Does Competition Protect Retail Investors? Role of Financial Advice*

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Abstract

This paper investigates how increased competition in the retail money management industry affects the price of advice-mediated fund products. Exploiting the staggered entry of low-cost Vanguard index funds as quasi-exogenous shocks to competition, I show that actively managed funds sold to self-directed investors respond by reducing their fees; however, funds sold with broker recommendations respond by increasing their distribution fees. Hence, competition hurts uninformed investors who rely on financial advice. I further show that the sensitivity of broker-sold fund flows to distribution fees increases, suggesting a compositional shift in the broker-sold segment towards investors more trusting of broker recommendations.

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1. Introduction

In the U.S. mutual fund industry, many retail investors lack the ability or the time to understand financial products, and thus they hire financial advisors to help them choose funds. Gennaioli et al. (2015) compare money managers to doctors and illustrate that the trust placed by retail investors enables money managers to charge fees above marginal cost in a competitive market. In this paper, I investigate what happens to the price of advice-mediated fund products under a sudden rise in competitive pressure. In particular, I focus on the competition from the entry of low-cost passive funds, which are perceived as the "Walmart" for the finance industry (Economist (2008)). Understanding the implications of increased competition for an advice-mediated market is important for at least three reasons. First, if financial products compete on trust but not on price, the equilibrium price reactions to increased competition can be significantly different from those found in other markets. Second, several recent studies have documented that fees in the U.S. financial industry remain high despite sharply rising competition (e.g., French (2008), Greenwood and Scharfstein (2013), and Philippon (2015)), and one important question is whether investors' reliance on financial advice plays a role in explaining this empirical puzzle. Third, it remains a central policy question as to whether increased competition, as opposed to more regulation, can effectively protect retail investors. Understanding the microeconomic channel through which competition interacts with trust relationships between investors and financial advisors can shed light on this policy debate.

Building on the key insights from Bergstresser et al. (2009) and Del Guercio and Reuter (2014), I consider the segmentation of the mutual fund market, where a subset of retail investors depend on financial advisors to buy mutual funds (the "broker-sold" channel), while the rest can evaluate and invest in funds independently (the "direct-sold" channel).[1] A feature of low-cost financial products such as index funds is that they are usually *unbundled* from financial advice.[2] In the self-directed distribution channel, index funds are direct cheap

[1]Bergstresser et al. (2009) show that while charging high fees, broker-sold funds deliver lower risk-adjusted returns even before fees, implying either intangible benefits delivered by financial advisors or agency costs. Del Guercio and Reuter (2014) document that different investor preferences across market segments affect the incentives of fund managers and industry dynamics. They show that only direct-channel fund flows chase risk-adjusted returns, thus only direct-sold mutual funds generate alpha. These papers have laid important foundations for studying the industrial organizations of the money management industry.

[2]Two related reasons drive this fact. First, financial advice is usually expensive to provide, which can

substitutes for actively managed portfolios, hence, as general economic principle predicts, price competition should lower fees in the direct-sold segment. On the contrary, it is much more costly for investors originally selected into the advice-mediated channel to switch to index funds, because it requires them to give up the consumption of financial advice and become self-directed. Thus, the effect of competition on the broker-sold segment depends on the potential change in investor composition in this segment. In the case where all advice-mediated investors are not capable of investing in index funds on their own, no one switches, and competition would have no effect. If, on the other hand, heterogeneity exists within the broker-mediated pool, and only a subset of investors leave the pool following index fund introduction, a "selection" effect may drive the outcome in the broker-sold channel. In particular, as the options in the unbundled segment become cheaper, financial advice becomes costlier at the margin, and the marginal investors with relatively lower trust in financial advisors can choose to become self-directed. Investors who remain with financial advisors when advice becomes costlier must be the ones who attach higher valuation to the trust relationship they have with their advisors. Due to this selection effect, money managers can charge these remaining investors a *higher* price for financial advice in the new equilibrium.

My empirical strategy exploits the market entry by Vanguard, the pioneering index fund company, into a variety of investment categories. The identification strategy is similar to that of Matsa (2011) which uses Walmart's market entry to identify the causal effect of competition in the supermarket industry. During the sample period 1970-2005, Vanguard rolled out low-cost index fund products in a range of U.S. equity investment categories in a staggered fashion. While product entry is generally endogenous to market conditions, in the case of Vanguard, a set of *idiosyncratic* factors drove the timing of new product

undermine the low-cost advantage of index funds. For example, one early index fund product "the Colonial Index Trust" was sold by brokers and carried a sales load of 4.75%, thus it created little competitive pressure due to the high cost. Second, research has documented, commission-based brokers have low incentive to market low-cost index funds to their clients. For example, through an audit study, Mullainathan et al. (2012) find that financial advisors steer investors toward expensive actively managed funds. The low availability of index funds through financial advisors is supported by data. Del Guercio and Reuter (2014) show that index funds account for only about 2% of the assets under management in the broker-sold channel in 2004, and Reuter (2015) shows this number remains below 3% in 2012. The market for financial advice is fast-evolving, and the pattern may evolve in most recent years thanks to the emergence of fee- (not commission-) based advisors, such as registered investment advisors, or robo-advice platforms. These compensation schemes or technology were not available in the period which this study concerns.

introductions.[3] Thus, the entry events provide an ideal setting to estimate the effects of competition in the money management industry. The estimation follows a difference-in-differences (DD) specification. At each entry date, the actively managed funds in the same investment category as the entering low-cost Vanguard index fund faced a discrete increase in the competitive pressure, while the funds in other investment categories serve as a control. To infer the effects of competition, I compare the changes in outcomes around the time of the Vanguard index fund introduction for funds affected by the competition to those for funds unaffected by the competition. Further, I examine the responses by market segments. The DD strategy allows one to separate the causal effect of index fund competition from time trends in money management fees.

The main result of this paper is that under the sudden rise in competitive pressure from Vanguard index funds, direct-sold actively managed funds cut fees by 6.4 basis points, or 5.2 percent of the mean fee for the direct channel. However, in sharp contrast, broker-sold funds *increase* fees by 12.2 basis points, or 5.6 percent of the mean fee. Therefore, because some retail investors' reliance on financial advice, the welfare implications of competition in the money management industry are more nuanced than often considered. While competition reduces fees paid by self-directed investors, it makes advice-mediated investment products more expensive. In other words, competition from more efficient financial products appear to benefit sophisticated investors but hurt unsophisticated, advice-dependent investors (Campbell (2016)). After combining both distribution channels, the opposite effects across the channels offset each other. In the aggregate, the strong competitive pressure from Vanguard index funds does *little* to lower the overall cost of active investment management. Hence, this paper offers a potential explanation for why mutual fund fees decline extremely slowly in what would appear to be an intensely competitive industry (French (2008), Greenwood and Scharfstein (2013), Cochrane (2013), and Philippon (2015)).

Next, I investigate the economic mechanism for the price increase in the advice-mediated market segment. First, breaking down the total fees into components, I find a strong increase in the distribution fees which are mainly used to compensate brokers for their services,[4] and only a weak increase in the portfolio management fees. Therefore, the fee increase in the

[3]Section 5 elaborates on the identification assumption.

[4]Financial advisors are compensated out of total fees collected by mutual fund companies. Among all fee components, the sales loads and the 12b-1 fees are mainly used to compensate financial advisors for their sales efforts.

broker-sold channel is mostly driven by higher prices of financial advice after competition rises. This result is consistent with the idea that the new pool of broker-channel investors have higher willingness to pay for the trust relationship with their financial advisors.[5] Second, I examine whether the competitive pressure from Vanguard reduce fund flows to the incumbents. In the direct-sold channel, I expect actively managed funds to lose flows to the new competitor. In the broker-sold channel, fund flows may not be affected because broker-channel investors prefer fund products bundled with financial advice, which low-cost index funds do not provide. However, I find that actively managed funds in *both* distribution channels experience a decrease in their fund flows. For the broker-sold channel in particular, this suggests that a subset of investors give up the consumption of financial advice and switch – either to index funds in the direct-sold channel or to actively managed funds in that channel, which are now selling at reduced prices. The reduction in asset growths in the broker-sold channel is consistent with potential selection among the investors. Third, I directly investigate the selection effect, i.e., whether investors remaining in the advice-mediated segment demonstrate higher reliance on financial advice compared to the pre-index-fund market. Using distribution fees to approximate for financial advisors' sales incentives and their recommendations (Christoffersen et al. (2013) and Chalmers and Reuter (2015)), I find that the positive influence of distribution fees on fund flows *strengthens* in the broker channel after a Vanguard index fund enters the same investment category. This result implies stronger trust by the new pool of broker-channel investors in their advisors' recommendations. Moreover, financial advisors increasingly move investors to more expensive products in response to index fund competition.

I also show that portfolio adjustments by actively managed funds accompany the fee changes. Incumbents in both distribution channels increase their levels of active management when facing increased competitive pressure from index funds. In the direct-sold channel, I find evidence that portfolio differentiation appears to soften price competition. In the broker-sold channel, this result suggests that even funds sold with brokers' recommendations face pressure to become more actively managed. The reason may have to do with advisors'

[5] An alternative cost-based explanation which I do not rule out is that the new pool of broker-channel investors demand more service from financial advisors, for example, more hours of phone calls, thus driving the price increase for financial advice. The key idea of selection would still hold under this alternative explanation. Assume financial advisors always optimize, they need not change the service level had investors' composition stayed the same.

reputation concerns. As low-cost index funds become available in the market, recommending actively managed funds with closet-index portfolios becomes harder to justify. I find further evidence that the price of financial advice only goes up after competition if it is bundled with truly actively managed fund products.

This article contributes to the literature on the impact of financial advice on the money management industry. Bergstresser et al. (2009) show that advice provided by brokers does not deliver tangible value to investors and that broker-sold funds have lower risk-adjusted returns even before fees. Del Guercio and Reuter (2014) separate returns into raw and risk-adjusted returns and illustrate that only direct-channel fund flows chase risk-adjusted returns, leading direct-sold funds to invest more in active management and generate higher alpha. Gil-Bazo and Ruiz-Verdú (2008) and Del Guercio et al. (2010) provide theoretical investigation on mutual fund market segmentation. Christoffersen et al. (2013) document the agency problem in the broker channel by showing that brokers' incentives influence fund flows. Through an audit study, Mullainathan et al. (2012) find that financial advisors steer investors toward expensive actively managed products. Chalmers and Reuter (2015) show that having access to broker service leads to significantly lower after-fee performance for investors compared to the counter-factual case had the investors been defaulted into age-specific target-date funds. The contribution of the current paper is to examine how investors' reliance on financial advice interacts with competition to determine equilibrium prices in the money management industry.

With respect to the information costs facing retail investors, Sirri and Tufano (1998) find search costs to play an important role in determining fund flows, and show that the negative price sensitivity of fund flows is mitigated by a positive effect of distribution fees. Hortacsu and Syverson (2004) estimate the search costs among S&P 500 index funds, which have largely identical portfolios, and demonstrate that investors in load funds (a classification with a high degree of overlap with broker-sold funds) have higher search costs. Christoffersen and Musto (2002) show that asset attrition after poor performance leads money market funds to increase fees, because the remaining investors have exhibited low performance sensitivity through the self-selection. In addition, Berk and Tonks (2007) show that returns are predictable for the worst-performing funds, because the flow-performance relationship is weak. These studies emphasize the heterogeneous performance sensitivity, whereas the current paper reveals a different selection mechanism which is based on the degrees to which investors

trust financial advice. In addition, the cause of selection in the present setting is a rise in competition, rather than poor performance.

In addition, this paper extends the literature on the economics of competition in the mutual fund industry. Coates and Hubbard (2007) and Khorana and Servaes (2012) show that the growth rates and market shares of funds are negatively associated with fees. Wahal and Wang (2011) are the first to study entry competition in the money management industry and they find that the incumbents reduce their management fees but increase their distribution fees. Cremers et al. (2016) examine the relationship between indexing and active management in a cross-country study, and show that the availability of explicit index funds in a country leads to higher level of active management and lower fees among actively managed funds. These studies have focused on estimating the *mean* effect of competition. Complementing this literature, the current paper examines the self-directed and advice-mediated market segments separately. By considering the *heterogeneous* responses by different market players, the paper offers an explanation for the fact that fees of actively managed funds have tended to stay high despite strong forces of competition from passive funds in the recent decades.

The remainder of the paper is organized as follows. Section 2 provides background information on the market entry by Vanguard index funds. Section 3 discusses the theoretical framework. Section 4 describes the data. Section 5 introduces of the empirical strategy and discusses the identification assumptions. Section 6 presents the results, and Section 7 concludes.

2. Market Entry by Vanguard Index Funds

In recent decades, the entry of index funds, most notably those managed by the Vanguard Group, created a wave of significant competitive shocks to the actively managed fund industry. The concept of index funds originated in the early 1970s as scholars advocated the strategy of diversified low-cost passive investment.[6] Index funds build on several competitive advantages. First, the passive portfolio strategy brings significant cost savings, enabling index funds to charge fees substantially below those of the incumbents. Second, index funds

[6]Academic publications on the potential advantages of index funds include, for example, Malkiel (1973), Samuelson (1974) and Ellis (1975).

produce performance close to the benchmark, outperforming a large number of actively managed mutual funds.[7] Third, index funds reduce information asymmetry: unlike the case of actively managed funds, index fund investors know the quality in advance.

In 1969-1971, Wells Fargo Bank developed the first index fund account for a single pension fund client.[8] In 1976, the Vanguard Group launched the first index fund open to retail investors. The fund, named "Vanguard First Index Investment Trust", tracks the S&P 500 index. John Bogle, the CEO of Vanguard, aggressively promoted passive investment strategies. Though the First Index fund initially received skepticism, its growth took off rapidly after 1980. Vanguard has since grown to become the largest mutual fund company in the United States. The competitive pressure from Vanguard index funds has been a common topic of industry media coverage. For example, Henry McVey, research analyst at Morgan Stanley, once called Vanguard index funds "a category killer" (Lux (1999)). The Economist (2014) also argues that "... [I]nvestors are trading down from expensive brands to white-label goods. That may put many active managers out of a job."

Vanguard rolled out index fund products in a variety of investment categories at different points in time. In the U.S. domestic equity fund market which is the focus of this paper, Vanguard was almost always the first low-cost index fund player to enter the market. Table 1 Panel A lists the years of the introduction of Vanguard index funds and the details of the offerings. Three facts are particularly worth noting. First, the timing of the entry, a key variation exploited in this paper, is staggered across categories, enabling the analysis to identify the effect of competition while fully controlling for time trends. Second, each Vanguard fund introduction is followed by rapid growth in the market share of index funds in the respective category (see also Figure 1). As pointed out by Berk and van Binsbergen (2015), Vanguard index funds are broadly recognized as the least expensive method to hold well-diversified portfolios. For this reason, I use the introduction of Vanguard index funds as the timing of competitive shocks.[9]

[7]The performance of actively managed mutual funds has been a topic under extensive study. See Berk and van Binsbergen (2015) for a review of this literature.

[8]In the early 1970s, Batterymarch Financial Management and American National Bank in Chicago also experimented with index fund products, but like Wells Fargo, these funds were not available to retail investors.

[9]Several Lipper investment categories (listed in Table 1 Panel B) did not directly face entry by Vanguard index funds during the sample period. In the main body of the analysis, I limit my sample to the investment categories entered by Vanguard. In a robustness analysis, I show that the results are unchanged if I extend to the full sample including all Lipper categories.

Third, while product entry is generally endogenous to market conditions, Panel A shows that the drivers for the specific timing of Vanguard product introductions are in fact largely *idiosyncratic*. The details listed under "timing determinant" summarize from the history of Vanguard written by its CEO John Bogle (Bogle (1997)) the considerations by Vanguard with respect to the timing of its product introductions. For example, Vanguard introduced the First Index fund in 1976 after academics strongly encouraged the invention of passive investment vehicles. In 1987, Bogle had the idea to build a fund family, and a natural step for him was to roll over to the next segment of stocks in terms of market capitalization, hence he introduced the "Extended Market Fund". The "Small-Cap Index Fund" was introduced in 1989 because a former actively managed small-cap fund was under-performing, and Bogle "impulsively" terminated it, converting it into an index fund. Vanguard introduced the "Growth Fund" and the "Value Fund" in 1992 because the BARRA growth and value indices became available in that year, and the "Total Stock Market Portfolio" was introduced to make it "more convenient to hold the entire market". Based on the above evidence, the *timing* of the competitive shocks studied in this paper is plausibly *orthogonal* to the outcome variables, allowing for a causal interpretation of the DD estimation. I further elaborate on the identification assumption in Section 5.

3. Theoretical Framework

A commonly-held economic intuition is that increased competition generally leads to lower prices. However, considering the vertical segmentation of the mutual fund market makes more nuanced predictions about competition. Below, I present a brief theoretical framework where competition can lead to increased prices in the advice-mediated segment of the market.

- Investor Heterogeneity and Market Segmentation

First consider a market of actively managed mutual fund products for retail investors before the invention of the index fund. Investors differ in the costs they incur to process the information on mutual fund products (Sirri and Tufano (1998)), thus, there is a distribution in the investors' valuation for the hand-holding services provided by financial advisors (Gennaioli et al. (2015)).

The market offers unbundled fund products through the direct-sold channel, where investors directly transact with fund companies, and it offers funds bundled with financial advice through the broker-sold channel, where investors make fund purchase decisions with advice from brokers. The market is vertically segmented, and investors in the broker channel pay a fee premium for the service – the "add-on" product. In the equilibrium, investors who do not have the ability or time to evaluate fund products on their own will select into the broker-sold channel and pay a high price. Their fund choice is subsequently influenced by the brokers' recommendations. Meanwhile, investors with lower valuation for advice will choose the self-directed channel and pay a low price. The fee difference between the two channels equals the marginal investor's valuation for financial advice.

- Market with Low-Cost Index Fund Player

Now consider the same market with an entering index fund. As discussed in Section 1, I assume that the low-cost feature of the index fund precludes it from broker distribution – largely because brokers have lower incentives to sell index funds (Mullainathan et al. (2012)) – therefore, the index fund is available solely through direct sales. I expect price competition to be the main force in the direct-sold channel. However, the competitive pressure should be weak in the broker-sold channel because the entering index fund does not provide the financial advice which broker-channel investors value. Instead, as competition lowers the price in the direct-sold channel, the fee premium charged for broker advice can exceed the marginal investor's valuation for advice, thus, relatively well-informed investors (with relatively lower valuation for advice) can leave the broker-sold channel. As a result of this *selection* effect, investors remaining in the broker channel are the type who are the least informed and have the most trust in financial advisors. Consequently, broker-sold funds may raise fees, because the remaining investors have revealed higher willingness to pay for advice. Another testable implication is that, because of their higher trust, the new pool of investors are more likely to purchase the funds that brokers are most incentivized to sell (Christoffersen et al. (2013)).

4. Data

4.1. Data Sources

This paper uses data from the Center for Research in Security Prices (CRSP) Survivor-Bias-Free Mutual Fund Database.[10] Data on mutual fund fees, returns and other characteristics, share class, fund and fund family identifiers, as well as investment category classifications are downloaded from this database. The sample contains annual data on general U.S. domestic equity funds during the years 1970-2005. As this study focuses on the retail mutual fund sector, I drop all institutional share classes.

One weakness of the CRSP data is that it does not explicitly identify the distribution channels of the fund share classes, therefore, I take two approaches to classify the shares. First, I use the fee structure to approximate for the distribution channels. I follow the definition of "no-load" funds in ICI (2013) to identify the share classes sold through the direct channel, since "no-load" and "direct-sold" are often used interchangeably in the industry. In particular, I classify a fund share class in the CRSP database as direct-sold if it charges no front or back load, and has an annual distribution fee ("12b-1" fee) of no more than 25 basis points. In contrast, a share class is considered broker-sold if it charges either a front load, a back load, or a 12b-1 fee larger than 25 basis points. Second, I obtain share-class level distribution channels from the Financial Research Corporation (FRC) database which classifies retail share classes as either broker- or direct-sold.[11] I cross-validate the channel classification obtained from the two methods above. FRC channel classifications have good coverage for 1992-2004. During this period, 88 percent of the channel indicators created using fee approximations are consistent with those indicated by the FRC data. However, the match rate between FRC and CRSP is low in the first half of the sample. For the main body of the paper, I use channel classifications based on the fee schedules. To alleviate concerns over classification errors, I show in the robustness section that the main results are robust if I adopt the limited sample with the FRC channel classifications.

Because the decisions on strategic fee adjustments are made at the fund level for its

[10] Carhart (1997), Elton et al. (2001) and Carhart et al. (2002) describe the details of this database.

[11] See Bergstresser et al. (2009) and Del Guercio and Reuter (2014) for a detailed description of the FRC database. FRC has discontinued providing fund distribution channel data and is now owned by Strategic Insight.

given distribution channel(s), the main analysis uses fund-channel level observations which combine different share classes of the same fund in the same distribution channel. For fund fees, I take the equal-weighted average within fund-channel, so as to reflect the average price of the alternatives offered by a fund.[12] The size of a fund-channel is calculated as the sum of assets in all share classes of the fund-channel, the age measures the years since the inception of the oldest share class, and all other fund-channel level characteristics are calculated as size-weighted averages among the share classes within a fund-channel. The final sample used for the difference-in-differences regressions, which includes the investment categories entered by Vanguard during the sample period, contains 2,733 fund-channels and 16,796 observations. The detailed sample selection and data cleaning procedure is described in Appendix 1.

To define the investment categories of funds, I use the Lipper portfolio-based classifications on U.S. domestic equity funds. The reporting of Lipper classification in CRSP starts in 1999, and I back-fill the categories for the earlier period. Prior research implies that mutual fund name and style changes were rare before 1999 (Cooper et al. (2005)), so the measurement errors created by the back-filling should be limited. Another problem with back-filling is that it may create a survivor bias, as funds that closed before 1999 would not have a classification. To mitigate this problem, I use the self-declared benchmarks data (starting in 1980) from Antti Petajisto's website,[13] and rely on them to assign categories for the funds whose Lipper categories are not available. In sum, I obtain the investment categories for 94 percent of all observations. To measure the levels of active management, I use data on active share and tracking error calculated by Cremers and Petajisto (2009). Lastly, monthly benchmark index returns used to compute benchmark-adjusted returns are obtained from Compustat North America Index Prices.

4.2. Definitions of Variables

Mutual Fund Fees

Investors usually pay different types of fees to buy and hold mutual funds, and these fee

[12]The results are robust to using size-weighted average fees. However, size-weighted fees reflect not only the prices set by fund companies but also the choices made by the investors. This paper focuses on former, thus it uses the equal-weighted fees as the main outcome variable.

[13]See Petajisto (2013) for details of the dataset.

items are quoted as percentages of assets under management. In the broker channel, three types of fees are the most common: a sales load up front, called the front load, a back load at the redemption of the fund, and an annual expense ratio. An annual distribution charge (12b-1 fee) is often included in the expense ratio. In the direct channel, the investment cost is usually only the annual expense ratio which may include a small 12b-1 fee. Following the literature, I calculate the total fee paid by investors as the expense ratio plus total loads amortized over a seven-year holding period.[14]

Fund Flows

I calculate net fund flows at fund-channel level as the percentage growth in assets in excess of the growth that would have occurred given the investment return had no new money flowed in, and had all dividends been reinvested. The calculation follows:

$$Flow_{i,t} = \frac{TNA_{i,t} - TNA_{i,t-1} \times (1 + R_{i,t})}{TNA_{i,t-1}}, \tag{1}$$

where $TNA_{i,t}$ is fund-channel i's total net assets at the end of year t and $R_{i,t}$ is the return over year t.

The fund flow measure is very volatile. To reduce the influence of the outliers, I drop the observations where lagged total net assets are below one million dollars, and winsorize the observations where the net fund flow percentage is larger than 300 percent.

4.3. Summary Statistics

Table 2 reports the summary statistics for actively managed funds, and it contrasts the characteristics between the broker channel and the direct channel. In comparison, the table also reports characteristics of Vanguard index funds.

The fee structure across market segments reflects vertical product differentiation. On average, an actively managed mutual fund in the broker channel costs a total fee of 2.19% per year, out of which 1.58% is the expense ratio, and 0.61% represents amortized total loads. The average total fee in the direct channel is lower, at 1.21% per year. Following

[14]Sirri and Tufano (1998) estimate that the implied average holding period of U.S. equity mutual funds is approximately seven years. I make the same assumption for the sample period in this paper, 1970-2005. The main results of this paper are largely robust under alternative calculations of the total fee, for example, using amortization periods of five or nine years, or excluding the back load.

Gil-Bazo and Ruiz-Verdú (2009), I divide the total fee into a distribution fee – calculated as the amortized loads plus the 12b-1 fee, and a non-marketing (mostly management) fee – the expense ratio minus the 12b-1 fee. The distribution fee in the broker channel is used to compensate the brokers for their advice and sales efforts, whereas in the direct channel, it covers advertising costs. Consistent with a vertical differentiation model, the price of portfolio management (the non-marketing fee) is equal across the channels, and investors in the broker channel pay a price premium for the brokers' advice.

The statistics in this table also highlights Vanguard as a low-cost and large-scale competitor for the actively managed funds. Distributed to retail investors solely through direct sales, Vanguard index funds on average charge a fee of 22 basis points per year, which is one fifth of the fee in the direct channel. Vanguard index funds grow at much higher rate than the actively managed funds, highlighting it as a strong competitive force. The average annual fund flow rate is at 43% of lagged assets, compared with 21% (23%) in the direct (broker) channel. The passive portfolio holdings of index funds are also evident. I examine two measures of active management which are used in Cremers and Petajisto (2009). Active share is defined as the sum of portfolio weight differences between an actively managed fund and its benchmark index. Among actively managed funds, the average active share is 0.82 (0.80) in the direct (broker) channel, implying that 18% (20%) of the portfolios overlap with the benchmark. Tracking error, which measures the standard deviation of the fund return around the benchmark return, is on average 8% (7%). For Vanguard index funds, in contrast, the active share is only 0.17, and the tracking error is 1%.[15]

Turning to the control variables, we observe that certain fund characteristics differ across the channels. For example, the direct channel has higher turnover ratio and outperforms the broker channel in terms of benchmark-adjusted returns. One may suspect that funds with different characteristics naturally react to competition in different ways. In the robustness section, I show that even after allowing all co-variates to interact with the effect of competition, the difference in the competitive responses between the channels remains significant.

[15]The statistics show, consistent with Cremers and Petajisto (2009), that index funds in fact do not perfectly overlap with benchmark portfolios.

5. Methodology

I examine the effect of index fund competition on various outcome variables with a difference-in-differences methodology. Using fund-channel level data, the regression I estimate is:

$$\begin{aligned} Y_{ijt} =& \tau_0 Post0to4_{jt} + \tau_1 Post0to4_{jt} \times Direct_i + \tau_2 Post5+_{jt} + \tau_3 Post5+_{jt} \times Direct_i \\ &+ \lambda Direct_i + X_{ijt}^{'}\delta + \phi_j \times t + \psi_t + \alpha_i + \gamma_0 Pre5-_{jt} + \gamma_1 Pre5-_{jt} \times Direct_i + \epsilon_{ijt}, \end{aligned} \tag{2}$$

where i indexes fund-channels, j refers to investment category, and t indexes time. Y_{ijt} is the dependent variable of interest. In the analysis of this paper, Y_{ijt} represents fees, net fund flow, or the degree of active management.

As the series of Vanguard fund introductions spreads out over more than two decades, the "Post" dummy variable in a general DD specification is split into $Post(0to4)$ and $Post(5+)$, indicating, respectively, years zero through four after Vanguard's entry into category j as well as years five and beyond. The purpose is to identify whether the estimated effects arise in a relatively short period or in the longer term: The former is likely to support a causal interpretation, while the latter may be confounded by long-run market trends.[16] I also dummy out observations more than five years before Vanguard entry with an indicator variable $Pre(5-)$, to exclude these observations from estimating the pre-event window. The main coefficients of interest are τ_0 and τ_1. τ_0 gives the short-term effect of index fund competition in the broker channel. τ_1 measures the *difference* in the effects between the broker channel and the direct channel, and the net effect for the direct channel is given by $\tau_0 + \tau_1$. τ_2 and $\tau_2 + \tau_3$ measure the long-term adjustments, but as indicated above, they could also reflect long-term trends.

In addition, $Direct_i$ is an indicator that equals one if fund-channel i is distributed through the direct channel. X_{ijt} are category-level and fund-channel-level control variables which are listed in Table 2. ϕ_j, ψ_t and α_i are category, year and fund-channel fixed effects, respectively, and the specification allows the outcome variables in different categories to be on separate

[16] In Section 6, I also estimate dynamics in the effects by replacing $Post(0to4)$ and $Post(5+)$ with a series of dummy variables to indicate one year before, the year of entry, one year after, as well as two and more years after entry.

linear trends. ϵ_{ijt} is the error term.

The DD methodology using panel data to estimate the impact of index fund competition improves upon a cross-sectional specification. Index funds could choose to be in the markets where it expects to be profitable, thus, cross-sectional estimates of the effects of index funds are not desirable, because omitted variables such as abilities of fund managers can affect both the index fund's decision to enter a sub-market and the fees of the actively managed funds. The DD strategy addresses this problem by fully controlling for the unobserved reasons that Vanguard chooses to be in certain categories. The estimation exploits only the time-series variation in the degree competition at the introduction of index funds. Another advantage of the empirical set-up is that the multiple entry events by Vanguard are staggered over time, which allows me to separate the effect of competition from time-varying industry characteristics. For example, the U.S. mutual fund industry grew substantially over the past decades and became increasingly competitive (Wahal and Wang (2011)). A full set of year fixed effects in the DD strategy control for such broad industry trends, while the effects of competition are identified through comparing the changes in affected categories with those in unaffected categories.

At each time t, funds experiencing the offering of a Vanguard index fund in the same category are "treated" in the sense that they face increased competitive pressure, while other categories not currently affected by the entry are taken as control. The specification first takes a difference in the outcome variables of actively managed funds before and after each entry. Then, it compares the differences in the treatment and control groups and takes a second difference. In addition, it allows the estimated effects to be different for the fund-channels in the broker-sold and the direct-sold channels.

Identification Assumption

For equation (2) to identify the causal effects of index fund competition, we must assume that $Post(0to4)$ and $Post(5+)$ are uncorrelated with the error term ϵ_{ijt}. As the regression controls for category- and even fund-channel fixed effects, this identification assumption is satisfied if, conditional on entry, the exact *timing* of Vanguard index fund introduction is uncorrelated with the outcome variables.

I evaluate the validity of the identification assumption from three aspects. First, I rely on the history of Vanguard written by the CEO John Bogle (Bogle (1997)) to infer the determinants for the product timing, and the drivers are listed in Table 1, Panel A. As

discussed in Section 2, the timing appears to be a function of *idiosyncratic* decisions by John Bogle. Second, I estimate a hazard model using data at the investment category level to assess the drivers for the timing of Vanguard index fund entry. In particular, I estimate how entry correlates with characteristics such as market size and concentration, as well as with lagged fees in the broker and direct channels. The result is presented in Table A.2. The independent variables in this table are lagged two-year averages. The result suggests no systematic determinant for the timing of Vanguard fund introduction, thus lending further support for the assumption that the timing of the entry is quasi-exogenous. Third, I directly investigate the dynamics in the effects under the DD framework. If Vanguard chose to enter investment categories based on past trends, one might expect an "effect" even prior to the actual entry. As presented in the next section, I do not find any effect before Vanguard's entry. Hence, the reverse causality story does not seem to be the case.

6. Results

6.1. Main Results: Fee Reactions

Table 3 reports the ordinary least squares estimates of equation (2). The dependent variable is the total fee expressed in percentage points. The coefficients on $Post(0to4)$ and $Post(5+)$ represent the effects of Vanguard index fund entry on fees in the broker channel in years zero through four post entry and year five and beyond post entry, and the coefficients on the interaction terms with the direct channel dummy represent the differential reactions between the two channels. The net effects in the direct channel are calculated using the delta method and presented at the bottom of the table. Columns (1)-(3) use fund-channel level data. These regressions include category fixed effects – to control for the fixed differences in fees between categories, year fixed effects – to control for the evolution in fee levels from year to year, and channel fixed effects – to account for the fact that broker-sold funds are more expensive than direct-sold funds. The fees in different categories are allowed to be on separate linear trends. In addition, the regressions control for category-level characteristics such as lagged category fund flow, return, size and concentration, the descriptions of which are presented in Table 2. I cluster the standard errors by management company, to account for serial correlations in mutual fund fees and for cross-sectional correlations within fund families.

Column (1) presents a baseline estimation of equation (2) without fund-channel fixed effects or fund-channel level co-variates. It shows that competition from a Vanguard index fund in a category *increases* the fees of broker-sold actively managed funds in the same category by 13 basis points (six percent of the mean) in the first five years since the entry, meanwhile, it *decreases* the fees of the direct-sold active funds by 11 basis points (nine percent of the mean). The long-term estimates suggest these effects are permanent.

The number of funds in the market has increased dramatically over the sample period. It could be the case that the existing funds adjust their fees in response to competition; alternatively, entry and exits may drive the estimates. To assess the intensive margin, Column (2) includes fund-channel fixed effects. In addition, it controls for fund-channel level time-varying control variables, including characteristics documented by previous research to determine mutual fund fees. The result for the broker channel remains unchanged, while the magnitude of the fee reduction in the direct channel drops to 6.4 basis points (five percent of the mean). The smaller magnitude is due to the inclusion of fund-channel fixed effects and suggests that part of the fee reduction in the direct channel is attributed to exits of high-fee funds or the entry of low-fee funds. The coefficients on the fund-channel level control variables are consistent with the literature: Total fees are negatively correlated with fund size, age, fund family size, benchmark-adjusted return, and positively correlated with the turnover ratio and fund return volatility (see, e.g., Carhart (1997), Gil-Bazo and Ruiz-Verdú (2009)).

In Column (3), I study the dynamics in the fee adjustments. The regression replaces $Post(0to4)$ and $Post(5+)$ with four dummy variables: $Before(-1)$ is a dummy that equals one in a category one year before Vanguard index fund enters this category, $Post(0)$ indicates the year of Vanguard entry, $Post(1)$ refers to one year after Vanguard entry, and $Post(2+)$ takes on a value of one for observations at least two years after Vanguard entry. I also include the interactions of these dummy variables with $Direct$. The result finds no price reactions *prior* to the introduction of Vanguard index funds - the coefficients on $Before(-1)$ and $Before(-1) \times Direct$ are small and insignificant, thus, reverse causality is unlikely. We observe significant effects on fees in the year of Vanguard index fund entry (coefficients on $Post(0)$ and $Post(0) \times Direct$), and the magnitudes are smaller than those of the permanent effects (coefficients on $Post(2+)$ and $Post(2+) \times Direct$).

In Columns (4)-(5), I turn to investigate the effect of index fund competition on the

aggregate price of actively managed funds. The dependent variables are weighted-average total fees at the category-by-channel or the category level, and the weights are lagged asset size. Standard errors in these two columns are clustered by investment category. Column (4) suggests that Vanguard index fund introduction leads to an increase in the average fee in the broker-sold channel by 10.5 basis points, and a decrease in that in the direct-sold channel by 9.3 basis points. Column (5) shows that due to the offsetting effects in the two distribution channels, the average *overall* price of active management after combining both channels decreases only by three basis points which is also not statistically significant. Therefore, competitive pressure from Vanguard index funds does *little* to lower the aggregate fee of actively managed funds. Hence, I offer an explanation for the observation by several recent studies that mutual fund fees decline only slowly despite the high level of competition in this industry (French (2008), Greenwood and Scharfstein (2013) and Cochrane (2013)).

6.2. Economic Channel

I now turn to investigate the economic channel through which broker-sold funds increase their fees as a result of increased competition. Motivated by Section 3, I examine whether the fee increase can be explained at least in part by a change in the composition of broker-channel investors toward the types more trusting of financial advice.

First, in Table 4, I divide up the total fee into a distribution fee and a non-marketing fee, following Gil-Bazo and Ruiz-Verdú (2009). The distribution fee is calculated as the amortized loads plus the 12b-1 fee and, in the broker-sold channel, it is mainly used to compensate the brokers for their efforts. The non-marketing fee is the expense ratio minus the 12b-1 fee and it represents the price of portfolio management. Column (1) does not control for fund-channel fixed effects or the fund-channel level co-variates, while Column (2) controls for them. The results show a strong and significant increase in the distribution fee in the broker channel. The magnitude is 7.7 basis points, which explains 63 percent of the total fee increase in the broker channel (12.2 basis points). This result is consistent with the idea that the new pool of investors in the broker channel are willing to pay a higher price for financial advice. Columns (3)-(4) find weak evidence that these investors also pay a higher non-marketing fee (mainly portfolio management fee), implying a plausible small positive correlation between the investors' willingness to pay for financial advice and

their willingness to pay for active management. Turning to the effects in the direct-sold channel, even though its demand elasticity may also change,[17] price competition is likely to dominate in this segment due to the strong competitive force from Vanguard. The bottom rows of Table 4 presents the net effects in the direct-sold channel. We see reductions in both the distribution fee and the non-marketing fee. Columns (1)-(2) show that direct-sold actively managed funds cut the distribution fee by about 3 basis points. The average non-marketing fee in the direct channel decreases by 8.5 basis points (Column (3)), and this effect becomes insignificant after I control for fund-channel fixed effects (Column (4)), suggesting the effect may be driven by the extensive margin, i.e. the exits of direct-sold funds with high management fees. Overall, price competition appears to dominate in the self-directed market segment. Though distribution expenditure (e.g., advertisements) would also improve sales in the direct-sold channel, evidence suggests the incumbents face pressure to cut marketing fees as well as management fees.

Second, I estimate how index fund competition affects fund flows to actively managed funds, in particular, whether even the advice-mediated segment of the market loses a subset of potential investors. As Vanguard enters the market solely through direct sales, I expect that competition reduces fund flows to direct-sold actively managed funds. For broker-sold funds, index funds cannot substitute for the financial advice piece in the bundle. As financial advice becomes costlier at the margin, however, relatively well-informed investors in the broker-sold channel may switch away, either to index funds or to direct-sold actively managed funds that now sell at reduced fees. In this case, flows to broker-sold actively managed funds should also decline. Table 5 reports the estimates of equation (2) using net fund flows to actively managed funds as the dependent variable. The regression compares the changes in the growth rates of actively managed funds in categories affected and unaffected by the competition, and an estimated negative effect implies a relative slowdown in the funds growths compared with the case had index funds not entered. Standard errors in this table are clustered by year to adjust for cross-sectional correlations in fund flows.

Columns (1)-(3) use fund-channel level data. Column (1) does not control for fund-channel fixed effects or micro co-variates. The result suggests that the net average fund flow

[17]The directs-sold actively managed funds may absorb the marginal demand leaving the broker-sold segment, which would have higher search costs compared with the original self-directed investors. In addition, the most price-elastic investors in the direct channel may move to the index fund.

of actively managed funds declines in both distribution channels. Therefore, competition from direct-sold Vanguard index funds not only takes away investors from direct-sold actively managed funds, which they compete with head on, but also it reduces the growths of broker-sold funds. The magnitude of the effect is about a 15 percent reduction in net fund flow, which is substantial, considering that the mean is 22 percent. Column (2) includes fund-channel fixed effects and fund-channel level co-variates which are likely to determine flows. The results are robust and the coefficients on the co-variates are consistent with prior studies on fund flows. Larger funds tend to grow at a slower rate, meanwhile, funds in larger families or that have better performance growth faster. In Column (3), I study dynamics in the effects on fund flows. The result suggests no decline in fund flows before the entry of Vanguard – the coefficients on $Before(-1)$ and $Before(-1) \times Direct$ are small and insignificant. Therefore, it is not the case that Vanguard chose to enter the categories where the actively managed funds were already losing flows from investors. Instead, the reduction in fund flows occur after the entry of Vanguard, supporting a causal interpretation of the result. Another interesting observation is that the largest negative impact on fund flows occurs in the year of entry and the following year, which implies a relatively fast asset re-allocation when the index fund enters the market.

In Columns (4)-(5), I examine the effect of index fund competition on aggregate fund flows calculated using actively managed funds only. Column (4) uses net fund flows at the category-by-channel level as the dependent variable. The result shows an overall negative impact on the broker-channel fund flows, suggesting that a subset of the original pool of investors give up the consumption of financial advice and switch away, either to direct-sold index funds or to direct-sold actively managed funds which become cheaper under the competitive pressure, thus, the remaining pool can be different. Turning to the direct-sold segment, it is possible that it absorbs part of the demand leaving the broker-sold segment. However, at the same time, it loses flows to the index fund. Therefore, the net effect in the direct channel is an empirical question: the two effects might cancel out. However, the result suggests that the negative impact of the index fund outweighs any asset re-allocation from broker-sold to direct-sold actively managed funds, and on net, direct-sold actively managed funds experience a slow-down in their growth rates. Column (5) uses category-level net fund flows (after combining both channels) as the dependent variable and shows that competition from Vanguard index funds negatively affects the growths of actively managed assets in the

affected investment categories.

Third, I examine the hypothesis that the remaining investors in the broker-sold segment after the low-cost Vanguard index fund introduction are the types with higher degrees of trust in their financial advisors. To test this hypothesis, I use the distribution fee to approximate for the brokers' sales incentives, and estimate the change in the sensitivity of fund flows to the distribution fees in the broker-sold channel. The regression uses fund-channel level data of only the broker channel and follows a DD specification:

$$\begin{aligned} Flow_{ijt} =& \beta_1 Post0to4_{jt} \times Distrn_{ijt-1} + \beta_2 Post5+_{jt} \times Distrn_{ijt-1} \\ &+ \psi_t \times Distrn_{ijt-1} + \phi_j \times Distrn_{ijt-1} + \beta_3 Post0to4_{jt} + \beta_4 Post5+_{jt} + X'_{ijt}\delta \\ &+ \beta_5 Pre5-_{jt} \times Distrn_{ijt-1} + \beta_6 Pre5-_{jt} + \epsilon_{ijt}, \end{aligned} \tag{3}$$

where i indexes fund-channels, j refers to investment category, and t indexes time. The dependent variable $Flow_{ijt}$ is the percentage net fund flow. $Distrn_{ijt-1}$ stands for the lagged distribution fee of fund-channel i. X_{ijt} includes category-level and fund-channel level control variables. $\psi_t \times Distrn_{ijt-1}$ controls for the variation in the flow-to-distribution-fee sensitivity from year to year, and $\phi_j \times Distrn_{ijt-1}$ controls for different sensitivity across investment categories. The estimation compares the changes in flow sensitivity in categories affected and unaffected by Vanguard index fund competition, and the coefficients β_1 and β_2 estimate the short-term and long-term effects of competition. Under the null hypothesis that there is no investor composition change in the broker channel, we expect β_1 and β_2 to be zero. Similar to equation (2), I use $Pre(5-)$ to dummy out the period more than five years before the entry to exclude these observations from estimating the fee sensitivity in the "pre" window.

Table 6 reports the estimate of equation (3) for the broker channel. Column (1) shows positive estimates for β_1 and β_2. Therefore, fund flows become *more* positively influenced by distribution fees after the Vanguard entry. A 10-basis-point increase in the distribution fee can increase fund flows by an additional 2.6% in the short term after the entry, and the effect is long-lasting. Column (2) estimates the sensitivity of fund flows to both distribution fees and non-marketing fees in the same equation. The result in Column (1) stays robust, and I find no change with respect to non-marketing fees. Therefore, accompanying the reduction in fund flows to broker-sold funds following index fund competition, brokers also

become more likely to channel demand into products which they are incentivized to sell. This result suggests that the pool of broker-mediated investors are indeed more reliant on financial advice compared to the pre-index-fund case.

I further investigate whether it is selection on trust or selection on performance sensitivity (e.g., Christoffersen and Musto (2002) and Berk and Tonks (2007)) that drives my finding. In Column (3), I replace distribution fee with benchmark-adjusted performance in equation (3), and find no change in the flow-performance sensitivity. Column (4) shows that the change in the distribution fee sensitivity stays positive and significant even after fully controlling for any potential changes in performance sensitivity. Overall, Columns (3)-(4) suggest that selection based on heterogeneous degrees of trust in financial advisors, rather than selection based on heterogeneous performance sensitivity, drives the findings in this paper.

6.3. Changes in Portfolios and Cross-Sectional Heterogeneity

Fees and portfolios are decisions simultaneously determined by fund companies. Hence, in addition to price adjustments, I examine whether portfolios of actively managed funds change as a result of index fund competition. In the direct-sold channel, funds face a sudden rise in the competitive pressure, and they may engage in product differentiation to soften the price competition (Shaked and Sutton (1982)). In the broker channel, the expected reaction is less clear-cut. The portfolios in the broker channel may not be affected at all as there is no direct increase in the pressure of price competition. However, it is possible that even the less-informed investors in the broker channel learn about the index funds, in which case it may become difficult for the brokers to justify recommending closet-index funds. In this scenario, broker-sold funds may also have an incentive to differentiate their portfolios from the index.

I estimate the effects of Vanguard index fund entry on the degrees of active management by estimating equation (2) using the active share and the tracking error as the dependent variables, and the results are reported in Table 7. Columns (1)-(2) show that the introduction of a Vanguard index fund leads actively managed funds to increase their active share, i.e. to reduce their portfolio overlap with the benchmark, by about 0.02 (2.5 precent of the mean), and there is no difference between the broker channel and the direct channel. Column (3) evaluates dynamics in the effects. In line with a causal interpretation, we see no pre-existing

trends in the portfolios. In addition, the increase in active share is the strongest in the year(s) right after the entry, suggesting that fund managers take immediate adjustments in portfolio strategies. However, the impacts of index fund competition on portfolios appear temporary and are much weaker in the long run. Columns (4)-(6) reveal similar effects on tracking errors of actively managed funds.

The finding that index fund competition increases active management is interesting given that Cremers and Petajisto (2009) and Stambaugh (2014) have shown that aggregate active share and tracking error have *declined* substantially over the period. The trends coincide with the increasing market share of passive funds, however, with a difference-in-differences strategy, this paper demonstrates that competition from index funds causes the level of active management to go up.

To examine whether portfolio strategies interact with pricing strategies, I estimate the impact of Vanguard index fund entry on fees conditional on different degrees of active management. Table 8 presents the results of this cross-sectional heterogeneity analysis. The main DD specification in equation (2) is estimated separately in two sub-samples based on whether the lagged active share is above the median (the "truly active" funds) or below the median (the "closet-index" funds) in a category. Columns (1) and (2) compare the reactions in total fees in these two groups. Among broker-sold funds, the truly active funds increase the total fee by 14 basis points, while the closet index funds increase that by a small and insignificant amount (a one-sided test for the difference in the coefficients between the two groups has a p-value of 0.07). The downward price pressure in the direct channel is stronger for the closet-index funds (p-value of the difference is 0.08), suggesting that a higher degree of active management can indeed soften price competition. Columns (3)-(4) examine the distribution fee as the outcome variable, and again finds the increase to be stronger among the truly active funds. The difference between the two groups has a p-value of 0.15. The results in Table 8 suggest that the price of nancial advice only goes up after competition if it is bundled with truly actively managed fund products. One possible explanation is that after the index fund's entry, financial advisors may lose investors' trust if they recommend closet indexed products. Thus, closet-index funds may not find it optimal to increase sales compensation to brokers, because they are unlikely to profit from this strategy.

6.4. Robustness

Miscellaneous Robustness Checks

I now examine the robustness of the main findings in this paper in Table 9. One concern is that approximating the distribution channels using the fee schedules may lead to misclassification. To assess this potential problem, Columns (1)-(2) replicate the main analysis using the distribution channel identifiers from the FRC database. The weakness of the FRC data is that they are unavailable before 1992, and using back-filled data may create survivor bias. However, Columns (1)-(2) show that the main results of this paper carry through when we rely on the sub-sample that has FRC channel classifications.

Columns (3)-(6) present the main results using alternative regression specifications. Column (3) addresses the concern that funds in different channels have different characteristics which can mechanically lead to different fee responses during competition. In this regression, I include interactions of the pre- and post dummy variables with all fund-channel level co-variates, thus explicitly controlling for different reactions to competition by funds with different characteristics. Because of these interaction terms, the coefficient on $Post(0to4)$ no longer represents the effect in the broker channel, and the net effect on the direct channel cannot be directly computed. Instead, the net effect for each channel is evaluated at the means of the co-variates for this channel and presented in the highlighted (middle) rows. We see that broker-sold funds increase fees by 6.8 basis points, and direct-sold funds cut fees by 11.7 basis points under this specification. In Column (4), I interact all co-variates with all year dummies to allow for the possibility that funds with different characteristics may be experiencing different shocks in any year, and the results still hold.

Strategic decisions of mutual funds are often made at the fund family level. This paper does not focus on explaining the strategic behavior of fund families, however, the staggered feature of Vanguard index fund entry allows me to identify the effects of competition even conditional on the time-varying strategies of fund families. The reason is that fund families usually offer products across different investment categories, yet Vanguard index funds affect different categories at different points in time. Thus, the DD specification can be estimated even with fund family-by-year fixed effects.[18] The result in Column (5) shows that when Vanguard introduces an index fund, the actively managed funds affected by the competition

[18]Due to the large number of fixed effects in this regression, this specification does not include fund-channel fixed effects.

adjust fees even relative to other funds in the same fund family and year that are unaffected by competition.

Lastly, Column (6) uses the full sample with all investment categories including the ones not entered by Vanguard during the sample period 1970-2005. For the non-Vanguard-entry categories, I use the ETF entry years as the timing of the competitive shock, the dates of which are listed in Table 1, Panel B. The estimated effects are similar to those obtained using Vanguard entry only.

Placebo Tests

Although we have strong reason to believe that the timing of Vanguard index fund introduction is orthogonal to fee policies of the incumbents, there may still be concerns that some particular trends in fees may spuriously drive the estimates. To make sure this possibility does not drive my results, I perform placebo tests using *randomly-generated* fictitious years for the onset of index fund competition. I conduct the simulation five hundred times and in each trial estimate the DD regression specification (equation (2)) using the total fee or the distribution fee as the dependent variable. Figure 2 plots the histograms of the coefficients. Comparing the estimates obtained using the actual Vanguard entry dates (i.e. Tables 3 and 4) and the distributions of placebo coefficients produces the bootstrapped p-values for the former, which I also report in Figure 2. Across the estimated effects, the boostrapped p-values are smaller than 5%, thus they are unlikely to be caused by spurious correlations.

7. Conclusion

This paper studies what happens to the price of advice-mediated financial products under increased competition. There has been continuing public debate about whether competition protects retail investors in the money management industry, and this paper highlights the differential responses in the self-directed segment and the advice-mediated segment of the market. Exploiting the staggered introduction of low-cost Vanguard index funds as quasi-exogenous shocks, I find that direct-sold incumbents cut fees under the competitive pressure, however, broker-sold funds raise their fees. I shed light on the mechanism by showing a change in the demand elasticity in the broker-sold channel. In particular, fund flows become more positively influenced by brokers' sales incentives, suggesting the remaining pool of investors are more reliant on advisors' recommendations.

Overall, the results emphasize that intensified price competition in the market segment with sophisticated investors can make advice-dependent investors worse off. Due to the opposite effects across the channels, competition from index funds may have little impact on reducing the overall price of active investing. This paper suggests that policy efforts aimed at encouraging more competition in the money management industry may have unintended consequences, especially if financial advisors have low incentive to sell the low-cost products. Instead, policies aimed at limiting the agency cost of financial advisors can prove effective. The identification strategy in this paper can prove useful for studying other important questions on the market structure in the money management industry. Broader implications of the continued trend toward passive investing also deserve further research.

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Table 1. Timing of Index Fund Entry

Panel A presents the years of the initial Vanguard index fund entry into U.S. domestic equity (Lipper) investment categories during 1970-2005. Introduction dates and fund names are based on information obtained from CRSP Survivor-Bias-Free U.S. Mutual Fund Database as well as Bogle (1997). Determinants for the timing are summarized from Bogle (1997). Panel B lists the investment categories not entered by Vanguard during the sample period, together with the dates when these categories first experience competitive threats from passive investment vehicles, namely, the exchange-traded funds (ETFs). The entry timing determinants of the ETFs are procured via news article search.

Panel A	Timing of Index Fund Competitive Shock - Retail Investment Categories Entered by Vanguard			
Investment Category	Introduction Date of Vanguard Index Fund	Index Fund Name	Timing Determinant	Introduction Year of Earliest Non-Vanguard Index Fund and Offering Company
Large-Cap Core	1976	Vanguard First Index Investment Trust	In response to advocacy by academics.	1985, B.C. Ziegler
Mid-Cap Core	1987	Vanguard Extended Market Fund	Extension to the next segment of market in terms of stock market cap.	1991, Dreyfus
Small-Cap Core	1989	Vanguard Small-Cap Index Fund	"Impulsive" termination of externally-managed active small-cap fund. Assets converted into small-cap index fund.	1986, Colonial
Large-Cap Growth	1992	Vanguard Growth Fund	Introduction of S&P/BARRA growth index.	1994, Padco
Large-Cap Value	1992	Vanguard Value Fund	Introduction of S&P/BARRA value index.	1998, Waterhouse
Multi-Cap Core	1992	Vanguard Total Stock Market Portfolio	Decision to make it convenient to own the total stock market.	1997, Fidelity
Small-Cap Growth	1998	Vanguard Small-Cap Growth Index Fund	N/A.	2000, Barclays (ETF)
Small-Cap Value	1998	Vanguard Small-Cap Value Index Fund	N/A.	2000, Barclays (ETF)

Panel B	Timing of Index Fund Competitive Shock - Retail Investment Categories Not Entered by Vanguard		
Investment Category	Introduction Year of First Exchange-Traded Fund	Index Fund Name	Timing Determinant
Mid-Cap Growth	2000	iShares S&P Mid-Cap 400 Growth	Expansion of Barclays.
Mid-Cap Value	2000	iShares S&P Mid-Cap 400 Value	Expansion of Barclays.
Multi-Cap Growth	1999	NASDAQ-100 Trust	SEC approval.
Multi-Cap Value	2000	iShares Russell 3000 Value	Expansion of Barclays.

Table 2. Summary Statistics, 1970-2005

This table presents the summary statistics on the actively managed U.S. equity mutual funds. Fund-channel level outcome and control variables are reported separately for the broker channel and the direct channel. For comparison, statistics on Vanguard index funds are also reported. Total Fee is calculated as the annual expense ratio plus one-seventh of total loads. Distribution fee is the sum of amortized loads and the annual 12b-1 fee. Non-marketing fee is the annual expense ratio minus the 12b-1 fee. The fee items are equal-weighted averages among share classes in the same fund and same distribution channel. Other fund-channel characteristics are weighted averages unless otherwise stated, and the weights are lagged share class size. Net fund flow is the percentage growth in assets in excess of the growth that would have occurred given the investment return. Observations where the lagged fund-channel size is smaller than one million dollars are deleted. I also winsorize the observations with net fund flow percentages larger than 300 percent. Active share is the sum of portfolio weight differences between a fund's portfolio and the benchmark portfolio. Tracking error is the standard deviation of the difference between a fund's return and the benchmark return. Fund-channel size is the total net asset (TNA) size in millions. Age is the years since inception for the oldest share class of a fund-channel. Fund family size is the total assets managed by a management company. Turnover is the the fraction of fund holdings that have changed over a year. Standard deviation of monthly returns is calculated using monthly returns over a one-year period. Benchmark-adjusted return is the annual raw return minus the benchmark return for the given investment category. Investment-category level control variables are aggregated using fund-channel level data. Category flow is calculated as the percentage growth in assets for a category in excess of the growth that would have occurred given the return of the category. Net category return is the lagged-size-weighted average net raw return across all actively managed funds in a category. Category size is the sum of total assets invested in a category. Number of funds counts the number of distinct fund-channels in a category. Herfindahl index, a measure of market concentration, is calculated for each category as the sum of the individual fund-channels' market shares squared. Broker channel share is the percentage of the assets of a category invested through the broker channel.

	Actively Managed Funds						**Vanguard Index Funds**		
	Broker Channel			**Direct Channel**					
Fund-Channel Level	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Outcome Variables:									
Total Fee %	15,444	2.19	0.53	10,242	1.21	0.51	136	0.22	0.05
Expense Ratio %	15,444	1.58	0.57	10,242	1.21	0.51	136	0.22	0.05
Distribution Fee %	15,444	1.03	0.35	10,242	0.04	0.09	136	0.01	0.01
Non-Marketing Fee %	15,444	1.16	0.46	10,242	1.16	0.51	136	0.21	0.06
Net Fund Flow	12,819	0.23	0.71	8,377	0.21	0.69	126	0.43	0.55
Active Share	10,247	0.80	0.15	6,815	0.82	0.16	124	0.17	0.18
Tracking Error	10,247	0.07	0.05	6,815	0.08	0.05	124	0.01	0.02
Control Variables:									
ln (Fund-Channel Size)	15,444	4.49	2.20	10,242	4.38	2.29	136	7.40	2.05
ln (Age)	15,444	2.05	1.00	10,242	2.01	0.96	136	2.14	0.97
ln (Fund Family Size)	15,444	7.49	2.45	10,242	6.96	2.73	136	11.50	1.52
Turnover	13,631	0.89	0.86	9,197	0.92	1.03	126	0.25	0.21
Std Dev of Monthly Returns %	14,515	4.82	2.45	10,094	5.00	2.63	133	4.47	1.92
Benchmark Adj. Return %	12,670	0.14	10.80	8,778	0.80	11.64	130	1.00	2.62

Investment Category Level	Obs.	Mean	Std. Dev.
Control Variables:			
Category Flow	507	0.09	0.32
Net Category Return	507	0.13	0.19
ln (Category Size)	507	8.63	2.53
ln (Number of Funds)	507	3.23	1.36
Herfindahl Index	507	0.21	0.20
Broker Channel Share	507	0.66	0.24

Table 3. Effects of Index Fund Competition on Fees of Actively Managed Funds

This table reports the effects of Vanguard index fund entry on the fees of actively managed funds for the period 1970-2005, estimated using equation (2). The main dependent variable total fee is the annual expense ratio plus amortized loads expressed in percentages. Columns (1)-(3) use fund-channel level data, Column (4) uses category-channel level data, and Column (5) uses category level data. $Post(0to4)$ is an indicator which equals one in years zero through four after Vanguard's entry into an investment category, and $Post(5+)$ equals one in years five and beyond after Vanguard's entry. *Direct* is an indicator that equals one if a fund-channel is distributed through the direct channel, and zero if it is distributed through the broker channel. $Before(-1)$ is a dummy that equals one in a category one year before Vanguard index fund enters this category, $Post(0)$ indicates the year of Vanguard entry, $Post(1)$ indicates one year after Vanguard entry, and $Post(2+)$ takes on a value of one for observations at least two years after Vanguard entry. Category-level control variables, the coefficients on which are unreported, are listed in Table 2 and are lagged by one year. All other variables are defined in Table 2. Estimates for the net effect in the direct channel are calculated using the delta method and reported at the bottom. The period more than five years before Vanguard entry, together with its interaction with *Direct*, is dummied out. Standard errors (in parentheses) are clustered by fund family in Columns (1)-(3) and by investment category in Columns (4)-(5). The sample includes actively managed mutual funds in investment categories which experienced Vanguard entry during the sample period. $*$, $**$, and $***$ denote significance at at 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
		Total Fee %		Category-Channel VW Total Fee %	Category VW Total Fee %
Post (0 to 4)	**0.127*** **	**0.122*** **		**0.105** **	**-0.030**
	(0.036)	**(0.040)**		**(0.040)**	**(0.044)**
Post (0 to 4) × Direct	**-0.240*** **	**-0.186*** **		**-0.198***	
	(0.060)	**(0.037)**		**(0.092)**	
Post (5+)	0.120***	0.158***			
	(0.041)	(0.043)			
Post (5+) × Direct	-0.270***	-0.257***			
	(0.058)	(0.038)			
Before (-1)			-0.001		
			(0.034)		
Before (-1) × Direct			-0.034		
			(0.035)		
Post (0)			0.083**		
			(0.042)		
Post (0) × Direct			-0.141***		
			(0.040)		
Post (1)			0.089*		
			(0.047)		
Post (1) × Direct			-0.139***		
			(0.046)		
Post (2+)			0.152***		
			(0.049)		
Post (2+) × Direct			-0.255***		
			(0.041)		
ln (Fund-Channel Size), t-1		-0.030***	-0.029***		
		(0.008)	(0.008)		
ln (Fund-Channel Age)		-0.091***	-0.093***		
		(0.028)	(0.028)		
ln (Fund Family Size), t-1		-0.028***	-0.028***		
		(0.007)	(0.007)		
Turnover, t-1		0.039***	0.039***		
		(0.008)	(0.008)		
Std Dev of Monthly Returns, t-1		0.559*	0.542*		
		(0.311)	(0.312)		
Benchmark Adj. Return, t-1		-0.078**	-0.078**		
		(0.035)	(0.034)		
Category-Level Controls	Yes	Yes	Yes	Yes	Yes
Fixed Effects:					
Year	Yes	Yes	Yes	Yes	Yes
Category	Yes	Yes	Yes	Yes	Yes
Channel	Yes	Yes	Yes	Yes	N/A
Fund-Channel	No	Yes	Yes	N/A	N/A
Differential Time Trends by Category	Yes	Yes	Yes	No	No
Observations	16,831	11,956	11,956	360	220
R-squared	0.496	0.923	0.923	0.946	0.745
Net Effect on Direct (0 to 4)	**-0.113** **	**-0.064*** **	**N/A**	**-0.093**	**N/A**
	(0.048)	**(0.035)**		**(0.055)**	
Net Effect on Direct (5+)	-0.150***	-0.099**		-0.051	
	(0.056)	(0.043)		(0.055)	

Table 4. Fee Changes by Components

This table reports the effect of Vanguard index fund entry on different components of fees of actively managed funds for the period 1970-2005, estimated using equation (2). Distribution fee is the sum of amortized loads and the annual 12b-1 fee, and non-marketing fee is the annual expense ratio minus the 12b-1 fee; both are expressed in percentages. $Post(0to4)$ is an indicator which equals one in years zero through four after Vanguard's entry into an investment category, and $Post(5+)$ equals one in years five and beyond after Vanguard's entry. *Direct* is an indicator that equals one if a fund-channel is distributed through the direct channel, and zero if it is distributed through the broker channel. Category-level control variables, the coefficients on which are unreported, are listed in Table 2 and are lagged by one year. All other variables are defined in Table 2. Estimates for the net effect in the direct channel are calculated using the delta method and reported at the bottom. The period more than five years before Vanguard entry, together with its interaction with *Direct*, is dummied out. Standard errors (in parentheses) are clustered by fund family. The sample includes the actively managed mutual funds in the investment categories which experienced Vanguard entry during the sample period. $*$, $**$, and $***$ denote significance at at 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Distribution Fee %		Non-Marketing Fee %	
Post (0 to 4)	**0.066*** **	**0.077*** **	**0.061***	**0.045**
	(0.022)	**(0.021)**	**(0.033)**	**(0.032)**
Post (0 to 4) × Direct	**-0.094*** **	**-0.114*** **	**-0.146****	**-0.072****
	(0.023)	**(0.021)**	**(0.057)**	**(0.033)**
Post (5+)	0.049**	0.097***	0.071*	0.060*
	(0.024)	(0.024)	(0.039)	(0.034)
Post (5+) × Direct	-0.110***	-0.168***	-0.161***	-0.088***
	(0.027)	(0.024)	(0.054)	(0.033)
ln (Fund-Channel Size), t-1		0.009**		-0.039***
		(0.004)		(0.006)
ln (Fund-Channel Age)		-0.064***		-0.027
		(0.016)		(0.019)
ln (Fund Family Size), t-1		0.009**		-0.037***
		(0.004)		(0.006)
Turnover, t-1		0.006		0.033***
		(0.005)		(0.007)
Std Dev of Monthly Returns, t-1		0.028		0.532*
		(0.142)		(0.282)
Benchmark Adj. Return, t-1		-0.004		-0.073**
		(0.013)		(0.032)
Category-Level Controls	Yes	Yes	Yes	Yes
Fixed Effects:				
Year	Yes	Yes	Yes	Yes
Category	Yes	Yes	Yes	Yes
Channel	Yes	Yes	Yes	Yes
Fund-Channel	No	Yes	No	Yes
Differential Time Trends by Category	Yes	Yes	Yes	Yes
Observations	16,831	11,956	16,831	11,956
R-squared	0.762	0.964	0.108	0.852
Net Effect on Direct (0 to 4)	**-0.028****	**-0.037****	**-0.085***	**-0.027**
	(0.012)	**(0.017)**	**(0.047)**	**(0.033)**
Net Effect on Direct (5+)	-0.060***	-0.071***	-0.090*	-0.028
	(0.017)	(0.022)	(0.052)	(0.037)

Table 5. Effects on Fund Flows to Actively Managed Funds

This table shows the effects of Vanguard index fund entry on net fund flows to actively managed funds for the period 1970-2005, estimated using equation (2). The main dependent variable net fund flow is the percentage growth in fund assets in excess of the growth that would have occurred given the investment return. Columns (1)-(3) use fund-channel level data, Column (4) uses category-channel level data, and Column (5) uses category level data. $Post(0to4)$ is an indicator which equals one in years zero through four after Vanguard's entry into an investment category, and $Post(5+)$ equals one in years five and beyond after Vanguard's entry. *Direct* is an indicator that equals one if a fund-channel is distributed through the direct channel, and zero if it is distributed through the broker channel. $Before(-1)$ is a dummy that equals one in a category one year before Vanguard index fund enters this category, $Post(0)$ indicates the year of Vanguard entry, $Post(1)$ indicates one year after Vanguard entry, and $Post(2+)$ takes on a value of one for observations at least two years after Vanguard entry. Category-level control variables, the coefficients on which are unreported, are listed in Table 2 and are lagged by one year. All other variables are defined in Table 2. Estimates for the net effect in the direct channel are calculated using the delta method and reported at the bottom. The period more than five years before Vanguard entry, together with its interaction with *Direct*, is dummied out. Standard errors (in parentheses) are clustered by year. The sample includes the actively managed mutual funds in the investment categories which experienced Vanguard entry during the sample period. $*$, $**$, and $***$ denote significance at at 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)
	Fund-Channel Flow			Category-Channel Flow	Category Flow
Post (0 to 4)	**-0.155*** **	**-0.116** **		**-0.139***	**-0.112** **
	(0.043)	**(0.055)**		**(0.074)**	**(0.044)**
Post (0 to 4) × Direct	**0.010**	**0.022**		**-0.048**	
	(0.043)	**(0.040)**		**(0.065)**	
Post (5+)	-0.092*	-0.046		-0.110	-0.084
	(0.046)	(0.057)		(0.098)	(0.055)
Post (5+) × Direct	0.007	-0.016		-0.041	
	(0.042)	(0.054)		(0.098)	
Before (-1)			-0.007		
			(0.079)		
Before (-1) × Direct			-0.000		
			(0.083)		
Post (0)			-0.139**		
			(0.055)		
Post (0) × Direct			0.004		
			(0.047)		
Post (1)			-0.174**		
			(0.075)		
Post (1) × Direct			-0.013		
			(0.052)		
Post (2+)			-0.077		
			(0.067)		
Post (2+) × Direct			0.008		
			(0.044)		
ln (Size), t-1		-0.320***	-0.319***		
		(0.026)	(0.026)		
ln (Fund Age)		0.037	0.034		
		(0.057)	(0.056)		
ln (Fund Family Size), t-1		0.055***	0.056***		
		(0.010)	(0.010)		
Std Dev of Monthly Returns, t-1		-0.211	-0.372		
		(0.907)	(0.895)		
Benchmark Adj. Return, t-1		0.940***	0.950***		
		(0.149)	(0.148)		
Category-Level Controls	Yes	Yes	Yes	Yes	Yes
Fixed Effects:					
Year	Yes	Yes	Yes	Yes	Yes
Category	Yes	Yes	Yes	Yes	Yes
Channel	Yes	Yes	Yes	Yes	N/A
Fund-Channel	No	Yes	Yes	N/A	N/A
Differential Time Trends by Category	Yes	Yes	Yes	No	No
Observations	13,797	12,517	12,517	360	220
R-squared	0.053	0.505	0.506	0.222	0.459
Net Effect on Direct (0 to 4)	**-0.146*** **	**-0.094** **	**N/A**	**-0.187** **	**N/A**
	(0.030)	**(0.043)**		**(0.075)**	
Net Effect on Direct (5+)	-0.085**	-0.062		-0.151	
	(0.039)	(0.063)		(0.098)	

Table 6. Changes in Flow-Fee Sensitivity

This table reports the effect of Vanguard index fund entry on the flow-fee sensitivity in the broker channel estimated using equation (3). The dependent variable net fund flow is the percentage growth in fund assets in excess of the growth that would have occurred given the investment return. The sample contains actively managed mutual funds in the investment categories that experienced Vanguard entry during the sample period and is restricted to the observations in the broker channel. $Post(0to4)$ is an indicator which equals one in years zero through four after Vanguard's entry into an investment category, and $Post(5+)$ equals one in years five and beyond after Vanguard's entry. *Distrn* stands for the distribution fee expressed in percentages. Category-level control variables, the coefficients on which are unreported, are listed in Table 2 and are lagged by one year. All other variables are defined in Table 2. The period more than five years before Vanguard entry, together with their interactions with the fee (or performance) component(s) under investigation, is dummied out. Standard errors (in parentheses) are clustered by year. $*$, $**$, and $***$ denote significance at at 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
		Net Fund-Channel Flow		
Post (0 to 4) × Distrn, t-1	**0.264****	**0.246***		**0.177**
	(0.126)	**(0.141)**		**(0.108)**
Post (5+) × Distrn, t-1	0.338***	0.319**		0.257**
	(0.116)	(0.129)		(0.100)
Post (0 to 4) × Non Mktg, t-1		-0.123		
		(0.116)		
Post (5+) × Non Mktg, t-1		-0.083		
		(0.121)		
Post (0 to 4) × Benchmark Adj. Return, t-1			0.039	-0.037
			(0.832)	(0.857)
Post (5+) × Benchmark Adj. Return, t-1			-0.003	-0.099
			(0.922)	(0.948)
Post (0 to 4)	-0.350***	-0.177	-0.109**	-0.272***
	(0.115)	(0.247)	(0.052)	(0.092)
Post (5+)	-0.382***	-0.265	-0.058	-0.309***
	(0.108)	(0.240)	(0.053)	(0.085)
ln (Size), t-1	-0.118***	-0.121***	-0.117***	-0.120***
	(0.007)	(0.007)	(0.006)	(0.007)
ln (Fund Age)	-0.048***	-0.053***	-0.046***	-0.045***
	(0.013)	(0.014)	(0.014)	(0.014)
ln (Fund Family Size), t-1	0.055***	0.052***	0.053***	0.054***
	(0.005)	(0.007)	(0.006)	(0.006)
Std Dev of Monthly Returns, t-1	-1.559*	-1.435*	-1.103*	-1.237*
	(0.804)	(0.733)	(0.648)	(0.629)
Benchmark Adj. Return, t-1	1.116***	1.148***	-1.453***	-1.993***
	(0.208)	(0.207)	(0.081)	(0.099)
Category-Level Controls	Yes	Yes	Yes	Yes
Fixed Effects:				
Year	Yes	Yes	Yes	Yes
Inv Category	Yes	Yes	Yes	Yes
Year FE × Distrn, t-1	Yes	Yes	No	Yes
Category FE × Distrn, t-1	Yes	Yes	No	Yes
Year FE × NonMktg, t-1	No	Yes	No	No
Category FE × NonMktg, t-1	No	Yes	No	No
Year FE × Benchmark Adj. Return, t-1	No	No	Yes	Yes
Category FE × Benchmark Adj. Return, t-1	No	No	Yes	Yes
Observations	7,493	7,493	7,493	7,493
R-squared	0.182	0.189	0.206	0.215

Table 7. Effects on Active Management

This table shows the estimated effects of Vanguard index fund entry on the degree of active management of the actively managed funds for the period 1970-2005, estimated using equation (2). Active share is the sum of portfolio weight differences between a fund's portfolio and the benchmark portfolio. Tracking error is the standard deviation of the difference between a fund's return and the benchmark return. $Post(0to4)$ is an indicator which equals one in years zero through four after Vanguard's entry into an investment category, and $Post(5+)$ equals one in years five and beyond after Vanguard's entry. *Direct* is an indicator that equals one if a fund-channel is distributed through the direct channel, and zero if it is distributed through the broker channel. $Before(-1)$ is a dummy that equals one in a category one year before Vanguard index fund enters this category, $Post(0)$ indicates the year of Vanguard entry, $Post(1)$ indicates one year after Vanguard entry, and $Post(2+)$ takes on a value of one for observations at least two years after Vanguard entry. Category-level control variables, the coefficients on which are unreported, are listed in Table 2 and are lagged by one year. All other variables are defined in Table 2. Estimates for the net effect in the direct channel are calculated using the delta method and reported at the bottom. The period more than five years before Vanguard entry, together with its interaction with *Direct*, is dummied out. Standard errors (in parentheses) are clustered by fund family. The sample includes the actively managed mutual funds in the investment categories which experienced Vanguard entry during the sample period. $*$, $**$, and $***$ denote significance at at 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
		Acitve Share			Tracking Error	
Post (0 to 4)	**0.020****	**0.016***		**0.008*****	**0.007****	
	(0.008)	**(0.008)**		**(0.003)**	**(0.003)**	
Post (0 to 4) × Direct	**-0.007**	**0.001**		**-0.001**	**0.003**	
	(0.010)	**(0.010)**		**(0.003)**	**(0.004)**	
Post (5+)	-0.002	0.004		0.005	0.007*	
	(0.012)	(0.011)		(0.003)	(0.004)	
Post (5+) × Direct	-0.007	0.004		-0.000	0.005	
	(0.013)	(0.015)		(0.004)	(0.004)	
Before (-1)			0.002			0.001
			(0.008)			(0.004)
Before (-1) × Direct			0.003			-0.004
			(0.008)			(0.005)
Post (0)			0.019**			0.002
			(0.008)			(0.004)
Post (0) × Direct			-0.000			0.004
			(0.008)			(0.005)
Post (1)			0.026**			0.010**
			(0.010)			(0.004)
Post (1) × Direct			0.007			0.004
			(0.010)			(0.005)
Post (2+)			0.016			0.008*
			(0.011)			(0.004)
Post (2+) × Direct			0.008			0.002
			(0.012)			(0.004)
ln (Fund Size), t-1		-0.004	-0.002		-0.001	-0.001
		(0.002)	(0.002)		(0.001)	(0.000)
ln (Fund Age)		-0.006	-0.000		-0.004*	-0.001
		(0.006)	(0.004)		(0.002)	(0.001)
ln (Fund Family Size), t-1		-0.006***	-0.006***		-0.001	-0.001*
		(0.002)	(0.002)		(0.001)	(0.001)
Category-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects:						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Category	Yes	Yes	Yes	Yes	Yes	Yes
Channel	Yes	Yes	Yes	Yes	Yes	Yes
Fund-Channel	No	Yes	Yes	No	Yes	Yes
Differential Time Trends by Category	Yes	Yes	Yes	Yes	Yes	Yes
Observations	11,205	10,048	10,048	11,205	10,048	10,048
R-squared	0.530	0.663	0.855	0.349	0.670	0.656
Net Effect on Direct (0 to 4)	**0.013**	**0.017****	**N/A**	**0.006***	**0.010*****	**N/A**
	(0.010)	**(0.008)**		**(0.003)**	**(0.004)**	
Net Effect on Direct (5+)	-0.009	0.008		0.004	0.012**	
	(0.014)	(0.012)		(0.004)	(0.005)	

Table 8. Cross-Sectional Heterogeneous Effects

This table reports the cross-sectional heterogeneous effect of Vanguard index fund entry on fees of actively managed funds for the period 1970-2005. Total fee is the annual expense ratio plus amortized loads expressed in percentages. Distribution fee is the sum of amortized loads and the annual 12b-1 fee expressed in percentages. Equation (2) is estimated in sub-samples of funds with high and low active share, respectively. A high- (low-) active-share fund is one where the lagged active share is above (below) the median in an investment category in a given year. $Post(0to4)$ is an indicator which equals one in years zero through four after Vanguard's entry into an investment category, and $Post(5+)$ equals one in years five and beyond after Vanguard's entry. *Direct* is an indicator that equals one if a fund-channel is distributed through the direct channel, and zero if it is distributed through the broker channel. Category-level control variables, the coefficients on which are unreported, are listed in Table 2 and are lagged by one year. All other variables are defined in Table 2. Estimates for the net effect in the direct channel are calculated using the delta method and reported at the bottom. The period more than five years before Vanguard entry, together with its interaction with *Direct*, is dummied out. Standard errors (in parentheses) are clustered by fund family. The sample includes the actively managed mutual funds in the investment categories which experienced Vanguard entry during the sample period. $*$, $**$, and $***$ denote significance at at 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)
	Total Fee %		Distribution Fee %	
	High Active Share	Low Active Share	High Active Share	Low Active Share
Post (0 to 4)	**0.140*** **	**0.032**	**0.097*** **	**0.053**
	(0.048)	**(0.071)**	**(0.034)**	**(0.034)**
Post (0 to 4) × Direct	**-0.169*** **	**-0.139*** **	**-0.150*** **	**-0.102*** **
	(0.048)	**(0.047)**	**(0.038)**	**(0.030)**
Post (5+)	0.172***	0.052	0.114***	0.085**
	(0.053)	(0.083)	(0.037)	(0.041)
Post (5+) × Direct	-0.196***	-0.193***	-0.183***	-0.178***
	(0.047)	(0.045)	(0.039)	(0.032)
ln (Fund-Channel Size), t-1	-0.035***	-0.007	0.012*	0.007
	(0.013)	(0.012)	(0.007)	(0.007)
ln (Fund-Channel Age)	-0.066	-0.146***	-0.090***	-0.078***
	(0.053)	(0.047)	(0.031)	(0.026)
ln (Fund Family Size), t-1	-0.010	-0.032***	0.007	0.002
	(0.011)	(0.010)	(0.006)	(0.007)
Turnover, t-1	0.047***	0.043***	0.016**	0.006
	(0.013)	(0.012)	(0.007)	(0.009)
Std Dev of Monthly Returns, t-1	0.079	-0.101	-0.056	0.154
	(0.381)	(0.396)	(0.223)	(0.287)
Benchmark Adj. Return, t-1	-0.047	-0.042	0.001	0.014
	(0.036)	(0.039)	(0.016)	(0.026)
Category-Level Controls	Yes	Yes	Yes	Yes
Fixed Effects:				
Year	Yes	Yes	Yes	Yes
Category	Yes	Yes	Yes	Yes
Channel	Yes	Yes	Yes	Yes
Fund-Channel	Yes	Yes	Yes	Yes
Differential Time Trends by Category	Yes	Yes	Yes	Yes
Observations	4,253	4,166	4,253	4,166
R-squared	0.940	0.950	0.973	0.967
Net Effect on Direct (0 to 4)	**-0.049***	**-0.108** **	**-0.053***	**-0.048***
	(0.027)	**(0.053)**	**(0.030)**	**(0.027)**
Net Effect on Direct (5+)	-0.024	-0.142**	-0.069*	-0.093***
	(0.048)	(0.067)	(0.035)	(0.035)

Table 9. Robustness Checks

This table reports results from miscellaneous robustness checks. Total fee is the annual expense ratio plus amortized loads expressed in percentages. Distribution fee is the sum of amortized loads and the annual 12b-1 fee expressed in percentages. $Post(0to4)$ is an indicator which equals one in years zero through four after Vanguard's entry into an investment category, and $Post(5+)$ equals one in years five and beyond after Vanguard's entry. *Direct* is an indicator that equals one if a fund-channel is distributed through the direct channel, and zero if it is distributed through the broker channel. Category-level control variables, the coefficients on which are unreported, are listed in Table 2 and are lagged by one year. All other variables are defined in Table 2. The net effects by distribution channel are presented in the middle section below the main regressors of interest and above the co-variates. In Column (3), the net effect for each distribution channel is calculated at the means of co-variates for the given channel. In all other columns, the net effect in the direct channel is calculated using the delta method. The period more than five years before Vanguard entry, together with its interaction with *Direct*, is dummied out. Standard errors (in parentheses) are clustered by fund family. The sample in Columns (1)-(6) includes the actively managed mutual funds in the investment categories which experienced Vanguard entry during the sample period 1970-2005. In Column (7), it includes actively managed mutual funds in all Lipper U.S. domestic equity category boxes including categories not entered by Vanguard during the sample period. $*$, $**$, and $***$ denote significance at at 10%, 5%, and 1% levels, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
	FRC Channel Classifications					
	Total Fee %	Distribution Fee %		Total Fee %		
Post (0 to 4)	0.092**	0.078**	-0.012	0.129***	0.127***	0.062***
	(0.041)	(0.036)	(0.131)	(0.040)	(0.046)	(0.019)
Post (0 to 4) × Direct	-0.151***	-0.175***	-0.184***	-0.179***	-0.218***	-0.124***
	(0.042)	(0.039)	(0.037)	(0.037)	(0.075)	(0.023)
Post (5+)	0.138***	0.096**	0.057	0.159***	0.148***	0.089***
	(0.050)	(0.045)	(0.138)	(0.043)	(0.056)	(0.022)
Post (5+) × Direct	-0.240***	-0.229***	-0.250***	-0.246***	-0.253***	-0.169***
	(0.046)	(0.043)	(0.039)	(0.037)	(0.086)	(0.026)
Net Effect on Broker (0 to 4)	**0.092****	**0.078****	**0.068****	**0.129*****	**0.127*****	**0.062*****
	(0.041)	**(0.036)**	**(0.033)**	**(0.040)**	**(0.046)**	**(0.019)**
Net Effect on Direct (0 to 4)	**-0.059**	**-0.097*****	**-0.117*****	**-0.051**	**-0.091**	**-0.063*****
	(0.041)	**(0.036)**	**(0.029)**	**(0.035)**	**(0.069)**	**(0.017)**
Net Effect on Broker (5+)	0.138***	0.096**	0.100***	0.159***	0.148***	0.089***
	(0.050)	(0.045)	(0.038)	(0.043)	(0.056)	(0.022)
Net Effect on Direct (5+)	-0.101**	-0.133***	-0.152***	-0.088**	-0.105	-0.080***
	(0.052)	(0.045)	(0.035)	(0.041)	(0.082)	(0.225)
ln (Fund-Channel Size), t-1	-0.049***	-0.003	-0.021	-0.060	-0.031***	-0.034***
	(0.009)	(0.006)	(0.017)	(0.138)	(0.008)	(0.007)
ln (Fund-Channel Age)	0.023	0.072**	-0.097***	-0.264		-0.083***
	(0.032)	(0.030)	(0.034)	(0.200)		(0.026)
ln (Fund Family Size), t-1	-0.024***	0.015**	-0.024	-0.087		-0.028***
	(0.008)	(0.007)	(0.016)	(0.095)		(0.006)
Turnover, t-1	0.026***	0.001	0.010	0.721		0.022***
	(0.010)	(0.007)	(0.021)	(0.459)		(0.006)
Std Dev of Monthly Returns, t-1	0.027	-0.298	0.403	-28.194		0.370*
	(0.412)	(0.243)	(0.668)	(21.721)		(0.223)
Benchmark Adj. Return, t-1	-0.069*	0.003	-0.094	-3.250		-0.076***
	(0.041)	(0.025)	(0.091)	(2.739)		(0.026)
Category-Level Controls	Yes	Yes	Yes	Yes	Yes	Yes
Fixed Effects:						
Year	Yes	Yes	Yes	Yes	Yes	Yes
Category	Yes	Yes	Yes	Yes	Yes	Yes
Channel	Yes	Yes	Yes	Yes	Yes	Yes
Fund-Channel	Yes	Yes	Yes	Yes	No	Yes
Fund Family-Year	No	No	No	No	Yes	No
All Co-Variates × Post Dummies	No	No	Yes	No	No	No
All Co-Variates × Year FE	No	No	No	Yes	No	No
Differential Time Trends by Category	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,618	10,618	11,956	11,956	14,295	16,786
R-squared	0.888	0.898	0.921	0.928	0.878	0.926

Figure 1. Market Share of Passive Retail Funds by Investment Category, 1970-2005

This figure plots the market share growths of passive funds in retail Lipper investment categories which Vanguard entered during the sample period. The dates of Vanguard entry are presented in Table 1. The market share of passive funds in each category is calculated as the total asset size of index funds and exchange-traded funds divided by the total size of all assets invested in the category.

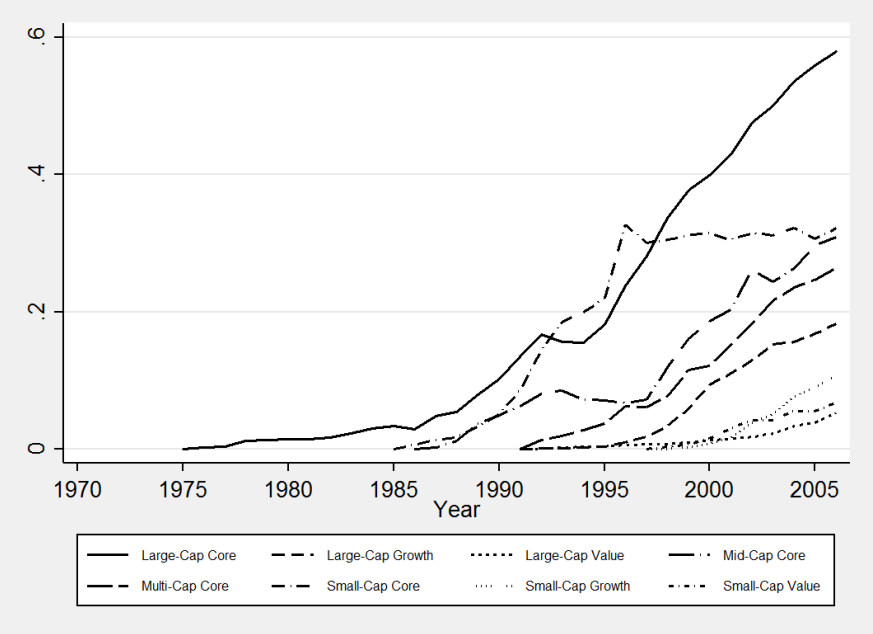
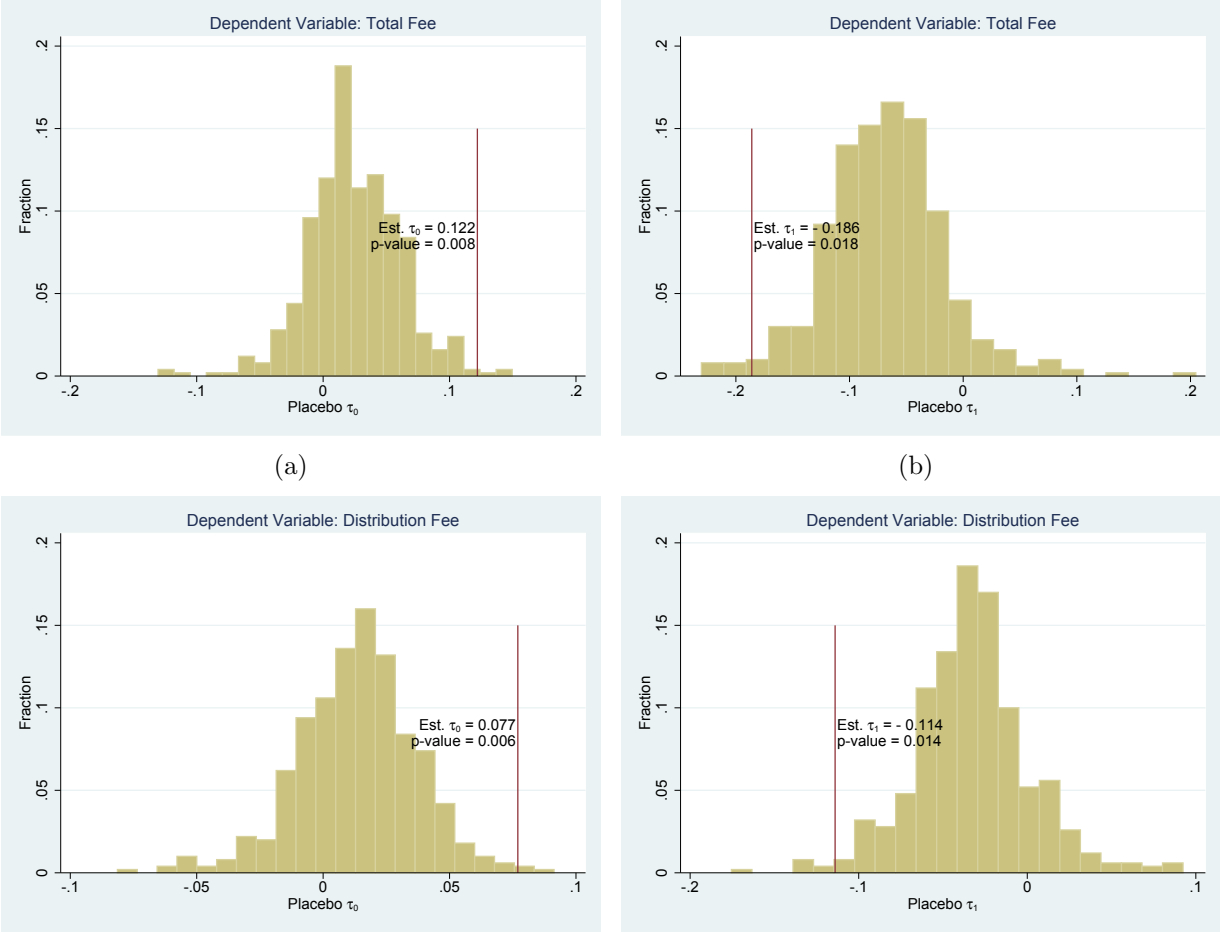


Figure 2. Placebo Tests

This figure plots the distributions of estimated coefficients τ_0 and τ_1 of equation (2) obtained from 500 simulations using randomly-generated dates for index fund entry. The outcome variables are the total fee expressed in percentage points in subfigures (a) and (b) and the distribution fee expressed in percentage points in subfigures (c) and (d). The sample includes actively managed funds in all Lipper U.S. domestic equity category boxes including the categories not entered by Vanguard during the sample period. At each simulation, the main difference-in-differences specification in equation (2) is estimated using the fictitious entry dates. The regressions include year, category and fund-channel fixed effects, as well as category-level and fund-channel level co-variates. The vertical lines indicated the estimated coefficients using the *actual* entry dates of Vanguard index funds. Bootstrapped p-values are reported in the figure.



(a) (b)

(c) (d)

Appendix 1

Sample Selection

The sample is constructed for years 1970-2005 from the CRSP Survivor-Bias-Free Mutual Fund Database and includes all U.S. domestic diversified equity mutual funds. Sample selection follows the procedure described in Gil-Bazo and Ruiz-Verdu (2009) and includes the following steps. A mutual fund share class qualifies as a U.S. domestic diversified equity fund share class if it meets the following criteria in a given years. For 1962-1989, fund "policy" is common stock and the Wiesenberger Objective code is Growth, Growth-Income, or Maximum Capital Gains. For 1990-1991 (when there is no fund policy indicator), the Wiesenberger Objective code (which changed in 1990) is one of the following: Growth and Current Income, Long-term Growth, Maximum Capital Gains, or Small Capitalization Growth. For 1992-1997, the Strategic Insight objective code is one of Aggressive Growth, Mid-cap, Growth and Income, Growth, or Small-cap. From 1998 on, the Lipper objective code is one of Growth, Capital Appreciation, Growth and Income, Small-cap, Mid-cap, Micro-cap, or S&P 500 Index. This sample selection procedure leads to 67,931 share class-by-year observations for 10,032 distinct share classes. I further drop the observations with no information on share class size, expense ratio, or offer date, which reduces the sample size to 58,575 observations of 9,192 share classes. Lastly, I identify and drop the share classes that are exclusively available through retirement plans or available only to employees of the fund company. This reduces the sample to 56,640 observations of 8,649 share classes.

Next, I distinguish between retail and institutional share classes using fund names. Share classes with names containing Class I, Class Y, Class X, Class K, Institutional share, Inst, Trust Class, Premier Class, Fiduciary Class, Consultant Class, or variations of the strings,

such as Y Class or /Y for Class Y, are classified as institutional. As this study focuses on the retail mutual fund market, I drop the institutional share classes, which brings the sample size to 7,127 share classes and 47,392 observations.

Investment Categories

For the investment categories of funds, I used the Lipper classifications in the CRSP database based on portfolio holdings. I focused on 12 major categories of general U.S. domestic equity mutual funds: Large-Cap Core, Large-Cap Growth, Large-Cap Value, Mid-Cap Core, Mid-Cap Growth, Mid-Cap Value, Small-Cap Core, Small-Cap Growth, Small-Cap Value, Multi-Cap Core, Multi-Cap Growth, and Multi-Cap Value. Lipper has a separate category for S&P 500 index funds. For the purpose of my study, I treated this category as being in the same style as Large-Cap Core. Lipper classification is available from 1999. I used the earliest observed classification for each share class to backfill all earlier years. In this way, I obtained the category variable for 90 percent of the share classes in sample. I further merged the CRSP data with data on fund benchmarks from (Petajisto, 2013) and filled the missing categories using the benchmark information as much as possible. The coverage of investment categories expands to 94 percent of the observations. After dropping the share classes for which no category is available, I obtain a sample of 6,485 share classes and 44,533 observations.

Index funds

In order to distinguish the index funds from the actively managed funds, I use the CRSP indicators, which start in 2008, combined with textual matching based on key words in fund names. Funds with names containing the following strings are classified as index funds: Index, INDX, IDX, NASDAQ, BARRA, S&P, Dow Jones, Russell, ETF, exchange-traded, exchange traded. All funds classified as index funds by their fund names but not marked

in CRSP are all manually examined against their prospectus and classified accordingly. All funds marked as index-based or index-enhanced in CRSP are also classified as index funds and all index funds are excluded from the sample.

The final sample contains 5,907 share classes and 41,311 observations. The data are then aggregated at fund-channel level. The final sample contains 3,578 fund-channels and 25,686 fund-channel-by-year observations. The main sample used for the difference-in-differences regressions, which includes the investment categories entered by Vanguard during the sample period, contains 2,733 fund-channels and 16,796 observations.

Data Cleaning

Fund Identifiers

The fund identifiers are based on the class group codes in CRSP, which contains data starting in 1998. The identifiers available in 1998 are back-filled. Nine percent of the share classes still do not have a fund identifier after the back-filling. For these share classes, I manually designated fund identifiers to them using the fund name parsing and grouping method following that described in the CRSP documentation. Eventually, all share classes in the sample were assigned a fund identifier. Those share classes not grouped with others are assigned an individual fund identifier and treated as a single-share-class fund.

Fund Family Identifiers

The fund family identifiers in this paper are based on the management codes in CRSP, which start in 1999. Between 1992 and 1999, management codes are filled based on keywords in the management names. For the management names that do not have codes, I searched for key words of the names of fund families in the sample and manually assign the corresponding management codes. For fund families that cannot be matched to any codes following the

above procedure, I tabulated the management names and assigned a separate code for each name. In this way, I identified the management codes for 96 percent of all share classes.

Active Share and Tracking Error

I downloaded the active share data from Antti Petajisto's website,[19] and merged them with the CRSP database using CRSP fundno. In the active share data set, the CRSP fundno is listed only for the largest share class of each fund. Therefore, I copied the data to other share classes within the same fund and same year. The active share data start in 1980 and are available only for the funds that file the 13-F form with the SEC (with assets larger than $100 million). About 71 percent of the share classes observed in or after 1980 have available active share data.

Benchmark Returns

I use the monthly index fundamental data from Compustat for the period 1970-2005 and calculate the monthly returns for the benchmarks as if the dividends are reinvested. Below lists the index for each investment category. The index returns are total returns which includes re-investments of dividends.

Inv. Category	Benchmark Index
Large-Cap Core	S&P 500
Large-Cap Growth	S&P 500/Barra Growth
Large-Cap Value	S&P 500/Barra Value
Mid-Cap Core	S&P Mid-Cap 400
Mid-Cap Growth	S&P 400 Growth
Mid-Cap Value	S&P 400 Value
Small-Cap Core	S&P Small-Cap 600
Small-Cap Growth	S&P 600 Growth
Small-Cap Value	S&P 600 Value
Multi-Cap Core	Russell 3000
Multi-Cap Growth	Russell 3000 Growth
Multi-Cap Value	Russell 3000 Value

[19] http://www.petajisto.net/data.html

Table A.1. Summary Statistics, Index Funds 1970-2005

Panel A reports the aggregate total net assets in domestic equity funds in 1985, 1995, and 2005 by distribution channels and by active vs. passive management. The number of funds is counted after aggregating different share classes of the same fund in the same distribution channel into one observation. Panel B reports the summary statistics on characteristics of U.S. equity index funds across distribution channels over the period 1990-2005. All variables are defined in Table 2.

Panel A		1985		1995		2005	
		Index	Active	Index	Active	Index	Active
Aggregate Size	Broker	0	47.5	4.8	412.4	71.5	1243.9
($ Billion)	Direct	1.3	28.7	31.1	229.4	278.6	906.8
	Total	1.3	76.2	35.9	641.8	350.1	2150.7
Number of Funds	Broker	0	113	24	547	139	1367
	Direct	3	128	33	380	111	646
	Total	3	241	57	927	250	2013

Panel B	Index Funds - Broker			Index Funds - Direct		
	Obs.	Mean	Std. Dev.	Obs.	Mean	Std. Dev.
Total Fee %	939	1.51	0.73	1112	0.69	0.50
Expense Ratio %	939	1.16	0.69	1112	0.69	0.50
Distribution Fee %	939	0.78	0.46	1112	0.05	0.09
Non-Marketing Fee %	939	0.73	0.45	1112	0.64	0.49
Benchmark Adj. Return %	840	-0.25	6.33	1048	0.33	6.86

Table A.2. Determinants of Vanguard Index Fund Entry, 1970-2005

This table reports the estimates of a Cox proportional hazard model for the determinants of Vanguard index fund entry into various investment categories. The estimate uses data aggregated at the category level. The sample includes actively managed mutual funds in all Lipper U.S. domestic equity category boxes including the categories not entered by Vanguard during the sample period. All regressors are calculated as the average value of years t-1 and t-2. Category size is the sum of assets under management among all actively managed funds in a category. Number of funds counts the number of distinct fund-channels in a category. The Herfindahl index is calculated as the sum of market shares squared for each category. VW net return is the weighted average net annual raw return across all actively managed funds in a category. VW active share is the weighted average active share. Net category flow is calculated as the percentage growth in assets for each category in excess of the growth that would have occurred given the return of the category. Broker channel share is the percentage of the assets of a category invested through the broker channel. VW (EW) fee in broker (direct) channel is the size-weighted (equal-weighted) average total fee among the broker (direct) channel funds in a given category. Standard errors are reported in the parentheses.

	Hazard Model	
	(1)	(2)
ln (Category Size)	1.608	0.445
	(1.411)	(1.206)
ln (Total Number of Funds)	0.365	0.757
	(2.135)	(2.102)
Herfindahl	11.900	6.385
	(8.477)	(7.285)
VW Return	4.504	11.758
	(11.408)	(13.506)
VW Active Share	11.762	5.374
	(13.992)	(12.297)
Net Category Flow	-5.031	-2.348
	(3.839)	(3.417)
Broker Channel Share	0.778	2.214
	(2.786)	(2.591)
VW Fee in Broker Channel	0.352	
	(4.527)	
VW Fee in Direct Channel	4.451	
	(2.977)	
EW Fee in Broker Channel		9.240
		(7.516)
EW Fee in Direct Channel		-3.744
		(4.299)
Observations	327	327