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The Cost of Owning ETFs and Index Mutual Funds

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Executive Summary

While index investing has been gaining traction, exchange-traded funds have been taking market share away from index mutual funds during the past decade. This could be due to ETFs' intraday tradability and broad accessibility. Many also attribute this trend to ETFs' perceived cost and tax advantages over index mutual funds. ETFs do not incur some of the administrative costs that their index mutual fund counterparts face, but they are not always cheaper.

We find that ETFs in most categories do not have lower asset-weighted average expense ratios than index mutual funds that track the same benchmarks. The difference in the asset-weighted expense ratios between the two vehicles is small in most categories. Although ETFs carry lower equal-weighted expense ratios in most categories, the most expensive mutual funds do not attract significant assets. Investors have overwhelmingly chosen low-cost funds. As a result, comparing expense ratios on an equal-weighted basis paints an inaccurate picture of the average investor's experience. Not surprisingly, institutional mutual fund share classes look cheaper than retail share classes. The asset-weighted expense ratios for institutional mutual fund share classes are lower than ETFs' in all but one Morningstar Category.

Vanguard's funds skew the results in favor of index mutual funds because the firm prices its funds at cost and has a larger share of the index mutual fund market than the ETF market. Vanguard is also the only firm that offers ETFs as a separate share class of its index mutual funds, which really puts these funds in a class of their own. Excluding all Vanguard funds, ETFs look cheaper than their mutual fund counterparts in all but the foreign large-blend category.

Expense ratios are not the only consideration. Tracking performance, tax efficiency, and trading costs all influence the total cost of ownership. While it can be challenging to quantify the latter two, we discuss these important issues and offer a checklist to help investors evaluate whether ETFs or index mutual funds better meet their needs.

While we examine the differences in cost between ETFs and index mutual funds in great detail, these differences are generally small on an asset-weighted basis. In the large-blend category, the asset-weighted difference in costs between the two vehicles has become smaller over time. More importantly, expense ratios have generally come down across the board. There are plenty of low-cost ETFs and index mutual funds that track some of the most widely cited benchmarks. In many cases, the optimal vehicle is simply a matter of personal preference.

Introduction

A fund's expense ratio is one of the most important determinants of its long-term performance relative to its peers. That relationship has driven the growing acceptance of low-cost index investing. Over the trailing 15 years through December 2013, index fund assets have increased 12 fold to $3.3 trillion from $260 billion. During that time, active fund assets grew much slower, roughly doubling to $9.5 trillion. While index mutual funds have been around for decades, exchange-traded funds have enjoyed most of the recent inflows into index-tracking investments. Exhibit 22 in the appendix shows the divergence in flows to index mutual funds and ETFs. As a result of these strong flows, ETFs accounted for about half of index fund assets at the end of 2013, up from 5% 15 years earlier. ETFs offer three potential advantages over index mutual funds that might explain this growth: intraday liquidity, better tax efficiency, and lower costs. While the first advantage is self-evident, the latter two are not.

Market-cap-weighted index investing is fairly tax-efficient because it does not usually require turnover in response to changing fundamentals. Where the median active fund in the large-blend category had a median turnover of 46% in 2013, the corresponding figure for the median market-cap-weighted index fund was only 5%. ETFs build on this tax advantage through their in-kind redemption and creation process. This process allows managers to transfer low-cost-basis shares out of the fund in a tax-free transaction with the fund's authorized participants. The resulting incremental tax savings may give ETFs an edge over mutual funds that track the same indexes, particularly during periods of net withdrawals. While many well-run index mutual funds have been just as tax-efficient as their ETF counterparts during the past decade, this may be partially because index mutual funds enjoyed net inflows as index investing has grown in popularity.

Unlike index mutual funds, ETF managers do not have to maintain accounts for individual investors, which helps reduce their administrative expenses. But the apparent magnitude of savings that investors enjoy in the form of lower expense ratios depends on how the data is sliced. In a blog post entitled, "Yes, Virginia, ETF investors pay higher expense ratios than mutual fund investors," Joel Dickson, a principal at Vanguard, found that index ETFs had a higher average asset-weighted expense ratio than index mutual funds. He argued that this was because a larger portion of ETF assets are invested in alternatively weighted index strategies and commodities, which are more expensive than the plain-vanilla market-cap-weighted equity and bond indexes that most passive mutual funds track. Dickson also cited institutional share classes with low fees and Vanguard's large share of the traditional index mutual fund market as additional factors contributing to this surprising result. But that comparison does not answer the more important question: For any given index, do ETFs or index mutual funds offer lower cost exposure? This study seeks to answer that question.

We attempt to compare the total costs of investing in index mutual funds and ETFs in several broad categories. In the first section of this paper, we match ETFs and index mutual funds that track the same indexes within each style category and compare their annual report net expense ratios. While

differences in expense ratios do not tell the whole story, they offer a good starting point, because they often represent the largest and most predictable component of the total cost of owning a fund. We compare current ETF and index mutual fund fees and look at how they have changed during the past decade. In the second section of the paper, we evaluate other considerations that affect the total cost of ownership, including tracking error, liquidity, and tax efficiency. We conclude with a checklist that should help investors better assess whether ETFs or index mutual funds are more suitable for their particular needs.

Part I: Expense-Ratio Analysis

Scope

In order to facilitate a meaningful comparison, we limited our data set to broad market-cap-weighted stock and bond indexes that both ETFs and index mutual funds track. This requirement removes the vast majority of ETFs from our study because most track specialty indexes that are not available in a mutual fund format. We eliminated funds that were launched after Jan. 1, 2013, and grouped the remainder by Morningstar Category. Each category also had to include at least three index mutual funds and three ETFs as of April 2014 in order to remain in the sample. This left 521 mutual fund share classes (representing 193 mutual funds) and 94 ETFs, representing 48% of the ETF market, as measured by assets at the end of April 2014. Exhibit 23 in the appendix illustrates the target indexes included in each category.

Where We Are Today

Exhibit 1 illustrates the asset- and equal-weighted net expense ratios for each category of ETFs and index mutual funds we examined, based on their 2013 annual reports. The equal-weighted expense ratios suggest that ETFs offer substantial cost savings. On this measure, only the ETFs in the long government bond category were not cheaper than their mutual fund counterparts. However, outliers can have a significant impact on these averages. The asset-weighting approach mitigates this problem because low-cost funds tend to attract a disproportionate share of assets. It also better reflects the average investor's experience.

Not surprisingly, the mutual funds' asset-weighted expense ratios are generally lower than the equal-weighted expense ratios. The difference between the asset- and equal-weighted expense ratios is less pronounced among the ETFs in the sample. One possible explanation is that institutional investors may be attracted to funds that offer the best liquidity, such as SPDR S&P 500 SPY and iShares MSCI Emerging Markets EEM, even if they do not carry the lowest fees. This is because they are the cheapest to trade in large quantities and often have deep options markets. These features are particularly attractive to large institutional investors, who may use these funds for short-term asset-class exposure and hedging. These funds are often early entrants. Once they build a liquidity advantage over their peers, there may be less pressure on their fees. However, if the price gap is substantial, it could erode the funds' liquidity edge over time.

The asset-weighted expense ratio comparison narrowed ETFs' cost advantage in every category. Only three of the 14 ETF categories sport a lower asset-weighted expense ratio than their mutual fund counterparts. They look more expensive in eight of the categories.

Exhibit 1 Average 2013 Expense Ratios By Category (%)

	Index MF		ETFs		ETF Cost Advantage	
	Asset-Weighted	Equal-Weighted	Asset-Weighted	Equal-Weighted	Asset-Weighted	Equal-Weighted
Emerging Markets	0.19	0.46	0.37	0.32	–0.18	0.13
Foreign Large Blend	0.17	0.44	0.25	0.23	–0.09	0.21
Inflation-Protected Bond	0.18	0.14	0.19	0.12	–0.02	0.01
Intermediate Bond	0.11	0.37	0.11	0.11	0.00	0.27
Large Blend	0.10	0.52	0.09	0.13	0.01	0.39
Large Growth	0.18	1.05	0.18	0.19	0.00	0.86
Large Value	0.13	0.59	0.15	0.15	–0.02	0.44
Long Gov Bond	0.11	0.12	0.12	0.13	–0.01	0.00
Mid-Blend	0.16	0.51	0.18	0.16	–0.02	0.35
Mid-Growth	0.39	1.11	0.23	0.23	0.16	0.88
Mid-Value	0.19	1.28	0.19	0.23	0.00	1.05
Small Blend	0.18	0.67	0.17	0.16	0.01	0.51
Small Growth	0.14	1.14	0.20	0.23	–0.06	0.92
Small Value	0.15	1.30	0.20	0.24	–0.05	1.06

Source: Morningstar Direct. Data as of the end of each fund's fiscal 2013.

Institutional and Retail

Index mutual funds' institutional share classes pull the asset-weighted average expense ratio down. However, they require high minimum investments or are only available on select retirement plan platforms. In order to separate these restricted share classes from those that are broadly available to individual investors, we grouped the mutual fund share classes by minimum investment. Those with a minimum investment of $10,000 or less fell into the retail category, and those with minimums above this threshold went into the institutional group. We also categorized all share classes that require an intermediary to access as institutional. Each retail and institutional category needed at least three funds in order to remain in the sample.

On an asset-weighted basis, ETFs were slightly cheaper than the mutual funds' retail share classes in six of the 10 categories included. However, the institutional share classes were cheaper than the ETFs in every category except for mid-growth[1]. ETFs look like a better bargain on the equal-weighted expense ratios, though the institutional share classes narrowed the gap in five categories.

1. The asset-weighted institutional mid-growth expense ratio was higher than the total mutual fund mid-growth expense ratio because it excluded Vanguard Mid-Cap Growth Admiral, which is a large fund with a low expense ratio.

Exhibit 2 Average 2013 Expense Ratios By Share Class Type (%)

	Institutional		Retail		ETFs	
	Asset-Weighted	Equal-Weighted	Asset-Weighted	Equal-Weighted	Asset-Weighted	Equal-Weighted
Emerging Markets	0.16	0.50	0.21	0.36	0.37	0.32
Foreign Large Blend	0.13	0.44	0.19	0.48	0.25	0.23
Inflation-Protected Bond	—	—	0.20	0.18	0.19	0.12
Intermediate Bond	0.09	0.39	0.12	0.35	0.11	0.11
Large Blend	0.07	0.39	0.13	0.72	0.09	0.13
Large Growth	0.12	0.91	0.25	1.14	0.18	0.19
Large Value	0.11	0.66	0.15	0.39	0.15	0.15
Long Government Bond	—	—	—	—	0.12	0.13
Mid-Blend	0.14	0.52	0.20	0.49	0.18	0.16
Mid-Growth	0.74	1.10	—	—	0.23	0.23
Mid-Value	—	—	—	—	0.19	0.23
Small Blend	0.15	0.58	0.21	0.83	0.17	0.16
Small Growth	0.09	1.18	—	—	0.20	0.23
Small Value	0.11	1.17	0.16	1.36	0.20	0.24

Source: Morningstar Direct. Data as of the end of each fund's fiscal 2013.

Exhibit 3 ETF Cost Advantage Against Institutional and Retail Mutual Fund Share Classes (%)

	Asset Weighted		Equal Weighted	
	Institutional	Retail	Institutional	Retail
Emerging Markets	–0.22	–0.16	0.17	0.03
Foreign Large Blend	–0.12	–0.06	0.20	0.24
Inflation-Protected Bond	—	0.01	—	0.05
Intermediate Bond	–0.02	0.01	0.28	0.24
Large Blend	–0.02	0.04	0.26	0.59
Large Growth	–0.07	0.07	0.72	0.95
Large Value	–0.04	0.00	0.51	0.23
Long Government Bond	—	—	—	—
Mid-Blend	–0.05	0.01	0.36	0.33
Mid-Growth	0.51	—	0.87	—
Mid-Value	—	—	—	—
Small Blend	–0.02	0.04	0.42	0.67
Small Growth	–0.11	—	0.95	—
Small Value	–0.09	–0.04	0.93	1.12

Source: Morningstar Direct. Data as of the end of each fund's fiscal 2013.

The Vanguard Factor

The results of this analysis are also sensitive to whether Vanguard funds are included. Because Vanguard prices its funds at cost, many of its index mutual funds are cheaper than ETFs from other providers. Vanguard's index funds have significant influence on the asset-weighted averages because they tend to be among the largest mutual funds in each category. However, Vanguard has a smaller

share of the ETF market. Vanguard funds accounted for 80.0% of the assets in our index mutual fund sample and 32.3% of the assets in the ETF group.

After removing Vanguard's funds, ETFs look cheaper than their mutual fund counterparts on an asset-weighted basis in every category included except foreign large blend. The asset-weighted expense ratios for Vanguard's ETFs are slightly lower than the corresponding values for its mutual funds. All of Vanguard's U.S. ETFs are separate share classes of its mutual funds. Vanguard charges the same expense ratio for the Admiral and ETF share classes. This hybrid structure is unique to Vanguard funds.

Exhibit 4 Average 2013 Expense Ratios for Vanguard and Non-Vanguard Funds (%)

	Index MF (Ex Vanguard)		**Index MF** (Vanguard)		**ETF** (Ex Vanguard)		**ETF** (Vanguard)	
	Asset-Weighted	Equal-Weighted	Asset-Weighted	Equal-Weighted	Asset-Weighted	Equal-Weighted	Asset-Weighted	Equal-Weighted
Emerging Markets	0.34	0.61	—	—	—	—	—	—
Foreign Large Blend	0.23	0.51	0.15	0.14	0.34	0.34	0.11	0.13
Inflation-Protected Bond	—	—	—	—	—	—	—	—
Intermediate Bond	0.21	0.47	0.09	0.10	0.16	0.34	0.08	0.10
Large Blend	0.20	0.59	0.07	0.09	0.10	0.16	0.06	0.10
Large Growth	0.59	1.26	0.11	0.11	0.20	0.23	0.09	0.13
Large Value	0.23	0.96	0.11	0.12	0.19	0.20	0.09	0.12
Long Gov Bond	—	—	—	—	—	—	—	—
Mid-Blend	0.42	0.60	0.10	0.11	0.21	0.21	0.09	0.11
Mid-Growth	1.14	1.43	—	—	0.26	0.28	—	—
Mid-Value	—	—	—	—	0.26	0.28	—	—
Small Blend	0.36	0.73	0.11	0.10	0.19	0.19	0.09	0.13
Small Growth	—	—	—	—	0.25	0.28	0.09	0.16
Small Value	1.71	1.89	—	—	0.25	0.29	0.09	0.16

Source: Morningstar Direct. Data as of the end of each fund's fiscal 2013.

Exhibit 5 ETF Cost Advantage for Vanguard and Non-Vanguard Funds (%)

	Ex Vanguard		**Vanguard**	
	Asset-Weighted	Equal-Weighted	Asset-Weighted	Equal-Weighted
Emerging Markets	—	—	—	—
Foreign Large Blend	–0.11	0.17	0.04	0.01
Inflation-Protected Bond	—	—	—	—
Intermediate-Term Bond	0.05	0.13	0.01	0.00
Large Blend	0.10	0.43	0.01	–0.01
Large Growth	0.39	1.03	0.02	–0.01
Large Value	0.04	0.76	0.02	0.00
Long Government Bond	—	—	—	—
Mid-Blend	0.21	0.40	0.01	0.00
Mid-Growth	0.89	1.16	—	—
Mid-Value	—	—	—	—
Small Blend	0.17	0.54	0.01	–0.03
Small Growth	—	—	—	—
Small Value	1.46	1.60	—	—

Source: Morningstar Direct. Data as of the end of each fund's fiscal 2013.

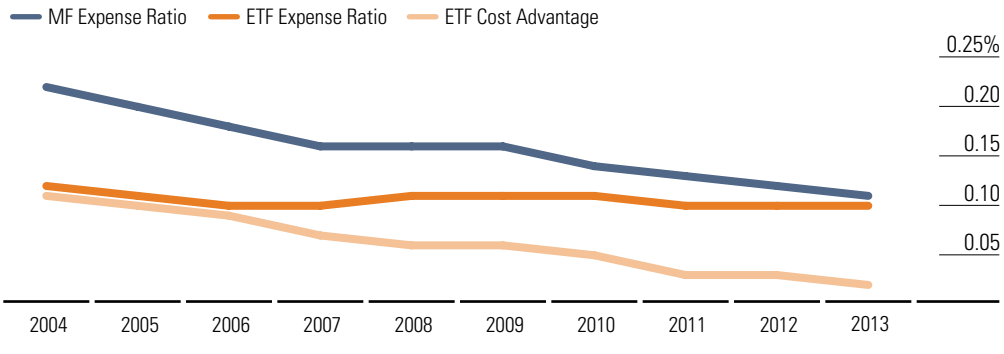
Investors in Vanguard funds with mutual fund and ETF share classes have a claim on the same underlying pool of assets, with the same tax liabilities. Vanguard is able to use this structure for its mutual fund investors' benefit by transferring low-cost-basis shares out of the portfolio through an in-kind transaction with the ETF market makers. However, it may be less tax-efficient for ETF investors than a stand-alone ETF because Vanguard's ETF investors must share the tax liabilities that could result when mutual fund investors sell their shares.

Fee Trends

We extended our analysis back 10 years to uncover fee trends, including funds that are no longer surviving[2]. As before, each category had to have at least three funds to qualify for inclusion. Only six categories made the cut for the full 10 years: large blend, large value, large growth, mid-blend, small growth, and small value. Exhibits 29 through 31 in Appendix 3 show the historical asset-weighted expense ratios for all the categories, even if they do not have 10 years of history.

Based on these funds' annual reports from 2004 through 2013, ETFs' asset-weighted cost advantage relative to their index mutual fund counterparts in the large-blend category fell to 0.01% from 0.10%. As the chart below illustrates, this was almost entirely due to a decline in asset-weighted index mutual fund expenses.

Exhibit 6 Large Blend Asset-Weighted Expense Ratio (%)

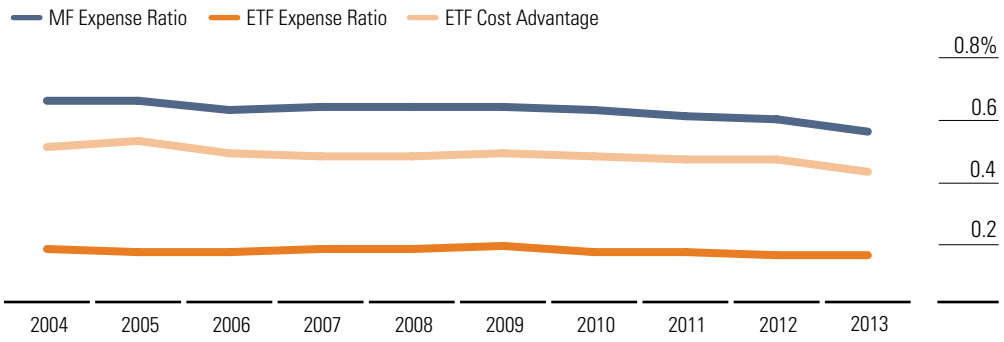


Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

During this time, some of the most expensive index mutual funds shut down and new funds entered with lower expense ratios. However, most of this decline resulted from assets moving to the lowest-cost mutual funds. The reduction in the equal-weighted mutual fund expense ratio was much smaller, as the chart below shows. On this metric, large-blend ETFs continue to look considerably cheaper than the mutual funds in the category.

2. In order to compare like with like, at least one mutual fund and ETF had to track each index in the sample. When the closure of three nonsurviving mutual funds in our sample violated that condition, we also removed the ETFs that tracked the corresponding benchmarks.

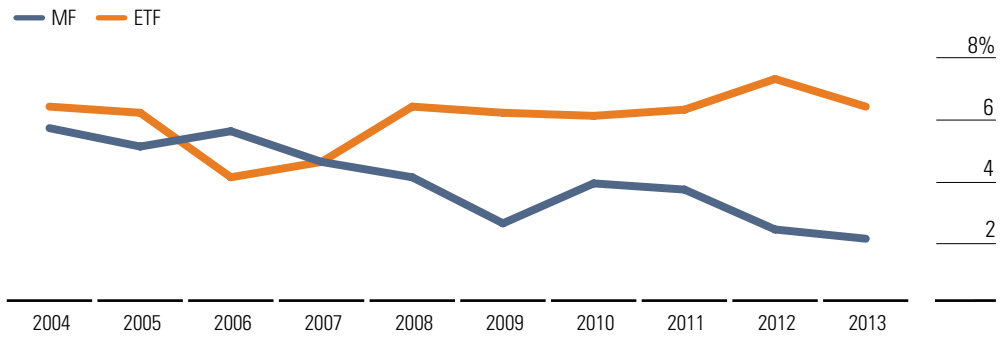
Exhibit 7 Large Blend Equal-Weighted Expense Ratio (%)



Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

The fact that the equal-weighted mutual fund expense ratios were significantly higher than the asset-weighted expenses suggests that there are still a number of expensive index mutual fund share classes with very few assets. The chart below nicely illustrates this point. It shows the percentage of assets in the large-blend category invested in mutual fund share classes and ETFs with expense ratios above the median for each vehicle.

Exhibit 8 Percentage of Assets Invested in Large Blend Index Funds with Above-Median Expense Ratios



Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

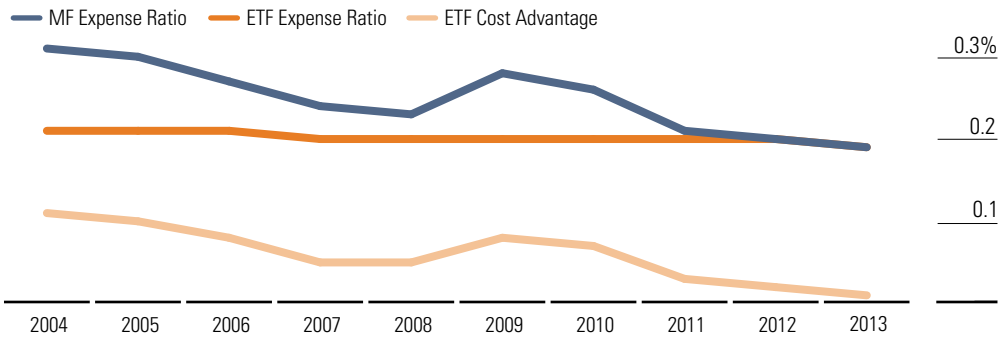
In many cases, there were cheaper funds that offered identical exposure. The market was efficient in the sense that money tended to flow toward the lowest-cost options. But it is surprising that the most expensive funds survived at all. Inertia is a powerful force. These funds tend to be older, and investors may be deterred from selling them to avoid capital gains and the tax liabilities they could trigger. Some of the more expensive mutual fund options may also gain new assets through retirement platforms, where investors have limited choices.

The difference between the asset-weighted and equal-weighted expense ratios for ETFs was much less pronounced. This may be because it is often easier for investors to switch among ETFs, while some mutual funds enjoy a more captive audience through retirement platforms. Similar to

their mutual fund counterparts, expensive ETFs did not garner significant market share in the large-blend category.

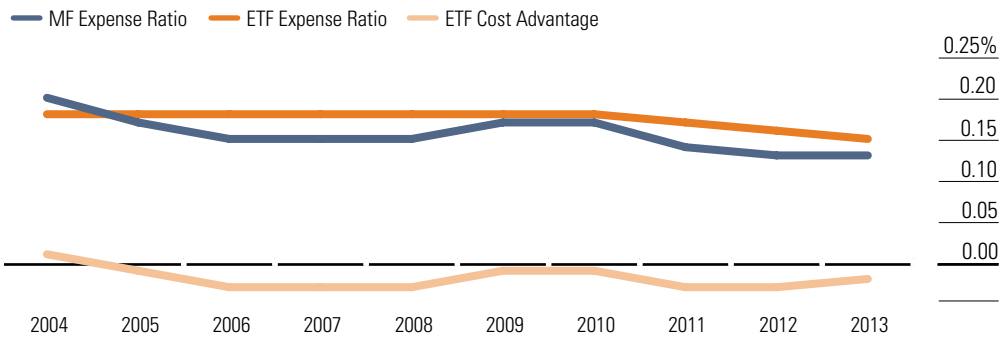
The fee trends are similar for the large-growth, large-value, mid-blend, small-growth, and small-value categories. Asset-weighted mutual fund expense ratios have declined during the past decade. However, the asset-weighted differences between ETF and mutual fund expense ratios have not changed much, with the exception of the large-growth category. ETFs' asset-weighted cost advantage in each category was also much smaller (and in some cases negative) than the equal-weighted cost advantage, suggesting that there were many expensive mutual fund share classes with few assets. The charts below illustrate how the asset-weighted expense ratios for these five categories have changed during the past decade. Appendix 2 shows this data on an equal-weighted basis.

Exhibit 9 Large Growth Asset-Weighted Expense Ratio (%)



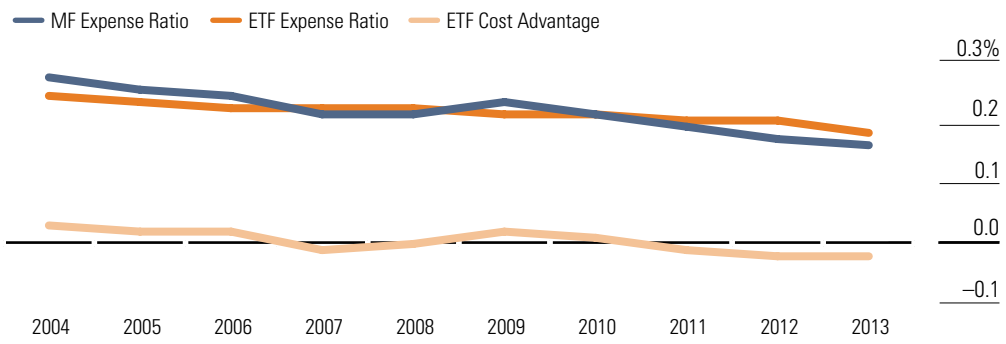
Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 10 Large Value Asset-Weighted Expense Ratio (%)



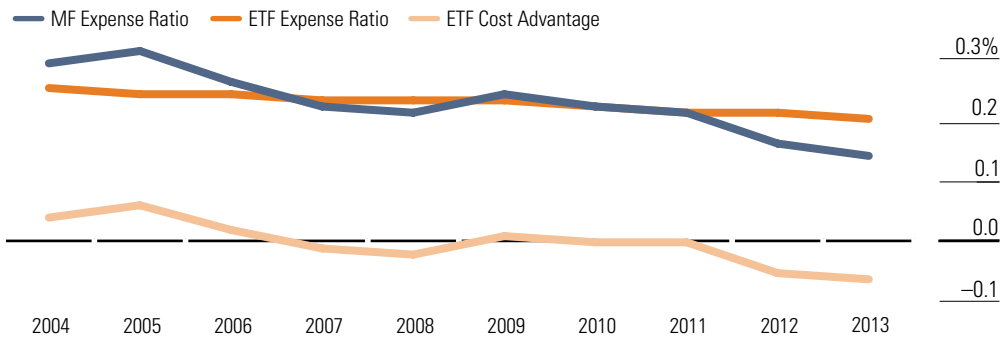
Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 11 Mid-Blend Asset-Weighted Expense Ratio (%)



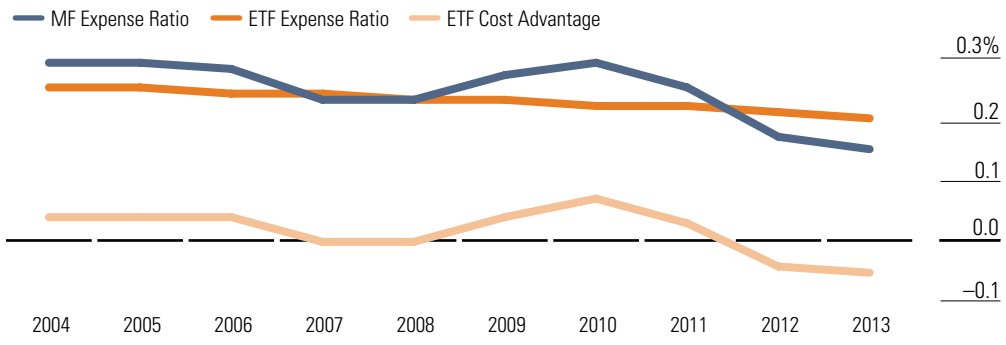
Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 12 Small Growth Asset-Weighted Expense Ratio (%)



Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 13 Small Value Asset-Weighted Expense Ratio (%)



Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Although they were not included in the sample for the whole 10-year period, the asset-weighted ETF cost advantage eroded the most in the mid-blend and mid-value categories from 2006 to 2013, to 0.16% from 0.85% and to 0.00% from 0.78%, respectively. The cost advantage in the small-blend category also meaningfully eroded to 0.01% from 0.14% from 2005 to 2013.

Exhibits 32 through 35 in Appendix 3 show the historical expense-ratio trends for the retail and institutional mutual fund share classes in each category. Since each category needed to have at least three separate funds to remain in the sample, the early years of the sample only include a few categories. Not surprisingly, the retail share classes were more expensive than their institutional counterparts in most categories. Yet, ETFs were only a little cheaper than the retail share classes in most categories during the past decade. Retail share classes have become more competitive relative to ETFs in the large-blend, large-growth, large-value, and small-blend categories. Institutional share classes in the foreign large-blend, U.S. large-blend, mid-blend, and small-blend categories have become cheaper relative to their ETF counterparts, while those in the emerging-markets, intermediate-bond, and large-value categories have become slightly more expensive.

We also tracked expense-ratio trends for Vanguard funds and all other funds separately. Exhibits 36 through 41 in Appendix 3 present these results. The decline in ETFs' asset-weighted cost advantage relative to mutual funds during the past decade is more pronounced in the large-blend, large-value, and large-growth categories after removing the Vanguard funds. While ETFs' asset-weighted cost advantage appears to have declined in the small-value category as a whole, their cost advantage actually grew to 1.46% from 0.94% between 2005 and 2013 after excluding Vanguard funds. Similarly, Vanguard's low-cost mutual funds explain the decline in ETFs' cost advantage in the mid-growth category. Excluding Vanguard's funds, ETFs maintained a sizable edge over their mutual fund counterparts from 2006 through 2013.

It was more challenging to run this analysis for the Vanguard funds in each category because only three categories met the minimum fund requirement for more than three years. However, there was little change in the asset-weighted difference in expense ratios between Vanguard's ETFs and mutual funds in each category during the period where sufficient data is available.

The Bottom Line

Investors have plenty of low-cost options, regardless of whether they choose to go with an ETF or index mutual fund. There are expensive funds, to be sure, but they do not usually attract much attention—nor should they, given the multitude of increasingly inexpensive options that investors have at their disposal. The difference in expenses between the two vehicles is small, at least on an asset-weighted basis. As measured on the basis of fees alone, one vehicle is not categorically better than the other.

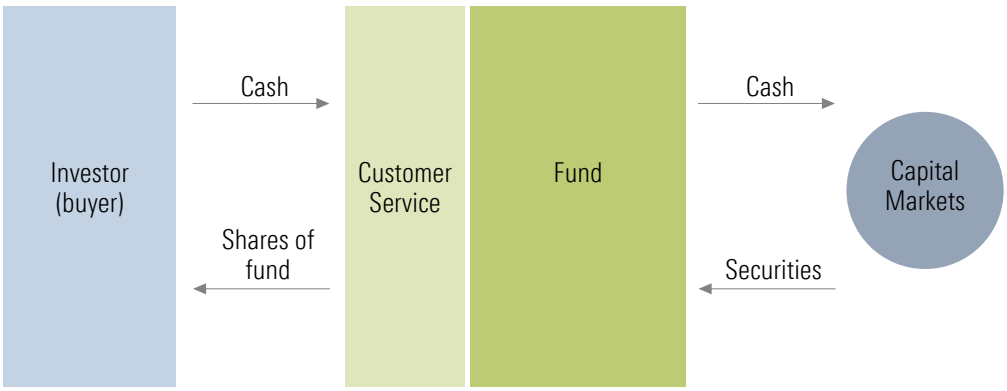
Part II: Total Cost of Ownership

While the expense ratio is the most visible—and usually largest—component of the total cost of owning a fund, investors must take additional factors into account to assess the total cost of ownership. These include tax efficiency, tracking ability, and trading costs. Because many of these issues can be difficult to quantify and are dependent on investors' specific circumstances and objectives, we provide a general framework for evaluating their impact on total cost of fund ownership.

Taxes

Market-cap-weighted index funds tend to be relatively tax-efficient because they typically have lower turnover than most actively managed funds and recognize fewer capital gains as a result. But investors' sales of an index mutual fund can reduce its tax efficiency. The figure below illustrates how a transaction between an investor and a mutual fund works. When an investor purchases a mutual fund, she sends cash directly to the fund company and in return receives newly created fund shares from the fund company. The fund then goes out and uses this cash to buy securities in the capital markets. The reverse occurs when investors want to take money out. The fund must sell securities for cash. If the fund realizes a gain when it sells these securities, all of the fund's investors are responsible for the tax bill, even those who don't sell.

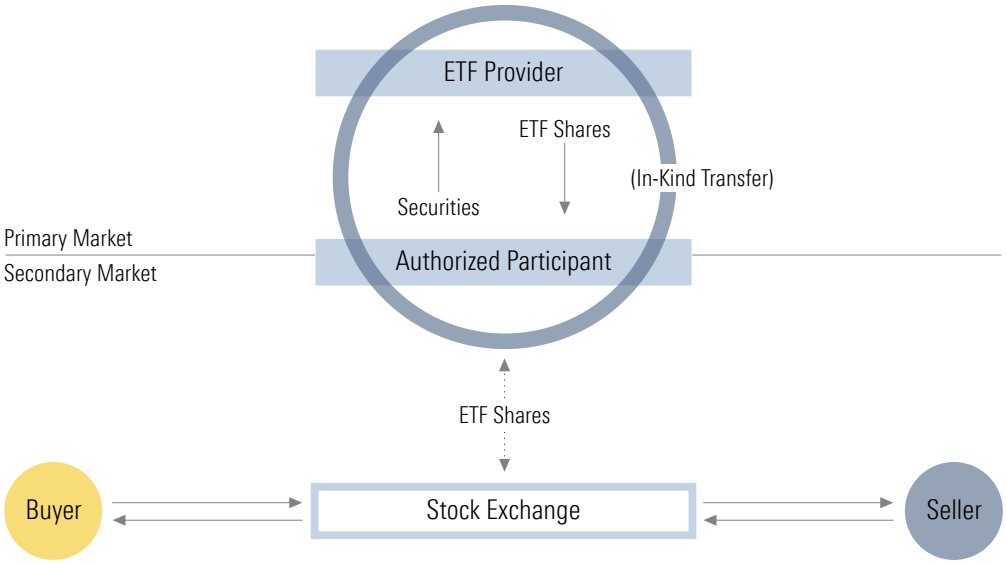
Exhibit 14



ETFs have a few structural advantages over index mutual funds that make them less likely to distribute capital gains. The figure below shows how ETF shares are created and destroyed. Most ETF investors trade with one another on the secondary market. As a consequence, the ETF's manager does not need to sell any securities in the portfolio to raise cash for these investors. ETFs can only be created and redeemed by authorized participants in the primary market. If demand for an ETF is strong, and it begins to trade above net asset value, an authorized participant may buy the underlying securities in the ETF and deliver them to the ETF provider. In exchange, the authorized participant will receive newly created ETF shares. This increase in supply of ETF shares should meet the increased demand on the secondary market.

In contrast, when selling pressure causes an ETF to trade below NAV, an authorized participant could buy the ETF on the secondary market and deliver it to the fund company in exchange for the fund's underlying securities. Unlike a cash sale, this in-kind transaction is not a taxable event in the United States. The manager can elect to transfer out the shares with the lowest cost basis to further reduce potential tax liabilities. This structural advantage should help mitigate an ETF's realized capital gains and improve its tax efficiency relative to an index mutual fund that tracks the same benchmark.

Exhibit 15



In order to assess the relative tax efficiency of index mutual funds and ETFs, we compared the median potential capital gains exposure, tax-cost ratio, and the frequency of capital gains distributions for all funds in our study with at least five years of history. We analyzed the potential capital gains exposure as of August 2014. It reflects the unrealized capital gains in a fund. If a fund had to sell all of its holdings immediately (without the benefit of the in-kind redemption mechanism in the case of ETFs), potential capital gains would become realized capital gains. The tax-cost ratio is an estimate of the extent to which taxes erode a fund's annualized return. It is calculated as 100[1-((1+Ra)/(1+Rp))], where Ra represents aftertax returns, measured at the highest marginal tax rate for U.S. investors, and Rp represents the fund's pretax returns. The frequency of capital gains distributions is the percentage of years that a fund distributed capital gains, of any magnitude, during the past five years.

For purposes of this analysis, we grouped all funds into one of three categories: U.S. equity, international equity, and taxable bond. The U.S. equity ETFs in our sample appeared to be slightly more tax-efficient than index mutual funds according to each of the three statistics, as the table below illustrates. International-equity ETFs also appear more tax-efficient than index mutual funds,

but their advantage is smaller in this case. This is partially because some foreign tax jurisdictions do not allow for in-kind redemptions, which diminishes ETFs' structural tax advantage. Also, most international-equity funds' performance lagged that of U.S. equity funds over the five-year period analyzed, resulting in fewer capital gains. Consequently, there were also fewer opportunities for international-equity ETFs to leverage any potential tax advantage.

The picture was more mixed for taxable-bond funds. Although the median taxable-bond ETF had the same tax-cost ratio as the median mutual fund and lower potential capital gains, taxable-bond mutual funds made capital gain distributions less frequently. Bond ETFs may not be able to use the in-kind redemption mechanism as effectively as their equity counterparts. Turnover tends to be higher for bond indexes than equity indexes because bond index funds may sell bonds as they approach maturity. Bond ETFs may not be able to manage all of these trades through the in-kind redemption process. In addition, income tends to represent a larger share of the taxable distributions for bond funds than equity funds. In many cases, these distributions are larger than bond funds' capital gains. The ETF vehicle does not have an advantage over the mutual fund vehicle in mitigating the tax liabilities that income distributions trigger.

Exhibit 16 Tax Efficiency Comparison

Type	Category Group	Median Potential Captial Gains Exposure %	Median Tax Cost Ratio 5-Year %	Frequency of Capital Gains Distributions last 5-Year %
MF	US Equity	52	0.72	30
ETF	US Equity	20	0.37	2
MF	International Equity	10	0.82	16
ETF	International Equity	7	0.67	0
MF	Taxable Bond	4	1.19	67
ETF	Taxable Bond	3	1.19	85

Source: Morningstar Direct. Data as of August, 2014.

The in-kind redemption mechanism may allow equity ETFs to be more tax-efficient during a period of massive redemptions following strong market appreciation. However, investors usually do not sell after a period of strong performance, but rather after periods of poor performance when their balance of unrealized capital gains is likely to be lower. Therefore, the tax efficiency of index mutual funds and ETFs may have more to do with diligent portfolio management and investor behavior than simply a choice of vehicle. For further reading on this topic, see "*ETFs Under the Microscope: Tax Efficiency Survey*".

Trading Costs

An assessment of the total cost of ETF ownership must account for trading costs. Even though an ETF may have a lower expense ratio than a comparable mutual fund, it may be more expensive to own after factoring in trading costs. Investors buy and sell mutual funds at NAV, often directly from the fund issuer without paying trading commissions. In contrast, ETF investors usually pay commissions

and are rarely able to trade at NAV, as many ETFs tend to trade at (typically small) premiums and discounts to the value of their underlying assets. There are also implicit trading costs to consider, such as bid-ask spreads and market-impact costs. Of course, mutual fund investors ultimately bear some of these trading costs too, though their effect is reflected in funds' benchmark-relative (that is, tracking) performance. The ETF structure largely externalizes these costs—they are borne by market makers, authorized participants, and investors buying and selling ETF shares—rather than spreading them among all investors, as mutual funds do.

Trading costs may put ETFs at a slight disadvantage relative to no-load index mutual funds, which investors can often purchase directly from the fund issuer with no brokerage fee. But because commissions are typically fixed fees, they become less significant as the size of the trade or the length of an investor's anticipated holding period increases. Many brokers also offer commission-free ETF trading programs, which help reduce this cost hurdle.

While trading commissions are the most conspicuous component of trading costs, indirect trading costs, such as the bid-ask spread and market impact of trading can often be more important. The magnitude of these costs depends on the size of a trade, the liquidity of the ETF, and the liquidity of its holdings. Investors can often place small trades in heavily traded ETFs at the quoted bid-ask spread with little to no market impact. An ETF with high trading volume will typically have a narrower bid-ask spread than an ETF with a low volume. A trade that accounts for a large percentage of the daily trading volume can cause the bid-ask spread to widen and move the market price. This is called market impact. However, a large trade may not cause the bid-ask spread to widen if the fund's authorized participants can create new ETF shares to meet the demand. This is easier to do when the ETF has liquid underlying securities or correlated securities that allow authorized participants to hedge their exposure when they create or redeem ETF shares.

The bid-ask spread as a percentage of price is calculated throughout the trading day as the best bid minus the best ask, divided by the average of the two. We averaged this daily value over three months in the summer of 2014 for all of the large-blend ETFs in our study. The value ranged from just half a basis point for the most liquid ETF, SPDR S&P 500 SPY, to a hefty 22 basis points for SPDR Russell 1000 ETF ONEK. SPY trades more than $20 billion dollars a day while ONEK trades less than $200,000 in an average day. The average bid-ask spread to price ratio for Vanguard Total Stock Market VTI was 1.5 basis points. Limit orders can help reduce trading costs in more thinly traded funds.

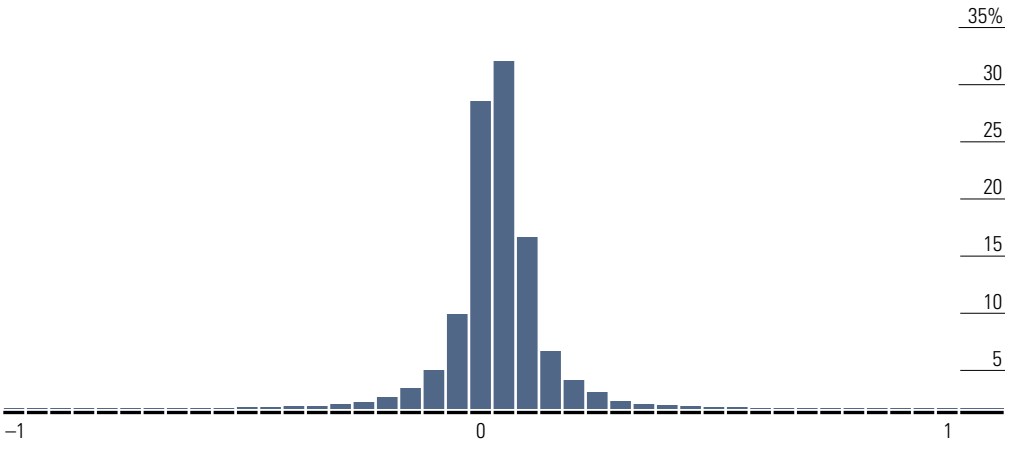
Similar to trading commissions, the bid-ask spread and market-impact cost of trading tend to become less important as the holding period increases. They are also smaller in more heavily traded funds. However, these additional costs can represent a meaningful portion of the total cost of ownership of ETFs, particularly for short-term traders and small funds. No comparison of the cost of owning mutual funds and ETFs would be complete without considering them.

Premiums and Discounts

ETFs trading at premiums or discounts to NAV may be a concern for investors, but they rarely impact the total cost of ownership in a predictable way. The arbitrage mechanism that the creation and redemption process facilitates typically keeps ETFs' market prices within rational bounds of net asset value, particularly for the plain-vanilla index ETFs we examined in this study. For U.S. equity index ETFs, premiums and discounts are typically small and mean-reverting. Small premiums and discounts can still occur because of slight differences between the time of the last trade and the time that the NAV is struck. A large market-on-close order can also push the market price of an ETF slightly away from the NAV of the underlying securities.

The histogram below illustrates the distribution of daily premiums and discounts for all surviving U.S. equity ETFs in our study for every trading day in 2013. About 86% of the time, the deviation between these ETFs' closing prices and their end-of-day NAVs was less than 0.15%. In fact, the average premium was only 1 basis point. While there were some meaningful deviations from NAV, they were more likely to occur in the less liquid ETFs. Sometimes these differences are due to timing differences between the last ETF trade and calculation of NAV, which does not represent a real cost to investors.

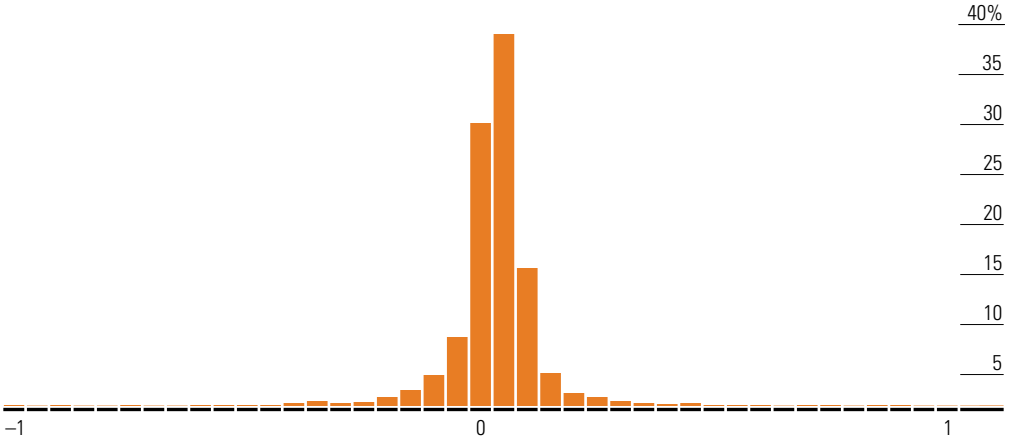
Exhibit 17 Distribution of Daily Premiums and Discounts for U.S. Equity ETFs in 2013



Source: Morningstar Direct. Data as of December, 2013.

Large premiums and discounts were also uncommon for the taxable-bond ETFs in our sample in 2013, as the histogram below shows. About 91% of the time, these deviations from NAV were less than 15 basis points. Those results were better than we expected and may be due to the heavy exposure the funds in our sample had to Treasury bonds. Corporate bonds tend to be thinly traded are likely to suffer from stale pricing, which can create larger deviations from NAV. Furthermore, where equity ETFs' NAVs are calculated based on the last trading price for the underlying securities, bond ETFs' NAVs are usually based on the underlying securities' bid prices[3]. As a result, if a bond ETF has heavy buy volume, it can appear to trade at a premium.

Exhibit 18 Distribution of Daily Premiums and Discounts for Taxable-Bond ETFs in 2013



Source: Morningstar Direct. Data as of December, 2013.

Not surprisingly, international-equity ETFs were more likely to exhibit large deviations from NAV. The funds we analyzed in this group only closed within 15 basis points of NAV 59% of the time, largely because of timing differences between when the fund and its underlying holdings trade. The net asset values for these funds are based on closing prices for the local markets of the securities in each fund, which are struck at different times than the closing market price of the ETF. When the foreign markets are closed, U.S. listed international-equity ETFs may act as price discovery vehicles. Therefore, it is usually not accurate to interpret the resulting premiums and discounts as some form of mispricing.

3. Unlike Vanguard, BlackRock, and SSGA, which use bid prices to calculate NAV for most bond ETFs, Schwab bond ETFs use the midpoint of the underlying holdings' spreads to calculate NAV.

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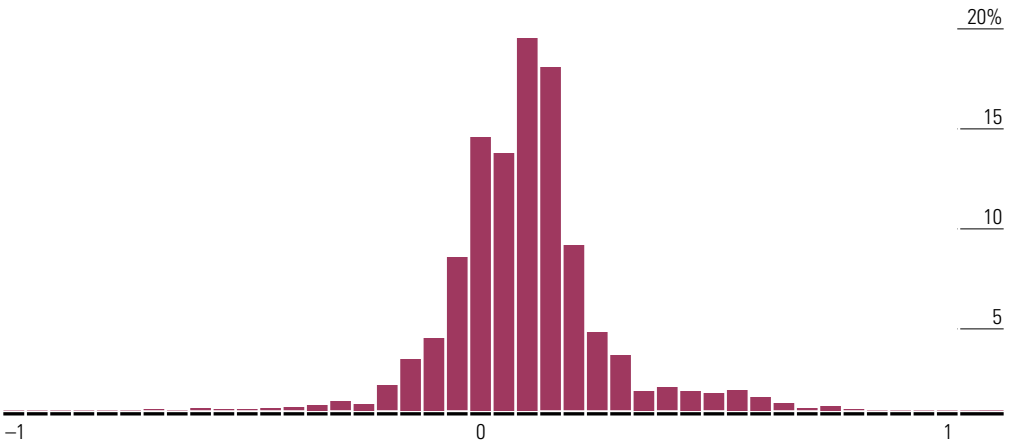
Exhibit 19 Distribution of Daily Premiums and Discounts for International Equity ETFs in 2013



Source: Morningstar Direct. Data as of December, 2013.

Tracking Ability: Estimated Holding Costs

There are two common approaches to measuring the ability of a fund to track its index. One measures the difference between the long-term performance of a fund and its index. This is commonly referred to as tracking difference. But this metric is susceptible to endpoint bias that can result from temporary premiums or discounts or fair value adjustments to the fund's NAV. In order to correct for this potential noise, we take 20 different observations of a fund's one- or five-year return and then use the geometric average of these values. Morningstar calls this estimated holding cost.

Holding all else equal, an investor should expect an index fund to have a return equal to that of its benchmark index, less fees. However, real-world index fund returns can vary from that ideal for a variety of reasons, including trading costs, variability resulting from index sampling, income distributions, differences in tax assumptions, and securities lending revenue. From an investor's standpoint, a lower estimated holding cost is better because it indicates that the fund is hewing closely to the performance of its benchmark index.

We looked at the estimated holding cost for the funds in our study for the one- and five-year periods through June 30, 2014. In order to remain in the sample for this analysis, all funds had to track the same index for the full period. This eliminated a large number of Vanguard funds from the five-year comparison, as many of the firm's funds switched benchmarks during that horizon. On an equal-weighted basis, ETFs did a better job of tracking their indexes than mutual funds for the one-year period. But on an asset-weighted basis, mutual funds' tracking performance was better than ETFs' among U.S. and international-equity funds.

The high estimated holding cost for U.S. equity ETFs was reflective of the effect of two large ETFs, SPDR S&P 500 SPY and PowerShares QQQ. SPY is structured as a unit investment trust, which prevents it from engaging in securities lending or reinvesting cash dividends. These restrictions encumber its ability to track its benchmark, which increases its estimated holding cost. And QQQ's 0.20% expense ratio is fairly high compared with the expense ratios of the largest index mutual funds.

Similarly, two of the largest international-equity ETFs, iShares MSCI EAFE EFA and iShares MSCI Emerging Markets EEM, drove up the category's asset-weighted estimated holding cost. These two funds are fairly expensive, and have high estimated holding costs as a result. They exerted a stronger influence on the category over the five-year period—when these two funds had a greater share of assets—relative to the one-year period.

During the five-year period, taxable-bond ETFs had a lower estimated holding cost than bond index mutual funds. This was partially because two of the largest bond index ETFs, iShares TIPS Bond TIP and iShares Core U.S. Aggregate Bond AGG, have very low expense ratios, while several of the largest and cheapest bond index mutual funds from Vanguard were excluded from the sample because they have not tracked the same index for five years. This left the relatively expensive Fidelity Spartan U.S. Bond Index Investor FBIDX as the largest bond index mutual fund in the group, giving it the greatest sway on the asset-weighted estimated holding cost.

Exhibit 20 Estimated Holding Cost Comparison

		1-year Estimated Holding Cost %		5-year Estimated Holding Cost %	
Type	Category Group	Asset-Weighted	Equal-Weighted	Asset-Weighted	Equal-Weighted
MF	US Equity	0.09	0.64	0.10	0.81
ETF	US Equity	0.13	0.13	0.14	0.10
MF	International Equity	0.12	0.39	0.15	0.32
ETF	International Equity	0.18	0.05	0.58	0.44
MF	Taxable Bond	0.10	0.30	0.29	0.49
ETF	Taxable Bond	0.04	0.16	0.15	0.21

Source: Morningstar Direct. Data as of September, 2014.

Tracking Ability: Tracking Volatility

The second approach to measuring tracking ability looks at the likelihood that a fund is going to match its index over a short holding period. Morningstar calls this measure tracking volatility. Among the largest U.S. equity index funds, tracking volatility is typically negligible, but some smaller funds can have noticeable tracking volatility. ETFs had slightly lower tracking volatility than index mutual funds among U.S. equity and taxable-bond funds, although the difference is small.

While funds that invest in international securities may appear to have greater tracking volatility than their domestic-equity counterparts, part of this is due to timing differences between when the fund's holdings close overseas and the time the fund strikes its NAV at the end of the U.S. trading day. This issue can be particularly noticeable if the fund applies a fair value adjustment to its NAV to protect investors from market-timing arbitragers, because the underlying index does not make such an adjustment. International-equity mutual funds are more likely to apply these fair value adjustments than their ETF counterparts, since they stand ready to transact with investors at NAV—unlike ETFs. This helps explain why international-equity mutual funds appear to have greater tracking volatility over short time horizons.

Exhibit 21 5-Year Tracking Volatitly Comparison

Type	Category Group	Median %	Asset Weighted %
MF	US Equity	0.14	0.06
ETF	US Equity	0.04	0.05
MF	International Equity	2.14	2.11
ETF	International Equity	0.59	0.69
MF	Taxable Bond	0.23	0.30
ETF	Taxable Bond	0.12	0.14

Source: Morningstar Direct. Data as of September, 2014.

Tracking volatility appears to be more related to fund size than vehicle type, where larger funds have the edge. The two S&P 500 ETFs with a five-year track record, SPDR S&P 500 SPY and iShares Core S&P 500 IVV, had tracking volatility during the past five years of about 0.03% and 0.04%, respectively. Both of these funds had well over $10 billion in assets during that period. S&P 500 index mutual funds with more than $10 billion in assets had a similar median five-year tracking volatility of about 0.04%. Funds with between $1 billion and $10 billion had a slightly greater median tracking volatility of 0.08%, while the corresponding figure for those with less than $1 billion was 0.13%.

Checklist

There is a lot to think about when choosing between an index mutual fund and an ETF. As we have discussed, expense ratios don't tell the whole story. Here are some questions investors should keep in mind to evaluate whether an ETF or index mutual fund is more suitable for their specific needs.

Will this investment be held in a taxable account?

Because ETFs tend to be more tax-efficient than index mutual funds, they may be the better option for taxable accounts.

Will the holding period be greater than a year?
When amortized over longer holding periods, the costs of trading ETFs become less significant.

Are your brokerage commissions $10 a trade, or less?
Because investors can often purchase mutual funds directly from the fund company without commission, higher commissions swing the equation in favor of mutual funds. But check whether the broker offers commission-free ETF trades.

Will you make frequent, small investments into or withdrawals out of the fund over time?
The fixed commissions that investors incur when they trade ETFs can add up for small or frequent trades. The bid-ask spread can also become a meaningful cost for frequent ETF trades.

Is the investment larger than $10,000?
When investing in ETFs, a large trade reduces the significance of fixed trading costs relative to the size of the trade.

Do you wish to reinvest dividends?
Mutual funds typically offer automatic dividend reinvestment, with no transaction fees. In contrast, investors may incur additional commissions when they reinvest dividends in ETFs, though some brokerage firms offer commission-free dividend-reinvestment programs.

Does the ETF in question have at least $500 million in assets or trade at least $1 million in average daily dollar volume?
The bid-ask spread and market-impact cost of trading tend to decline as a fund's trading volume and asset base increase.

Do you require intraday tradability?
Mutual funds are priced and traded once a day while ETFs are traded throughout the day.

Is there a different fund tracking the same benchmark with a lower expense ratio?
It is important to look across both the mutual fund and ETF universes for the lowest-cost option.

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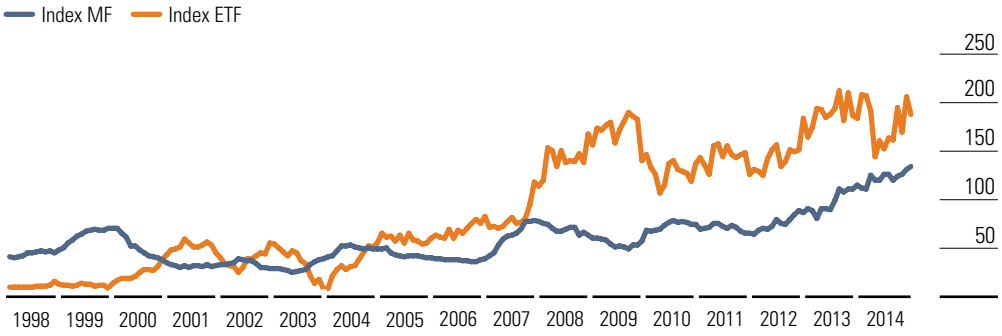
Appendix 1

Exhibit 22 Rolling 12-Month Flows to index Mutual Funds and ETFs ($ Bil), January 1998 through September 2014



Source: Morningstar Direct. Data as of September, 2014.

Exhibit 23 Underlying Indexes and Number of Funds Tracking Them

	Mutual Fund		ETF	
Category / Index	Fund Count	Assets ($ Mil)	Fund Count	Assets ($ Mil)
Emerging Markets				
FTSE Emerging	1	15,825	2	47,449
MSCI EM	3	3,497	1	40,123
Foreign Large Blend				
FTSE Global All Cap ex US (USA)	1	111,208	1	2,331
MSCI EAFE	15	31,546	1	52,823
FTSE AW Ex US	1	9,150	1	11,522
MSCI ACWI Ex USA	4	2,664	2	2,192
FTSE Developed ex North America	1	2,542	1	19,021
Inflation-Protected Bond				
Barclays U.S. TIPS 0-5 Year	1	6,726	1	1,085
Barclays U.S. Treasury US TIPS	2	349	2	12,973
Intermediate Bond				
Barclays U.S. Agg Float Adj	2	163,067	1	17,637
Barclays U.S. Aggregate Bond	13	34,065	3	16,414
Barclays U.S. 5-10Y GovCredit FIAdj	1	10,772	1	3,695
Barclays U.S. MBS Float Adjusted	1	377	1	378
Large Blend				
S&P 500	50	490,548	3	243,588
CRSP U.S. Total Market	2	304,658	1	39,165
Russell 3000	3	8,544	3	6,062
Russell 1000	4	8,376	3	9,003
CRSP U.S. Large Cap	1	3,504	1	4,707

Exhibit 23 Underlying Indexes and Number of Funds Tracking Them (Continued)

	Mutual Fund		ETF	
Category / Index	Fund Count	Assets ($ Mil)	Fund Count	Assets ($ Mil)
NASDAQ U.S. Div Achievers Select	1	3,466	1	19,474
S&P 100	1	1,545	1	4,258
Russell Top 200	1	774	1	74
CRSP U.S. Mega Cap	1	311	1	669
Large Growth				
CRSP U.S. Large Cap Growth	1	24,221	1	13,265
Russell 1000 Growth	2	2,844	2	22,905
NASDAQ 100	4	1,327	1	45,338
NASDAQ Composite	1	721	1	312
Russell Top 200 Growth	1	480	1	442
S&P 500 Growth	2	178	3	9,713
S&P 500 Pure Growth	1	134	1	938
CRSP U.S. Mega Cap Growth	1	20	1	1,231
Large Value				
CRSP U.S. Large Cap Value	1	16,138	1	12,461
FTSE High Dividend Yield	1	3,191	1	7,276
Russell 1000 Value	2	2,903	2	20,905
CRSP U.S. Mega Cap Value	1	187	1	671
Russell Top 200 Value	1	163	1	129
S&P 500 Value	2	126	3	6,819
Long Gov Bond				
Barclays U.S. Treasury STRIPS 20–30 Year Equal Par Bond	1	398	1	127
Barclays U.S. Treasury Long	1	267	1	36
Barclays U.S. Long Govt Float Adj	1	77	1	70
Mid-Blend				
CRSP U.S. Mid Cap	1	39,996	1	6,728
S&P Completion	2	34,218	1	3,105
S&P MidCap 400	14	16,667	3	38,297
Russell Midcap	2	2,882	1	9,316
Mid-Growth				
CRSP U.S. Mid Cap Growth	1	2,161	1	1,896
Russell Midcap Growth	1	337	1	4,766
S&P MidCap 400 Pure Growth	1	298	1	805
S&P MidCap 400 Growth	2	108	3	4,919
Mid-Value				
CRSP US Mid Cap Value	1	2,393	1	2,256
S&P MidCap 400 Value	2	101	3	3,687
S&P 500 Pure Value	1	94	1	565
Small Blend				
CRSP U.S. Small Cap	1	36,026	1	8,217
Russell 2000	15	10,428	2	27,864
S&P SmallCap 600	6	6,498	3	14,808

Exhibit 23 Underlying Indexes and Number of Funds Tracking Them (Continued)

	Mutual Fund		ETF	
Category / Index	Fund Count	Assets ($ Mil)	Fund Count	Assets ($ Mil)
Small Growth				
MSCI U.S. Small Cap Growth	1	11,563	1	3,637
Russell 2000 Growth	1	149	2	6,425
S&P SmallCap 600 Pure Growth	1	75	1	120
S&P SmallCap 600 Growth	1	46	3	3,359
Small Value				
CRSP U.S. Small Cap Value	1	8,445	1	3,908
S&P SmallCap 600 Value	1	144	3	3,397
Russell 2000 Value	1	82	2	6,224
S&P SmallCap 600 Pure Value	1	40	1	156
S&P MidCap 400 Pure Value	1	12	1	89

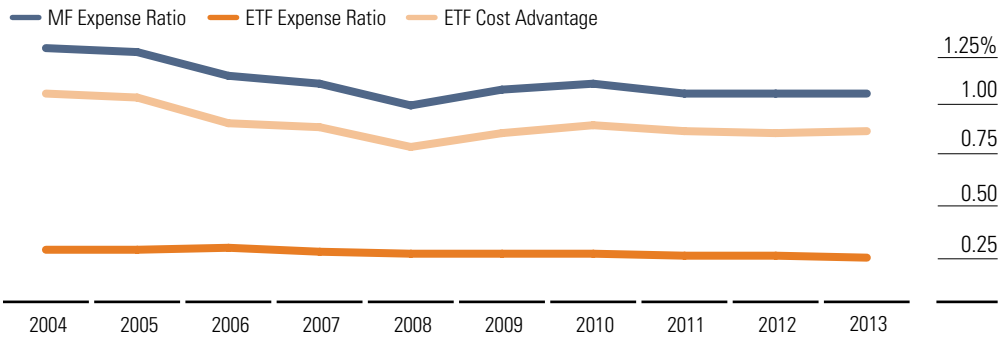
Source: Morningstar Direct. Data as of September 30, 2014.

Notes on terminology

Throughout this paper, we exclude money market funds. We refer to index funds as those ETFs that list a primary prospectus benchmark and index mutual funds as those that describe themselves as index funds in their prospectus. We use the annual report net expense ratio or the prospectus expense ratio when the annual report expense ratio is unavailable. All data is survivorship bias free when possible or unless otherwise noted. Restricted Access fund have investment minimums greater than $10,000 or restrict direct purchase in some way.

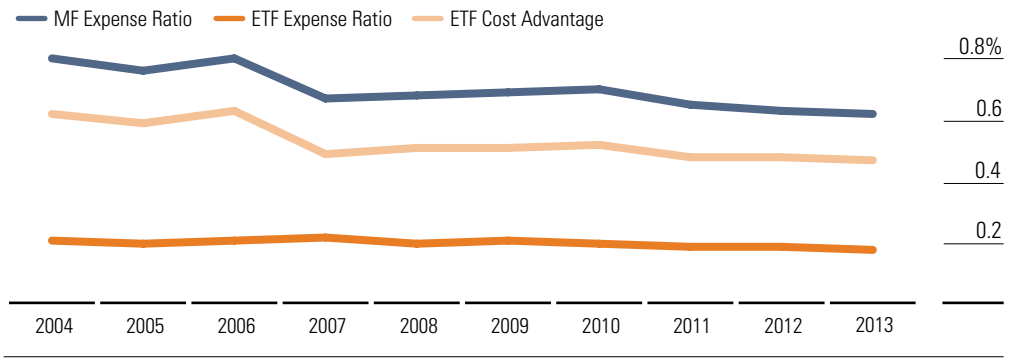
Appendix 2

Exhibit 24 Large Growth Equal-Weighted Expense Ratio (%)



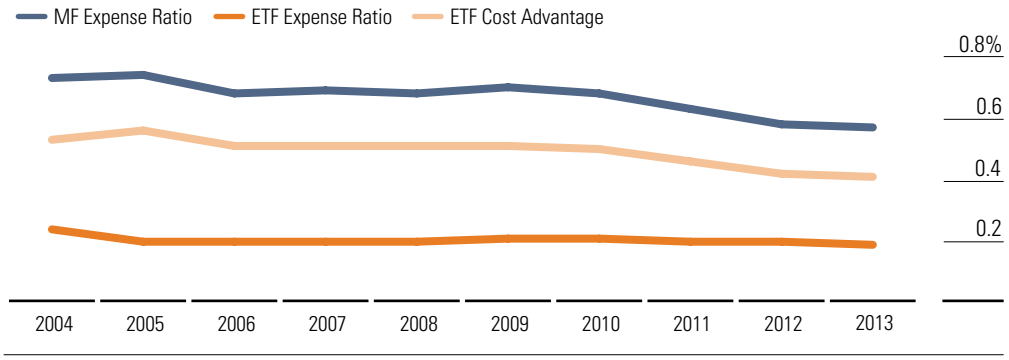
Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 25 Large Value Equal-Weighted Expense Ratio (%)



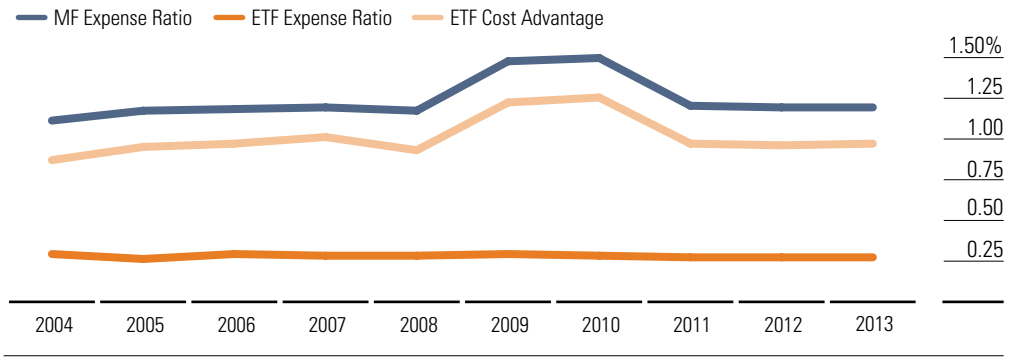
Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 26 Mid-Blend Equal-Weighted Expense Ratio (%)



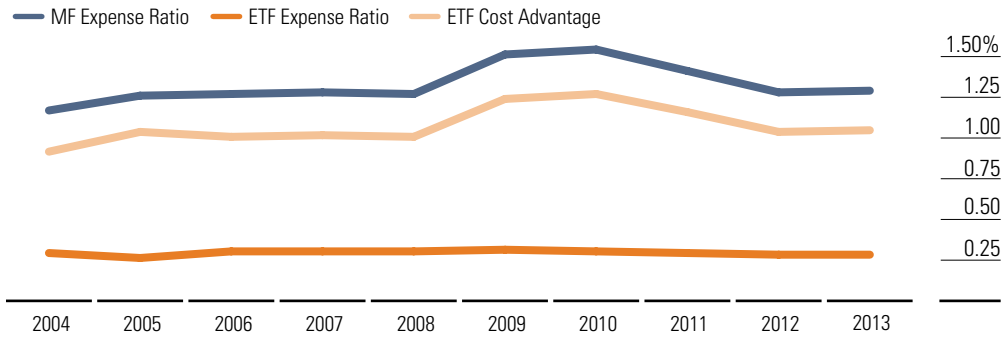
Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 27 Small Growth Equal-Weighted Expense Ratio (%)



Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 28 Small Value Equal-Weighted Expense Ratio (%)



Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Appendix 3

All data is asset weighted, unless noted otherwise

Exhibit 29 Historical Mutual Fund Expense Ratios (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	0.30	0.26	0.23	0.19
Foreign Large Blend	0.45	0.40	0.38	0.31	0.14	0.24	0.24	0.19	0.17	0.17
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	0.18
Intermediate-Term Bond	0.21	0.2	0.19	0.17	0.17	0.17	0.16	0.14	0.12	0.11
Large Blend	0.21	0.19	0.17	0.15	0.15	0.15	0.13	0.12	0.11	0.10
Large Growth	0.30	0.29	0.26	0.23	0.22	0.27	0.25	0.2	0.19	0.18
Large Value	0.20	0.17	0.15	0.15	0.15	0.17	0.17	0.14	0.13	0.13
Long Gov Bond	—	—	—	—	—	—	0.14	0.12	0.12	0.11
Mid-Blend	0.27	0.25	0.24	0.21	0.21	0.23	0.21	0.19	0.17	0.16
Mid-Growth	—	1.32	1.10	0.70	0.45	0.51	0.48	0.46	0.46	0.39
Mid-Value	—	1.25	1.02	0.98	0.43	0.43	0.40	0.36	0.23	0.19
Small Blend	0.36	0.34	0.31	0.28	0.28	0.27	0.25	0.21	0.19	0.18
Small Growth	0.29	0.31	0.26	0.22	0.21	0.24	0.22	0.21	0.16	0.14
Small Value	0.29	0.29	0.28	0.23	0.23	0.27	0.29	0.25	0.17	0.15

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 30 Historical ETF Expense Ratios (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	0.49	0.42	0.38	0.37
Foreign Large Blend	—	—	—	0.34	0.33	0.32	0.31	0.29	0.28	0.25
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	0.19
Intermediate-Term Bond	—	—	—	0.19	0.17	0.17	0.16	0.15	0.14	0.11
Large Blend	0.11	0.10	0.09	0.09	0.10	0.10	0.10	0.09	0.09	0.09
Large Growth	0.20	0.20	0.20	0.19	0.19	0.19	0.19	0.19	0.19	0.18
Large Value	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.17	0.16	0.15
Long Gov Bond	—	—	—	—	—	—	0.13	0.14	0.12	0.12
Mid-Blend	0.24	0.23	0.22	0.22	0.22	0.21	0.21	0.20	0.20	0.18
Mid-Growth	—	—	0.25	0.24	0.24	0.24	0.24	0.23	0.23	0.23
Mid-Value	—	—	0.25	0.25	0.24	0.23	0.22	0.21	0.21	0.19
Small Blend	—	0.20	0.20	0.19	0.19	0.19	0.18	0.18	0.18	0.17
Small Growth	0.25	0.24	0.24	0.23	0.23	0.23	0.22	0.21	0.21	0.20
Small Value	0.25	0.25	0.24	0.24	0.23	0.23	0.22	0.22	0.21	0.20

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 31 ETF Cost Advantage

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	–0.19	–0.17	–0.15	–0.18
Foreign Large Blend	—	—	—	–0.02	–0.19	–0.08	–0.07	–0.10	–0.10	–0.09
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	–0.02
Intermediate-Term Bond	—	—	—	–0.02	0.00	0.00	0.01	–0.01	–0.02	0.00
Large Blend	0.10	0.09	0.08	0.06	0.05	0.05	0.04	0.02	0.02	0.01
Large Growth	0.10	0.09	0.07	0.04	0.04	0.07	0.06	0.02	0.01	0.00
Large Value	0.01	–0.01	–0.03	–0.03	–0.03	–0.01	–0.01	–0.03	–0.03	–0.02
Long Gov Bond	—	—	—	—	—	—	0.01	–0.01	0.00	–0.01
Mid-Blend	0.03	0.02	0.02	–0.01	0.00	0.02	0.01	–0.01	–0.02	–0.02
Mid-Growth	—	—	0.85	0.45	0.21	0.27	0.25	0.23	0.22	0.16
Mid-Value	—	—	0.78	0.74	0.19	0.20	0.18	0.15	0.02	0.00
Small Blend	—	0.14	0.11	0.08	0.09	0.07	0.06	0.03	0.01	0.01
Small Growth	0.04	0.06	0.02	–0.01	–0.02	0.01	0.00	0.00	–0.05	–0.06
Small Value	0.04	0.04	0.04	0.00	0.00	0.04	0.07	0.03	–0.04	–0.05

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 32 Retail Mutual Fund Share Class Expense Ratios (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	0.34	0.30	0.28	0.21
Foreign Large Blend	0.48	0.41	0.37	0.28	0.10	0.24	0.24	0.21	0.20	0.19
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	0.20
Intermediate-Term Bond	0.23	0.22	0.21	0.20	0.21	0.19	0.18	0.16	0.14	0.12
Large Blend	0.23	0.21	0.19	0.16	0.17	0.17	0.16	0.14	0.14	0.13
Large Growth	0.33	0.33	0.32	0.28	0.31	0.35	0.31	0.27	0.26	0.25
Large Value	0.23	0.20	0.18	0.17	0.19	0.23	0.22	0.17	0.16	0.15
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	0.27	0.25	0.24	0.22	0.23	0.26	0.25	0.21	0.21	0.20
Mid-Growth	—	—	—	—	—	—	—	—	—	—
Mid-Value	—	—	—	—	—	—	—	—	—	—
Small Blend	0.36	0.34	0.32	0.29	0.32	0.31	0.27	0.23	0.22	0.21
Small Growth	—	—	—	—	—	—	—	—	—	—
Small Value	—	0.28	0.29	0.24	0.25	0.29	0.32	0.28	0.18	0.16

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 33 Institutional Mutual Fund Expense Ratios

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	0.16	0.14	0.14	0.16
Foreign Large Blend	0.39	0.40	0.39	0.36	0.37	0.35	0.21	0.16	0.14	0.13
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	—
Intermediate-Term Bond	0.15	0.14	0.14	0.12	0.11	0.13	0.13	0.12	0.10	0.09
Large Blend	0.17	0.16	0.14	0.12	0.11	0.11	0.10	0.09	0.08	0.07
Large Growth	0.15	0.13	0.09	0.10	0.08	0.14	0.15	0.13	0.13	0.12
Large Value	0.11	0.10	0.09	0.13	0.10	0.11	0.12	0.11	0.11	0.11
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	0.27	0.25	0.23	0.19	0.18	0.19	0.18	0.17	0.15	0.14
Mid-Growth	—	—	—	—	—	—	—	0.83	0.76	0.74
Mid-Value	—	—	—	—	—	—	—	—	—	—
Small Blend	0.35	0.33	0.28	0.25	0.22	0.22	0.21	0.18	0.17	0.15
Small Growth	—	—	—	—	—	—	—	0.11	0.09	0.09
Small Value	—	—	—	—	—	—	—	—	0.11	0.11

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 34 ETF Cost Advantage Against Retail Mutual Fund Share Classes (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	-0.15	-0.13	-0.11	-0.16
Foreign Large Blend	—	—	—	–0.06	–0.23	–0.08	–0.07	–0.08	–0.08	–0.06
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	0.01
Intermediate-Term Bond	—	—	—	0.00	0.03	0.02	0.03	0.01	0.00	0.01
Large Blend	0.12	0.11	0.10	0.07	0.07	0.08	0.06	0.04	0.04	0.04
Large Growth	0.13	0.13	0.12	0.09	0.12	0.16	0.12	0.08	0.08	0.07
Large Value	0.04	0.02	0.00	–0.01	0.00	0.05	0.04	0.00	0.00	0.00
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	0.03	0.02	0.02	0.00	0.02	0.05	0.04	0.01	0.01	0.01
Mid-Growth	—	—	—	—	—	—	—	—	—	—
Mid-Value	—	—	—	—	—	—	—	—	—	—
Small Blend	—	0.15	0.13	0.10	0.13	0.12	0.09	0.05	0.04	0.04
Small Growth	—	—	—	—	—	—	—	—	—	—
Small Value	—	0.04	0.05	0.01	0.02	0.06	0.10	0.06	–0.03	–0.04

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 35 ETF Cost Advantage Against Institutional Mutual Fund Share Classes (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	–0.33	–0.29	–0.24	–0.22
Foreign Large Blend	—	—	—	0.03	0.04	0.02	–0.10	–0.13	–0.14	–0.12
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	—
Intermediate-Term Bond	—	—	—	–0.07	–0.06	–0.04	–0.03	–0.03	–0.03	–0.02
Large Blend	0.05	0.06	0.05	0.03	0.01	0.01	0.00	–0.01	–0.02	–0.02
Large Growth	–0.05	–0.07	–0.11	–0.09	–0.11	–0.05	–0.04	–0.05	–0.06	–0.07
Large Value	–0.08	–0.08	–0.09	–0.05	–0.08	–0.07	–0.06	–0.06	–0.05	–0.04
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	0.03	0.03	0.01	–0.02	–0.03	–0.03	–0.03	–0.04	–0.05	–0.05
Mid-Growth	—	—	—	—	—	—	—	0.59	0.52	0.51
Mid-Value	—	—	—	—	—	—	—	—	—	—
Small Blend	—	0.13	0.08	0.06	0.03	0.03	0.03	0.00	–0.02	–0.02
Small Growth	—	—	—	—	—	—	—	–0.10	–0.12	–0.11
Small Value	—	—	—	—	—	—	—	—	–0.10	–0.09

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 36 Mutual Fund ex Vanguard Expense Ratios (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	—	0.68	0.57	0.34
Foreign Large Blend	0.51	0.46	0.42	0.35	0.32	0.28	0.27	0.24	0.23	0.23
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	—
Intermediate-Term Bond	0.37	0.37	0.36	0.36	0.36	0.36	0.36	0.31	0.24	0.21
Large Blend	0.37	0.33	0.28	0.27	0.25	0.25	0.26	0.23	0.22	0.20
Large Growth	0.81	0.75	0.59	0.71	0.57	0.62	0.73	0.69	0.64	0.59
Large Value	0.30	0.21	0.14	0.28	0.18	0.19	0.31	0.26	0.25	0.23
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	0.45	0.42	0.45	0.39	0.38	0.39	0.41	0.42	0.41	0.42
Mid-Growth	—	1.32	1.16	1.7	0.97	0.96	0.91	1.03	1.15	1.14
Mid-Value	—	—	—	—	—	—	—	—	—	—
Small Blend	0.58	0.53	0.5	0.49	0.47	0.41	0.41	0.39	0.37	0.36
Small Growth	—	—	—	—	—	—	—	—	—	—
Small Value	—	1.19	1.14	1.62	0.54	1.66	1.59	1.6	1.65	1.71

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 37 ETF ex Vanguard Expense Ratios (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	—	—	—	—
Foreign Large Blend	—	—	—	—	0.34	0.35	0.35	0.34	0.34	0.34
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	—
Intermediate-Term Bond	—	—	—	—	—	—	—	0.20	0.20	0.16
Large Blend	0.11	0.10	0.09	0.09	0.10	0.10	0.10	0.10	0.10	0.10
Large Growth	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.20
Large Value	0.18	0.18	0.19	0.19	0.19	0.19	0.19	0.19	0.19	0.19
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	0.24	0.24	0.23	0.23	0.23	0.22	0.22	0.22	0.22	0.21
Mid-Growth	—	—	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26
Mid-Value	—	—	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.26
Small Blend	—	—	0.20	0.20	0.20	0.20	0.20	0.20	0.20	0.19
Small Growth	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Small Value	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 38 ETF Cost Advantage ex Vanguard (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	—	—	—	—
Foreign Large Blend	—	—	—	—	–0.02	–0.07	–0.08	–0.10	–0.11	–0.11
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	—
Intermediate-Term Bond	—	—	—	—	—	—	—	0.11	0.04	0.05
Large Blend	0.26	0.23	0.19	0.18	0.15	0.15	0.16	0.13	0.12	0.10
Large Growth	0.61	0.55	0.39	0.51	0.37	0.42	0.53	0.49	0.44	0.39
Large Value	0.12	0.03	–0.06	0.09	–0.02	0.00	0.11	0.07	0.06	0.04
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	0.21	0.18	0.22	0.17	0.16	0.17	0.19	0.19	0.19	0.21
Mid-Growth	—	—	0.91	1.45	0.72	0.71	0.65	0.77	0.89	0.89
Mid-Value	—	—	—	—	—	—	—	—	—	—
Small Blend	—	—	0.30	0.29	0.27	0.21	0.21	0.19	0.17	0.17
Small Growth	—	—	—	—	—	—	—	—	—	—
Small Value	—	0.94	0.89	1.37	0.29	1.41	1.33	1.35	1.40	1.46

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 39 Vanguard Mutual Fund Expense Ratios (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	—	—	—	—
Foreign Large Blend	—	—	—	—	0.04	0.22	0.23	0.18	0.16	0.15
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	—
Intermediate-Term Bond	0.16	0.15	0.15	0.13	0.14	0.13	0.12	0.11	0.10	0.09
Large Blend	0.13	0.12	0.12	0.09	0.10	0.10	0.09	0.08	0.07	0.07
Large Growth	—	—	—	—	—	—	—	0.13	0.12	0.11
Large Value	—	—	—	—	0.14	0.17	0.16	0.13	0.12	0.11
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	—	—	—	—	—	—	—	0.12	0.11	0.10
Mid-Growth	—	—	—	—	—	—	—	—	—	—
Mid-Value	—	—	—	—	—	—	—	—	—	—
Small Blend	—	—	—	—	—	—	—	0.12	0.12	0.11
Small Growth	—	—	—	—	—	—	—	—	—	—
Small Value	—	—	—	—	—	—	—	—	—	—

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 40 Vanguard ETF Expense Ratios (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	—	—	—	—
Foreign Large Blend	—	—	—	—	—	—	—	0.15	0.12	0.11
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	—
Intermediate-Term Bond	—	—	—	—	—	—	0.11	0.10	0.10	0.08
Large Blend	—	—	—	0.07	0.07	0.08	0.08	0.07	0.07	0.06
Large Growth	—	—	—	—	—	—	—	0.10	0.10	0.09
Large Value	—	—	0.11	0.15	0.13	0.11	0.10	0.09	0.10	0.09
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	—	—	—	—	—	—	—	0.10	0.10	0.09
Mid-Growth	—	—	—	—	—	—	—	—	—	—
Mid-Value	—	—	—	—	—	—	—	—	—	—
Small Blend	—	—	—	—	—	—	—	0.10	0.10	0.09
Small Growth	—	—	—	—	—	—	—	0.10	0.10	0.09
Small Value	—	—	—	—	—	—	—	0.10	0.10	0.09

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.

Exhibit 41 Cost Advantage of Vanguard ETFs Against Vanguard Mutual Funds (%)

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Diversified Emerging Markets	—	—	—	—	—	—	—	—	—	—
Foreign Large Blend	—	—	—	—	—	—	—	0.15	0.12	0.11
Inflation-Protected Bond	—	—	—	—	—	—	—	—	—	—
Intermediate-Term Bond	—	—	—	—	—	—	0.11	0.10	0.10	0.08
Large Blend	—	—	—	0.07	0.07	0.08	0.08	0.07	0.07	0.06
Large Growth	—	—	—	—	—	—	—	0.10	0.10	0.09
Large Value	—	—	0.11	0.15	0.13	0.11	0.10	0.09	0.10	0.09
Long Gov Bond	—	—	—	—	—	—	—	—	—	—
Mid-Blend	—	—	—	—	—	—	—	0.10	0.10	0.09
Mid-Growth	—	—	—	—	—	—	—	—	—	—
Mid-Value	—	—	—	—	—	—	—	—	—	—
Small Blend	—	—	—	—	—	—	—	0.10	0.10	0.09
Small Growth	—	—	—	—	—	—	—	0.10	0.10	0.09
Small Value	—	—	—	—	—	—	—	0.10	0.10	0.09

Source: Morningstar Data. Data as of the end of each fund's fiscal 2013.