The growth of passive indexing and smart-beta: Competitive effects on actively managed funds.

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Abstract

Using a sample of US equity funds, I investigate the extent to which competition from low-cost index funds affects fees, performance, and survival rates of actively managed funds. I measure the intensity of competition using the market value of holdings overlap between the portfolios of index entrants and active incumbents. Disentangling the competitive effects of traditional index funds (market index) from smart-beta index funds (factor index), I find that future changes in actively managed net fees are negatively related to factor index fund entry but unrelated to market index fund entry. Additionally, I find that both factor and market index entry are negatively related to active incumbent survival rates and that this effect is most pronounced for relatively expensive active incumbents. Importantly, I show that entry of index funds has had an attenuating effect on dispersion in fees across actively managed funds. Lastly, I find evidence that factor index entry has had an attenuating effect on active incumbent future performance.

Keywords: Mutual Funds, Competition, Index Funds, Smart-beta, Fees, Attrition.

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1 Introduction

Over the past decade the US mutual fund industry has seen a dramatic shift from active management towards explicitly indexed funds, including both exchange traded funds (ETFs) and open-ended index funds. Historically, index fund assets have been concentrated in funds that provide investors with diversified exposure to the market portfolio. For example, the SPDR trust (ticker: SPY) and the NASDAQ 100 trust (ticker: QQQ) provide investors with exposure to the total return of the US stock market by passively replicating the performance of the S&P 500 and NASDAQ 100 indexes respectively. For the remainder of this paper, these types of funds are referred to as *market index* funds. More recently, there has been a proliferation of index funds that strategically select stocks based on metrics other than market capitalization (e.g., smart-beta funds). Common examples of these metrics include risk factors such as momentum and volatility or firm fundamentals such as earnings growth or profitability. For instance, Invesco's DWA Momentum ETF (Ticker:PDP) tracks the Dorsey Wright Technical Leaders Index which selects stocks based on security and industry performance. Hereafter, I refer to these types of index funds as *factor index* funds. As show in Figure 1, the recent growth in both market and factor US equity index funds has been accompanied by a significant decline in flows to actively managed US equity funds.[1]

[Figure 1]

The increased popularity in index investing can be attributed to, at least partially, the low cost and comparable performance relative to actively managed funds. Indeed, the debate on active versus passive management tends to focus on the relative value, or performance net of fees.[2] In this paper, I investigate the degree to which increased competition

[1]According to the 2020 ICI Factbook, US equity index funds and ETFs received $1.8 trillion in new cash and reinvested dividends, whereas actively managed US equity funds experienced a net outflow of $1.7 trillion from 2010 to 2019.

[2]Research in agreement with the implications of Sharpe (1991)'s arithmetic of active management, active investing is a negative sum game at the aggregate level (French, 2008) and on average, include: Carhart (1997), Edelen (1999), Gruber (1996), Fama and French (2010), Jensen (1968), Malkiel (1995) and Wermers (2000).

from index funds has affected actively managed mutual fund fees, survival, and future performance. Factor index funds provide investors with active risk exposure whereas market index funds deliver diversified exposure to the broad market. Thus, investors seeking active risk strategies are likely to substitute actively managed mutual funds with factor index funds rather than market index funds. By the same token, active funds are more likely to respond to competitive threats from factor index funds than to competitive threats from market index funds. Thus, my conjecture is that factor index funds are more of a competitive threat to actively managed funds than market index funds.

The question of whether competitive forces from open-ended index funds and ETFs has affected actively managed mutual funds is important for several reasons. The existing evidence on the competitiveness of the money management industry is mixed. For example, research showing relatively stable average, or aggregate, expense ratios during periods of rapid industry growth (Barber, Odean and Zheng, 2005; Wahal and Wang, 2011; Khorana and Servaes, 2012; Sun, 2020) has raised questions about whether sufficient price competition exists. Along the same vein, net expense ratios have been shown to be unrelated to market share growth (Sirri and Tufano, 1993) or fund inflows (Barber, Odean and Zheng, 2005) and are higher for funds that operate in more competitive regions (Ellis and Underwood, 2018). On the other hand, competition between actively managed funds has been shown to attenuate management fees (Wahal and Wang, 2011; Ellis and Underwood, 2018; Hoberg, Kumar and Prabhala, 2018), and relative family level fees have been found to predict family market share (Khorana and Servaes, 2012). With the exceptions of Cremers, Ferreira, Matos and Starks (2016) and Sun (2020), very little has been said about the consequences of index fund competition on active management.

Determining an appropriate measure of competition is not an easy task. I follow Wahal and Wang (2011) and measure the intensity of index fund competition using the overlap between entrant and incumbent portfolio holdings. This measure is calculated by multiplying the ratio of the market value of each overlapping security in each incumbent's and entrant's portfolio by the weight of the security in the incumbent's portfolio. Wahal and Wang (2011) use this measure to examine competition between actively managed funds whereas my focus is on investigating the consequences of index fund competition on actively managed mutual funds, and whether the competitive effects differ based on index fund strategy. I therefore calculate overlap measures for three types of entrants: factor index overlap, market index overlap and active overlap. I include the latter group to control for direct competition from active entrants.

There are several reasons why this measure is appropriate in my empirical setting. First, a new fund must enter for an incumbent to experience a change in competition. Aside from being intuitive, this ensures that the variation over time is influenced by the number of new entrants. There is also considerable variation in the degree to which incumbents are affected by new entry. Importantly, this variation is a function of the similarity between the portfolios (products) of the incumbent and entrant which is reflected by the number of overlapping stocks in their portfolios. This is important since investors holding an actively managed incumbent fund that has a high factor or market index overlap can obtain exposure to a similar set of stocks, and pay lower fees, by switching to the index entrant. Moreover, concentrating on overlapping stocks speaks to competition in security selection, which can have implications for performance and costs. A second source of incumbent level variation is the weight of each overlapping security in each incumbent's portfolio. This ensures that entrants who hold the most important stocks in an incumbent's portfolio are treated as a greater competitive threat than entrants who hold stocks that are less important to the incumbent's portfolio.

Using the entrant-incumbent overlap measure as a proxy for competition, I first investigate the consequences of index fund entry on active incumbent fee decisions. Standard theory on competition suggests that active incumbent fees should decline following the entry of relatively inexpensive index funds that offer exposure to a similar portfolio. In contrast, investor search costs, and increased product diversity can lead to substantial fee dispersion (Gârleanu and Pedersen, 2018; Hortaçsu and Syverson, 2004). On the one hand, factor index funds offer active risk exposure at a relative discount to active mutual funds. On the other hand, the advent of active risk exposure packaged into an index fund increases the diversity of products available to investors and therefore could result in increased search costs. The effect of factor index fund entry on active mutual fund fees is therefore unclear. The objective of market index funds is distinctly different – to provide diversified exposure to the market portfolio. Actively managed funds presumably differentiate themselves from market index funds by delivering active risk exposure. Nonetheless, questions regarding the relative performance suggest that actively managed fees most likely decline with increased market index fund entry.

I test these hypotheses by regressing post entry changes in net fees (and their various components) on the index overlap measures. My findings indicate that index fund competition has had significant effects on actively managed net fees, but that the effect depends on the type of index fund. In particular, there is no significant relationship between market index overlap and changes in net fees. In contrast, active funds reduce net fees by approximately 1.1 basis points following a one standard deviation increase in factor index overlap. The effect is largest for funds that charge above the median of their actively managed peers at approximately 1.52 basis points. While the magnitude may seem marginal, it represents roughly 6.3% of the total reduction in the average net fee charged by active funds over my sampling period. Thus, competitive pressure from relatively low-cost index funds that offer active risk exposure (factor index funds) has directly contributed to a reduction in the net cost of actively managed US equity mutual funds.

Next, I investigate the source of net fee changes by examining the impact on the three largest components: management fees, operating fees, and distribution fees. Management fees provide the cleanest price of a fund's investment performance, and increased competition should reduce the ability of funds to extract profit through management fees. Ex-ante, index fund competition is expected to be positively related to distribution fees as they are generally used to generate investor attention. The expected effect on operating fees is ambiguous as it is unclear how index competition affects the supply and demand for the types of services they include.

My findings indicate that both factor and market index fund competition are positively related to future changes in active management fees, negatively related to changes in operating fees and insignificantly related to changes in distribution fees. With market index fund competition, the increase in management fees is offset by the decrease in operating fees, resulting in no significant change in net fees. In contrast, the increase in management fees associated with factor index fund competition is more than offset by a reduction in operating fees which is not surprising given the negative effect on net fees.

It may seem counter-intuitive that management fees are positively related to index overlap, however, my results indicate that this effect is driven by funds that: 1) outperform their peers and 2) charge relatively low management fees to begin with. A similar observation can be made for operating fees – reductions are restricted to funds with relatively high operating costs and who have outperformed their peers. The implication is that entry of low-cost alternatives has helped to drive fee components towards their peer group median. These findings are important as prior criticisms against sufficient competition in the mutual fund industry point to the considerable dispersion in fees charged by similar funds (Cooper, Halling and Yang, 2020).

Importantly, the observed relationships between changes in active fund fees and index fund competition are, for the most part, consistent with funds optimizing future net flow. Funds that reduce net fees or operating fees over the prior two years experience significantly positive net flows over the subsequent year relative to funds that either increase these fees or leave them unchanged. For example, reducing net (operating) fees is associated with an increase in annual net flows of about 1.9% (2.03%) relative to increasing or maintaining current net (operating) fee levels. Increases in management fees are positively related to future net flow, however, the effect is statistically insignificant. Thus, the changes in active incumbent fees associated with increased index fund entry appear to be rewarded by the typical investor through increased net flow.

Although my findings show a direct relationship between active fund net fees and factor index fund competition, casual inspection of Figure 1 might lead one to hypothesize that factor index competition has also had an indirect effect on actively managed net fees through increased exit rates. I test this conjecture by analyzing the relationship between active incumbent survival rates and the index entry overlap measures. I find that liquidation rates of actively managed funds are positively related to both factor and market index overlap measures. In line with my conjecture, the negative effect on liquidation rates is most prevalent for active funds that charge net fees above the median of their actively managed peers. These findings are, to the best of my knowledge, new to the literature.

In the final section I examine the performance implications. If markets are complete and frictionless, then composite assets (i.e., mutual funds and ETFs) are redundant and do not impact the prices of their constituent securities. Nonetheless, theoretical and empirical evidence suggests otherwise.[3] Moreover, Hoberg, Kumar and Prabhala (2018) and Wahal and Wang (2011) find that competition amongst active funds has a moderating effect on performance. Factor index funds seek active risk exposure which is, at least in some cases, similar to the active risk exposure offered by active mutual funds. Presumably, increases in the number of investors trading on a given risk factor reduces the associated profitability. I therefore expect that the increase in factor-based trading associated with factor index fund entry is detrimental to the performance of actively managed incumbents.

Ex-ante, the effect of market index fund entry on the performance of actively managed funds is not overly clear. On the one hand, buying and selling by passive market index funds is based solely on market-capitalization rather than fundamental values which may provide active managers with opportunities to capitalize on mis-priced securities. On the other hand, institutional investors have been shown to hold relatively large proportions of stocks held in common indices (Dannhauser, 2017) and to reduce information asymmetries and pricing inefficiencies in the stocks they hold (Bartov, Radhakrishnan and Krinsky, 2000; Boehmer and Kelley, 2009; Boone and White, 2015). In this case, it should be more difficult for active managers to identify mis-priced securities.

I find some evidence that index fund entry is detrimental to the future performance of actively managed mutual funds. For instance, a one-standard deviation increase in

[3] Basak, and Pavlova (2013) provide theoretical evidence that institutional investors have incentive to tilt their portfolios toward benchmark constituents which amplifies prices, volatility and return correlation of constituent stocks and overall market volatility which are supported empirically by Dannhauser (2017) and Boone and White (2015). Additions (deletions) from large indices have been found to increase (decrease): prices, correlations and trading volume with other constituent stocks (Chen, Noronha and Singal , 2004; Greenwood and Sosner, 2007). ETF activity has been shown to have similar effects (Da and Shive, 2018; Ben-David, Franzoni and Moussawi, 2018).

factor index overlap is associated with a reduction in performance over the next 24 months between 17 and 38 basis point. In contrast, while I find a negative relationship between market index overlap and active incumbent future performance, the effect is not robust. Given that I have shown that higher index fund competition is positively related to future attrition, future performance cannot be estimated for the worst performing funds since returns are unavailable. My estimates are therefore conservative.

The main contribution of the current paper is to investigate whether index fund strategy interacts with competition in determining actively managed fees, survival rates and performance. In this respect, my research complements the vast literature that explores competition within the actively managed space.[4] In contrast, research examining the effects of index fund competition on actively managed mutual funds is sparse.

Two notable exceptions include Cremers, Ferreira, Matos and Starks (2016) and Sun (2020). The former performs a cross-country study on the relationship between index fund availability and active fund strategies and find that funds operating in countries with more explicit indexing have lower total shareholder costs and higher levels of active share. The latter finds that funds distributed through broker (direct) channels increase (decrease) total shareholder costs following entry of Vanguard index mutual funds launched between 1976 and 1998. My paper differs from these papers in a few distinct ways. First, my objective is to determine whether competition originating from factor index funds is distinct from competition arising from market index funds in the US equity market, which is not addressed by previous studies. Sun (2020) analyzes the first wave of open-ended index funds offered by the "Walmart" of the index fund industry over a period in which: 1) the average actively managed net fee was stable and 2) ETFs were relatively non-existent. In contrast, I examine a period over which there was a proliferation of ETFs and more elaborate factor-based indexing, as well as an observable reduction in the average net fee charged by actively managed mutual funds. Thus, Sun's objective was to explain the lack of observable reduction in average actively managed net fees over sample period, while

[4]Noteworthy studies on competition between actively managed funds include: Coates and Hubbard (2007), Gil-Bazo and Ruiz-Verdu (2009), Wahal and Wang (2011), Ellis and Underwood (2018), Hoberg, Kumar and Prabhala (2018), Khorana and Servaes (2012) and Hortaçsu and Syverson (2004).

mine is to explain the recently observed reduction.

Other notable differences include the methodological approach and specific tests performed. For instance, I not only provide evidence that index fund competition has had a negative effect on average net fees, but show which components are responsible for the reduction. Moreover, I provide evidence on how index fund entry has impacted active fund exit rates and offer an indirect channel through which active net fees have been affected, neither of which were addressed in Cremers, Ferreira, Matos and Starks (2016) or Sun (2020). Lastly, I close by examining the performance implications whereas the prior two papers concentrate on investigating activeness.

The remainder of this paper is as follows. Section 2 describes the data and sample construction. Section 3, presents the results and Section 4 offers concluding remarks.

2 Data and variable construction

2.1 Data

The mutual fund data is from Morningstar Direct's Mutual Fund Database over the period 1998 to 2018. To avoid survivorship bias, I include live and defunct funds. The sample of actively managed funds is restricted to domestic equity-only funds sold in the US since this asset class has suffered more pronounced declines in assets under management relative to fixed income or international/global equity funds. Accordingly, I include only funds that fall into one of the following Morningstar classifications: small blend, small growth, small value, mid-cap blend, mid-cap growth, mid-cap value, large blend, large growth, and large value. This filter eliminates: bond funds, money market funds, international funds, funds of funds, sector funds, real estate funds and life-cycle funds. I use Morningstar identifiers to confirm that the sample of active funds is free from: index funds, leveraged funds, fund-of-funds, feeder funds and life cycle funds.

Mutual funds often offer multiple share classes of the same fund. Individual share classes of a given fund are managed by the same manager and provide claims to the same portfolio of assets. The primary difference between share classes is their fee structure. For example, institutional share classes generally charge lower fees than retail share classes. Therefore, I aggregate all share classes of the same fund. I compute fund assets under management (AUM) by summing the AUM across a fund's share classes and aggregate share class level characteristics using AUM weighted averages. I collect quarterly holdings data from Morningstar which includes all equity positions and their associated CUSIP, as well as other non-equity positions; including bond and option holdings. I link Morningstar holdings data to the CRSP stock database by security CUSIP.

Pastor, Stambaugh and Taylor (2015) find that instances of extreme reversal patterns exist in net asset data provided by Morningstar and that it is likely due to decimal-place mistakes. I follow their methodology to identify these observations and treat reversals as missing values.[5] As is standard in the mutual fund literature (e.g., Evans, 2010; Kacperczyk et al., 2014 among others), I address the potential bias that results from fund incubation periods being included in the mutual fund databases by eliminating observations prior to a fund's inception date.[6] In addition, a fund is included in the sample only after it's aggregate AUM across all share classes passes a threshold of $10 million. Funds that fall below $10 million are not subsequently deleted. The resulting data set contains 2914 actively managed US equity funds.

Evidence in Sun (2020) suggests that fund responses to changes in competition might differ based on distribution channel. I classify funds as either direct- or broker-sold following Christoffersen, Evans and Musto (2013). This methodology relies on data from fund semi-annual reports (form N-SAR) filed with the Securities and Exchange Commission (SEC). Christoffersen, Evans and Musto (2013) describes the N-SAR data in detail, so here I focus primarily on how I define broker-sold funds. The N-SAR form reports mutual fund data on combined share classes (i.e., at the aggregate fund level). Thus, the classifi-

[5]The precise methodology is described on page 10 of the online data appendix for Pastor, Stambaugh and Taylor (2015).

[6]The inception date given in the Morningstar Direct database provides the first date that the fund was listed.

cation is at the fund level rather than the share class level. Fund i is defined as broker-sold if, over the prior fiscal year, it received loads through unaffiliated brokers/dealers (N-SAR Q32 > 0) or through captive broker/dealers (N-SAR Q33 > 0). I merge the N-SAR data to the aggregated Morningstar data by fund name, and confirm imperfect name matches by checking the difference between net assets reported by each database.

2.1.1 Market and factor index funds

This sub-section describes how I construct the samples of market and factor index funds. Open-ended index funds and ETFs differ primarily by structure and, depending on the type account in which they are held, tax implications. Nevertheless, they offer exposure to similar, and often times the same, indexes, charge comparable fees, and have been shown to be substitutes (Agapova, 2011). I therefore do not explicitly differentiate between open-ended index funds and ETFs.

The sample of open-ended index funds and ETFs comes from Morningstar Direct and is selected in a manner that is consistent with the selection of active mutual funds in regards to asset class and end-investor. In specific, my objective is to select the sub-set of US equity index funds, both open-ended and exchanged traded, that are most likely to be considered as alternatives to the sample of actively managed mutual funds. I collect all live and defunct ETFs and open-ended funds flagged as index funds by Morningstar between 1998 and 2018. ETFs sold in the US over this period were required to disclose portfolio holdings on a daily basis which led to the vast majority being structured as index funds. In any case, I use Morningstar's actively managed flag to remove all actively managed ETFs. I also remove all ETFs that are not sold on a US exchange to keep the end investor consistent across samples. Similarly, I exclude all open-ended index funds that are not registered for sale in the US. Lastly, I remove leveraged funds, life-cycle funds, and funds that do not invest primarily in US equity.

Next, I classify funds as either a market index fund or a factor index fund. Market index funds track broad market indexes using market capitalization weighting schemes.[7] In contrast, factor index funds generally seek to enhance returns by tracking benchmarks that provide active risk exposure, for example, momentum and volatility factors or firm fundamentals. I use Morningstar's strategic beta flag as a starting point – all index funds Morningstar flags as strategic beta are defined as factor index funds. As noted in Broman (2019), this filter fails to account for a number of factor-based index funds. I manually examine fund names, stated benchmarks and objectives to classify the remaining index funds as either market index or factor index.[8] Lastly, I remove any funds where the first reported holdings date is more than 18 months after the fund's reported inception date but note that my main results are robust to more stringent restrictions. Applying these filters results in 151 market index funds and 552 factor index funds.

2.2 Definition of variables

2.2.1 Measuring competition

Various methodologies for studying the effects of fund competition have been proposed in prior literature. Self-disclosed benchmarks provide a simple method for inferring a fund's investment universe but are not strictly regulated. Moreover, they are not suitable for identifying fund style since they do not necessarily coincide with holdings-based style metrics.[9] Morningstar institutional categories are intended to help institutional investors identify peer groups (Box, Davis and Fuller, 2018) but are static and therefore problematic since fund styles vary over time.

In this paper, I use a variation of the holdings overlap measure proposed by Wahal and Wang (2011). This measure is based on the ratio of the market value of overlapping securities in entrant's and incumbent's portfolios, with each ratio being multiplied by the

[7]Common examples of broad market indexes include: Russell 1000 and 3000, S&P 500, Wilshire 5000 total market, CRSP US Large Cap and CRSP US total market.

[8]I am grateful to Markus Broman for providing me an initial list of manual classifications. I extend this list since our samples are not identical.

[9]For example, see Sensoy (2009) and Cremers and Petajisto (2009).

weight of the overlapping security in the incumbent's portfolio. This provides a measure of the degree of competition between entrants and incumbents based on the substitutability of their products (portfolios), and effectively assumes that investors behave as if they observe fund holdings. The latter may seem problematic, however, prior evidence indicates that many investors are interested in fund holdings. For example, Solomon, Soltes and Sosyura (2014) find that flows are related to returns on individual holdings, particularly holdings with recent media coverage.[10] Furthermore, prior evidence indicates that managers engage in window dressing and that this behaviour can ultimately influence investor flows (Agarwal, Gay and Ling, 2014). Lastly, the most relevant portion of a fund's portfolio (i.e., the most heavily weighted stocks) is readily available to investors at no cost through public sources (e.g., Morningstar's website).[11]

The calculation and notation are as follows. $MVO_{i,t}$ denotes the average market value of overlapping securities between active incumbent i and new entrants $e = 1, 2, ..., N$ during quarter t. I calculate the measure separately for each type of entrant: factor index fund entrants ($Factor\ Index\ MVO_{i,t}$), market index fund entrants ($Market\ Index\ MVO_{i,t}$) and actively managed mutual fund entrants ($Active\ MVO_{i,t}$), but discuss only the general construction for concision. I include $Active\ MVO_{i,t}$ in my analysis to control for the competitive effects from actively managed entrants.

Let $s = 1, ..., M$ denote the subset of securities that exist in both the incumbent's and entrant's portfolio. Let $j = 1, ..., K$ denote the full set of securities in active incumbent i's portfolio. The overlap measure is then computed as:

$$w_{i,e,s,t} = \left(\frac{P_{e,s,t}S_{e,s,t}}{P_{i,s,t-1}S_{i,s,t-1}}\right)\left(\frac{P_{i,s,t-1}S_{i,s,t-1}}{\sum_{j=1}^{K} P_{i,j,t-1}S_{i,j,t-1}}\right) \quad (1)$$

$$MVO_{i,t} = \frac{1}{N}\sum_{e=1}^{N}\sum_{s=1}^{M} w_{i,e,s,t} \quad (2)$$

[10] Solomon, Soltes and Sosyura (2014) also note that Morningstar indicates that 42% of retail investors would prefer holdings to be disclosed more frequently.

[11] Page 44 in Wahal and Wang (2011) provides a similar discussion.

where $P_{i,s,t}$ ($P_{e,s,t}$) is equal to the price of overlapping security s at the beginning of quarter t. The subscripts e and i are used to denote the entrant and incumbent respectively. $S_{i,s,t}$ and $S_{e,s,t}$ denote the number of shares of stock s in incumbent i's and entrant e's portfolio at the beginning of quarter t respectively. The weight, $w_{i,e,s,t}$, is the ratio of the dollar value of overlapping security s, scaled by the weight of security s in the incumbent's portfolio. The first term in $w_{i,e,s,t}$ accounts for the relative market value of the overlapping security. The second term accounts for the relative importance of the overlapping security in the incumbent's portfolio. $MVO_{i,t}$ is calculated by summing the weights ($w_{i,e,s,t}$) for all overlapping securities between incumbent i and entrant e and then averaging across all entrants. I remove entrants with zero holdings overlap from the calculation. This eliminates the impact of entrants that have zero overlap with an incumbent. Unlike, Wahal and Wang (2011) I define entry dates as 6 months after the entrant's reported inception date and include the subsequent two quarters in the calculation. This is important since a large portion of the index funds in my sample are ETFs, which, as shown by Broman and Shum (2018) take time to establish liquidity. Investors, and active incumbent's, are less likely to consider funds that are still establishing liquidity as a viable substitute and competitive threat respectively. Less importantly, I use the average overlap measure over the prior year when estimating annual regressions.[12]

Rather than treating all entrants within a certain group (e.g., investment category or region of sale) as equally important, the overlap approach measures the intensity of competition based on the similarity between entrant and incumbent portfolios. This is important since incumbents that have high portfolio overlap with entrants are more likely to face increased competitive pressure relative to incumbents that have more unique portfolios. By using market values, this approach also addresses an important element of competition – large entrants, and particularly the size of their overlapping holdings, are more of a competitive threat than small entrants.

[12]My main results are numerically similar when using alternative constructions. For example, defining various entry windows and, to a lesser extent, restricting the calculation to incumbent-entrant pairs that are located in the same Morningstar style box.

2.2.2 Fund performance

When studying the impact of index fund entry of active incumbent future performance, I measure fund performance relative to factor models or style benchmark indices. For factor models, I use the capital asset pricing model (CAPM), and the 4-factor model (4F) from Carhart (1997). I estimate factor loadings with rolling 36 month windows and use the US equity factors provided on Fama and French's website.

Evans, Gomez, Ma and Tang (2020) document that fund managers are evaluated based on their performance relative to pure index benchmarks, peer group benchmarks, or both. I therefore include benchmark-adjusted returns and the equal-weighted peer benchmark-adjusted returns in assessing fund performance. Peer benchmark-adjusted returns are equal to the difference between fund i's gross return and the equally weighted gross return of its peer group based on Morningstar categories. Benchmark-adjusted returns use traded style benchmarks provided by Morningstar. Morningstar classifies US equity funds into nine different categories based on style and assigns a benchmark portfolio to each category[13] that is defined based on actual fund holdings meaning it does not suffer from any self selection bias. Pastor, Stambaugh and Taylor (2015) and Zhu (2018) suggest the use of Morningstar benchmark portfolios over factor models (e.g. Fama-French factors) since the former are accessible to the typical investor while the latter are not. These benchmarks are also free from the "cherry-picking bias" associated with prospectus benchmarks (Sensoy, 2009) and, as argued by Cremers, Petajisto and Zitzewitz (2013) and Pastor, Stambaugh and Taylor (2015), index-based benchmarks are more likely to capture style and risk than the Fama-French factors.

[13] The categories are based on size and the book-to-market ratio of the stocks held. The specific benchmark indices and associated styles are: Russell 1000 Total Return for large blend, Russell 1000 Growth Total Return for large growth, Russell 1000 Value Total Return Index for large value, S&P 400 Mid Cap Total Return for mid blend, Russell Mid Cap Growth Total Return for mid growth, Russell Mid Cap Value Total Return for mid value, Russell 2000 Total Return for small blend, Russell 2000 Growth Total Return for small growth and Russell 2000 Value Total Return for small value.

2.3 Descriptive statistics

Table 1 presents the time series variation in: the number of existing funds, new entries, total net assets and the equally weighted net expense ratio. Statistics are grouped by three fund types: actively managed mutual funds (Active), factor index funds (Factor) and market index funds (Market). Entry dates are identified using the inception date of each fund's oldest share class. Statistics on the number of existing funds, total AUM and net expense ratios are calculated using all funds with non-missing net asset data. Note that some funds shown in this table are removed from my main analysis due to missing data. I present this broader sample to provide a more complete picture of the US equity fund industry.

Consistent with the aggregate flow statistics in Figure 1, the past two decades have seen a substantial increase in the number of index funds, reflected by both the number of new entries and the number of existing funds. For example, the number of existing factor (market) index funds increases from 16 (46) in 1998 to 485 (152) in 2018. Similarly, the number of existing, and newly launched, active funds increases until around 2009, at which point it starts to decline.

[Table 1]

The size of each market segment, AUM (Billions USD), is also illuminating. As of the end of 1998, the total amount of net assets invested in market index funds was approximately 11 times the total net assets invested in factor index funds. By the end of 2018 this number was closer to 2. The equally weighted expense ratios (EW Net Expense) highlight the cost differential between active and passive management as well as the additional cost associated with factor indexing relative to market indexing. In addition, the decline in average active fund expense ratios from 1998 to 2018 is quite large at 24 basis points. In sum, the observed patterns in Table 1 roughly coincide with the concept that average actively managed net fees have declined with the growth of passive index investing.

Before proceeding to my empirical tests, I provide some basic summary statistics on the variables used in this paper. Table 2 presents the distributions over the full sample period. The median factor index MVO and market index MVO are 0.062 and 0.125 respectively, both of which are well below their means (0.306 and 0.724 respectively). As noted in Wahal and Wang (2011), this variation is important as funds with high overlap are expected to face stronger competitive pressure than incumbents with little overlap.

[Table 2]

The average annual net fee is approximately equal to 1.14% of fund net assets. Management fees make up the largest portion of net expenses at 0.69%, while operating fees and distribution fees are generally smaller at 0.20% and 0.25% per year respectively. Performance measures (benchmark adjusted returns and alphas) are stated as annual percentage returns gross of fees. The average benchmark adjusted return is approximately 0.74% per year while the mean 3- and 4-factor alphas are slightly lower at 0.637% and 0.412% per year respectively. Given the average net expense ratio is 1.14%, the average after fee performance is indeed negative. The equally weighted peer benchmark return (Peer Bmk. Adj. Ret.) is closer to zero at 0.024% per year. The average fund in my sample has about 1.6 billion in assets under management, 30% of which is in an institutional class, and is approximately 154 months old.

3 Empirical results

3.1 Strategic fee adjustment

In this section I investigate the consequences of index fund entry overlap on actively managed fee decisions. Factor index funds offer investors active risk exposure at a considerable discount relative to actively managed mutual funds. It is therefore reasonable to expect that factor index competition has put negative pressure on actively managed net fees. In contrast, the packaging of active risk exposure into a passive product is a relatively new concept which suggests an increase in product diversity and investor search costs. Thus, the expected relationship between factor index overlap and changes in active fund net fees is ambiguous. Market index funds are another low-cost alternative to active management but are distinct from actively managed funds in that they provide diversified exposure to market beta rather than active risk exposure. Despite these differences, questions regarding relative performance suggest that actively managed net fees are likely to be negatively related to market index fund overlap.

Fee changes require approval from the fund's board of trustees and typically occur on an annual basis. I therefore examine fees change over the two years following the entry of a new index fund competitor but reproduce the primary results for three- and four-year changes in Table A2 of the appendix. I proceed by regressing changes in active fund net fees over the next two years (t to $t+2$) on the average overlap measures over the prior year, control variables and fixed effects:

$$\Delta Fee_{i,t:t+2} = \alpha + \beta_1 FactorIndex\ MVO_{i,t} + \beta_2 MarketIndex\ MVO_{i,t} + \beta_3 Active\ MVO_{i,t} + \gamma \times C_{i,t} + v_t + z_s + \epsilon_{i,t} \quad (3)$$

The dependent variable, $\Delta Fee_{i,t:t+2}$, is the change in fund i's fee from year t to year $t+2$. The control variables, $C_{i,t}$, include: turnover, the standard deviation of gross returns over the prior 24 months (std.(Gross Ret.)), fund size as measured by the natural log of net assets (ln(AUM)), the equally weighted peer benchmark adjusted return compounded over the prior year (Peer Bmk. Adj. Ret.), and the natural log of a fund's age in months (ln(Age)). The explanatory variables of interest, factor index overlap ($Factor\ Index\ MVO_{i,t}$) and market index overlap ($Market\ Index\ MVO_{i,t}$), are equal to the average overlap measures over the prior fiscal year ($t-1$ to t).

All specifications are estimated with year fixed effects (v_t) to control for unobserved heterogeneity in the cross-section of funds over time. Additionally, I control for fund (Panel A) and style fixed effects (Panel B) to account for fund and style specific differences in fee changes (z_s). I address the concern that errors might be correlated within funds or across time by estimating standard errors that allow for clustering along the fund and year dimensions (shown in parentheses). I employ two main specifications in my baseline regressions. First, I concentrate solely on index competition by analyzing the effects of the two index overlap measures. Next, I ensure that I am not picking up the direct effects of active competition by controlling for the active overlap measure.

Panel A of Table 3 reports the results from estimating Equation 3 with fund and year fixed effects. To ease interpretation of the overlap measures, I report average marginal effects and their associated t-statistics instead of the raw coefficient estimates. The results suggest that the negative effect on fees arising from cheap, factor-based, alternatives outweighs any increase in investor search costs. In particular, factor index overlap has a significantly negative effect on two-year changes in net fees ($\Delta Net\ Fee_{i,t:t+2}$). A one-standard deviation change in factor index overlap is associated with a reduction in net fees of around 1.1 basis points. Although this represents only a fraction of the observed reduction in actively managed net fees over my sample period, evidence presented in later sections shows that this is only part of the story. In contrast, market index overlap is not significantly related to future changes in net fees.

[Table 3]

Net fees can be decomposed into management fees, distribution fees, and other operating fees. Management fees are the proportion of fund net assets used to compensate the portfolio manager(s) and, unlike net fees, provide a purer price of a fund's investment performance. Fund's facing increased competition should have a reduced ability to extract profit through management fees which suggests competition should negatively affect changes in management fees. That said, total manager revenue is equal to assets under management multiplied by the management fee. Thus, the large withdrawals from actively managed US equity funds, shown in Figure 1, indicate a considerable reduction in the compensation paid to active managers. Since managers require some base level of compensation, the relationship between management fees and index competition could instead be positive.

The other two fee components are distribution fees and operating expenses. Distribution fees are comprised of marketing and distributing costs and are often used as a commission to brokers for selling the fund. Operating fees include accounting, administrator, auditor, board of directors, custodial, legal, organizational, professional, registration, shareholder reporting, and transfer agency fees. Ex-ante, index fund competition is expected to be positively related to distribution fees as they are generally used to generate investor attention. The expected effect on operating fees is ambiguous as it is unclear how index competition effects the supply and demand for the types of services they include.

The results show that both factor and market index overlap are positively related to changes in active incumbent management fees ($\Delta Mgmt.Fee_{i,t:t+2}$), negatively related to future changes in operating fees ($\Delta OperatingFees_{i,t:t+2}$) and generally unrelated to changes in distribution fees ($\Delta Dist.Fee_{i,t:t+2}$). The magnitudes of the changes in management and operating fees are also quite large. For instance, a one-standard deviation increase in factor index MVO is associated with a 3.36 basis point increase in management fees which represents almost 5% of the sample average (68.7 basis points). Similarly, a one-standard deviation increase in factor index MVO is associated with a 4.57 basis point reduction in operating fees which is around 20% of the sample average. While the change in operating fees may seem excessive relative to the mean, results in the subsequent sub-section show that this effect is restricted to funds that incur relatively high operating expenses to begin with. In short, the reduction in net fees associated with factor index competition is due to reductions in operating fees.

In some cases, fund managers contractually agree to waive/reimburse expenses above and beyond a pre-specified threshold. Alternatively, fee waivers can be used as a discretionary tool by fund companies to temporarily improve their net performance (Christoffersen, 2001). While they are not meant to permanent, active funds may use waivers in response to increased index fund competition to improve net performance, thereby increasing expected fund flows. I estimate the probability that a fund uses a waiver in the next year with a logistic regression. The dependent variable, Prob.(Waiver$_{i,t+1}$), is an indicator that is equal to one if a fund uses an expense waivers in year $t+1$ and zero otherwise.

As with distribution fees, neither factor nor market index MVO are significantly related to active incumbent fee waivers.

In Panel B of Table 3, I replace fund fixed effects with style fixed effects. Although the t-statistics are generally smaller, the main results are still significant at the one percent level. In unreported results, I find that the main results are also robust to alternative clustering specifications. Moreover, separating the sample into broker- and direct-sold funds does not significantly alter my findings. I find that restricting the sample to the pre-2005 period yields results similar to Sun (2020) – factor index fund entry is associate with an increase in net expense ratios for broker-sold funds and no significant change for direct-sold funds. Differences in results could be due to variations in methodologies, sampling period and the type of index funds considered. For example, Sun (2020) concentrates solely on Vanguard index mutual funds whereas I include a broad sample of index mutual funds and ETFs investing in US equities that are sold in the US. Additionally, there is very little overlap in the entry dates of index funds between our samples.

3.1.1 Fee change explanations

In this sub-section I investigate explanations for the relationships between fee changes and index competition. Intuitively, the observed relationships should be a function of various fund characteristics. For example, investors have gravitated towards relatively cheap funds over the past two decades[14] which suggests that funds charging fees above the average (median) charged by their actively managed peers have the strong incentives to reduce fees, particularly in response to entry of new low-cost index funds that offer exposure to similar stocks. Thus, I expect the positive (negative) relationship between index fund overlap and actively managed management (net and operating) fees from Panel A to be confined to funds that charge relatively low (high) fees to begin with. I test this conjecture by interacting index overlap measures with fee indicators, denoted by $High\ Fee_{i,t}$, that are equal to one if fund i charges a fee above the median fee charged by all other active

[14] By the end of 2019, actively managed funds in the lowest expense ratio quartile held 73 percent of actively managed fund assets (Investment Company Institute Factbook 2020, Chapter 6).

funds in the same Morningstar style box, in year t, and zero otherwise. To be clear, the $High\ Fee_{i,t}$ indicators in Panels C and D of Table 3 coincide with the dependent variable under consideration.

The results from interacting high fee indicators with factor index overlap are shown in Panel C of Table 3. I include all control variables from Panel A, but report only the coefficients on the overlap measures and their interaction effects to conserve space. The results generally support my conjecture. The observed fee increases (decreases) associated with the factor index overlap measure are restricted to funds that charge below (above) the median fee charged by their active peers. For example, the coefficient estimate on $Factor\ Index\ MVO_{i,t} \times HighFee$ in the net fee regression is -0.0152 and is significant at the 1 percent level, while the coefficient on $Factor\ Index\ MVO_{i,t}$ is now positive but insignificant. The implication is that the relatively expensive active funds respond to increased factor index competition by reducing net fees while the least expensive funds do not make any significant changes. A 1.5 basis point may not seem overly meaningful; however, it represents approximately 6.3% of the total reduction in average net fees observed over my sampling period.

The results for the interactions between factor index overlap measures and the various fee components are largely similar to the net fee results. The increase (decrease) in management (operating) fees is restricted to funds that charge below (above) the median charged by their peers. Moreover, the interaction between $Factor\ Index\ MVO_{i,t}$ and the high distribution fee indicator is significantly negative while $Factor\ Index\ MVO_{i,t}$ is now significantly positive. This helps explain the somewhat puzzling finding of no significant relationship between distribution fees and index fund competition. An interesting implication of these results is that factor index competition appears to be driving net fees, and their various components, towards the peer group median.

Next, I investigate the role of past performance. My hypothesis is that the positive relationship between management fees and factor index fund competition should be related to prior performance. That is, the funds that increase management fees in response to index fund entry are expected to have outperformed their peers in the recent past. The effect on net, operating and distribution fees is less clear. Evans, Gomez, Ma and Tang (2020) show that fund managers are evaluated based on their performance relative to peer funds in a similar style, pure index benchmarks, or both. I therefore measure performance using benchmark-adjusted returns or the equal-weighted peer benchmark-adjusted returns compounded over the prior 12 months. I present results using equal-weighted peer benchmark-adjusted returns ($Peer\ Bmk.\ Adj.\ Ret._{i,t}$) but note that the results are numerically similar, though statistically weaker, when using benchmark-adjusted returns. As expected, peer benchmark-adjusted performance strongly influences the relation between factor index overlap and changes in management fees – the top performing funds increase their management fees the most. The reductions in net and operating fees are also most pronounced for funds that have performed well relative to their peers.

The interaction effects of market index overlap and high fee dummies, reported in Panel D of Table 3, are generally similar to those reported in Panel C for factor index overlap interactions. That is, market index overlap seems to drive fees towards their peer group median. In contrast, the interaction between index overlap and past performance does not significantly effect changes in fees.

The results in this section show that both market index fund competition and factor index fund competition are positively related to future changes in management funds, but negatively related to future changes in operating fees. With market index fund competition, the effects are offsetting which results in no significant change in net fees. In contrast, the increase in management fees associated with factor index fund competition is more than offset by a reduction in operating fees, resulting in a negative effect on net fees. Moreover, retaining talented managers is exceedingly important in the actively managed equity space. Active managers who have performed well in the face of increased competition from cheap alternatives are rewarded through increased management fees. When taking stock of the survivorship bias associated with looking at future changes in fees this finding is quite intuitive. Lastly, my findings indicate that competitive pressure from index funds has helped to drive active fees towards their peer group median. To the best of my knowledge, this finding is new to the literature.

3.2 Investor response and rationality

3.2.1 Investor response to fee changes

In this sub-section I investigate how investors respond to the changes in fund fees associated with index entrant overlap in Section 3.1. The objective is to determine whether the observed relationships between fund fee changes and market/factor index overlap measures are consistent with flow optimizing behavior. To answer this question, I construct dummy variables based on changes in fees over the prior two years. The direction of the fee change is set to correspond to the relationship between the fee in question and the index overlap measures from Panel A in Table 3. For example, $Increase\ Mgmt.\ Fee_{i,t}$ is equal to one if fund i increased it's management fee over the prior two years and zero otherwise. I measure monthly dollar flow following the approach in Sirri and Tufano (1998) and obtain forward dollar flows by adding monthly flows over the next one, two and four quarters. Percentage flow is calculated by dividing forward dollar flows by the fund's current period net assets. I then regress forward percentage flow on the fee change indicators, a set of control variables and fixed effects:

$$Flow_{i,t:t+T} = \alpha + \beta_1 Reduce\ Net\ Fee_{i,t} + \gamma C_{i,t} + v_t + z_s + \epsilon_{i,t} \tag{4}$$

$$\begin{aligned} Flow_{i,t:t+T} = \alpha + \beta_1 Increase\ Mgmt.\ Fee_{i,t} + \beta_3 Reduce\ Operating\ Fee_{i,t} \\ + \beta_3 Increase\ Dist.\ Fee_{i,t} + \gamma C_{i,t} + v_t + z_s + \epsilon_{i,t} \end{aligned} \tag{5}$$

$Flow_{i,t:t+T}$ denotes cumulative flow (in percent) from quarter t to T, with T equal to t plus one, two or four quarters. The control variables, $C_{i,t}$, include variables shown to influence flows by prior literature: size, age, net fees, turnover, return volatility, performance and tracking error. I account for past performance using CAPM alpha compounded over the prior year as prior research has shown that CAPM outperforms other models in explaining investor capital allocation decision (Berk and Binsberger, 2015; Barber, Huang and Odean, 2016).[15] The remaining control variables are as defined in Section 3.1. I account for style and fund specific differences in net flow by including style or fund fixed funds, z_s, and allow for time specific differences by including time fixed effects, v_t. To address the concern that errors might be correlated within styles or time periods, I cluster standard errors by fund style and year-quarter. To minimize the impact of outliers, I winsorize all control variables at the 1st and 99th percentiles. I winsorize net flow at the 1st and 98th percentile since the positive side is extremely volatile. The results I present are robust to winsorizing net flow measures using other methods proposed in the literature, (e.g., winsorizing observations where the net fund flow percentage is larger than 300% in a year as in Sun, 2020).

The results in Panel A of Table 4 show that the relationships between fund fee changes and factor index fund entry are generally consistent with flow optimizing behavior. Reducing net fees, and particularly operating fees, is associated with positive net flow over the next year. For example, the estimated coefficient on $Decrease\ Net\ Fee_{i,t}$ is 0.639 when predicting fund net flow over the next quarter ($Net\ Flow_{i,t:t+1}$) and 1.901 when predicting fund net flow over the next year ($Net\ Flow_{i,t:t+4}$). These values translate to increases in net flow of about 0.64 and 1.9 percent over the next quarter and year respectively. Decomposing net fees confirms that the effect is indeed restricted to reductions in operating fees. The estimated coefficients on $Decrease\ Operating\ Fee_{i,t}$ are positive and significant, while the estimated coefficients on $Increase\ Mgmt.\ Fee_{i,t}$ are positive, but insignificant.

[Table 4]

In Panel B of Table 4, I show that the results in Panel A are robust to replacing fund fixed effects with style fixed effects. The regression specifications are otherwise the same, but I omit control variable coefficient estimates for concision. In unreported results, I find that the results are also robust to clustering standard errors along alternate dimensions.

[15] I find numerically similar results when accounting the asymmetrical relationship between flows and past performance (Ippolito, 1992; Sirri and Tufano, 1998) when using Morningstar fund ratings which follows Del Guercio and Tkac (2008) who provide evidence that Morningstar fund ratings have a causal impact on fund flows.

Thus, the results in this sub-section suggest that the changes in fees made by active funds following entry of similar factor or market index funds are rational in the sense that they are consistent with optimizing net flow. That is, investors respond positively through increased net flow.

3.3 Active Incumbent attrition

In this section I study the impact of index fund entry on active fund attrition rates. Morningstar Direct identifies the exact date and reason for exit which allows me to study liquidations and mergers separately. Funds frequently merge or liquidate single share classes in which case the portfolio still exists. For this reason, I consider exits at the fund level rather than the share class level.

I start by sorting all active funds into quintiles based on the average factor index, market index and active overlap measures over the prior year. Sorts are performed on an annual basis and I examine attrition rates over the next one, two and five years. The results are reported in Panel A of Table 5. There is no apparent relationship between active fund merger rates and any of the three overlap measures. On the other hand, liquidation rates monotonically increase with all three overlap measures. For example, the two-year (five-year) liquidation rate for funds in factor index MVO quintile 5 is 6.53% (14.95%), compared to 3.77% (9.31%) for funds in factor index MVO quintile 1.

The sorting exercise suggests that active fund liquidations are correlated with the entry of index funds that have relatively high post-entry holdings overlap. However, it is well known that various fund characteristics influence a fund's probability of exiting which could explain the differences in attrition rates shown in Panel A. For example, performance, size and inflows have been shown to be negatively related to mergers while net fees and age have been shown to be positively predict mergers (Jayaraman, Khorana and Nelling, 2002; Zhao, 2005). I additionally control for return volatility and tracking error since risk and activeness might influence exit. I proceed by estimating a Cox proportional hazard model:

$$Exit_{i,t} = h_{0,i,t}e^{(\beta_1 FactorIndex\ MVO_{i,t}+\beta_2 MarketIndex\ MVO_{i,t}+\beta_1 Active\ MVO_{i,t}+\beta_2 Controls_{i,t})} \quad (6)$$

The baseline hazard function, $h_{0,i,t}$, is year and style specific. Funds that survive until the end of the sample period are included as censored observations. To ease the interpretation of results, I report average marginal effects and their associated z-scores instead of the raw coefficient estimates. I estimate the covariance using the "sandwich estimator" developed in Lin and Wei (1989).[16] The control variables, size, return volatility, tracking error, age and net fees are as defined in Section 3.1. I control for fund performance using benchmark-adjusted returns compounded over the prior two years and fund flow using percentage net flows over the prior 6 months. To minimize the impact of outliers, I winsorize all control variables at the 1st and 99th percentiles.

[Table 5]

Panel B of Table 5 presents the hazard ratios and z-scores (in parentheses) from estimating equation 6. Consistent with the univariate results, the factor index overlap measure has a positive and significant effect on liquidation rates and no significant effect on merger rates. A one-standard deviation increase in factor index overlap increases the implied probability of liquidation by between 16 and 21 percent. In contrast, market index fund overlap has a positive effect on both merger and liquidation rates, although the effect on merger rates is marginally significant. The magnitude of the effect on liquidations is again quite large – a one-standard deviation increase in market index MVO is associated with about a 28 percent increase in the baseline hazard ratio.

Next, I investigate whether index fund overlap measures interact with active incumbent relative net fees, and past performance, in predicting future exit rates. I contend that part of the reduction in actively managed average net fees over my sample period can be explained by increased exit rates of the most expensive funds following an increase in competition from low-cost index fund alternatives. In addition, I expect that funds that

[16] Results are very similar when specifying a parametric survival model with a Weibull distribution. The Weibull distribution also fits the data better than other commonly used distributions.

have performed well are more likely to be insulated from the effects of index fund entry and are therefore less likely to be liquidated. I test these hypotheses by interacting benchmark adjusted returns compounded over the prior 24 months and the high net fee dummy variable defined in Section 3.1.1 with the market and factor index overlap measures.

The results generally support my conjectures – the positive effect of factor and market index fund competition on active incumbent liquidation rates is most severe for the funds that charge relatively high net expense ratios. The coefficient estimates on the interactions between the high net fee indicator and both factor and market index overlap measures are positive and significant at the 1 percent level. In contrast, there is only marginal evidence that liquidation rates are less pronounced for funds that have performed well over the prior 24 months. These findings, combined with the findings in Section 3.1, suggest that increased index fund competition has put negative pressure on active fund net fees both directly, through actual fee reductions, and indirectly through increased liquidation rates of the funds charging the highest net fees. Furthermore, the average net fee charged by active funds that exit, either through a liquidation or merger, my sample subsequent to 2010 is 1.19%. In contrast, the average actively managed entrant over the same time period charges a net fee of 0.97%.

3.4 Future performance

This section investigates the performance implications. My expectation is that entry of factor index funds negatively affects the performance of actively managed incumbents with high overlap as both chase active risk. In contrast, market index funds deliver passive exposure to the market portfolio. On the one hand, increased overlap with passive investors might enhance manager's ability to capitalize on mis-priced securities. On the other hand, it may reduce informational asymmetries, thereby making it more difficult to identify mispriced securities. To provide an answer to these questions, I first estimate cumulative performance over the 8-quarters ($t : t + 8$) after a new fund enters. I define performance using the Fama, French and Carhart 4-factor alpha, peer adjusted benchmark returns or benchmark adjusted returns. Next, I regress estimated post-entry performance on the three overlap measures, a standard set of control variables, year-quarter fixed effects and style or fund fixed effects. I estimate standard errors that allow for clustering along year and fund dimensions to account for residual dependence in a given year and within funds.

The results are shown in Table 6 with column headings specifying the dependent variable. In Panel A I include fund and year-quarter fixed effects while in Panel B I replace fund fixed effects with style fixed effects. As with the prior regressions, I report average marginal effects of overlap measures and their associated t-statistics instead of the raw coefficient estimates. Whether considering alpha, peer benchmark adjusted returns or benchmark adjusted returns, I find significant evidence that active incumbents with high factor index overlap underperform over the next two years. For example, the underperformance associated with a one-standard deviation increase in factor index overlap ranges between 17 basis points (4-factor alpha and controlling for style fixed effects) and 38 basis points (using the 4-factor alpha and controlling for fund fixed effects).[17] In contrast, the effects of market index overlap on future performance is restricted to peer benchmark adjusted returns.

[Table 6]

Active incumbents that have high overlap with factor index entrants chase performance by investing in a largely similar set of stocks. Thus, a possible explanation for the negative effect on future performance is that the future profitability of these assets diminishes as more investors invest in them. In this case, underperformance might be reflected by increased trading costs as more funds invest in the same set of securities. I test this latter conjecture by regressing active incumbent return gaps (Kacperczyk et al. (2008)) compounded over the 2 years after entry on the entrant overlap measures. As noted in Kacperczyk et al. (2008), the return gap measures the costs, or benefits, of managers unobserved actions. A large portion of the costs consist trading costs, e.g., the price impact of trade execution and trading commissions. In unreported results I find some support of

[17] In unreported results, I find some evidence of underperformance over the next year. Results are also similar when measuring performance with 3-factor alpha.

my conjecture – factor index overlap is negatively related to future return gaps, however, the statistical significance is marginal at best.

4 Conclusion

In this paper, I study the consequences of increased index fund competition on actively managed mutual fund fees, survival, and performance. While there is ample anecdotal evidence supporting the conjecture that index competition has significantly affected the actively managed industry, this paper provides a rigorous empirical investigation. Importantly, I find that the competitive effects of index competition varies depending on the type of exposure offered, namely exposure to active risk or broad market beta. Measuring the intensity of index competition using entry/incumbent holdings overlap, I show that future changes in net fees are negatively related to factor index overlap but insignificantly related to market index overlap.

Decomposing net fees into their various components suggests that the reduction in net fees associated with factor index overlap is due to a reduction in operating expenses. However, investors only realize approximately one-quarter of this reduction as the rest is diminished by an accompanied increase in management fees. The effects of market index overlap on changes in operating fees is negative, but is completely offset by a positive changes in management fees.

The direct effect on net fees, or lack there of in the case of market index funds, is only part of the story. Competitive pressure from index funds has also had an indirect effect on actively managed net fees through increased liquidation rates. In particular, active incumbents charging relatively high net fees are more likely to be liquidated following entry of both factor and market index funds compared to active incumbents charging relatively low net fees.

Lastly, critics have argued that the substantial fee dispersion for nearly identical mutual funds that has existed for some time does not reflect pricing in a competitive market. The evidence in this paper indicates that increased availability of index funds, and particularly factor index funds, has not only contributed to the reduction in average net fees but has also led to a reduction in fee dispersion by helping to drive fees towards their peer group medians.

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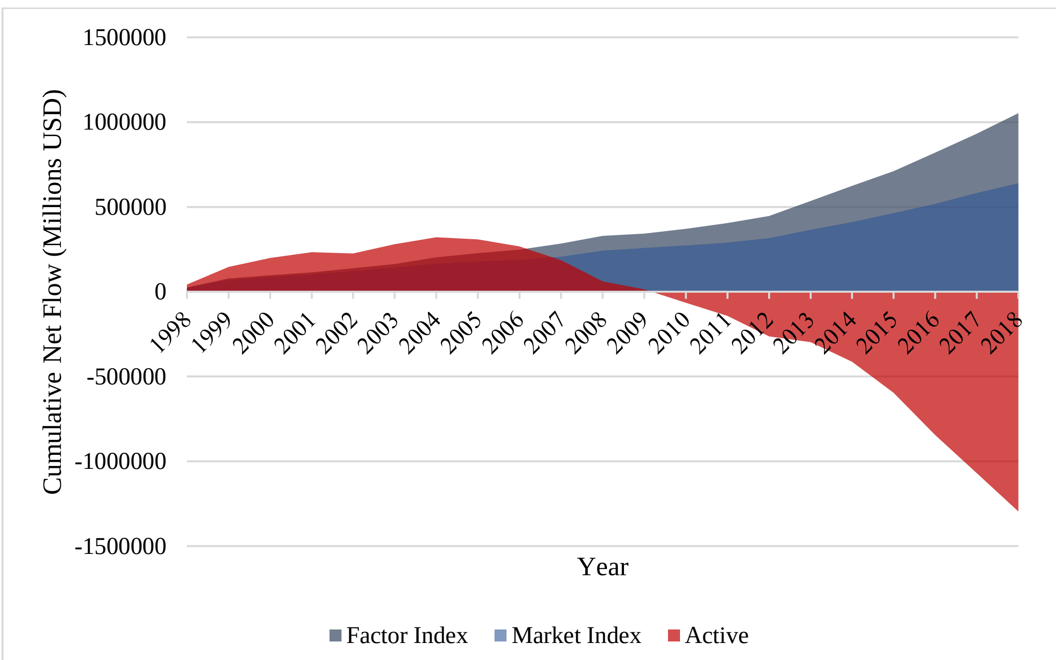
5 Figures

Figure 1: Cumulative Annual Flows by Fund Type

This figure presents cumulative dollar net flows, in millions of USD, from 1998 to 2018 for the three fund types used in this paper: actively managed mutual funds, market index funds and factor index funds. A complete description of how factor index funds differ from market index funds is provided in section 2.1.1.



6 Tables

Table 1: Sample Fund Entry Statistics

For each calendar year in my sample period, this table presents: 1) the number of new mutual funds created (entrants), 2) the number of existing funds (entrants plus incumbents), 3) the total AUM and iv) the equally weighted net expense ratio (EW Net Expense). Statistics are grouped by the three fund types: actively managed mutual funds, market index funds and factor index funds. Entry dates are defined as the inception date of a fund's oldest share class. A complete description of how factor index funds differ from market index funds is provided in section 2.1.1.

	Number of Existing Funds			Number of New Entries			AUM (Billions USD)			EW Net Expense (%)		
		Index			Index			Index			Index	
Year	Active	Factor	Market	Active	Factor	Market	Active	Factor	Market	Active	Factor	Market
1998	957	16	46	104	2	9	1505.9	16.9	190.7	1.28	0.55	0.42
1999	1059	17	59	102	2	13	1968.0	28.6	292.4	1.26	0.57	0.42
2000	1161	38	82	102	21	23	1937.6	29.7	312.4	1.30	0.40	0.43
2001	1308	49	95	147	10	11	1776.3	34.4	311.2	1.33	0.63	0.47
2002	1378	57	100	70	8	6	1398.4	34.2	264.1	1.31	0.64	0.47
2003	1464	68	106	86	11	5	1934.9	56.4	370.5	1.30	0.55	0.44
2004	1549	83	114	86	15	8	2268.1	89.5	435.6	1.27	0.57	0.43
2005	1673	102	117	125	19	4	2489.5	110.7	473.0	1.25	0.56	0.41
2006	1800	146	120	130	44	3	2829.4	149.3	549.3	1.21	0.55	0.41
2007	1906	190	124	107	45	5	2993.1	171.8	615.8	1.21	0.61	0.42
2008	1982	199	126	78	9	4	1737.5	124.1	435.3	1.27	0.58	0.40
2009	2018	207	137	51	12	11	2289.7	163.2	582.0	1.19	0.55	0.42
2010	2003	218	143	79	26	13	2537.9	215.4	697.4	1.17	0.53	0.37
2011	1972	257	148	74	46	8	2392.7	232.4	729.1	1.15	0.51	0.35
2012	1951	279	142	86	27	1	2597.5	286.4	868.3	1.12	0.51	0.34
2013	1948	274	132	105	25	3	3508.3	450.7	1178.4	1.09	0.50	0.32
2014	1938	297	130	77	28	4	3708.6	549.0	1389.7	1.08	0.50	0.32
2015	1953	352	139	62	58	12	3516.4	584.2	1444.8	1.07	0.48	0.31
2016	1950	396	142	63	48	6	3621.2	736.7	1690.1	1.05	0.44	0.32
2017	1922	464	146	61	87	10	4153.4	901.6	2100.9	1.02	0.42	0.30
2018	1894	485	152	44	34	12	3685.4	909.6	2054.7	1.04	0.42	0.30

Table 2: Descriptive statistics

This table presents descriptive statistics on the annual sample of actively managed funds. The sampling period is from January 1998 to December 2018. Fees are reported as annual percentages of fund net assets. Benchmark adjusted returns (Bmk. Adj. Ret.), 3F alpha, 4F alpha and equal weighted peer benchmark adjusted returns (EW Peer Bmk. Adj. Ret.) are annualized returns expressed in %. Net flow is equal to annual percentage flows. AUM (Billions) is fund total net assets in billions of USD. % AUM Inst. Class is the proportion of fund assets that are in an institutional class. Age in months refers to a fund's oldest share class. Turnover is the lesser of the dollar value of purchases or sales divided by previous period assets under management. The standard deviation of gross returns (std.(Gross Ret.)) and tracking error are calculated using 24 months of return data.

	Mean	Std. Dev.	25th Pctl.	50th Pctl.	75th Pctl.
Overlap measures					
Factor Index MVO	0.306	0.519	0.012	0.062	0.323
Market Index MVO	0.724	1.258	0.022	0.125	0.732
Outcome variables					
Net Fee (%)	1.144	0.393	0.900	1.104	1.352
Mgmt. Fee (%)	0.687	0.341	0.556	0.728	0.888
Operating Fee (%)	0.199	0.399	0.001	0.165	0.327
Dist. Fee (%)	0.248	0.236	0	0.250	0.379
Bmk. Adj. Ret. (% p.a.)	0.743	18.004	-7.954	0.205	8.809
3F Alpha (% p.a.)	0.637	16.961	-7.724	0.219	8.134
4F Alpha (% p.a.)	0.412	15.271	-7.472	0.140	7.655
Peer Bmk. Adj. Ret. (% p.a.)	0.024	16.552	-7.805	0.076	7.961
Net Flow (% p.a.)	-0.446	13.353	-4.982	-1.855	2.193
Control variables					
AUM (Billions)	1.596	5.941	0.070	0.270	1.045
%AUM Inst. Class	0.296	0.381	0	0.039	0.634
Age (Months)	154	135	63	122	198
Turnover (%)	77	184	31	57	96
std.(Gross Ret.)	4.515	1.703	3.225	4.127	5.631
Tracking Error	1.514	0.963	0.892	1.274	1.820
Broker Sold	0.427	0.495	0	0	1

Table 3: Strategic Fee Adjustment

This table presents regressions of post-entry changes in active fund fees on the set of overlap measures and control variables. Dependent variables are given in column headers. Logistic regressions are used to predict the probability that fund i uses a fee waiver in the next period (Pr.(Waiver)), all other columns show pooled Ordinary Least Square (OLS) estimates. The dependent variables: ΔNet Fee$_{i,t:t+2}$, ΔMgmt. Fee$_{i,t:t+2}$, ΔOperating Fee$_{i,t:t+2}$ and ΔDistribution Fee$_{i,t:t+2}$ are changes in active incumbent fees from fiscal year t to $t+2$. Ln(AUM) is the natural log of fund net assets as of the end fiscal year $t-1$. Peer Bmk. Adj. Ret. is equal to the difference between fund i's gross return and the equally weighted gross return of it's peer group based on Morningstar categories, and is compounded over the prior fiscal year $(t-1:t)$. The standard deviation of gross returns (std(Gross Ret.)) and tracking error are calculated over the prior 24 months. All regressions include year fixed effects. Regressions in Panel A, C and D include fund fixed effects and regressions in Panel B include style fixed effects. Reported t-statistics, shown in parentheses, use heteroskedasticity-robust standard errors that cluster by style and year. ***/**/* denote statistical significance at the 1%/5%/10% level.

Panel A: Strategic Fee Adjustments

Dependent Variable:	ΔNet Fee$_{i,t:t+2}$		ΔMgmt. Fee$_{i,t:t+2}$		ΔOperating Fee$_{i,t:t+2}$		ΔDist. Fee$_{i,t:t+2}$		Pr.(Waiver)
Factor Index MVO$_{i,t}$	-0.0114***	-0.0113***	0.0303***	0.0335***	-0.0444***	-0.0474***	0.0027	0.0027	-0.0116
	(5.42)	(5.35)	(3.68)	(4.18)	(5.03)	(5.51)	(1.16)	(1.14)	(0.20)
Market Index MVO$_{i,t}$	0.0028*	0.0031	0.0219**	0.0275***	-0.0227**	-0.0280***	0.0036*	0.0036	0.0379
	(1.68)	(1.58)	(2.50)	(3.13)	(2.48)	(3.00)	(1.75)	(1.59)	(0.71)
Active MVO$_{i,t}$		-0.0006		-0.0144***		0.0137**		0.0001	0.1196**
		(0.32)		(2.69)		(2.16)		(0.03)	(2.07)
Turnover$_{i,t}$	0.0032	0.0032	-0.0009	-0.0010	0.0088	0.0089	-0.0047*	-0.0047*	0.0538
	(1.16)	(1.15)	(0.14)	(0.15)	(1.08)	(1.10)	(1.94)	(1.94)	(0.78)
std(Gross Ret.)$_{i,t}$	0.0033*	0.0033*	-0.0035	-0.0038	0.0116***	0.0119***	-0.0049***	-0.0049***	0.0461
	(1.86)	(1.86)	(1.14)	(1.23)	(2.86)	(2.92)	(3.50)	(3.50)	(0.91)
Peer Bmk. Adj. Ret.$_{i,t}$	-0.1362***	-0.1362***	0.1311***	0.1304***	-0.2348***	-0.2341***	-0.0325*	-0.0325*	0.3498
	(8.22)	(8.23)	(3.51)	(3.50)	(5.12)	(5.12)	(1.68)	(1.68)	(0.76)
ln(Age)$_{i,t}$	-0.0144***	-0.0144***	-0.0689***	-0.0697***	0.0403***	0.0410***	0.0143***	0.0143***	-0.2039*
	(3.13)	(3.14)	(7.44)	(7.53)	(3.65)	(3.73)	(3.09)	(3.08)	(1.89)
Tracking Error	-0.0018	-0.0019	0.0056	0.0045	-0.0122**	-0.0112**	0.0049**	0.0049**	-0.0276
	(0.76)	(0.78)	(1.33)	(1.08)	(2.12)	(1.98)	(2.12)	(2.13)	(0.43)
ln(AUM)$_{i,t}$	0.0083***	0.0083***	-0.0216***	-0.0221***	0.0270***	0.0274***	0.0029**	0.0029**	-0.1616***
	(8.45)	(8.33)	(6.44)	(6.58)	(7.30)	(7.41)	(2.40)	(2.38)	(5.48)
Observations	20,632	20,632	20,632	20,632	20,632	20,632	20,632	20,632	20,755
R-squared	0.25	0.25	0.18	0.18	0.18	0.18	0.10	0.10	0.04

Panel B: Robustness

Dependent Variable:	ΔNet Fee$_{i,t:t+2}$	ΔMgmt.$_{i,t:t+2}$	ΔOperating$_{i,t:t+2}$	ΔDist. Fee$_{i,t:t+2}$
Factor Index MVO$_{i,t}$	-0.0058***	0.0224***	-0.0309***	0.0027
	(3.05)	(3.03)	(3.90)	(1.27)
Market Index MVO$_{i,t}$	0.0060***	0.0220***	-0.0183**	0.0022
	(3.38)	(2.67)	(2.15)	(1.14)
Observations	23,092	22,414	20,751	21,219
R-squared	0.09	0.03	0.06	0.02

Panel C: Factor Index Interaction Effects

Dependent Variable:	ΔNet Fee$_{i,t:t+2}$	ΔMgmt. Fee$_{i,t:t+2}$	ΔOperating Fee$_{i,t:t+2}$	ΔDist. Fee$_{i,t:t+2}$
Factor Index MVO$_{i,t}$	0.0028	0.0608***	-0.0089	0.0070***
	(1.27)	(6.50)	(1.19)	(2.85)
Factor Index MVO$_{i,t}$ × High Fee$_{i,t}$	-0.0152***	-0.0594***	-0.0490***	-0.0145***
	(5.67)	(6.96)	(4.62)	(4.79)
Factor Index MVO$_{i,t}$	-0.0077***	0.0378***	-0.0481***	0.0015
	(4.24)	(4.82)	(5.56)	(0.64)
Factor Index MVO$_{i,t}$ × Peer Bmk. Adj. Ret.$_{i,t}$	-0.0498**	0.1691***	-0.1781**	-0.0002
	(2.40)	(2.70)	(2.23)	(0.01)

Panel D: Market Index Interaction Effects

Dependent Variable:	ΔNet Fee$_{i,t:t+2}$	ΔMgmt. Fee$_{i,t:t+2}$	ΔOperating Fee$_{i,t:t+2}$	ΔDist. Fee$_{i,t:t+2}$
Market Index MVO$_{i,t}$	0.0136***	0.0433***	0.0187**	0.0070**
	(6.49)	(3.93)	(2.32)	(2.52)
Market Index MVO$_{i,t}$ × High Fee$_{i,t}$	-0.0155***	-0.0484***	-0.0564***	-0.0029
	(6.00)	(4.61)	(5.18)	(0.93)
Market Index MVO$_{i,t}$	0.0043**	0.0226***	-0.0245***	0.0035
	(2.55)	(2.75)	(2.68)	(1.61)
Market Index MVO$_{i,t}$ × Peer Bmk. Adj. Ret.$_{i,t}$	-0.0379	0.1056**	-0.1021	-0.0171
	(1.42)	(2.04)	(1.56)	(1.26)

Table 4: Investor Response to Fee Changes

This table presents results from estimating pooled OLS regressions of active fund net flows on a set of dummy variables corresponding to fee changes over the prior two years. The unit of observation is fund-quarter. The dependent variables, shown in column headings, are net fund flow over the next quarter ($i, t : t+1$), 6 months ($i, t : t+2$) or year ($i, t : t+4$) scaled by the AUM at the beginning of the measurement period. The explanatory variables include the natural log of fund net assets (ln(AUM)), gross return volatility estimated over the prior 24 months (std(Gross Ret.)), fund turnover, and the natural log fund age in months (ln(Age)) and prior performance. Prior performance is measured by CAPM alpha compounded over the prior year. Fee change variables are measured over the prior two years. For example, Decrease Net Fee$_{i,t-8:t}$ is equal to the change in net fees over the prior two years (eight quarters). Regressions in Panel A include fund and year-quarter fixed effects. Panel B includes style and year-quarter fixed effects and the full set of control variables from Panel A. Reported t-statistics, shown in parentheses, use heteroskedasticity-robust standard errors that are clustered by fund style × year-quarter. ***/**/* denote statistical significance at the 1%/5%/10% level.

Panel A: Investor response to active fund fee changes

Dependent Variable:	Net Flow$_{i,t:t+1}$	Net Flow$_{i,t:t+2}$	Net Flow$_{i,t:t+4}$	Net Flow$_{i,t:t+1}$	Net Flow$_{i,t:t+2}$	Net Flow$_{i,t:t+4}$
Decrease Net Fee	0.6392*	1.3453**	1.9010**			
	(2.79)	(4.60)	(4.99)			
Increase Mgmt. Fee				0.2136	0.4947	0.6188
				(0.92)	(1.27)	(1.19)
Increase Dist. Fee				-0.1449	-0.3586	0.2295
				(1.12)	(1.43)	(0.55)
Decrease Operating Fee				0.7418*	1.3781**	2.0322*
				(2.95)	(3.68)	(3.04)
Turnover	-0.0095***	-0.0164***	-0.0198*	-0.0079**	-0.0161**	-0.0240*
	(8.83)	(6.82)	(2.86)	(4.21)	(3.30)	(3.10)
std(Gross Ret.)	-0.1838	-0.4391	-1.2556	-0.1445	-0.4502	-1.5927
	(0.81)	(1.37)	(1.10)	(0.61)	(1.22)	(1.34)
CAPM Alpha	0.2755***	0.5108***	0.7480***	0.2778***	0.5179***	0.7571***
	(10.82)	(6.95)	(6.78)	(7.46)	(6.21)	(6.29)
Tracking Error	0.6913**	1.5728**	2.9520**	0.6619*	1.5681**	3.0171**
	(3.88)	(4.09)	(3.99)	(3.07)	(4.00)	(3.76)
ln(Age)	-2.1102**	-4.7418**	-14.3292***	-1.3370	-3.2498*	-11.9595***
	(3.42)	(3.34)	(7.98)	(2.14)	(2.42)	(7.10)
ln(AUM)	-2.4685***	-6.4770***	-19.5219***	-2.5978***	-6.7525***	-20.1269***
	(10.95)	(11.55)	(15.12)	(10.94)	(11.18)	(14.14)
Net Flow	0.2096***	0.4015***	0.7520***	0.2109***	0.4029***	0.7617***
	(10.82)	(11.21)	(14.47)	(10.14)	(11.37)	(10.48)
Observations	101,364	101,496	101,792	91,540	91,656	91,873
R-squared	0.31	0.32	0.34	0.33	0.34	0.35

Panel B: Robustness

Dependent Variable:	Net Flow$_{i,t:t+1}$	Net Flow$_{i,t:t+2}$	Net Flow$_{i,t:t+4}$	Net Flow$_{i,t:t+1}$	Net Flow$_{i,t:t+2}$	Net Flow$_{i,t:t+4}$
Decrease Net Fee$_{i,t-8:t}$	0.7216**	1.5610**	2.7918***			
	(4.37)	(5.58)	(5.90)			
Increase Mgmt. Fee$_{i,t-8:t}$				0.3087	0.7382	1.5528**
				(1.58)	(2.19)	(4.00)
Increase Dist. Fee$_{i,t-8:t}$				-0.2049	-0.3988	0.3759
				(1.98)	(1.74)	(0.61)
Decrease Operating Fee$_{i,t-8:t}$				0.8970**	1.7315**	2.9555**
				(4.52)	(4.90)	(5.18)
Observations	99,879	100,010	100,297	90,333	90,446	90,657
R-squared	0.29	0.28	0.22	0.31	0.30	0.22

Table 5: Active Incumbent Attrition

Panel A of this table provides one, two and five year attrition rates of active mutual funds sorted by the factor index, market index and active overlap measures. Portfolios are updated annually with rankings based on the average overlap measure over the prior year. One, two and five year attrition rates are equal to the proportion of funds that are liquidated or merged over the one, two and five years after the sort. Panel B presents the results from estimating a Cox proportional hazard model:

$$Hazard_{i,t} = h_{0,i,t}e^{(\beta_1 FactorIndexMVO_{i,t}+\beta_2 MarketIndexMVO_{i,t}+\beta_3 ActiveMVO_{i,t}+\gamma C_{i,t})}$$

The unit of observation is fund-quarter. Active funds that exist for the entire sample are included as censored observations. Control variables include: benchmark adjusted returns compounded over the prior two years (Bmk. Adj. Ret.), turnover, percentage net flow over the prior 6 months (Net Flow), the natural log of fund net assets size (ln(AUM), gross return volatility calculated over the prior 24 months (std.(Gross Ret.), the natural log of fund age in months (ln(Age), tracking error and the net expense ratio (Net Fee). The covariance matrix is estimated using the "sandwich estimator" developed in Lin and Wei (1989). Hazard ratios are reported with z-scores in parentheses. ***/**/* denote statistical significance at the 1%/5%/10% level.

Panel A: Attrition rates based on univariate sorts by competition ranking

	Merged			Liquidated		
Factor Index MVO Quintile	1 Year	2 Year	5 Year	1 Year	2 Year	5 Year
1	2.02	3.33	7.78	1.94	3.77	9.31
2	1.70	3.22	8.43	2.07	4.38	10.64
3	1.42	3.16	8.57	2.61	4.75	11.32
4	1.49	3.52	8.67	2.31	4.70	11.60
5	1.65	3.20	7.25	3.28	6.53	14.95
Market Index MVO Quintile	1 Year	2 Year	5 Year	1 Year	2 Year	5 Year
1	1.75	2.79	7.02	2.26	4.06	9.60
2	1.51	3.31	8.58	1.71	3.67	9.71
3	1.52	3.49	8.66	2.43	4.81	11.27
4	1.57	3.39	9.02	2.40	5.02	12.26
5	1.94	3.45	7.47	3.41	6.58	14.99
Active MVO Quintile	1 Year	2 Year	5 Year	1 Year	2 Year	5 Year
1	1.33	2.43	6.68	1.86	3.66	8.96
2	1.48	3.40	8.98	1.94	3.87	9.88
3	1.76	3.49	8.38	2.27	4.62	11.43
4	1.65	3.48	8.80	2.74	5.34	12.76
5	2.05	3.63	7.91	3.41	6.65	14.80

Panel B: Cox proportional hazard model estimation

	Baseline Regressions				Interaction Effects			
Dependent Variable:	Merged		Liquidated		Merged		Liquidated	
Factor Index $\text{MVO}_{i,t}$	0.9801	1.0297	1.1692***	1.1916***	1.0865	1.0375	1.0685	1.2258***
	(0.24)	(0.40)	(3.44)	(3.96)	(1.11)	(0.48)	(1.22)	(4.57)
Market Index $\text{MVO}_{i,t}$	1.0405	1.0774	1.2383***	1.2457***	1.0817	1.1588	1.2770***	1.1077
	(0.50)	(1.04)	(4.80)	(5.04)	(1.13)	(1.64)	(5.49)	(1.60)
Active $\text{MVO}_{i,t}$		0.7764***		0.9382*	0.7734***	0.7738***	0.9452	0.9433
		(3.89)		(1.69)	(3.92)	(3.92)	(1.48)	(1.56)
Bmark Adj. $\text{Ret.}_{i,t}$	0.9803***	0.9810***	0.9882***	0.9887***	0.9829***	0.9814***	0.9939	0.9903**
	(3.16)	(3.06)	(2.69)	(2.59)	(2.63)	(2.98)	(1.30)	(2.19)
$\text{Turnover}_{i,t}$	1.0006***	1.0006***	1.0006***	1.0006***	1.0006***	1.0007***	1.0004***	1.0005***
	(3.29)	(3.30)	(4.71)	(4.77)	(2.95)	(3.46)	(2.79)	(4.30)
Net $\text{Flow}_{i,t-2:t}$	0.9793***	0.9801***	0.9771***	0.9775***	0.9800***	0.9800***	0.9776***	0.9776***
	(7.01)	(6.75)	(10.59)	(10.29)	(6.68)	(6.70)	(10.29)	(10.33)
$\ln(\text{AUM})_{i,t}$	0.9245***	0.8775***	0.9264***	0.9069***	0.8912***	0.8916***	0.8861***	0.8902***
	(2.70)	(4.07)	(3.56)	(3.95)	(3.66)	(3.64)	(5.02)	(4.80)
$\text{std}(\text{Gross Ret.})_{i,t}$	1.2242**	1.2230**	1.0769	1.0724	1.2267**	1.2273**	1.0527	1.0558
	(2.49)	(2.45)	(1.46)	(1.38)	(2.47)	(2.49)	(0.99)	(1.03)
$\ln(\text{Age})_{i,t}$	1.5545***	1.5633***	0.7409***	0.7426***	1.5483***	1.5485***	0.7667***	0.7639***
	(6.82)	(6.88)	(6.95)	(6.95)	(6.70)	(6.70)	(6.29)	(6.43)
Tracking $\text{Error}_{i,t}$	0.7330***	0.7155***	0.9147*	0.9073*	0.7001***	0.7021***	0.9448	0.9461
	(3.75)	(4.00)	(1.74)	(1.88)	(4.36)	(4.33)	(1.12)	(1.08)
Net $\text{Fee}_{i,t}$	1.2633	1.2678*	1.5843***	1.5818***				
	(1.63)	(1.65)	(4.60)	(4.63)				
High Net $\text{Fee}_{i,t}$					1.4850***	1.4197***	1.1266*	1.2096***
					(3.91)	(3.60)	(1.71)	(2.86)
Factor Index $\text{MVO}_{i,t}$ × Bmk. Adj. $\text{Ret.}_{i,t}$					0.9951		0.9917*	
					(0.81)		(1.75)	
Factor Index $\text{MVO}_{i,t}$ × High $\text{Net}_{i,t}$					0.8955		1.1855***	
					(1.06)		(3.25)	
Market Index $\text{MVO}_{i,t}$ × Bmk. Adj. $\text{Ret.}_{i,t}$						1.0000		0.9963*
						(0.00)		(1.87)
Market Index $\text{MVO}_{i,t}$ × High $\text{Net}_{i,t}$						0.8950		1.1518***
						(1.32)		(3.00)
Observations	94,803	94,803	94,803	94,803	94,803	94,803	94,803	94,803
Pseudo R-squared	0.03	0.03	0.05	0.05	0.04	0.04	0.05	0.05

Table 6: Future Performance

This table presents pooled OLS regressions of active fund performance on the entry overlap measures, a standard set of control variables, year-quarter and fund or style fixed effects. The dependent variable is given by benchmark adjusted returns, peer benchmark adjusted returns or alpha compounded over the 24 months after entry. Turnover and expense ratio are annual values as of quarter t. Tracking error and the standard deviation of gross returns are calculated over the prior 24 months. ln(Age) is the natural log of the age, in months, of a fund's oldest share class and ln(AUM) is the natural log of a fund's total assets under management. Past performance is the compounded returns over the prior year and is calculated using the same performance measure as the dependent variable. Regressions in Panel A include fund fixed effects while regressions in Panel B include style fixed effects. Reported t-statistics, shown in parentheses, use heteroskedasticity-robust standard errors that are double clustered by fund and year. ***/**/* denote statistical significance at the 1%/5%/10% level.

Panel A: Future Performance

Dependent Variable:	Peer Bmk. Adj. Ret.$_{t:t+8}$		Bmk. Adj. Ret.$_{t:t+8}$		4F Alpha$_{t:t+8}$	
Factor Index MVO$_{i,t}$	-0.2930**	-0.2565**	-0.2908***	-0.2568**	-0.3750***	-0.3382***
	(2.52)	(2.45)	(2.89)	(2.82)	(4.16)	(4.71)
Market Index MVO$_{i,t}$	-0.3814***	-0.2845***	-0.3145***	-0.2258**	-0.2116**	-0.1188
	(4.46)	(3.46)	(3.39)	(2.60)	(2.86)	(1.64)
Active MVO$_{i,t}$		-0.3467***		-0.3184***		-0.3418***
		(3.30)		(3.41)		(3.74)
Past Performance$_{i,t}$	-0.1801**	-0.1798**	-0.1626***	-0.1623***	-0.0795**	-0.0796**
	(2.66)	(2.66)	(2.87)	(2.87)	(2.12)	(2.13)
Turnover$_{i,t}$	0.0014	0.0013	0.0004	0.0004	-0.0026	-0.0026
	(0.35)	(0.34)	(0.12)	(0.12)	(1.08)	(1.09)
ln(AUM)$_{i,t}$	-3.3545***	-3.3973***	-3.2610***	-3.3006***	-2.4605***	-2.5014***
	(7.78)	(7.77)	(8.06)	(8.06)	(11.32)	(11.09)
Tracking Error$_{i,t}$	0.7370**	0.7209**	1.0853**	1.0702**	0.0280	0.0130
	(2.56)	(2.52)	(2.23)	(2.22)	(0.15)	(0.07)
Net Fee$_{i,t}$	1.4366*	1.4267*	1.5841*	1.5744*	0.7720	0.7605
	(1.91)	(1.89)	(2.01)	(1.99)	(1.37)	(1.35)
%AUM Inst. Class$_{i,t}$	1.7994*	1.8180*	1.5917	1.6084	0.4579	0.4738
	(1.85)	(1.87)	(1.67)	(1.69)	(0.69)	(0.71)
Net Flow (%)$_{i,t}$	-0.0136**	-0.0131**	-0.0143*	-0.0138*	-0.0135*	-0.0129*
	(2.19)	(2.10)	(2.05)	(1.99)	(1.93)	(1.85)
Observations	96,865	96,865	97,302	97,302	93,839	93,839
R-squared	0.22	0.22	0.27	0.27	0.28	0.28

Panel B: Robustness

Dependent Variable:	Peer Bmk. Adj. Ret.$_{t:t+8}$		Bmk. Adj. Ret.$_{t:t+8}$		4F Alpha$_{t:t+8}$	
Factor Index MVO$_{i,t}$	-0.2439***	-0.2315***	-0.2569***	-0.2346***	-0.1720***	-0.1724***
	(2.95)	(2.78)	(3.14)	(2.83)	(2.69)	(2.69)
Market Index MVO$_{i,t}$	-0.2147***	-0.1716**	-0.1193*	-0.0448	0.0622	0.0607
	(2.91)	(2.36)	(1.65)	(0.63)	(1.15)	(1.14)
Active MVO$_{i,t}$		-0.1111**		-0.1937***		0.0040
		(2.40)		(4.07)		(0.13)
Past Performance$_{i,t}$	-0.0482***	-0.0481***	-0.0505***	-0.0500***	0.0795***	0.0795***
	(4.07)	(4.06)	(4.09)	(4.05)	(7.24)	(7.24)
Turnover$_{i,t}$	-0.0002	-0.0002	-0.0003	-0.0003	-0.0007	-0.0007
	(0.40)	(0.40)	(0.63)	(0.63)	(0.93)	(0.93)
ln(AUM)$_{i,t}$	-0.2801***	-0.2922***	-0.2255***	-0.2468***	-0.1861***	-0.1857***
	(5.14)	(5.27)	(4.14)	(4.47)	(4.50)	(4.40)
Tracking Error$_{i,t}$	0.3896***	0.3824**	0.2577*	0.2451	0.1843*	0.1846*
	(2.59)	(2.53)	(1.65)	(1.56)	(1.77)	(1.77)
Net Fee$_{i,t}$	-0.4536*	-0.4602*	-0.4861*	-0.4978*	-0.3988**	-0.3986**
	(1.75)	(1.78)	(1.84)	(1.89)	(2.14)	(2.14)
%AUM Inst. Class$_{i,t}$	-0.1355	-0.1378	-0.0860	-0.0897	-0.0704	-0.0703
	(0.72)	(0.74)	(0.46)	(0.48)	(0.48)	(0.48)
Net Flow (%)$_{i,t}$	-0.0204***	-0.0203***	-0.0182***	-0.0181***	-0.0119***	-0.0119***
	(4.91)	(4.89)	(4.30)	(4.27)	(3.89)	(3.89)
Observations	96,867	96,867	97,309	97,309	93,852	93,852
R-squared	0.01	0.01	0.14	0.14	0.15	0.15

7 Appendix

Table A1

Variable Definitions

Competition Measures	
Overlap Measure (MVO)	$\text{MVO}_{i,t} = \frac{1}{N}\sum_{e=1}^{N}\sum_{s=1}^{M} w_{i,e,s,t}$ $w_{i,e,s,t} = \left(\frac{P_{e,s,t}S_{e,s,t}}{P_{i,s,t-1}S_{i,s,t-1}}\right)\left(\frac{P_{i,s,t-1}S_{i,s,t-1}}{\sum_{j=1}^{K} P_{i,j,t-1}S_{i,j,t-1}}\right)$ i subscript denotes incumbent, e subscript denotes entrant, s denotes stocks held by both incumbent i and entrant e. $P_{i,s,t}$ $(P_{e,s,t})$ = the price of security s in quarter t. $S_{i,s,t}$ = number of shares of security s in incumbent i's portfolio in quarter t. $S_{e,s,t}$ = number of shares of security s in entrant e's portfolio in quarter t. M = the number of overlapping securities held by incumbent i and entrant e. N = the number of entrants in quarter t that have at least one overlapping security. K = the number of securities in incumbent i's portfolio in quarter t.
Factor Index $\text{MVO}_{i,t}$	Aggregate holdings overlap measure for fund i in quarter t. Computed for all factor index funds that enter in quarter $t-1$.
Market Index $\text{MVO}_{i,t}$	Aggregate holdings overlap measure for fund i in quarter t. Computed for all market index funds that enter in quarter $t-1$.
Performance Measures	
Bmk. Adj. Ret.	Gross fund returns in excess of the funds' benchmark return. I use the Morningstar US-equity Category benchmarks.
Peer Bmk. Adj. Ret.	Gross fund returns in excess of the funds' equally weighted peer group return. I use Morningstar US-equity Category to determine peer groups.
Alpha	CAPM, Fama and French 3-factor, Fama, French and Carhart 4-factor. Estimated using 36 months of gross return data.
Fund Characteristics	
ln(AUM)	The natural log of fund assets under management.
ln(Age)	The natural log of a fund's age in months.
Tracking Error	The standard deviation of the difference between gross fund returns and benchmark returns.
Turnover	The lesser of the dollar value of purchases or sales divided by previous period (year) assets under management.
Net Fee	The percentage of fund assets used to pay for operating and management fees. This includes 12b-1 fees, administrative fees and all other asset-based costs incurred by the fund, excluding brokerage costs.
Management Fee	The fee charged by manager(s) as given in the fund's annual report. Expressed as a % of fund net assets.
Distribution Fee	The % of fund net assets used for marketing and distribution.
Operating Fee	Net fees minus management fees minus distribution fees. Expressed as a % of fund net assets. These fees include: accounting, administration, auditing, compensating the board of directors, custodial, legal, organizational, professional, registration, shareholder reporting and transfer agency fees . Expressed as a % of fund net assets.
Expense Waiver	The difference between expenses incurred (gross expense ratio) and expenses charged to unit holders (net expense ratio).
High Fee	Indicator variables that measure relative: management fees, operating fees, distribution fees and and net fees. To be precise, high fee is equal to one if a fund charges a fee (as a % of net assets) that is above the median fee for all other actively managed mutual funds in the same style category, in the same year.

Table A2: Strategic Fee Adjustment: Three- and Four-Year Fee Changes

This table presents regressions of post-entry changes in active fund fees on the set of overlap measures and control variables. Dependent variables are given in column headers. Logistic regressions are used to predict the probability that fund i uses a fee waiver in the next period (Pr.(Waiver)), all other columns show pooled Ordinary Least Square (OLS) estimates. The dependent variables are changes in active incumbent fees over the three (t to $t + 3$) and four years (t to $t + 4$) after entry. The control variables are the same as those from Table 3. All regressions include year and fund fixed effects. The dependent variables in Panel A are three-year changes in fees and are four-year changes in Panel B. Reported t-statistics, shown in parentheses, use heteroskedasticity-robust standard errors that cluster by fund and year. ***/**/* denote statistical significance at the 1%/5%/10% level.

Panel A: Three-Year Fee Adjustments

Dependent Variable:	ΔNet Fee$_{i,t:t+3}$	ΔMgmt. Fee$_{i,t:t+3}$	ΔOperating Fee$_{i,t:t+3}$	ΔDist. Fee$_{i,t:t+3}$
Factor Index MVO$_{i,t}$	-0.0167***	0.0350***	-0.0525***	0.0015
	(6.30)	(4.23)	(5.88)	(0.59)
Market Index MVO$_{i,t}$	0.0019	0.0316***	-0.0350***	-0.0008
	(0.75)	(3.46)	(3.69)	(0.32)
Active MVO$_{i,t}$	0.0013	-0.0096*	0.0115*	0.0022
	(0.47)	(1.80)	(1.67)	(0.77)
Turnover$_{i,t}$	0.0084**	0.0028	0.0087	-0.0059**
	(2.55)	(0.44)	(1.07)	(2.31)
std(Gross Ret.)$_{i,t}$	0.0034	-0.0020	0.0106***	-0.0061***
	(1.53)	(0.66)	(2.77)	(3.32)
Peer Bmk. Adj. Ret.$_{i,t}$	-0.2029***	0.0501	-0.2249***	0.0094
	(8.46)	(1.11)	(4.14)	(0.46)
ln(Age)$_{i,t}$	-0.0237***	-0.0778***	0.0327**	0.0201***
	(4.12)	(7.66)	(2.60)	(3.82)
Tracking Error$_{i,t}$	-0.0017	0.0015	-0.0106*	0.0055**
	(0.57)	(0.37)	(1.81)	(2.48)
ln(AUM)$_{i,t}$	0.0139***	-0.0254***	0.0362***	0.0055***
	(11.58)	(6.66)	(8.58)	(4.55)
Observations	20,752	20,116	18,658	19,116
R-squared	0.29	0.23	0.25	0.16

Panel B: Four-Year Fee Adjustments

Dependent Variable:	ΔNet Fee$_{i,t:t+4}$	ΔMgmt. Fee$_{i,t:t+4}$	ΔOperating Fee$_{i,t:t+4}$	ΔDist. Fee$_{i,t:t+4}$
Factor Index MVO$_{i,t}$	-0.0182***	0.0325***	-0.0540***	0.0030
	(6.19)	(3.51)	(4.95)	(1.08)
Market Index MVO$_{i,t}$	-0.0030	0.0435***	-0.0461***	-0.0032
	(1.11)	(3.82)	(3.75)	(1.00)
Active MVO$_{i,t}$	0.0040	-0.0110	0.0187**	0.0009
	(1.21)	(1.64)	(2.40)	(0.31)
Turnover$_{i,t}$	0.0069*	0.0023	0.0112	-0.0078***
	(1.72)	(0.34)	(1.12)	(2.65)
std(Gross Ret.)$_{i,t}$	0.0024	-0.0001	0.0066	-0.0043*
	(0.86)	(0.03)	(1.32)	(1.85)
Peer Bmk. Adj. Ret.$_{i,t}$	-0.2007***	-0.0320	-0.1651***	0.0442*
	(7.83)	(0.66)	(2.91)	(1.85)
ln(Age)$_{i,t}$	-0.0237***	-0.0862***	0.0293*	0.0229***
	(3.22)	(6.94)	(1.78)	(3.47)
Tracking Error$_{i,t}$	-0.0002	-0.0070	-0.0053	0.0083***
	(0.07)	(1.40)	(0.80)	(2.96)
ln(AUM)$_{i,t}$	0.0168***	-0.0320***	0.0440***	0.0059***
	(12.16)	(8.27)	(9.69)	(3.67)
Observations	18,702	18,093	16,712	17,173
R-squared	0.36	0.29	0.30	0.23