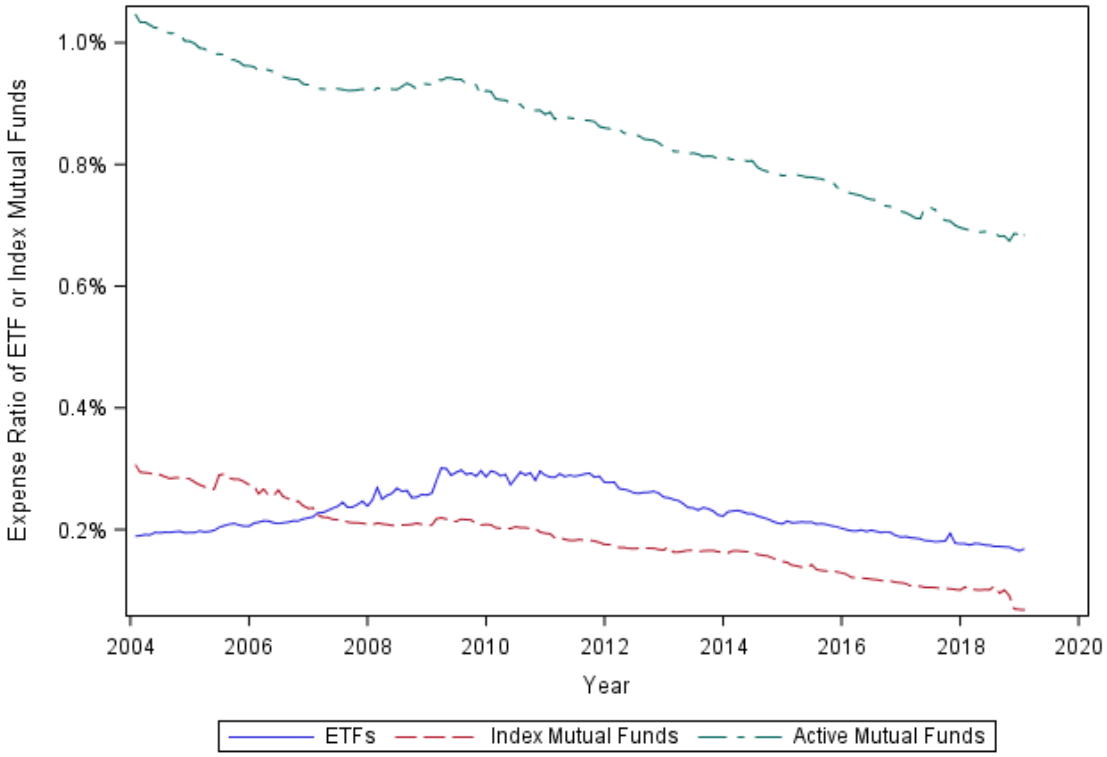


Figure II: Expense Ratios and Turnover

These two figures illustrate the average expense ratios and turnover ratios of ETFs, Index Mutual Funds, and Active Mutual Funds during our sample period.

Panel A: Expense Ratios of Equity Funds (CRSP Universe), weighted by AUM



Panel B: Annual Turnover Ratios of Equity Funds (CRSP Universe), weighted by AUM

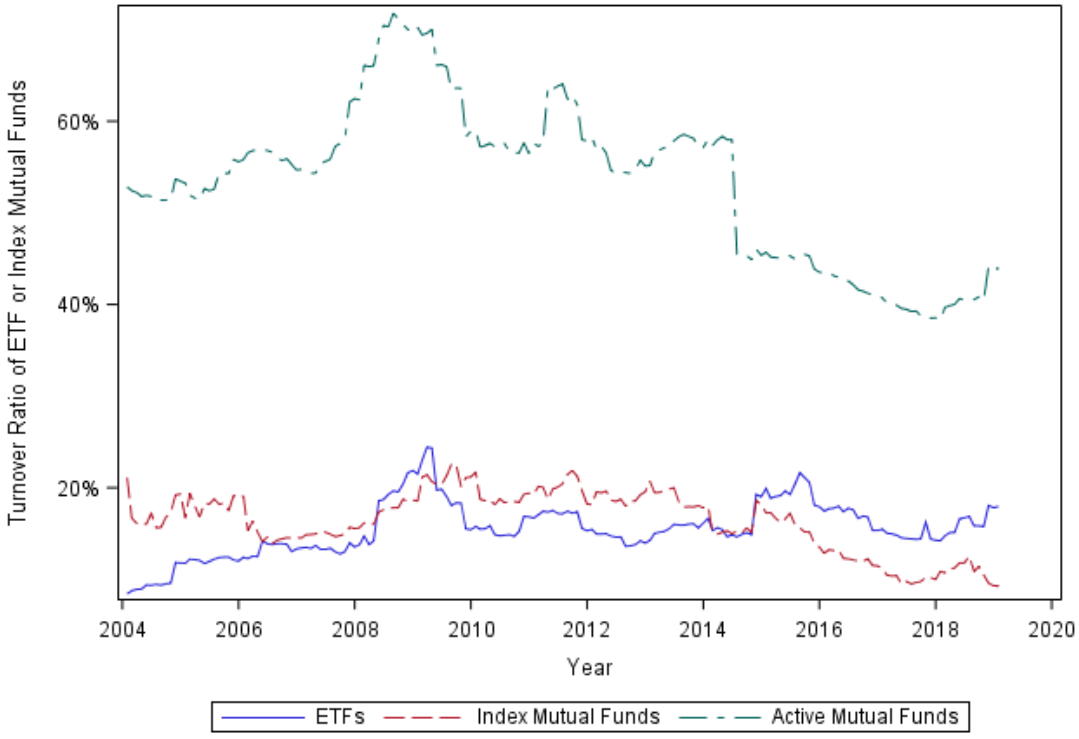


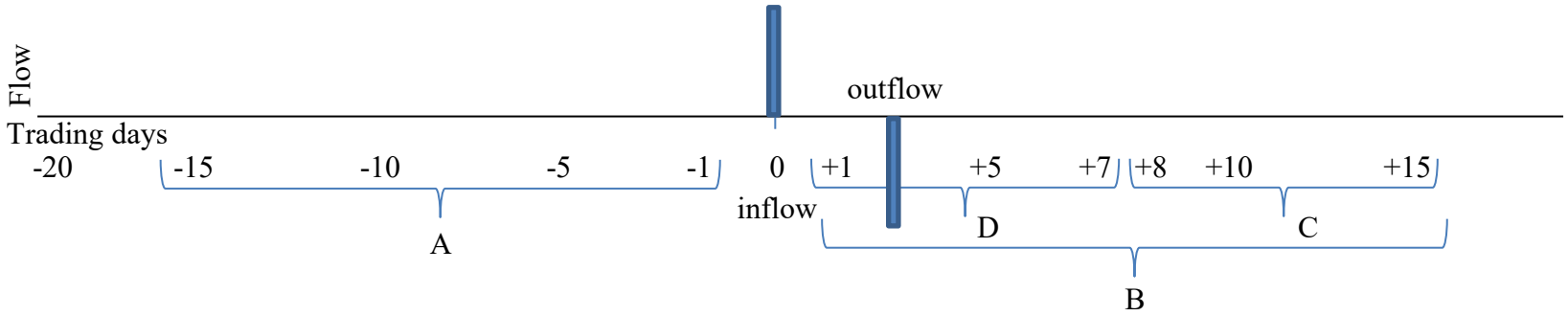
Figure III: Detecting Heartbeats

The figure shows the timeline and procedure that is used to detect heartbeats. Panel A shows a diagram of the process. Panels B and C show an example from the data.

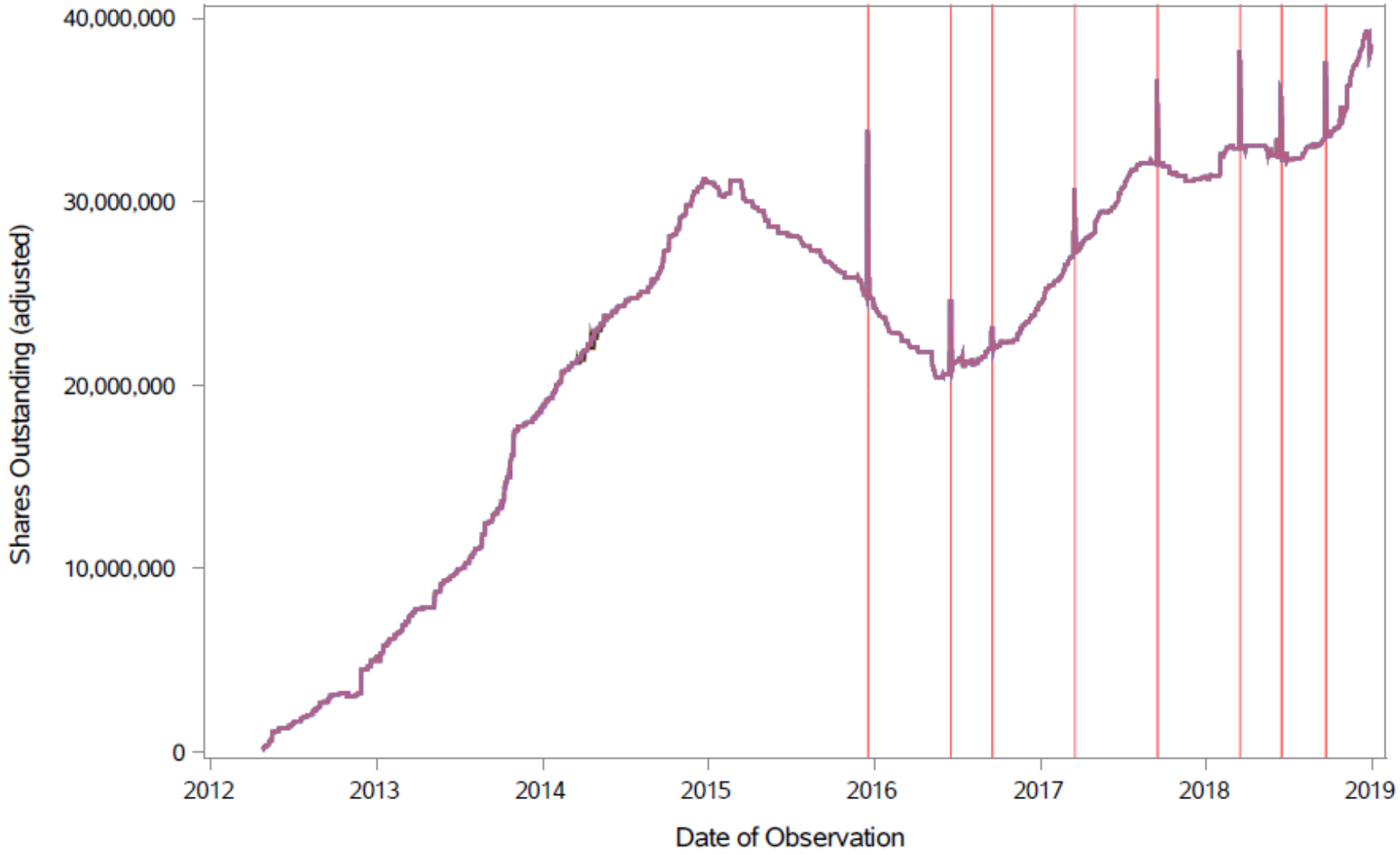
Heartbeat conditions:

1. Inflow on day 0 is at least 1% of AUM
2. The inflow is not exactly equal to 25,000 or 50,000 shares (typical size of one creation basket).
3. Inflow on day 0 is at least 3x as large as the largest of:
   a. The maximum absolute percentage flow during days -15 to -1 (window A)
   b. The maximum percentage inflow during days 1 to 15 (window B)
   c. The maximum absolute percentage flow during days 8 to 15 (window C)
4. The cumulative flow during days 1 to 7 (window D) reverses at least 75% of the magnitude of the inflow.

Panel A: Example of a heartbeat



Panel B: Time series of shares outstanding for the *VanEck Vectors Morningstar Wide Moat ETF* (*MOAT*) with markings indicating heartbeats



Panel C: Time Series of Daily Flows for the *VanEck Vectors Morningstar Wide Moat ETF* (*MOAT*) with markings indicating heartbeats

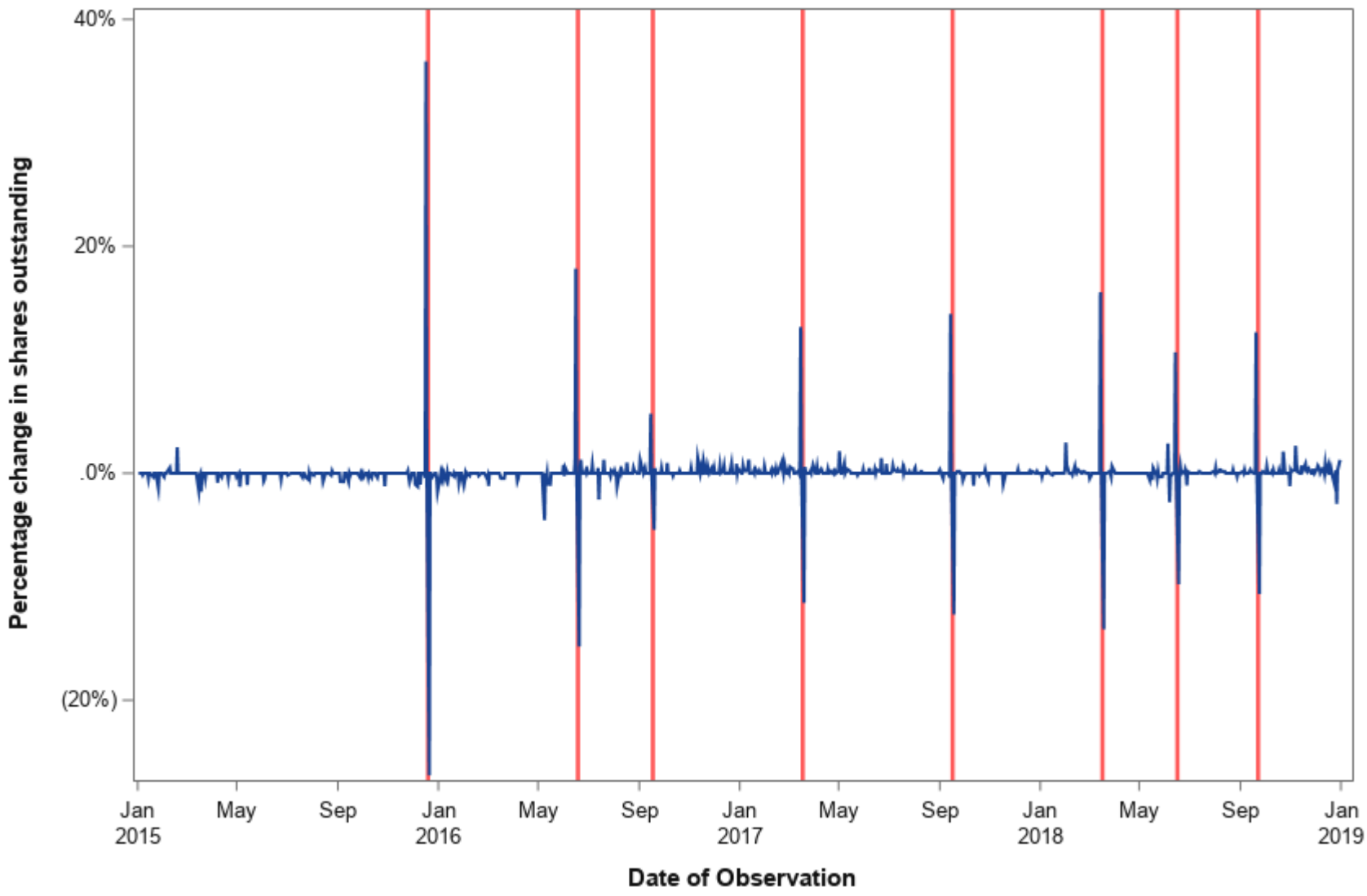


Figure IV: Number of Heartbeats per Month

The figure shows the number of heartbeats that are performed by ETFs in any given month.

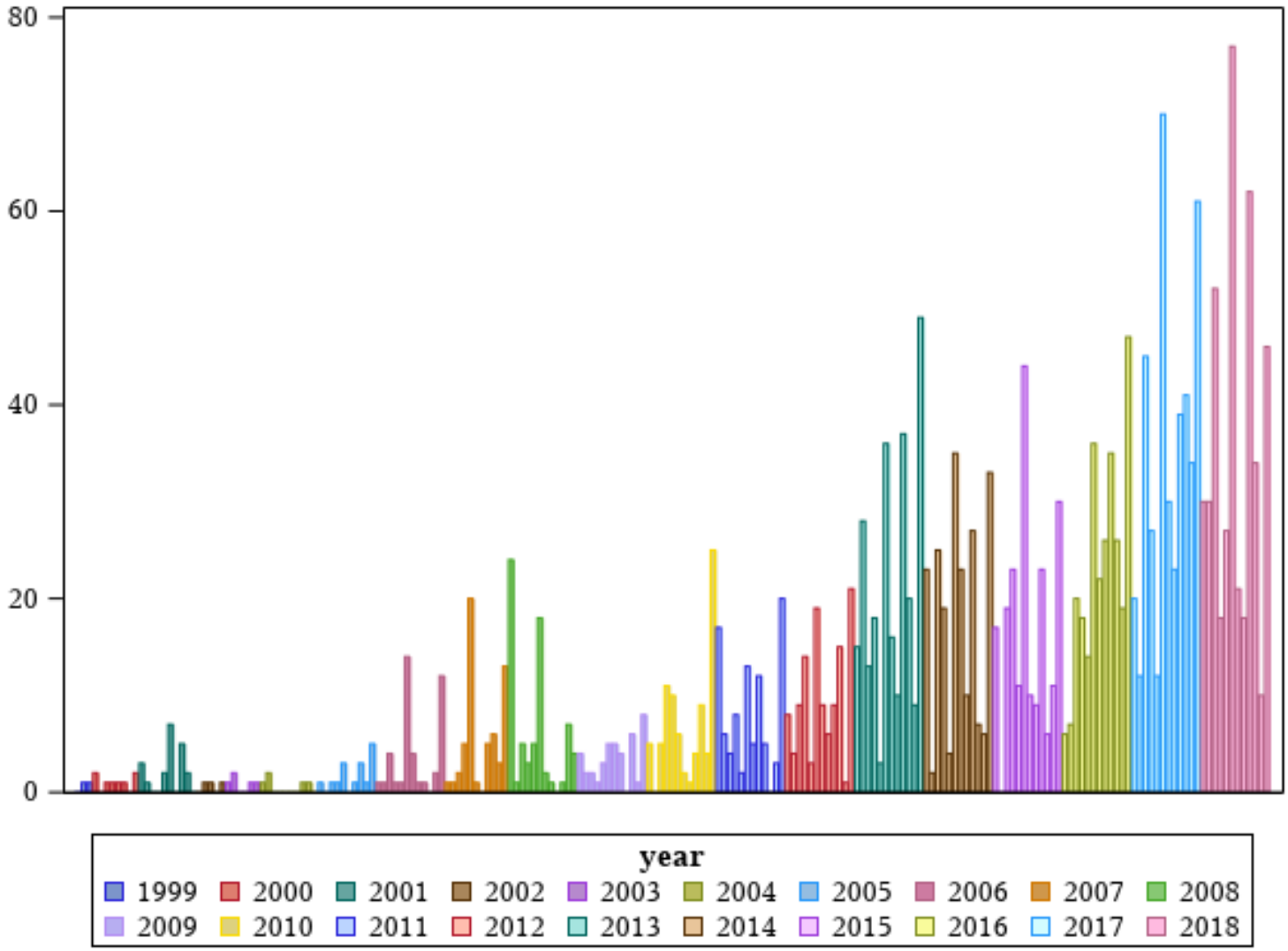
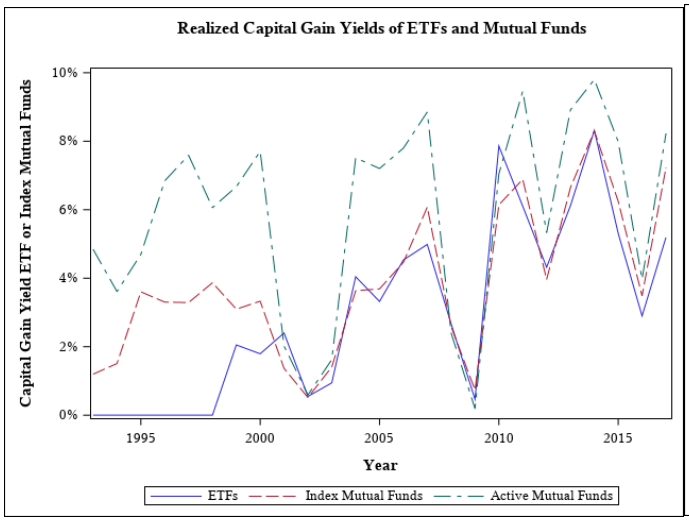
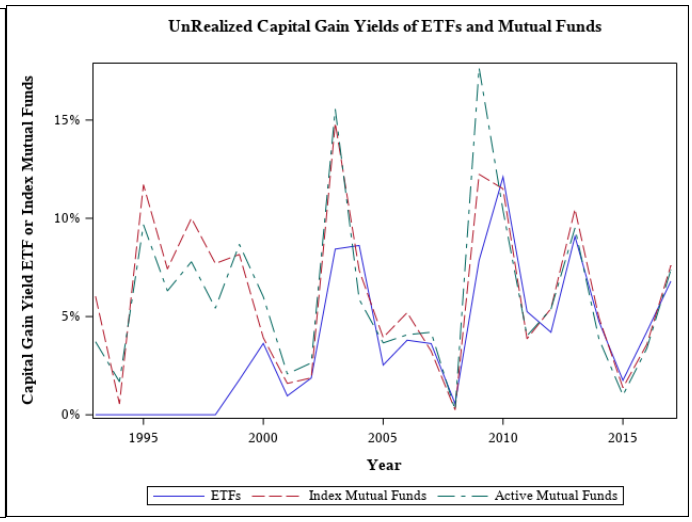
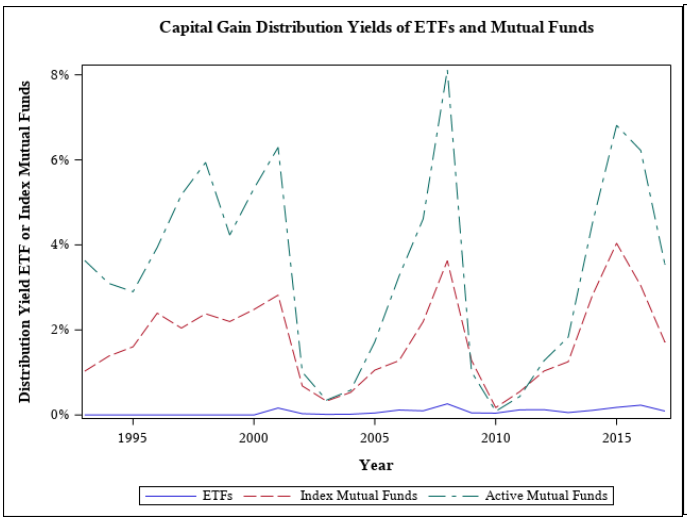


Figure V: Distribution Yields

The first two figures illustrate the realized and unrealized capital gains yields (relative to AUM) for ETFs, Index Mutual Funds, and Active Mutual Funds as collected from the N-SAR data. The second set of figures below represents the capital gains distribution yield (short and long term) as well as the dividend distribution yields by each of type of fund.







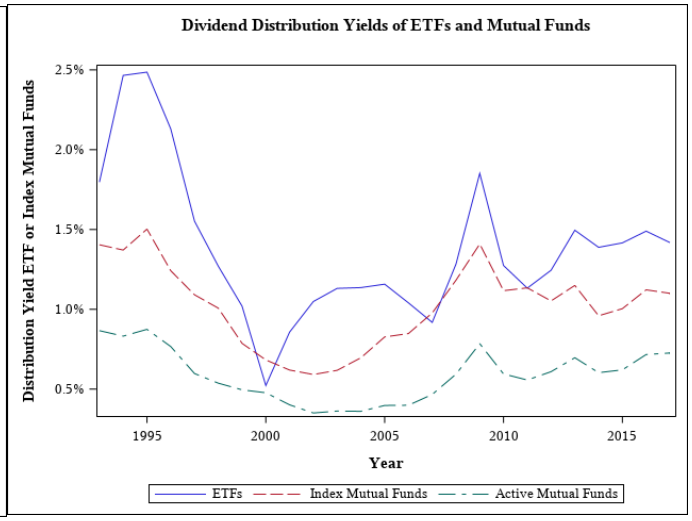


Figure VI: Tax Burdens

Tax Burdens for ETFs, Index Mutual Funds, and Active Mutual Funds computed following Sialm & Zhang (2019).

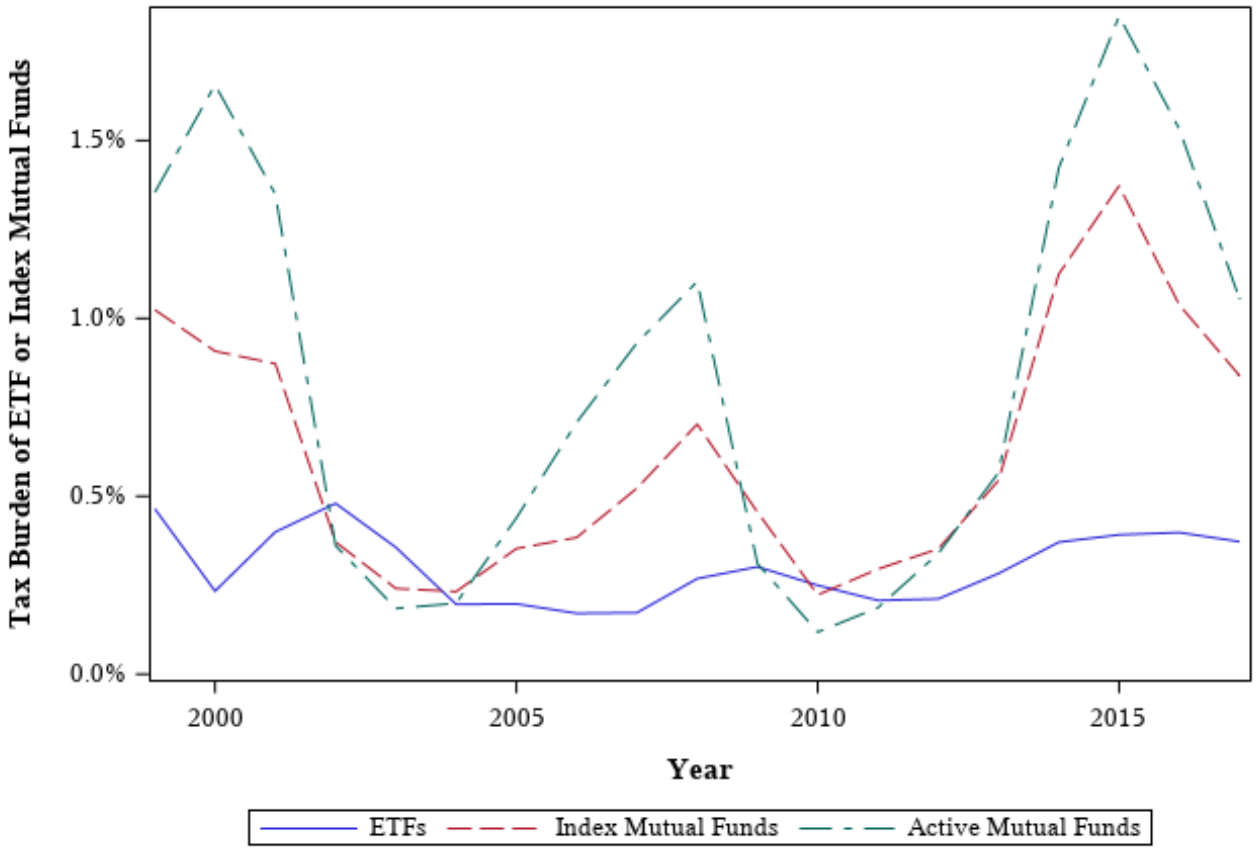


Figure VII: Allocation to ETFs by Investment Advisors to Tax-Sensitive Clientele

The figure shows the allocation to ETFs by investment advisors with high-net-worth clients, our proxy for tax-sensitive investors. ETF ownership by investment advisors is determined using 13F holdings data from Thomson-Reuters Global Ownership Database (OP), while the exposure to high-net-worth clients (HNW) is based on clients data reported on Form ADV. Advisors are determined to have high exposure to high-net-worth individuals if more than 25% of their AUM comes from high-net-worth clients (if assets are unavailable, the determination is made using a client count). Total assets of institutions are used to scale ETF allocations, averages are constructed using institutional assets as weights.

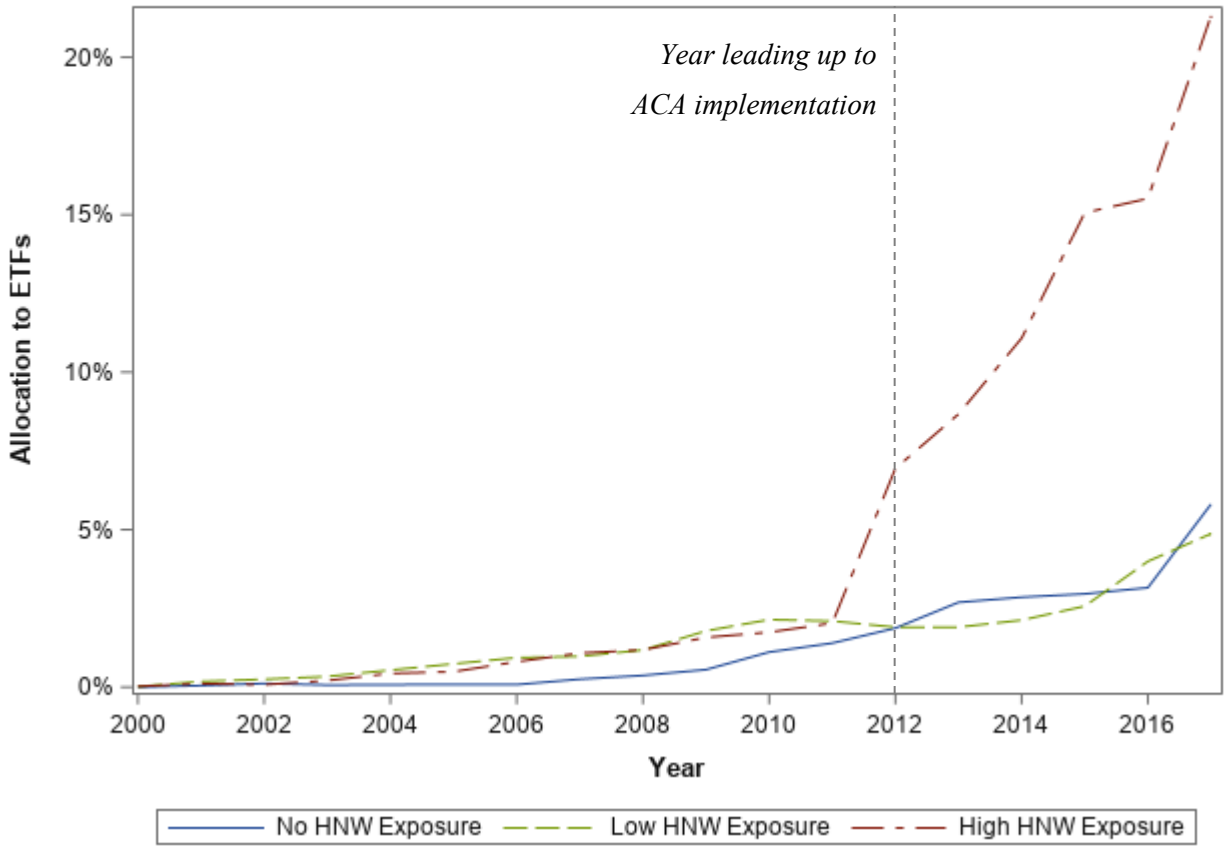


Table I: Sample Statistics

The table presents our sample coverage. Panel A compares the overall sample of U.S. equity mutual funds from CRSP with funds that file form N-SAR with the SEC, supplemented by ETF capital gains data collected from N-SAR-U and prospectuses for a few ETFs organized as Unit Investment Trusts (e.g. SPY and QQQ). Mutual funds often have multiple share classes per fund portfolio. We classify fund share classes into three groups: ETFs, index mutual funds, and active mutual funds. Panel B reports more details such as the number and types of funds in our merged sample.

Panel A: Coverage of N-SAR data

	Overall Sample					with N-SAR Data				
Year	**# of Fund Share Classes**	*# of ETFs*	*# of Index Mutual Funds*	*# of Active Mutual Funds*	**# of Fund Portfolios**	**# of Fund Share Classes**	*# of ETFs*	*# of Index Mutual Funds*	*# of Active Mutual Funds*	**# of Fund Portfolios**
1993	1,834	1	58	1,776	1,438	433	1	22	410	239
1994	2,450	1	68	2,382	1,694	1,404	1	57	1,346	765
1995	2,643	1	73	2,570	1,759	2,326	1	91	2,234	1,163
1996	3,021	1	90	2,931	1,872	2,898	1	124	2,773	1,379
1997	3,854	1	125	3,729	2,242	3,669	1	173	3,495	1,653
1998	5,363	28	180	5,155	2,805	4,549	2	250	4,297	1,986
1999	6,152	31	254	5,867	2,883	5,354	10	325	5,019	2,284
2000	7,465	88	348	7,029	3,202	6,281	48	468	5,765	2,609
2001	8,262	114	405	7,743	3,278	7,244	61	549	6,634	2,835
2002	8,777	120	443	8,214	3,240	8,057	68	641	7,348	3,011
2003	9,006	129	463	8,414	3,180	8,478	80	683	7,715	3,064
2004	9,359	162	481	8,716	3,183	8,860	99	763	7,998	3,111
2005	9,760	211	474	9,075	3,210	9,299	145	760	8,394	3,224
2006	10,472	315	492	9,665	3,321	9,397	175	773	8,449	3,298
2007	11,374	412	545	10,417	3,526	9,708	324	807	8,577	3,456
2008	14,119	485	749	12,885	4,811	9,619	368	831	8,420	3,412
2009	13,454	526	744	12,184	4,539	9,211	370	819	8,022	3,226
2010	13,647	594	780	12,273	4,547	8,825	402	771	7,652	3,082
2011	14,133	678	874	12,581	4,674	8,750	493	841	7,416	3,107
2012	14,517	683	892	12,942	4,744	8,528	528	824	7,176	3,031
2013	14,811	723	892	13,196	4,794	8,492	515	803	7,174	2,986
2014	15,257	768	878	13,611	4,878	8,476	532	787	7,157	2,973
2015	16,036	877	934	14,225	4,981	8,696	587	789	7,320	3,076
2016	15,845	953	951	13,941	4,851	8,912	654	807	7,451	3,170
2017	15,920	1,029	1,007	13,884	4,793	8,883	717	807	7,359	3,116

Panel B: Sample coverage after merging N-SAR data with ETF and Mutual Fund data from CRSP MFDB

	# of Fund Portfolios			Total Assets, $ billion		
Year	**# of Fund Portfolios**	*# of Index Mutual Funds*	*# of Active Mutual Funds*	*ETFs*	*IMF*	*AMF*
1993	239	15	223	$0	$12	$112
1994	765	36	729	$0	$19	$442
1995	1,163	62	1,102	$1	$37	$812
1996	1,379	78	1,303	$1	$63	$1,063
1997	1,653	98	1,558	$4	$114	$1,505
1998	1,986	136	1,854	$8	$210	$1,878
1999	2,284	174	2,107	$17	$318	$2,399
2000	2,609	235	2,336	$35	$334	$2,790
2001	2,835	260	2,526	$43	$308	$2,300
2002	3,011	300	2,657	$76	$271	$1,932
2003	3,064	304	2,696	$95	$358	$2,229
2004	3,111	324	2,709	$143	$450	$2,699
2005	3,224	318	2,787	$185	$508	$3,069
2006	3,298	328	2,827	$238	$594	$3,288
2007	3,456	344	2,821	$330	$677	$3,603
2008	3,412	354	2,724	$335	$496	$2,535
2009	3,226	341	2,552	$311	$585	$2,317
2010	3,082	323	2,392	$419	$710	$2,646
2011	3,107	344	2,308	$502	$767	$2,761
2012	3,031	336	2,207	$618	$890	$2,893
2013	2,986	326	2,185	$820	$1,206	$3,508
2014	2,973	311	2,170	$1,055	$1,459	$3,882
2015	3,076	319	2,210	$1,188	$1,530	$3,791
2016	3,170	321	2,235	$1,324	$1,750	$3,685
2017	3,116	317	2,122	$1,752	$2,186	$4,126

Table II: Summary Statistics

The table presents summary statistics for the variables used in this study. The unit of observation is at the share class level and the sample period ranges between 1993 and 2017. All variables are winsorized at 1% by year, except dummy variables, the number of portfolio holdings, yields from CRSP, and tax burden.

Variable	N	Mean	Std Dev	Min	1st Pctl	Median	99th Pctl	Max
ETF Dummy	176,349	3.51%	18.39%	0.00%	0.00%	0.00%	100.00%	100.00%
IMF Dummy	176,349	8.26%	27.53%	0.00%	0.00%	0.00%	100.00%	100.00%
AMF Dummy	176,349	88.23%	32.22%	0.00%	0.00%	100.00%	100.00%	100.00%
Total Return, last 12 months	159,040	8.54%	19.84%	-66.97%	-44.92%	10.65%	57.07%	100.00%
FF4F Excess Return, last 12 months	156,156	-1.45%	6.79%	-33.76%	-21.28%	-1.32%	17.27%	39.71%
Expense Ratio	151,621	1.35%	0.60%	0.06%	0.11%	1.28%	2.74%	3.25%
Fund Turnover Ratio	150,738	85.98%	90.17%	0.00%	3.00%	60.00%	500.00%	500.00%
Flow Volatility, last 12 months	153,746	7.63%	11.92%	0.15%	0.27%	3.04%	58.49%	83.34%
Total Net Flows, last 12 months, $m	153,714	0.090	0.531	-1.733	-1.224	-0.020	1.784	2.140
Total Outflows, last 12 months, $m	153,331	0.293	0.596	0.000	0.000	0.149	3.498	8.771
# Portfolio Holdings	77,441	167	304	1	3	81	1,947	3,805
Cap Gains Distribution >0 dummy, N-SAR	176,349	37.37%	48.38%	0.00%	0.00%	0.00%	100.00%	100.00%
Cap Gains Distr., % of Net Realized Cap Gain, N-SAR	176,349	46.57%	185.34%	0.00%	0.00%	0.00%	536.37%	6218.18%
Realized Cap Gain, N-SAR ($000s)	173,766	113,212	335,495	0	0	13,702	1,723,957	4,219,398
Realized Cap Loss, N-SAR ($000s)	173,376	40,589	159,932	0	0	72	679,506	2,731,846
Unrealized Cap Gain, N-SAR ($000s)	173,682	108,161	458,544	0	0	1,980	2,135,608	7,659,851
Unrealized Cap Loss, N-SAR ($000s)	173,256	63,902	359,352	0	0	0	1,418,589	8,785,179
Distributed Capital Gains, N-SAR ($000s)	173,444	51,682	202,846	0	0	0	1,001,239	3,203,313
Distribution per share, N-SAR ($)	172,934	0.58	1.22	0.00	0.00	0.00	5.91	11.20
Realized Cap Gain, N-SAR, % of Assets	167,338	8.38%	9.24%	0.00%	0.00%	6.17%	42.80%	97.85%
Net Realized Cap Gain, N-SAR, % of Assets	166,756	2.79%	14.49%	-160.32%	-50.05%	4.03%	34.37%	54.63%
Unrealized Cap Gains, N-SAR, % of Assets	175,782	6.05%	8.94%	-1.28%	0.00%	2.14%	39.13%	92.04%
Distribution, N-SAR, % of Assets	167,019	3.03%	5.55%	0.00%	0.00%	0.00%	26.04%	44.64%
Dividend Yield, CRSP	176,349	0.61%	1.05%	0.00%	0.00%	0.04%	4.76%	22.55%
Short Term Cap Gain Yield, CRSP	176,349	0.59%	1.83%	0.00%	0.00%	0.00%	9.24%	72.21%
Long Term Cap Gain Yield, CRSP	176,349	2.26%	4.22%	0.00%	0.00%	0.00%	18.84%	112.17%
Tax Burden	176,349	0.82%	1.30%	0.00%	0.00%	0.22%	5.73%	37.00%

Table III: ETFs vs. Mutual Funds

The table reports yearly averages regarding capital gains distributions as well as realized and unrealized capital gains for U.S. equity mutual funds using data from CRSP and N-SAR forms. IMF represents an Index Mutual Fund, and AMF stands for Active Mutual Fund. The sample ranges between January 1993 and December 2017.

Panel A: Capital Gains Distributions data from N-SAR

Year	ETF Heartbeats		Cap Gain Distribution >0 Dummy (%)			Cap Gain Distribution, % of Net Realized Cap. Gain			Cap Gain Distribution >0 Dummy, weighted by AUM (%)		
	% of ETFs	# of HBs per ETF	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*
1993	0.00	.	.	77.27	59.76	.	71.29	61.19	.	96.23	83.51
1994	0.00	.	.	78.95	55.87	.	195.10	89.91	.	87.41	76.00
1995	0.00	.	.	63.74	60.03	.	47.48	122.20	.	86.49	71.78
1996	0.00	.	.	66.94	70.07	.	64.70	53.12	.	89.39	86.45
1997	0.00	.	.	67.05	72.56	.	48.04	57.36	.	89.13	86.61
1998	0.00	.	.	53.60	66.09	.	73.21	83.85	.	83.29	87.33
1999	10.00	1.00	.	52.92	60.53	.	51.83	60.86	.	82.34	86.08
2000	10.42	1.20	.	43.16	57.81	.	73.64	67.62	.	35.50	81.52
2001	13.11	1.00	26.23	18.40	27.60	3.84	81.17	92.96	13.09	10.17	44.63
2002	16.18	1.45	2.94	8.58	10.07	1.98	15.69	18.42	0.11	5.84	17.97
2003	5.00	1.00	1.25	9.52	8.63	0.24	6.71	6.98	0.04	3.78	15.88
2004	7.07	1.00	2.02	20.71	20.66	0.22	8.89	8.89	0.38	6.04	29.16
2005	5.52	1.13	1.38	30.00	37.98	0.83	24.94	24.90	0.16	11.05	51.39
2006	10.86	1.79	5.14	33.51	53.00	1.60	25.29	41.73	2.56	14.07	71.12
2007	9.57	1.55	4.63	42.13	63.47	0.67	29.99	51.77	1.37	14.67	77.94
2008	18.21	1.54	7.61	26.96	25.86	2.03	64.55	100.70	1.72	20.90	41.84
2009	12.70	1.21	0.54	3.66	1.43	0.15	1.83	0.61	0.01	0.66	2.08
2010	10.95	1.75	2.24	8.30	6.40	0.45	2.54	1.82	0.33	2.53	16.61
2011	13.79	1.63	3.85	13.56	12.90	2.43	8.85	7.18	1.01	7.10	23.00
2012	14.58	1.64	2.84	25.12	26.60	3.36	23.69	28.46	0.42	9.13	39.13
2013	21.17	1.57	3.30	37.11	40.88	1.07	20.46	23.05	0.12	10.83	55.06
2014	25.75	2.15	7.14	44.60	62.07	2.26	33.10	44.37	3.03	13.71	81.47
2015	22.15	1.72	8.18	52.09	68.92	3.36	53.76	85.10	2.33	23.38	87.56
2016	22.94	1.63	5.20	48.45	56.19	4.18	78.59	195.30	1.59	39.82	82.20
2017	29.71	1.95	6.14	53.90	64.66	1.97	39.14	42.74	3.20	28.43	84.84
Avg.	*14.72*	*1.5*	*5.33*	*39.21*	*43.60*	*1.80*	*45.78*	*54.84*	*1.85*	*34.88*	*59.25*

Panel B: Distributions, Realized, and Unrealized Cap Gain Yield Data from N-SAR

Year	Cap Gain Distribution Yield (%)			Net Realized Cap Gain Yield (%)			Net Unrealized Cap Gain Yield (%)		
	ETF	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*
1993	.	1.03	3.63	.	1.20	4.84	.	6.03	3.72
1994	.	1.39	3.09	.	1.51	3.61	.	0.55	1.68
1995	.	1.60	2.90	.	3.60	4.70	.	11.71	9.67
1996	.	2.40	3.94	.	3.30	6.84	.	7.42	6.30
1997	.	2.04	5.18	.	3.29	7.59	.	10.00	7.79
1998	.	2.38	5.94	.	3.87	6.06	.	7.70	5.42
1999	.	2.20	4.23	2.05	3.10	6.67	1.78	8.16	8.68
2000	.	2.48	5.32	1.79	3.33	7.70	3.63	3.92	6.01
2001	0.16	2.82	6.29	2.40	1.37	2.02	0.96	1.60	2.08
2002	0.03	0.68	1.01	0.55	0.52	0.59	1.87	1.88	2.64
2003	0.01	0.33	0.35	0.94	1.41	1.62	8.43	14.84	15.56
2004	0.02	0.53	0.58	4.04	3.64	7.52	8.62	7.35	5.87
2005	0.05	1.06	1.72	3.32	3.69	7.20	2.53	3.93	3.66
2006	0.12	1.28	3.26	4.53	4.46	7.80	3.80	5.20	4.07
2007	0.10	2.20	4.61	4.99	6.08	8.85	3.62	3.24	4.20
2008	0.26	3.63	8.12	2.67	2.59	2.40	0.57	0.25	0.25
2009	0.05	1.28	1.01	0.46	0.74	0.19	7.85	12.24	17.66
2010	0.04	0.17	0.09	7.86	6.14	7.05	12.11	11.50	10.39
2011	0.12	0.55	0.44	6.10	6.89	9.46	5.25	3.87	4.02
2012	0.12	1.03	1.28	4.32	3.96	5.32	4.20	5.41	5.38
2013	0.06	1.25	1.83	6.12	6.65	8.92	9.08	10.46	9.51
2014	0.11	2.81	4.51	8.32	8.30	9.80	4.75	4.95	3.86
2015	0.18	4.04	6.81	5.31	6.25	7.99	1.75	1.38	1.00
2016	0.23	3.04	6.22	2.90	3.48	3.97	4.23	3.59	3.39
2017	0.09	1.71	3.53	5.19	7.23	8.22	6.80	7.60	7.38
Avg.	*0.10*	*1.76*	*3.44*	*3.89*	*3.86*	*5.88*	*4.83*	*6.19*	*6.01*

Panel C: Capital Gains Yield Comparison of N-SAR and CRSP Data

Year	# of ETFs		*Source: CRSP MFDB Database*						*Form N-SAR Data*		
			ST Cap Gain Distr Yield			LT Cap Gain Distr Yield			Cap Gain Distr Yield		
	CRSP	N-SAR	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*
1993	1	1	0.00	0.24	0.71	0.00	0.55	2.17	0.00	1.03	3.63
1994	1	1	0.06	0.44	0.65	0.00	0.81	2.11	0.00	1.39	3.09
1995	1	1	0.00	0.26	0.62	0.00	1.11	2.06	0.00	1.60	2.90
1996	1	1	0.00	0.68	1.15	0.00	1.81	2.58	0.00	2.40	3.94
1997	1	1	0.11	0.65	1.55	0.05	1.78	3.34	0.00	2.04	5.18
1998	2	2	0.00	0.99	1.97	0.00	1.67	3.49	0.00	2.38	5.94
1999	10	10	0.09	0.59	1.02	0.13	2.39	3.78	0.00	2.20	4.23
2000	48	48	0.06	0.70	1.65	0.01	1.80	4.07	0.00	2.48	5.32
2001	61	61	0.15	0.67	1.43	0.01	1.82	3.14	0.16	2.82	6.29
2002	68	68	0.18	0.06	0.22	0.01	0.59	0.70	0.03	0.68	1.01
2003	80	80	0.01	0.09	0.09	0.03	0.23	0.29	0.01	0.33	0.35
2004	99	99	0.07	0.22	0.22	0.01	0.33	0.46	0.02	0.53	0.58
2005	145	145	0.05	0.29	0.44	0.04	0.85	1.51	0.05	1.06	1.72
2006	175	175	0.01	0.27	0.70	0.07	1.09	2.69	0.12	1.28	3.26
2007	324	324	0.10	0.34	0.91	0.01	1.71	3.61	0.10	2.20	4.61
2008	368	368	0.21	0.48	1.22	0.01	2.39	3.93	0.26	3.63	8.12
2009	370	369	0.07	0.10	0.13	0.00	1.38	0.99	0.05	1.28	1.01
2010	402	402	0.17	0.12	0.05	0.00	0.10	0.07	0.04	0.17	0.09
2011	493	493	0.10	0.18	0.13	0.01	0.41	0.40	0.12	0.55	0.44
2012	528	528	0.05	0.18	0.16	0.04	0.88	1.27	0.12	1.03	1.28
2013	515	515	0.04	0.33	0.27	0.01	1.10	1.79	0.06	1.25	1.83
2014	532	532	0.07	0.90	0.84	0.04	2.12	3.84	0.11	2.81	4.51
2015	587	587	0.09	0.88	0.89	0.06	3.15	5.52	0.18	4.04	6.81
2016	654	654	0.06	0.32	0.40	0.08	2.65	4.98	0.23	3.04	6.22
2017	717	717	0.06	0.26	0.29	0.03	1.96	3.18	0.09	1.71	3.53
Avg.	*247*	*247*	*0.07*	*0.41*	*0.71*	*0.03*	*1.39*	*2.48*	*0.07*	*1.76*	*3.44*

Table IV: Tax Burden and Expense Ratio

The table reports average dividend, short-term and long-term capital gains distribution yields per year for ETFs, index mutual funds (IMF) and active mutual funds (AMF). These yields are then used in combination with effective tax rates for investors that fall in the highest tax brackets to compute the tax burden for fund investors following Sialm & Zhang (2019). The final columns report the average yearly expense ratios by fund type for benchmarking purposes. The sample ranges from January 1993 to December 2017.

Year	Dividend Yield (%)			ST Cap Gain Yield (%)			LT Cap Gain Yield (%)			Tax Burden (%)			Expense Ratio (%)		
	ETF	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*
1993	1.80	1.40	0.87	0.00	0.24	0.71	0.00	0.55	2.17	0.71	0.80	1.22	0.18	1.06	1.47
1994	2.47	1.37	0.83	0.06	0.44	0.65	0.00	0.81	2.11	1.00	0.95	1.18	0.31	1.03	1.41
1995	2.49	1.50	0.87	0.00	0.26	0.62	0.00	1.11	2.06	0.98	1.01	1.17	0.34	1.02	1.44
1996	2.13	1.24	0.77	0.00	0.68	1.15	0.00	1.81	2.58	0.84	1.27	1.48	0.24	0.87	1.43
1997	1.55	1.09	0.60	0.11	0.65	1.55	0.05	1.78	3.34	0.67	1.15	1.70	0.20	0.82	1.44
1998	1.27	1.01	0.54	0.00	0.99	1.97	0.00	1.67	3.49	0.50	1.12	1.69	0.19	0.85	1.48
1999	1.02	0.79	0.50	0.09	0.59	1.02	0.13	2.39	3.78	0.46	1.02	1.35	0.46	0.84	1.49
2000	0.52	0.68	0.48	0.06	0.70	1.65	0.01	1.80	4.07	0.23	0.91	1.66	0.27	0.97	1.51
2001	0.86	0.62	0.40	0.15	0.67	1.43	0.01	1.82	3.14	0.40	0.87	1.35	0.26	1.00	1.57
2002	1.05	0.59	0.35	0.18	0.06	0.22	0.01	0.59	0.70	0.48	0.37	0.36	0.36	1.02	1.60
2003	1.13	0.62	0.36	0.01	0.09	0.09	0.03	0.23	0.29	0.36	0.24	0.18	0.35	1.04	1.60
2004	1.14	0.70	0.36	0.07	0.22	0.22	0.01	0.33	0.46	0.20	0.23	0.20	0.33	1.04	1.54
2005	1.16	0.83	0.40	0.05	0.29	0.44	0.04	0.85	1.51	0.20	0.35	0.44	0.37	1.02	1.49
2006	1.04	0.85	0.40	0.01	0.27	0.70	0.07	1.09	2.69	0.17	0.38	0.71	0.37	1.01	1.46
2007	0.92	0.98	0.47	0.10	0.34	0.91	0.01	1.71	3.61	0.17	0.52	0.93	0.50	0.98	1.44
2008	1.28	1.18	0.59	0.21	0.48	1.22	0.01	2.39	3.93	0.27	0.70	1.10	0.55	0.98	1.43
2009	1.85	1.41	0.78	0.07	0.10	0.13	0.00	1.38	0.99	0.30	0.46	0.31	0.52	1.00	1.44
2010	1.27	1.12	0.59	0.17	0.12	0.05	0.00	0.10	0.07	0.25	0.22	0.12	0.52	1.01	1.39
2011	1.13	1.13	0.56	0.10	0.18	0.13	0.01	0.41	0.40	0.21	0.30	0.19	0.50	1.02	1.37
2012	1.24	1.05	0.61	0.05	0.18	0.16	0.04	0.88	1.27	0.21	0.35	0.34	0.50	1.01	1.35
2013	1.50	1.15	0.70	0.04	0.33	0.27	0.01	1.10	1.79	0.28	0.54	0.57	0.51	1.01	1.31
2014	1.39	0.96	0.60	0.07	0.90	0.84	0.04	2.12	3.84	0.37	1.12	1.42	0.48	0.99	1.29
2015	1.42	1.00	0.62	0.09	0.88	0.89	0.06	3.15	5.52	0.39	1.37	1.85	0.48	0.96	1.27
2016	1.49	1.12	0.72	0.06	0.32	0.40	0.08	2.65	4.98	0.40	1.04	1.53	0.48	0.88	1.25
2017	1.42	1.10	0.73	0.06	0.26	0.29	0.03	1.96	3.18	0.37	0.84	1.05	0.47	0.84	1.21
Avg.	*1.38*	*1.02*	*0.59*	*0.07*	*0.41*	*0.71*	*0.03*	*1.39*	*2.48*	*0.42*	*0.73*	*0.96*	*0.39*	*0.97*	*1.43*
13-17	*1.44*	*1.07*	*0.67*	*0.06*	*0.54*	*0.54*	*0.04*	*2.20*	*3.86*	*0.36*	*0.98*	*1.28*	*0.48*	*0.94*	*1.27*

Table V: Tax Burden by Style

The table reports average capital gains distribution yields as well as realized and unrealized capital gains yields for ETFs, index mutual funds and active mutual funds by style and year. Furthermore, the tax burden is computed for each of the three fund types. The final two columns display the difference between the tax burden of index mutual funds (IMF) and active mutual funds (AMF) relative to the tax burden of ETFs, respectively. Panel A displays average statistics for large-cap and broad market funds. Panel B focuses on small- and mid-cap funds. Panel C reports statistics for sector funds. The capital gains data come from form N-SAR. Tax rates are obtained from Sialm & Zhang (2019).

Panel A: Large-Cap and Broad Market Funds

Year	**# of Funds**	Cap Gain Dist Yield (%)			Realized Cap Gain Yield (%)			Unrealized Cap Gain Yield (%)			Tax Burden (%)				
		ETF	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*IMF Diff*	*AMF Diff*
2013	3,944	0.01	1.17	1.44	4.40	6.77	9.56	7.78	11.67	9.67	0.31	0.58	0.47	0.27	0.16
2014	3,764	0.10	3.24	4.08	5.87	7.41	10.55	5.83	6.21	4.36	0.43	1.28	1.34	0.85	0.91
2015	3,838	0.36	4.24	6.96	4.86	5.24	8.74	1.22	1.30	0.86	0.42	1.46	1.88	1.04	1.46
2016	3,887	0.13	3.06	6.72	2.81	3.26	4.44	2.43	3.15	2.30	0.41	1.08	1.65	0.67	1.24
2017	3,736	0.05	1.65	3.75	3.93	4.46	8.46	6.47	9.16	8.10	0.34	0.91	1.10	0.57	0.76
Avg.		*0.13*	*2.67*	*4.59*	*4.37*	*5.43*	*8.35*	*4.75*	*6.30*	*5.06*	*0.38*	*1.06*	*1.29*	*0.68*	*0.91*

Panel B: Small- and Mid-Cap Funds

Year	**# of Funds**	Cap Gain Dist Yield (%)			Realized Cap Gain Yield (%)			Unrealized Cap Gain Yield (%)			Tax Burden (%)				
		ETF	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*IMF Diff*	*AMF Diff*
2013	3,357	0.13	1.48	2.41	9.88	6.99	9.14	11.21	9.50	10.45	0.23	0.53	0.68	0.30	0.45
2014	3,468	0.14	2.60	5.66	11.03	9.88	10.11	4.79	3.36	2.59	0.31	1.01	1.67	0.70	1.36
2015	3,570	0.17	4.23	7.59	6.08	7.84	7.95	2.21	1.41	0.75	0.35	1.35	2.00	1.00	1.65
2016	3,684	0.17	3.31	6.40	3.90	3.85	3.63	3.92	3.92	3.71	0.36	1.04	1.52	0.68	1.16
2017	3,805	0.11	1.95	3.54	7.34	10.87	8.41	7.28	6.15	7.18	0.37	0.78	1.01	0.41	0.64
Avg.		*0.14*	*2.71*	*5.12*	*7.65*	*7.89*	*7.85*	*5.88*	*4.87*	*4.94*	*0.32*	*0.94*	*1.38*	*0.62*	*1.05*

Panel C: Sector Funds															
Year	**# of Funds**	Cap Gain Dist Yield (%)			Realized Cap Gain Yield (%)			Unrealized Cap Gain Yield (%)			Tax Burden (%)				
		ETF	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*ETF*	*IMF*	*AMF*	*IMF Diff*	*AMF Diff*
2013	1,028	0.03	0.06	1.52	4.26	2.10	6.01	8.12	6.93	6.14	0.30	0.29	0.54	-0.01	0.24
2014	1,048	0.08	0.16	2.55	7.66	4.03	6.84	4.12	6.85	6.73	0.37	0.41	0.98	0.04	0.61
2015	1,066	0.08	0.62	4.29	5.07	3.44	6.00	1.73	2.07	2.49	0.39	0.50	1.37	0.11	0.98
2016	1,097	0.33	0.60	4.37	2.31	3.67	4.00	5.09	6.33	5.69	0.41	0.71	1.27	0.30	0.86
2017	1,101	0.10	0.45	3.35	4.48	2.72	7.19	6.64	6.07	6.59	0.39	0.64	1.15	0.25	0.76
Avg.		*0.12*	*0.38*	*3.22*	*4.76*	*3.19*	*6.01*	*5.14*	*5.65*	*5.53*	*0.37*	*0.51*	*1.06*	*0.14*	*0.69*

Table VI: Determinants of ETF Tax Efficiency and Heartbeat Trades

This table reports estimates of regression analyses that relate ETF tax efficiency and heartbeat trade usage to various characteristics. Panel A reports estimates of regressions of realized capital gains yields (*CG Yield*) and capital gains distribution yields (*CG Distribution Yield*) on various fund characteristics. Fund characteristics are interacted with an ETF dummy to infer differences in effects between ETFs and mutual funds. Panel B reports regression estimates of short-term and long-term capital gains distribution yields as well as tax burdens on fund characteristics. Panel C regresses the ETF's use of heartbeats on fund characteristics, and Panel D regresses the unrealized capital gains yield on the same determinants used in Panels A and B. Total net assets, expense ratio, and turnover ratio are as reported by CRSP. Annual Return is a fund's total return compounded over the last twelve months. Outflows represent the cumulative monthly redemptions extracted from NSAR filings and scaled by total net asset at the beginning of the period. Realized and unrealized capital gains are also obtained from form NSAR. Flows and performance variables are computed on a rolling 12-month window. Number of holdings information has lower number of observations because the ETF holdings data is not available for the entire sample period. Heartbeat trades are identified as described in Section III.D. Observations are at the share class-year level. Standard errors are clustered by fund and year. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Panel A: Capital Gains Distribution of ETFs vs. Mutual Funds

	CG Yield		CG Distribution Yield		CG Yield		CG Distribution Yield		CG Distribution Yield	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ETF Dummy	-0.0122**	-0.0569***	-0.0398***	-0.0180***	-0.0052	-0.0509***	-0.036***	-0.0159***	-0.0346***	-0.0214***
	(-2.16)	(-3.459)	(-5.08)	(-3.62)	(-1.029)	(-3.30)	(-5.51)	(-3.71)	(-5.69)	(-4.16)
Log TNA	0.0005*	0.0005*	0.0013***	0.0013***	0.0005*	0.0006*	0.0013***	0.0014***	0.0012***	0.0012***
	(1.95)	(1.985)	(3.78)	(3.92)	(1.973)	(2.07)	(3.87)	(4.05)	(3.61)	(3.61)
x ETF Dummy		0.0020*		-0.0027***		0.0017*		-0.0030***		
		(1.992)		(-4.34)		(1.89)		(-4.23)		
Expense Ratio	0.4813***	0.4542***	0.1681	0.1688	0.4160***	0.3865***	0.0528	0.0501	-0.0520	-0.0466
	(3.11)	(2.929)	(1.31)	(1.34)	(3.229)	(3.01)	(0.45)	(0.43)	(-0.46)	(-0.41)
x ETF Dummy		7.0234**		-0.0577		8.6524***		1.1285**		
		(2.349)		(-0.14)		(2.92)		(2.63)		
Turnover Ratio	0.0068**	0.0069**	-0.0022	-0.0023	0.0064**	0.0066**	-0.0020	-0.0021	-0.0036**	-0.0038**
	(2.81)	(2.797)	(-1.49)	(-1.53)	(2.708)	(2.71)	(-1.49)	(-1.50)	(-2.62)	(-2.67)
x ETF Dummy		-0.0088		0.0002		-0.0163*		-0.0048		
		(-0.894)		(0.09)		(-1.72)		(-1.66)		
Annual Return	0.0669***	0.0666***	-0.0281**	-0.0293**	0.0636***	0.0636***	-0.0319**	-0.0329**	-0.0479***	-0.0476***
	(5.70)	(5.665)	(-2.36)	(-2.42)	(5.292)	(5.25)	(-2.59)	(-2.64)	(-3.16)	(-3.13)
x ETF Dummy		0.0054		0.0523*		-0.0043		0.0489*		
		(0.214)		(1.93)		(-0.21)		(1.97)		
Outflows, last 12	0.0709***	0.0695***	0.0277***	0.0292***	0.0754***	0.0741***	0.0292***	0.0306***	0.0103*	0.0109**
months %	(6.42)	(6.126)	(4.24)	(4.10)	(6.295)	(6.06)	(3.96)	(3.87)	(2.03)	(2.14)
x ETF Dummy		0.0143		-0.0273***		0.0141		-0.0259***		
		(0.883)		(-3.32)		(0.92)		(-3.28)		
Realized Capital									0.2520***	0.2589***
Gain Yield									(4.98)	(5.02)
x ETF Dummy										-0.2111***
										(-3.93)
Observations	122,629	122,629	122,629	122,629	122,629	122,629	122,629	122,629	122,629	122,629
R-squared	0.281	0.282	0.193	0.194	0.300	0.301	0.213	0.214	0.275	0.276
Fixed Effects	Date		Date		Style & Date		Style & Date		Style & Date	

Panel B: Tax Efficiency and Redemption-in-Kind, Outflows and Heartbeat Trades

	CG Yield	CG Distribution Yield	ST CG Distribution Yield	LT CG Distribution Yield	*Tax Burden*	CG Yield	CG Distribution Yield	ST CG Distribution Yield	LT CG Distribution Yield	*Tax Burden*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ETF Dummy	-0.0233***	-0.0258***	-0.0025***	-0.0277***	-0.0058***	-0.0155**	-0.0221***	-0.0021***	-0.0255***	-0.0052***
	(-3.67)	(-4.73)	(-3.15)	(-5.60)	(-4.28)	(-2.61)	(-5.15)	(-2.91)	(-6.40)	(-4.86)
Log TNA	0.0005*	0.0013***	-0.0000	0.0013***	0.0002***	0.0005*	0.0013***	-0.0000	0.0013***	0.0002***
	(1.94)	(3.81)	(-0.82)	(5.71)	(4.62)	(1.98)	(3.90)	(-0.80)	(5.66)	(4.69)
Expense Ratio	0.4822***	0.1672	-0.0313	0.2809**	-0.0666**	0.4183***	0.0522	-0.0537**	0.1950*	-0.0870***
	(3.12)	(1.31)	(-1.45)	(2.62)	(-2.38)	(3.26)	(0.45)	(-2.12)	(1.96)	(-3.01)
Turnover Ratio	0.0069**	-0.0023	0.0034***	-0.0046***	0.0003	0.0066**	-0.0021	0.0035***	-0.0045***	0.0005
	(2.81)	(-1.53)	(4.00)	(-5.75)	(1.05)	(2.71)	(-1.53)	(4.21)	(-6.01)	(1.53)
Annual Return	0.0667***	-0.0280**	0.0053*	-0.0014	0.0018	0.0635***	-0.0317**	0.0046	-0.0043	0.0010
	(5.69)	(-2.34)	(1.85)	(-0.27)	(1.12)	(5.28)	(-2.58)	(1.61)	(-0.85)	(0.67)
Outflows, last 12	0.0694***	0.0292***	-0.0009	0.0106***	0.0019**	0.0739***	0.0306***	-0.0010	0.0113***	0.0019**
months %	(6.12)	(4.11)	(-1.20)	(3.46)	(2.50)	(6.05)	(3.87)	(-1.27)	(3.27)	(2.08)
x ETF Dummy	0.0268	-0.0276***	0.0005	-0.0083*	-0.0023*	0.0285	-0.0248***	0.0016	-0.0068*	-0.0015
	(1.40)	(-3.31)	(0.44)	(-2.07)	(-2.00)	(1.53)	(-3.17)	(1.44)	(-1.81)	(-1.42)
Log (1 + # of	-0.0055	-0.0068***	-0.0019***	-0.0054***	-0.0021***	-0.0126**	-0.0121***	-0.0030***	-0.0088***	-0.0031***
Heartbeat Trades)	(-0.93)	(-3.40)	(-3.77)	(-3.84)	(-4.92)	(-2.15)	(-5.61)	(-4.24)	(-6.58)	(-6.46)
Observations	122,629	122,629	122,629	122,629	122,629	122,629	122,629	122,629	122,629	122,629
R-squared	0.281	0.193	0.127	0.186	0.233	0.300	0.214	0.138	0.206	0.253
Fixed Effects			Date					Style & Date		

Panel C: Determinants of Heartbeat Trades

	HBT Dummy	*Log(1+ # of HBTs)*	*HBT Dummy*	*Log(1+ # of HBTs)*	*HBT Dummy*	*Log(1+ # of HBTs)*
	(1)	(2)	(3)	(4)	(5)	(6)
Log TNA	0.0126*	0.0196**	0.0108	0.0238**	-0.0152	0.0060
	(1.84)	(2.70)	(1.27)	(2.52)	(-0.96)	(0.31)
Expense Ratio	-14.3336*	-10.0971	-3.4344	8.1876	-5.4591	-3.0029
	(-1.76)	(-1.05)	(-0.36)	(0.66)	(-0.53)	(-0.26)
Turnover Ratio	0.1989***	0.2401***	0.1806***	0.2220***	0.1049	0.1356*
	(6.49)	(6.70)	(5.92)	(6.18)	(1.81)	(1.96)
Annual Return	0.1371*	0.1275	0.2049**	0.2191*	-0.0316	-0.0084
	(2.03)	(1.36)	(2.35)	(1.87)	(-0.30)	(-0.07)
Realized Capital Gains Yield	0.4361**	0.4490**	0.3378*	0.4741*	0.4856**	0.6625**
	(2.31)	(2.12)	(2.03)	(2.19)	(2.83)	(2.68)
Unrealized Capital Gains Yield	-0.1070	-0.1328	-0.3435	-0.3881	0.0748	0.0646
	(-0.66)	(-0.83)	(-1.38)	(-1.55)	(0.33)	(0.304)
Outflows, last 12 months %	-0.0705***	-0.0754***	-0.0599**	-0.0698**	-0.0255	-0.0188
	(-5.29)	(-4.26)	(-3.20)	(-2.79)	(-1.23)	(-0.70)
Log # of Holdings			0.0169**	0.0188*	0.0029	0.0077
			(2.28)	(1.98)	(0.16)	(0.37)
Observations	4,484	4,484	3,154	3,154	3,059	3,059
R-squared	0.097	0.122	0.258	0.301	0.480	0.572
Fixed Effects	Date		Family & Date		Fund & Date	

Panel D: Tax Externalities of Outflows

	Unrealized Capital Gains Yield					
	(1)	(2)	(3)	(4)	(5)	(6)
ETF Dummy		0.0055		0.0010		0.0000
		(0.54)		(0.11)		(0.00)
Log TNA	0.0003	0.0003	0.0002	0.0002	0.0045***	0.0046***
	(0.73)	(0.77)	(0.51)	(0.54)	(3.62)	(3.63)
x ETF Dummy		0.0011		0.0013		-0.0027*
		(0.73)		(0.85)		(-1.91)
Expense Ratio	0.4981***	0.4874***	0.4161***	0.3750***	0.7634	0.7661
	(3.51)	(3.26)	(4.11)	(3.53)	(1.42)	(1.44)
x ETF Dummy		3.1705		2.1787		-4.9794*
		(1.45)		(0.95)		(-1.84)
Turnover Ratio	-0.0091**	-0.0093**	-0.0099***	-0.0103***	-0.0062	-0.0063
	(-2.74)	(-2.76)	(-3.22)	(-3.25)	(-1.69)	(-1.71)
x ETF Dummy		0.0061		0.0098		0.0121
		(0.65)		(1.05)		(0.97)
Annual Return	0.3022***	0.3021***	0.3042***	0.3040***	0.3161***	0.3157***
	(6.40)	(6.31)	(6.53)	(6.44)	(7.57)	(7.46)
x ETF Dummy		0.0141		0.0174		0.0216
		(0.44)		(0.54)		(0.63)
Outflows, last 12 months %	0.0192**	0.0222***	0.0168**	0.0200**	0.0105	0.0126
	(2.73)	(3.01)	(2.22)	(2.57)	(1.28)	(1.47)
x ETF Dummy		-0.0621***		-0.0612***		-0.0641***
		(-4.84)		(-4.83)		(-4.38)
Log (1 + # of Heartbeat Trades)		0.0014		0.0041		-0.0008
		(0.40)		(1.07)		(-0.17)
Observations	122,629	122,629	122,629	122,629	121,569	121,569
R-squared	0.497	0.498	0.506	0.507	0.583	0.584
Fixed Effects	Date		Style & Date		Fund & Date	

Table VII: Determinants of Flows

This table reports regression analyses of flows on various fund characteristics within the sample of active mutual funds. Panel A shows results on the flow-performance relationship controlling for differences in funds' fees and tax burdens relative to the style average. Performance Rank is a fractional rank variable based on the fund's relative performance within its style at a given point in time. Perf. Rank: Low, Mid, and High together make up a piecewise linear regression following Siri & Tufano (1998). Performance Quintile 1 and 5 are dummy variables. Annual Excess Return is a fund's excess return relative to the Fama-French four factors, compounded over the last twelve months. Flows and performance variables are computed on a rolling 12-month window, and all performance variables, fees and assets are as of the end of the previous year before flows are observed. Specifications (1) to (4) represent panel regressions with fixed effects and standard errors clustered by fund and year. Observations are at the share class-year level. Specifications (5) to (8) use observations from December only to mitigate any time series dependencies between observations. Specifications (1) to (8) include date and style fixed effects and standard errors are clustered by fund and year. Specifications (9) to (12) show results from a Fama-MacBeth regression using monthly data available for each share class, using Newey-West standard errors with twelve lags to compute *t*-statistics. ***, **, * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Panel B builds on specification (4) from Panel A by analyzing outflows, the components of tax burden, and various subsamples with different expected sensitivities to taxes. In Panels B and C, Annual Excess Return, Fee Gap, and Tax Burden Gap, as well as the components (Dividend yield, Capital Gains Distribution, Realized Capital Gains and Unrealized Capital Gains) are standardized to have zero mean and unit standard deviation (suffix *stdd*). Panel C report regression analyses using fund flows measured from funds' fiscal year-end to December 31 as the dependent variable. Funds with December fiscal year-end month are not included in the analysis in Panel C. Outflows in Panel B and C represent the cumulative monthly redemptions extracted from NSAR filing and scaled by total net asset at the beginning of the period. Net flows and negative net flows (sum of negative monthly net flows, in absolute value) are computed over 12 months and scaled by total net assets at the beginning of the period.

Panel A: Flow-Performance Relationship Augmented with Fee and Tax Burden Gap

Sample & Dependent Variable	Net Flows (%) – Pooled Sample				Net Flows (%) – December Observations Only				Net Flows (%) – Fama-MacBeth, with Newey West			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Perf. Rank: Low	0.455***				0.444***				0.475***			
	(6.84)				(5.04)				(10.03)			
Perf. Rank: Mid	0.299***				0.302***				0.317***			
	(17.11)				(13.21)				(16.45)			
Perf. Rank: High	1.064***				0.947***				1.089***			
	(14.87)				(10.06)				(16.12)			
Perf. Quintile 1		-0.130***				-0.129***				-0.135***		
		(-14.40)				(-10.04)				(-17.86)		
Perf. Quintile 5		0.197***				0.187***				0.202***		
		(17.39)				(14.75)				(18.25)		
Performance Rank			0.004***				0.004***				0.004***	
			(17.93)				(14.07)				(19.07)	
Annual Excess Return				1.492***				1.365***				1.587***
				(13.21)				(11.49)				(21.61)
Fee Gap	-8.658***	-8.783***	-8.405***	-8.425***	-8.428***	-8.599***	-8.192***	-8.468***	-9.170***	-9.421***	-8.955***	-9.559***
	(-7.65)	(-7.64)	(-7.43)	(-7.16)	(-7.09)	(-7.18)	(-6.84)	(-6.92)	(-7.87)	(-8.25)	(-7.82)	(-8.42)
Tax Burden Gap	-4.104***	-4.006***	-4.102***	-3.889***	-5.551***	-5.477***	-5.579***	-5.277***	-4.080***	-3.805***	-3.988***	-3.390***
	(-9.22)	(-8.79)	(-9.17)	(-8.83)	(-10.41)	(-10.28)	(-10.35)	(-9.87)	(-7.35)	(-6.58)	(-6.96)	(-5.39)
Log TNA	-0.038***	-0.037***	-0.038***	-0.034***	-0.037***	-0.036***	-0.037***	-0.033***	-0.047***	-0.046***	-0.047***	-0.043***
	(-10.16)	(-9.95)	(-10.03)	(-9.47)	(-8.74)	(-8.74)	(-8.63)	(-8.20)	(-11.69)	(-11.51)	(-11.45)	(-11.71)
Style Flows	1.066***	1.067***	1.070***	0.900***	1.071***	1.065***	1.070***	0.916***	0.871***	0.874***	0.878***	0.717***
	(11.82)	(11.77)	(11.99)	(11.80)	(9.15)	(9.17)	(9.18)	(10.13)	(9.16)	(9.42)	(9.30)	(9.21)
Return Volatility	-0.158	-0.086	-0.056	0.376	0.289	0.344	0.407	0.654	0.127	0.366	0.297	1.265**
	(-0.28)	(-0.15)	(-0.10)	(0.63)	(0.41)	(0.50)	(0.58)	(0.92)	(0.20)	(0.57)	(0.46)	(2.05)
Retail Dummy	0.037***	0.036**	0.038***	0.027**	0.031**	0.030*	0.031*	0.022	0.075***	0.075***	0.075***	0.069***
	(2.83)	(2.73)	(2.84)	(2.07)	(2.07)	(2.02)	(2.06)	(1.52)	(4.91)	(4.84)	(4.88)	(4.44)
Log Age	-0.200***	-0.203***	-0.201***	-0.193***	-0.198***	-0.201***	-0.199***	-0.195***	-0.183***	-0.187***	-0.184***	-0.180***
	(-24.35)	(-24.06)	(-24.42)	(-21.18)	(-22.04)	(-21.81)	(-22.04)	(-21.78)	(-22.64)	(-22.48)	(-22.75)	(-20.20)
Observations	1,119,685	1,119,685	1,119,685	1,100,330	98,175	98,175	98,175	95,856	1,119,685	1,119,685	1,119,685	1,100,330
R-squared	0.19	0.181	0.188	0.166	0.193	0.185	0.191	0.169	0.204	0.193	0.2	0.178
FE (# of Groups)	Fixed Effects: Date & Style								(288)	(288)	(288)	(288)

Panel B: The Effect of Tax Burden and Its Components on Flows and Outflows

	Net Flows (%)	Outflows (%)	Net Flows (%)	Outflows (%)			Outflows (%)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Annual Excess Return (*standardized*)	0.093***	-0.015***	0.084***	-0.017***	-0.014***	-0.015***	-0.001	-0.010***	-0.016***	-0.015***
	(13.57)	(-7.84)	(12.95)	(-7.68)	(-6.13)	(-6.47)	(-1.32)	(-5.87)	(-7.22)	(-6.25)
Fee Gap (*stdd*)	-0.050***	0.006***	-0.047***	0.009***	0.005*	0.004	0.006***	-0.006**	0.005**	0.007***
	(-6.95)	(3.22)	(-5.05)	(3.11)	(2.00)	(1.29)	(4.87)	(-2.36)	(2.18)	(2.88)
Tax Burden Gap (*stdd*)	-0.0565***	0.019***			0.016***		-0.000	0.014***	-0.028***	0.047***
	(-8.97)	(4.61)			(3.95)		(-0.05)	(3.60)	(-5.36)	(8.34)
Dividend Yield (*stdd*)			-0.013**	0.012***		0.007**				
			(-2.18)	(3.75)		(2.40)				
Capital Gains Distribution Yield (*stdd*)			-0.034***	0.009***		0.008**				
			(-6.37)	(2.91)		(2.39)				
Realized Capital Gains Yield (*stdd*)			-0.074***	0.051***		0.048***				
			(-10.08)	(10.79)		(9.91)				
Unrealized Capital Gains Yield (*stdd*)			-0.010	0.009***		0.006*				
			(-1.28)	(3.45)		(1.93)				
Log TNA	-0.034***	-0.003***	-0.033***	-0.005***	-0.004**	-0.007***	0.004***	-0.011***	-0.002*	-0.003
	(-9.64)	(-3.15)	(-8.73)	(-4.52)	(-2.46)	(-3.98)	(7.23)	(-9.95)	(-1.78)	(-1.64)
Style Flows	0.904***	-0.111***	0.794***	-0.182***	-0.089**	-0.149***	0.000	-0.031	-0.070*	-0.134***
	(12.44)	(-3.12)	(10.69)	(-4.71)	(-2.57)	(-3.76)	(0.03)	(-0.94)	(-2.01)	(-4.15)
Return Volatility	0.394	1.576***	0.801	0.497	1.831***	0.578*	0.128	0.721***	1.675***	1.462***
	(0.666)	(4.75)	(1.51)	(1.68)	(5.00)	(1.91)	(1.48)	(3.06)	(4.54)	(5.25)
Retail Dummy	0.026*	0.012***	0.023*	0.017***			0.001	0.014***	0.010***	0.013***
	(2.05)	(3.63)	(1.87)	(4.15)			(0.86)	(4.14)	(2.87)	(3.39)
Log Age	-0.192***	-0.016***	-0.166***	-0.023***	-0.021***	-0.028***	-0.004***	0.003	-0.011**	-0.022***
	(-21.12)	(-4.42)	(-17.94)	(-6.79)	(-5.06)	(-6.33)	(-2.84)	(0.84)	(-2.59)	(-4.52)
Observations	1,100,330	919,284	636,962	596,406	586,481	365,222	460,069	459,215	457,605	461,679
R-squared	0.166	0.113	0.165	0.171	0.133	0.195	0.123	0.131	0.133	0.116
Sample Subset					*Retail*	*Retail*	*< Median Outflows*	*Significant Outflows*	*< Median Tax Burden*	*> Median Tax Burden*

Panel C: Timing of Outflows – Focusing on Outflows Between Fund Fiscal Year-End Month and Calendar Year-End

	Net Flows (%)	Abs (Negative Net Flows) (%)	Outflows %	Net Flows (%)	Abs (Negative Net Flows) (%)	Outflows %
	(1)	(2)	(3)	(4)	(5)	(6)
Annual Excess Return (*stdd*)	0.018***	-0.008***	-0.004**	0.016***	-0.008***	-0.006**
	(7.50)	(-4.69)	(-2.70)	(6.74)	(-3.34)	(-2.42)
Fee Gap (*stdd*)	-0.016***	0.000	-0.004**	-0.019***	0.004	-0.003
	(-4.47)	(0.26)	(-2.78)	(-4.00)	(1.49)	(-1.49)
Tax Burden Gap (*stdd*)	-0.027***	0.014***	0.011***			
	(-9.01)	(8.19)	(5.98)			
Dividend Yield (*stdd*)				-0.008**	0.003	0.001
				(-2.39)	(1.08)	(0.27)
Capital Gains Distribution Yield (*stdd*)				-0.012***	-0.002	-0.004
				(-5.96)	(-0.56)	(-1.09)
Realized Capital Gains Yield (*stdd*)				-0.018***	0.015***	0.015***
				(-6.82)	(4.72)	(3.44)
Unrealized Capital Gains Yield (*stdd*)				-0.001	-0.007	-0.004
				(-0.33)	(-1.00)	(-0.40)
Log TNA	-0.011***	-0.010***	-0.002**	-0.011***	-0.010***	-0.003**
	(-6.47)	(-10.52)	(-2.11)	(-6.68)	(-8.13)	(-2.70)
Style Flows	0.327***	-0.159***	-0.075***	0.336***	-0.168***	-0.102***
	(7.16)	(-9.04)	(-3.79)	(9.00)	(-5.54)	(-3.35)
Return Volatility	0.338	0.344***	0.511***	0.356	0.124	0.088
	(1.47)	(2.93)	(3.45)	(1.45)	(0.70)	(0.36)
Retail Dummy	0.005	0.003	0.016***	0.011*	0.002	0.019***
	(0.94)	(1.09)	(5.90)	(2.06)	(0.44)	(5.38)
Log Age	-0.050***	0.022***	0.000	-0.049***	0.016***	-0.004
	(-15.33)	(10.22)	(0.14)	(-13.13)	(5.81)	(-0.96)
Observations	65,736	65,736	65,736	41,825	41,825	41,825
R-squared	0.111	0.098	0.105	0.104	0.126	0.135

Table VIII: Flow Migration

The table reports TNA-weighted annual averages of total net flows, realized capital gains, and distributions by quintiles of active mutual funds formed by sorting on their realized capital gains yields. Each fund in each quintile is matched to a benchmark created using similar funds within each fund type, year, and similar investment style. We use Lipper Class code for the investment style information as it is computed by Lipper using the holdings of the fund. We keep only Lipper Classes with more than one ETF, and the sample period spans 2005 to 2017 when we have enough ETFs in various Lipper Class categories. For each Lipper Class and year, benchmark values are computed as the AUM-weighted averages using all the funds with the designated fund type in same Lipper class. After sorting active funds into quintiles by realized capital gains, we match each sorting fund to its benchmark values within AMF, IMF, and ETF types, and compute value-weighted averages across all sorting funds-years, then report the time series averages below. IMF represents an Index Mutual Fund, and AMF is for Active Mutual Fund.

Realized Cap Gain Yield Quintile	Average # of Funds	Total Net Flow, last 12 months, %				Realized Cap Gains Yield				Cap Gains Distributions Yield			
		Sorting AMF	Benchmark Funds in Same Lipper Class			*Sorting AMF*	Benchmark Funds in Same Lipper Class			*Sorting AMF*	Benchmark Funds in Same Lipper Class		
		Fund	*AMF*	*IMF*	*ETF*	*Fund*	*AMF*	*IMF*	*ETF*	*Fund*	*AMF*	*IMF*	*ETF*
1 - Low	1,271	2.92%	-6.47%	1.68%	9.43%	0.82%	6.11%	3.50%	3.18%	1.33%	2.92%	2.92%	0.06%
2	1,583	-1.35%	-6.73%	1.09%	9.72%	3.29%	6.16%	3.53%	3.53%	2.63%	3.58%	3.58%	0.03%
3	1,857	-5.67%	-7.07%	1.52%	8.93%	5.88%	6.61%	3.81%	3.34%	3.25%	3.37%	3.37%	0.03%
4	1,387	-10.37%	-7.36%	0.90%	11.52%	9.05%	7.14%	4.16%	4.06%	4.43%	4.14%	4.14%	0.02%
5 - High	1,334	-22.76%	-7.50%	0.82%	10.38%	16.01%	7.13%	4.17%	4.03%	6.28%	4.07%	4.07%	0.02%

Table IX: ETF Asset Growth due to High-Net-Worth Individuals

The table reports the AUM and Flows of investment advisors that advise various levels of high-net-worth clients. ETF ownership by investment advisors is determined using 13F holdings data from Thomson-Reuters Global Ownership Database (OP), while the exposure to high-net-worth clients (HNW) is based on data reported on Form ADV. Advisors are determined to have high exposure to high-net-worth individuals if more than 25% of their AUM comes from high-net-worth clients (if assets are unavailable, the determination is made using a client count). In Panel A where total assets of institutions are used to scale ETF allocations, averages are constructed using institutional assets as weights, and the (high – none) difference represent the t-test with unequal variances where ***, **, * represent statistical significance at the 1%, 5%, and 10% levels, respectively. Panel B and C present ETF allocation and flow numbers scaled by total ETF assets.

Panel A: ETF Allocation by Institutional Advisors

	Total 13F Assets ($m)			**Allocation to ETFs (relative to 13F AUM)**			**Allocation to ETFs (relative to ADV AUM)**			
	Exposure to HNW Individual Accounts:			Exposure to HNW Individual Accounts:			Exposure to HNW Individual Accounts:			
Year	*None*	*Low*	*High*	*None*	*Low*	*High*	*None*	*Low*	*High*	*High – None*
2000	$3,437	$32,466	$102,841	0.00%	0.02%	0.09%	0.00%	0.02%	0.02%	*0.02%*
2001	$1,097,358	$615,241	$502,569	0.09%	0.26%	0.22%	0.05%	0.18%	0.11%	*0.06%* **
2002	$875,512	$488,400	$404,853	0.20%	0.40%	0.21%	0.12%	0.25%	0.08%	*-0.04%*
2003	$1,222,940	$868,698	$485,193	0.13%	0.51%	0.32%	0.07%	0.34%	0.21%	*0.14%**
2004	$1,457,222	$951,480	$676,848	0.14%	0.81%	0.80%	0.08%	0.54%	0.44%	*0.36%****
2005	$1,648,191	$1,332,052	$640,431	0.18%	1.19%	0.94%	0.08%	0.74%	0.49%	*0.41%****
2006	$1,896,248	$1,226,210	$753,864	0.17%	1.44%	1.47%	0.08%	0.93%	0.81%	*0.73%****
2007	$1,409,672	$1,339,750	$777,660	0.68%	1.61%	2.19%	0.25%	0.98%	1.08%	*0.83%****
2008	$828,799	$845,995	$460,667	1.22%	3.28%	3.71%	0.37%	1.18%	1.18%	*0.81%****
2009	$1,092,737	$1,020,152	$622,993	1.62%	3.68%	3.22%	0.56%	1.79%	1.58%	*1.02%****
2010	$1,272,242	$1,001,092	$807,321	2.61%	4.08%	3.42%	1.11%	2.14%	1.74%	*0.63%**
2011	$1,086,307	$921,973	$829,502	3.42%	4.52%	5.03%	1.40%	2.10%	2.03%	*0.63%**
2012	$1,210,147	$1,608,382	$391,751	4.33%	3.99%	14.52%	1.87%	1.90%	6.94%	*5.07%****
2013	$1,677,017	$2,113,444	$501,785	5.48%	3.61%	16.87%	2.69%	1.90%	8.67%	*5.98%****
2014	$1,821,796	$2,237,770	$629,039	6.03%	4.41%	20.00%	2.86%	2.13%	11.08%	*8.22%****
2015	$1,761,030	$2,117,604	$674,582	6.23%	5.62%	26.83%	2.96%	2.57%	15.06%	*12.10%****
2016	$1,879,681	$2,190,739	$714,990	6.25%	7.76%	26.38%	3.16%	3.99%	15.51%	*12.35%****
2017	$2,525,969	$2,257,215	$944,237	9.25%	8.32%	32.43%	5.81%	4.87%	21.31%	*15.50%****

Panel B: Aggregate Institutional Ownership of ETFs

		ETF Holdings by Institutions as % of Total ETF Assets				
		All Institutions	Investment Advisors	Advisors with High-Net-Worth Individual Accounts		
Year	# of ETFs			*None*	*Low*	*High*
2000	96	30.90%	10.88%	0.00%	0.01%	0.14%
2001	121	35.44%	10.17%	1.02%	1.94%	1.17%
2002	131	30.97%	10.70%	1.60%	1.97%	0.81%
2003	158	40.89%	8.98%	0.99%	2.81%	1.00%
2004	178	44.79%	12.97%	0.88%	3.37%	2.32%
2005	231	48.58%	13.00%	0.98%	5.13%	1.96%
2006	426	52.34%	14.84%	0.77%	4.13%	2.63%
2007	637	52.57%	13.33%	1.58%	3.55%	2.80%
2008	803	59.96%	17.27%	1.98%	5.64%	3.28%
2009	889	49.85%	17.85%	2.32%	4.92%	2.73%
2010	1,010	52.87%	19.66%	4.43%	4.21%	2.79%
2011	1,164	53.29%	19.18%	3.57%	3.98%	4.04%
2012	1,281	53.41%	20.00%	3.97%	4.77%	4.26%
2013	1,353	56.70%	22.38%	5.44%	4.53%	5.06%
2014	1,487	58.43%	24.72%	5.65%	4.95%	6.37%
2015	1,676	59.26%	27.40%	5.29%	5.63%	8.57%
2016	1,812	58.88%	27.49%	4.68%	6.71%	7.49%
2017	1,981	59.47%	30.09%	6.86%	5.51%	9.00%
Average		56.17%	23.51%	4.65%	5.10%	5.98%

Panel C: Explaining ETF Flows

	ETF Flows (t), as % of Total ETF Assets (t-1)							Active Mutual Funds: Capital Gains		
	Total ETF Flows Growth	All Institutions	Investment Advisors	Advisors with High-Net-Worth Individual Accounts				CG Distribution Yield	Realized CG Yield	Unrealized CG Yield
Year				*None*	*Low*	*High*	*High as %*			
2001	38.14%	19.34%	3.75%	0.72%	1.00%	1.04%	37.68%	5.48%	2.10%	2.32%
2002	46.36%	12.89%	4.84%	0.97%	0.68%	0.11%	6.25%	1.01%	0.55%	1.81%
2003	14.01%	19.18%	1.22%	0.18%	1.00%	0.68%	36.56%	0.35%	1.51%	14.14%
2004	31.12%	20.28%	8.39%	0.04%	2.02%	1.80%	46.63%	0.61%	6.61%	6.10%
2005	23.05%	19.43%	4.18%	0.25%	2.10%	1.01%	30.06%	1.85%	6.83%	3.69%
2006	17.44%	16.80%	5.42%	-0.05%	0.23%	1.37%	88.39%	3.34%	7.23%	3.77%
2007	29.44%	22.71%	4.79%	1.22%	0.70%	1.12%	36.84%	4.55%	8.25%	4.04%
2008	30.81%	23.76%	8.80%	0.94%	3.59%	1.54%	25.37%	7.72%	2.32%	0.24%
2009	14.11%	10.04%	6.56%	0.77%	0.86%	0.55%	25.23%	1.01%	0.14%	17.40%
2010	11.37%	11.48%	5.69%	1.48%	1.50%	0.58%	16.29%	0.09%	6.89%	10.23%
2011	11.54%	9.64%	3.76%	0.61%	0.54%	1.75%	60.34%	0.46%	9.27%	3.71%
2012	13.83%	9.54%	5.23%	1.11%	1.75%	1.25%	30.41%	1.37%	5.28%	5.51%
2013	14.42%	13.13%	6.56%	2.08%	1.49%	1.44%	28.74%	1.94%	9.26%	9.84%
2014	12.89%	10.49%	6.51%	1.28%	1.51%	2.24%	44.53%	4.72%	10.19%	3.77%
2015	10.72%	9.13%	6.78%	0.33%	1.78%	3.35%	61.36%	6.96%	8.20%	0.89%
2016	12.14%	8.45%	4.38%	0.99%	1.81%	0.19%	6.35%	6.72%	4.14%	3.41%
2017	14.78%	12.21%	8.53%	1.36%	1.69%	3.51%	53.51%	3.83%	8.39%	7.61%
Average	14.97%	11.90%	6.25%	1.07%	1.55%	1.85%				

Table X: Quasi-Natural Experiment using 2013 Tax Law Changes

The table reports the AUM and Flows of investment advisors that advise various levels of high-net-worth clients. ETF ownership by investment advisors is determined using 13F holdings data from Thomson-Reuters Global Ownership Database (OP), while the exposure to high-net-worth clients (HNW) is based on data reported on Form ADV. Advisors are determined to have high exposure to high-net-worth individuals if more than 25% of their AUM comes from high-net-worth clients (if assets are unavailable, the determination is made using a client count). Panel A reports the increase in allocations to ETFs by different advisors with tax-sensitive clients using various fixed effects. We use total 13F assets of institutions to scale ETF allocations, as well as the overall institution assets reported on form ADV. Panel B focuses on the sensitivity of mutual fund outflows to tax burden before and after the 2013 tax law change to increase capital gains taxes. Standard errors are clustered by fund (institution) and date in Panel A (Panel B).

Panel A: Change in ETF Allocation by Institutional Advisors with Tax-Sensitive Investors due Capital Gains Tax Increase

	ETF, % of *13F* AUM	ETF, % of *ADV* AUM	*ETF Flows, Quarter, %*	ETF, % of *13F* AUM	ETF, % of *ADV* AUM	ETF, % of *13F* AUM	ETF, % of *ADV* AUM	ETF, % of *13F* AUM	ETF, % of *ADV* AUM	*ETF Flows, Quarter, %*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
With HNW Clients	0.092***	0.042***	0.014***	0.042***	0.017***	-0.007	-0.008			
Dummy	(5.85)	(5.57)	(3.89)	(3.80)	(3.25)	(-0.84)	(-1.46)			
x Year >= 2012				0.097***	0.048***	0.015*	0.012**			
				(5.96)	(5.22)	(1.89)	(2.37)			
HNW >=75% of								-0.006	-0.004	-0.005
AUM Dummy								(-1.14)	(-1.42)	(-1.23)
x Year >= 2012								0.012*	0.011***	0.011**
								(1.85)	(3.03)	(2.25)
log (13F AUM)	-0.021***			-0.021***		-0.002		-0.002		
	(-6.71)			(-6.74)		(-0.84)		(-0.83)		
log (ADV AUM)		-0.013***	0.001		-0.013***		-0.009***		-0.009***	-0.002
		(-4.96)	(1.29)		(-4.92)		(-4.07)		(-4.05)	(-0.96)
Fixed Effects		Date		Date		Institution & Date		Institution & Date		
Observations	23,491	23,642	20,307	23,491	23,642	23,048	23,218	23,048	23,218	19,944
R-squared	0.145	0.130	0.015	0.150	0.133	0.911	0.875	0.911	0.875	0.250

Panel B: Change in Tax-Sensitivity of Mutual Fund Outflows due to Capital Gains Tax Increase

	Outflows, (%)		Outflows, FYE to End of Year (%)	
	(1)	(2)	(3)	(4)
Annual Excess Return	-0.015***	-0.015***	-0.002***	-0.002**
	(-7.84)	(-7.81)	(-2.83)	(-2.74)
Fee Gap	0.006***	0.006**	-0.003**	-0.002
	(3.22)	(2.39)	(-2.53)	(-1.50)
x Year >= 2012 Dummy		-0.000		-0.003
		(-0.14)		(-1.49)
Tax Burden Gap	0.019***	0.013**	0.010***	0.008***
	(4.61)	(2.74)	(5.90)	(3.79)
x Year >= 2012 Dummy		0.017***		0.005**
		(3.53)		(2.18)
Log TNA	-0.003***	-0.004***	0.001	0.001
	(-3.15)	(-3.26)	(0.85)	(0.82)
Style Flows	-0.111***	-0.105***	-0.047***	-0.045***
	(-3.12)	(-2.96)	(-3.04)	(-2.85)
Return Volatility	1.576***	1.599***	0.354**	0.353**
	(4.75)	(4.81)	(2.47)	(2.44)
Retail Dummy	0.012***	0.012***	0.011***	0.011***
	(3.63)	(3.68)	(5.71)	(5.69)
Log Age	-0.016***	-0.016***	-0.005**	-0.005**
	(-4.42)	(-4.38)	(-2.72)	(-2.62)
Observations	919,284	919,284	62,511	62,511
R-squared	0.113	0.114	0.067	0.068