Asset manager funds*

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Abstract

Institutional investors paid asset managers average annual fees of $172 billion between 2000 and 2012. We show that asset managers outperformed their benchmarks by 96 basis points per year before fees, and by 49 basis points after fees. Estimates from a Sharpe (1992) model suggest that asset managers achieved outperformance through factor exposures ("smart beta"). If institutions had instead implemented a long-only mean-variance efficient portfolio over the same factors via institutional mutual funds, they would have earned just as a high, but no higher, Sharpe ratio as by delegating to asset managers. Liquid, low-cost ETFs are likely eroding the comparative advantage of asset managers. Because asset managers account for 29% of investable assets, the adding-up constraint implies that the average dollar of everyone else had a negative alpha of 49 basis points.

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1 Introduction

When retail investors delegate their investments, they typically do so by buying retail mutual funds. When institutional investors delegate, however, they generally bypass institutional mutual funds and instead delegate assets to active, strategy-specific funds set up by asset managers to pool a small number of institutional client accounts. We refer to these investment vehicles as "asset manager funds." As of 2012, total worldwide institutional assets were \$64 trillion, of which institutions delegated \$48 trillion: \$43 trillion to asset manager funds and \$5 trillion to institutional mutual funds. For comparison, retail mutual funds worldwide held \$27 trillion in 2012. A lack of data has hindered research on asset managers. Whereas retail mutual funds are subject to mandatory disclosure under the 1940 Investment Company Act, asset manager funds are not. These data limitations and the concomitant limited research have persisted since Lakonishok, Shleifer, and Vishny (1992).

To shed light on the holdings and performance of asset manager funds, we obtained fund-specific data for the 2000–2012 period from a global consultant that advises pension funds, endowments, and other institutional investors on the allocation of capital into asset manager funds. This database contains quarterly assets, monthly returns, and fee structures for 22,289 asset manager funds offered by 3,272 asset manager firms. The data comprise \$25 trillion in assets under management as of June 2012, which represents more than half of the institutional capital delegated to asset managers at that time. Based on conversations with the database provider, the other half consists primarily of segregated accounts that are closed to investment. Our sample thus represents close to the universe of funds that were open to new investors during this period. We show that the database does not suffer from survivorship bias and is not biased toward better performing funds.

Our first contribution, reported above, is to document the size of the institutional asset management sector. We make seven additional contributions. First, we document the profile of asset manager funds.

The median fund has six clients and $285 million in capital. Nearly half (47%) of the aggregate capital included in the database is in fixed income, and 40% is in equities. The remainder splits between asset blends (7%) and hedge funds (6%). The United States hosts 43% of investments—19% in U.S. equity funds and 23% in U.S. fixed income funds.

Second, we contribute to the literature on the cost of financial intermediation by documenting the aggregate fees paid by institutional investors. Asset manager funds charge the average delegated dollar a fee of 47 basis points. We are not the first study to measure the fees paid by institutional investors. Prior literature primarily examines institutional equity funds and large pension funds, documenting that delegation costs approximately 50–60 basis points for large institutions (Coles, Suay, and Woodbury 2000; Busse, Goyal, and Wahal 2010; Dyck, Lins, and Pomorski 2013; Jenkinson, Jones, and Martinez 2015). However, the depth of our data globally and across asset classes allows us to go beyond the per-asset cost to document aggregate dollar fees. We estimate that, in aggregate, institutions paid $172 billion per year in fees over the 2000–2012 period, approximately twice the aggregate fees paid by retail mutual fund investors over the same period (French 2008; Bogle 2008).

Third, we document the extent of active management in asset manager funds. We estimate tracking errors of 8.7% in models that use broad asset class benchmarks and 5.9% in models that use granular strategy-level benchmarks. These tracking errors are comparable to Petäjistö's (2013) estimates for active retail mutual funds. Hence, asset manager funds are not passive vehicles. Given the size of the asset manager fund market, our findings imply that the literature on active management overlooks approximately two-thirds of actively managed capital.

Fourth, we document that the average asset manager fund earns an annual market-adjusted gross alpha of 119 basis points (t-statistic of 3.19) over the 2000–2012 period. In dollar terms, 119 basis points of gross alpha translates to $432 billion per year, with $260 billion accruing to institutions and \$172 billion to asset managers. These results do not necessarily imply that the delegated assets of institutions earn positive risk-adjusted returns because asset managers may take more risk than the rest of the market. However, positive gross alpha over the market together with the adding-up constraint implies that the market-adjusted gross alpha of all other investors must be negative (Sharpe 1991). If the \$48 trillion in delegated institutional capital has a market-adjusted positive gross alpha, and retail mutual funds earn gross alphas close to zero (Fama and French 2010), then non-delegating retail and institutional investors together must have a negative gross alpha.[1]

Fifth, we document performance from the perspective of an institutional investor delegating capital to an asset manager in order to gain exposure to a specific strategy (i.e., fulfill a "mandate"). As discussed by Goyal and Wahal (2008) and Jenkinson, Jones, and Martinez (2015), institutions typically construct their portfolios through a two-step process. Institutions first determine their strategy-level policy allocations by optimizing over strategy-level risk and return. Investment officers then fulfill strategy policy allocations either "in house" or by issuing an investment mandate to an external manager. Because portfolio risk is typically incorporated at a higher level, institutions appraise fund performance along two dimensions—net alpha and tracking error—both relative to the strategy benchmark in a single-factor model. We find that the average asset manager fund earns an annual strategy-level *net* alpha of 49 basis points (t-statistic of 1.87).

This positive performance is consistent with institutions being sophisticated investors (Del Guercio and Tkac 2002) but contrasts with most studies that examine the performance of institutions.[2] For example, using 13-F filings of U.S. institutional equity holdings, Lewellen (2011) finds that institutions

[1] This inference is consistent with Cohen, Gompers, and Vuolteenaho (2002), who find that retail investors lose to institutions in trading.

[2] A large literature studies performance of pension funds including Ippolito and Turner (1987), Lakonishok, Shleifer, and Vishny (1992), Coggin, Fabozzi, and Rahman (1993), Christopherson, Ferson, and Glassman (1998), Blake, Lehmann, and Timmerman (1999), Del Guercio and Tkac (2002), Ferson and Khang (2002), and Dyck and Pomorski (2012). Another literature studies endowments including Brown, Garlappi, and Tiu (2010), Lerner, Schoar, and Wang (2008), and Barber and Wang (2013).

did not significantly outperform the market. Lerner, Schoar, and Wang (2008) and Christopherson, Ferson, and Glassman (1998), by contrast, find positive performance for endowments and pension funds. The unit of observation in these aforementioned studies is usually an institution, rather than an investment vehicle offered by asset managers, and is thus not directly comparable to our setting. Most closely related to our asset manager fund-level unit of observation, Lakonishok, Shleifer, and Vishny (1992), Bange, Khang, and Miller (2008), Goyal and Wahal (2008), Evans and Fahlenbrach (2012), and Jenkinson, Jones, and Martinez (2015) examine sub-samples of delegated funds and do not find significantly positive alphas. The closest study, Busse, Goyal, and Wahal (2010), examines the performance of a large sample of asset manager funds that invest in U.S. public equities. They document a positive, but statistically insignificant, market-adjusted gross alpha of 64 basis points per year against broad asset class benchmarks, in line with our estimates for U.S. equity.

Sixth, our detailed data allow us to infer, in the spirit of Barber, Huang, and Odean (2015) and Berk and Binsbergen (2016), how asset managers achieve their positive net alphas. The marketing language used by asset managers speaks of smart betas or tactical factors,[3] and we therefore implement a multi-factor model based on Sharpe (1992). We form dynamic mimicking portfolios by estimating fund-level factor loadings. We choose factors that nest many of the literature's factor models across different asset classes. To reflect practice, we limit factors to be tradable indexes and the weights to be long-only and to sum to one. When we estimate fund performance compared against this mimicking portfolio, we find no excess return over the mimicking portfolio. The fact that asset managers outperform strategy-level benchmarks but earn returns comparable to that of a fund-level mimicking portfolio implies that asset managers provide institutional clients with profitable systematic deviations from benchmarks. When

[3]See, for example, Blitz (2013), Towers Watson (2013), and Jacobs and Levy (2014). Moreover, the employees of asset managers often publish professional articles about smart beta. See, for example, Staal, Corsi, Shores, and Woida (2015), which is authored by employees of Blackrock.

we examine cross sectional variation in fund fees, we find that institutions pay higher fees for those factors that have been more successful in the past.

Our seventh contribution emerges from the question of whether delegation was worth $172 billion per year. Could institutions have performed as well over the sample period by managing their assets in-house, assuming that they had the knowledge and ability to implement a factor portfolio? Following Berk and Binsbergen (2015), we consider the investment opportunity set of tradable indices that was available to institutions during the sample period. We find that if institutions had implemented dynamic, long-only mean-variance portfolios over factors to obtain their within-asset class exposures, they would have obtained a similar Sharpe ratio as asset manager funds once we take into account trading and administrative costs. This finding suggests that asset managers earned their fees at the margin. Our estimates also imply that the introduction of liquid, low-cost factor ETFs is likely eroding the comparative advantage of asset manager funds.

Our results contribute and build on the literature on institutional performance, including prior studies of asset managers (Bange, Khang, and Miller 2008; Busse, Goyal, and Wahal 2010), institutional mutual funds (Evans and Fahlenbrach 2012), pension funds (Ippolito and Turner 1987; Lakonishok, Shleifer, and Vishny 1992; Christopherson, Ferson, and Glassman 1998; Blake, Lehmann, and Timmerman 1999; Del Guercio and Tkac 2002; Ferson and Khang 2002; Dyck, Lins, and Pomorski 2013), and endowments (Brown, Garlappi, and Tiu 2010; Lerner, Schoar, and Wang 2008). Our results also complement the literature on the processes through which institutions delegate capital to asset managers (Coles, Suay, and Woodbury 2000; Busse, Goyal, and Wahal 2010; Dyck and Pomorski 2012). We build on the work of Jenkinson, Jones, and Martinez (2015), who find that consultants' investment recommendations do not add value for institutions investing in U.S. actively managed equity funds. Similarly, Goyal and Wahal (2008) find that, when pension fund sponsors replace asset managers, their future returns are no different from the returns that they would have earned had they stayed with the fired asset managers. Whereas these studies examine variation in performance conditional on delegation, we examine the benefits of delegation.

In addition, we contribute to the recent literature on the cost of financial intermediation. Philippon (2015) finds that financial services cost 2% of intermediated asset value. Greenwood and Scharfstein (2013) decompose costs across finance functions in the U.S. and show that securities intermediation function represents 22% of financial service revenues. Combining these estimates implies that the worldwide cost of securities intermediation was approximately $726 billion in 2012. If we aggregate the estimated costs for the sectors that comprise securities intermediation, we get close to Greenwood and Scharfstein's (2013) estimate: $100 billion for U.S. mutual funds (French 2008; Bogle 2008); $313 billion for worldwide individual trading (Barber, Lee, Liu, and Odean 2009); and now, with our evidence, $172 billion for asset manager funds.[4]

Our findings also relate to the literature on active versus passive fund management.[5] The underperformance of U.S. retail equity mutual funds is generally consistent with the "arithmetic of active management" argument that the average actively managed dollar's gross return should equal that of the market, and net returns should underperform by the amount of fees (Sharpe 1991; French 2008). This argument, however, does not rule out the possibility that some actively managed funds outperform the market while others fall short of it (Berk and Binsbergen 2015). We show that one group of active investors, institutional delegated investors, may profit at the expense of non-delegated investors.

[4]Barber, Lee, Liu, and Odean (2009) estimate that commissions cost individual investors 0.7% of GDP in Taiwan. If we adjust for the high turnover in Taiwan, their estimate suggests that individual traders incur $313 billion in fees annually worldwide. We thank Brad Barber and Robin Greenwood for data and guidance with these calculations.

[5]See, for example, Jensen (1968), Malkiel (1995), Gruber (1996), Carhart (1997), Kosowski, Timmerman, Wermers, and White (2006), French (2008), and Fama and French (2010).

2 Data and descriptive statistics

Institutional investors often use consultants to construct portfolios (Goyal and Wahal 2008). These consultants build and maintain databases of asset manager funds to facilitate the identification and evaluation of funds with investment strategies that fit an institution's investment mandate. We obtained one such database from a large global consulting firm (the "Consultant") that advises pension funds, endowments, and other institutional investors on the allocation of capital into asset manager funds. Asset managers self-report quarterly assets under management and monthly performance of their funds to the Consultant. The Consultant aggregates these reports into a database, which its consultants use to assist their clients in evaluating funds. The database allows funds to be sorted by strategy, asset class, geography, performance, cost, or a host of other filters, similar to mutual fund databases.

The Consultant's business model depends on data reliability. It therefore employs a staff of over 100 researchers who perform regular audits of each asset manager and its funds. In the course of these audits, the Consultant's researchers validate that the fund is classified in the most appropriate strategy and verify the accuracy of the performance and holdings data. When clients shop for asset manager funds, they can read these audits, compare the fund to benchmarks, and read the credentials of the people running the fund. Managers who do not fully report fees, assets under management, and performance can be penalized. Non-reporting funds can receive less attention when the Consultant makes recommendations to its clients, and investors with direct access to the database may view the lack of reporting as a negative signal of fund quality.

2.1 Aggregate assets under management

We start our analysis by estimating the size of the institutional sector of the asset management industry. We then use these estimates to evaluate the coverage of the Consultant's database. The first column of

Panel A of Table 1 reports our estimates of aggregate institutional assets under management for each year between 2000 and 2012. These estimates are based on the annual Pensions & Investments surveys, which we describe in the Appendix.[6] Total institutional assets increased from \$23 trillion in 2000 to \$48 trillion in 2012, representing approximately 900 asset manager firms throughout the period (column 2). The third column reports our estimates of worldwide investable assets, which we detail in the Appendix. Over the 2000–2012 sample period, worldwide investable assets rose from \$79 trillion to \$175 trillion. The last column shows that institutional assets held by asset managers remained relatively constant over the sample period at approximately 29% of worldwide investable assets.

Panel B of Table 1 compares the coverage of the Consultant's database with the Pensions & Investments survey estimates in Panel A. The Consultant's total assets cover 30% of institutional assets under management in 2000, and rise to over 60% post-2006. In 2012, for example, institutional assets under management in the Consultant's database are \$28 trillion, which represented 58.7% of total institutional assets according to Pensions & Investments. The third column lists the number of asset manager firms in the Consultant's database by year. When we hand match the names of the asset manager firms in the Consultant's database to those in the Pensions & Investments surveys, 82.6% of the asset managers covered in the Pensions & Investments surveys are included in the Consultant's database.[7]

For some of the asset manager firms included in the Consultant's database, the database does not provide full coverage of all of the manager's funds. Based on discussions with the Consultant, missing fund-level data for managers included in the database consist primarily of specialized proprietary

[6]Each year, Pensions & Investments magazine conducts several surveys of asset managers about their assets under management. These surveys are important to asset managers because they provide size rankings to potential clients. According to Pensions & Investments, nearly all medium and large asset managers are thought to participate.

[7]We examined the asset manager firms that are included in the Pensions & Investments surveys but do not show up in the Consultant's database. Two-thirds of these managers are independent insurance companies, regional banks, and individual wealth managers. In each of these cases, the manager's clients are more likely to be individual investors rather than institutions such as pensions and endowments. Thus, it is unlikely that these asset managers would offer institutional asset manager funds. In contrast, large insurance companies and banks that provide broad asset management services are generally included in the Consultant's database.

accounts. An important observation, similar to that of Ang, Ayala, and Goetzmann (2014), is that institutional investors can only draw inferences from the funds that appear in these data. Thus, although the data are incomplete, they nonetheless represent an institutional investor's information set for deciding among asset manager funds that are open for investment.

The last two columns in Panel B report the total institutional assets in the Consultant's database that we will use in this study, which are a subset of those reported in the first column. We restrict data on two fronts. First, we remove the 10.5% of the manager-level assets under management included in the database that lack corresponding returns. Second, we remove backfilled data, as described in the next subsection.

2.2 Selection and survivorship biases

Although missing data likely represent funds that are not open for institutional investment, our sample is not the universe of asset manager funds, and hence, we consider the possibility of selection and survivorship biases. The Consultant's record-keeping, however, mitigates concerns about survivorship bias. The Consultant records a "creation date" for each asset manager fund, reflecting the date the asset manager fund was first entered into the system. At the initiation of coverage, the manager can provide historical returns for the fund. Such backfilled returns would be biased upward if better performing funds were more likely to survive and/or provide historical returns. In our analysis, we always analyze returns generated after the creation date. Survivorship bias may also occur if funds that closed were removed from the database. However, this is not the case; the Consultant leaves dead funds in the database. Together, the detailed record-keeping of the Consultant almost ensures that our tests are free of survivorship concerns

A further issue is the possibility that managers selectively choose which funds to report to the

Consultant. To address this possibility, we follow the two-step procedure used by Blake, Lehmann, and Timmerman (1999). The first step is to compare the database's aggregate portfolio weights against the portfolio weights of a comprehensive benchmark. The Pensions & Investments Money Manager Directory survey reports broad asset class weights (equity, fixed income, cash, and other) for the U.S. tax-exempt institutional assets held by each asset manager. To compare portfolio weights, we match the asset managers in the Consultant's database with those who responded to the Pensions & Investments Money Manager Directory survey. Panel A of Table 2 compares the value-weighted asset class weights for managers who report to both Pensions & Investments and the Consultant. The broad asset class weights are similar across the two data sources.

The second test of Blake, Lehmann, and Timmerman (1999) looks for bias in reporting. They state on page 436 that "if survivor bias infected the funds included in our subsample, they should be more successful ex post than those in the overall universe." To implement their test, we regress fund-level monthly returns on the percentage of assets under management for which the manager provides returns data to the Consultant, a variable we call *coverage*. We include interactions of strategy and month fixed effects to absorb strategy-level performance and cluster standard errors at the month-strategy level. If managers refrain from reporting strategies with worse performance, we would expect coverage to be negatively related to performance. For example, if a manager's coverage is 100%, then this manager should have a lower overall return than a manager who only reports better performing funds. Panel B of Table 2 presents results for these regressions. We find the opposite of what one would expect if managers selectively reported based on performance: managers who provide higher levels of coverage have slightly higher (economically small) performance.

These estimates in Table 2 suggest that our data do not suffer from survival or selection biases. However, because the coverage of our data is lower in the 2000–2006 period, we later present our main results for alternative samples that select observations based on time periods and coverage.

2.3 Aggregate fees

We next use the fee data in the Consultant's database to estimate aggregate fees paid by institutional investors to asset managers. The Consultant's database includes fees and fee structure by asset manager fund. Asset managers provide and update the Consultant with multiple fee parameters per asset manager fund: the baseline fee for assets under management and discounts available at different asset thresholds. For example, one U.S. fixed income-long duration fund charges 40 basis points for investments up to $10 million, 30 basis points for investments up to $25 million, 25 basis points for investments up to $50 million, and 20 basis points for investments above $50 million. These parameters are static in the sense that the database records only the latest input of the fee schedule from the asset manager. However, because these fees are in percent rather than dollars, the use of the static structure should only be problematic if fees over the last decade materially changed per unit of assets under management. If anything, fees likely came down over time, rendering our estimates conservative.

We start by calculating a *fee schedule middle point estimate* that assumes that average dollar in each fund pays the median fee listed on the fund's fee schedule. This fee estimate could, however, be too high. Institutional investors could negotiate side deals that shift their placement in the fee schedule up (that is, they pay lower fees than their actual assets invested in the fund would suggest), or, in the case of the largest investors, shifting the fee rate lower than any price on the fee schedule. The first of these scenarios is easily handled. We can calculate a *fee schedule lower bound estimate* of the fees paid, which uses the lowest fee in the schedule for all capital invested in the fund. In the example above, we would apply the rate 20 basis points to all capital invested in the fund.

The *fee schedule lower bound estimate* does not, however, handle the possibility that large investors pay less than 20 basis points. Such instances are likely limited to select clients. Nonetheless, we implement a more precise conservative estimate that we call the *implied realized fee*. Some funds in the Consultant's database report both net and gross returns. These funds therefore provide an estimate of effective fees. We annualize the monthly gross versus net return difference, take the value-weighted average, and then re-weight the asset classes so that the weight of each asset class matches that in the entire database.

Figure 1 plots our annual estimates of aggregate fees received by asset managers for these three measures, aggregated to the total worldwide investable assets. We aggregate by taking the weighted average fees in the Consultant's data and then multiplying by the estimates of worldwide institutional assets under management based on the Pensions & Investments surveys. Based on this aggregation, we estimate that fees received by the top global asset managers range from \$132 to \$172 billion per year on average over the period.

2.4 Holdings statistics at asset manager fund level

For each asset manager fund, the database includes monthly returns and quarterly assets under management. The Consultant categorizes funds into eight broad asset classes: U.S. public equity, global public equity, U.S. fixed income, global fixed income, hedge funds, asset blends, cash, and other/alternatives. We drop other/alternatives because these funds are relatively small and are heterogeneous investment strategies that make benchmarking challenging. We also drop the cash asset class because these short term allocations play a different role in portfolios. Our database starts with 44,643 asset manager funds over the period 2000–2012. After removing funds with no returns, cash and other/alternatives funds, funds with backfilled returns, and funds that were inactive during the sample period, the sample consists of 22,289 funds across 3,272 asset manager firms. This sample encompasses 1,165,957 monthly return observations with 70.7% of the funds being alive as of 2012. The total assets under management (AUM) for the sample is $22.3 trillion in 2012. These statistics are reported in the last column of Panel A of Table 3. The other columns of Panel A report the descriptive statistics at the asset manager fund level (AUM, clients, AUM per client, and age). The statistics are panel-averaged cross-sections, in the sense that we calculate time series averages for each fund and then report the cross sectional statistics across funds.

The average fund has $1.6 billion in assets under management, and the median fund has $285 million. The skew is due to large institutional mutual funds in the database. Hence, we focus on median statistics. The median fund has 5.8 clients and $48.4 million AUM per client. A typical mandate thus is approximately $50 million, and asset managers pool six such mandates to comprise a fund. Many institutional investors have much smaller mandates. The 25th percentile mandate is just under $10 million. In terms of age, the funds in the database are relatively established with the average and median fund being eight to ten years old.

We next present fund-level descriptive statistics for the six broad asset classes: (1) U.S. public equity, (2) global public equity, (3) U.S. fixed income, (4) global fixed income, (5) asset blends, and (6) hedge funds. As in the aggregate statistics presented in Panel A, we first consider (in the last column of Panel B) the number of managers in the database who offer at least one fund in the broad asset class over the sample period, the total number of funds that exist in the broad asset class over the sample period, the percentage of funds that exist as of June 2012, and total assets under management as of June 2012. The largest asset classes in terms of total assets under management are U.S. and global fixed income, each with approximately $5.3 trillion in assets under management as of 2012, followed by global public equity ($4.6 trillion) and U.S. public equity ($4.3 trillion). Asset blends and hedge funds held $1.5 trillion and $1.4 trillion respectively as of 2012.

Moving to the main columns, we consider the fund-level statistics. Median fund size is largest in fixed income asset classes ($541.9 million for global and $481.3 million for U.S. fixed income), followed by global public equity ($309 million), asset blends ($256.3 million), U.S. equity ($241.2 million), and finally hedge funds ($158.4 million). Similar patterns hold in the means. Assets under management per client (the mandates) are also larger for fixed income funds than for equities. For example, the median per client investment in a U.S. fixed income fund is $74 million, compared to $23.5 million for U.S. public equity. Thus, fixed income investments are large in a number of dimensions: total AUM in asset manager funds, fund size, and mandates per client. Also noteworthy is although the global and U.S. total AUM are similar in equities and fixed income, global funds pool fewer clients and have larger AUM mandates per client.

2.5 Fees at the asset manager fund level

We next examine fee distributions by asset class and client size. Panel A of Table 4 reports that the mean value-weighted fee is 47.4 basis points. This corresponds with the *fee schedule middle point estimate* presented in Figure 1, adding up to $172 billion in aggregate fees if applied to all assets with asset managers. When we examine the fee distributions by asset class, we find that the value-weighted mean (28.9 basis points) and median (26.8 basis points) fees for U.S. fixed income funds are almost half of the value-weighted mean (49.6 basis points) and median (63.4 basis points) for U.S. public equity. Global fixed income and equity have medians similar to those for U.S. fixed income and public equity, but with more right-skewed distributions and thus larger means. Hedge funds have the highest fees. The value-weighted mean hedge fund fee is 91 basis points and the median is 106.8 basis points.[8]

A natural question arises of who pays these fees. The equal-weighted fee is 62.1 basis points, thirty

[8] For hedge funds, the fee estimates represent management fees and do not include performance fees.

percent higher than the value-weighted mean of 47.4 basis points. Funds with lower AUM are more expensive, as one might expect if larger clients get price breaks. We do not observe individual client investments in each fund; however, we can examine the distribution of fees conditional on the fund's average mandate size. Panel B of Table 4 presents these conditional distributions. Fees trend downward in assets per client. For example, when the assets per client are less than \$10 million, the value-weighted mean fee ranges from 66.7 to 79.9 basis points, but is less than 38 basis points when the assets per client are greater than \$1 billion.[9]

Our fee estimates are in line with those reported in both the press and academic research. For example, Zweig (2015) reports that CalPERS paid an average fee of 48 basis points in 2012. Coles, Suay, and Woodbury (2000) describe the fee price breaks for closed-end institutional funds. They find that a typical fund charges 50 basis points for the first \$150 million, 45 basis points for the next \$100 million, 40 basis points for the subsequent \$100 million, and 35 basis points allocations above \$350 million. Examining active U.S. equity institutional funds, Busse, Goyal, and Wahal (2010) find that fees are approximately 80 basis points for investments of \$10 million and approximately 60 basis points for investments of \$100 million. It is worth noting that beyond scale effects and the negotiating power held by large investors, asset managers may take into account additional factors to determine an institution's willingness-to-pay, such as the ability of institutions to manage capital in-house, behavioral biases, or agency issues associated with delegation.[10]

[9]The very small mandates (less than \$1 million) are likely to be in institutional mutual funds, which may explain why the the average fees are slightly lower on the first row than on the second.

[10]See, for example, Lakonishok, Shleifer, and Vishny (1992), Brown, Harlow, and Starks (1996), Chevalier and Ellison (1997), Gil-Bazo and Ruiz-Verdú (2009), and Gennaioli, Shleifer, and Vishny (2015).

3 Results

3.1 Alpha relative to the market

Panel A of Table 5 reports estimates of gross and net alphas from a market model that subtracts the returns on the broad asset class benchmarks.[11] We implement monthly value-weighted regressions of asset manager fund returns on broad asset class benchmark returns, constraining the market beta to be equal to one. Alphas in this specification represent simple value-weighted, monthly returns over the benchmark index. Tracking errors are defined as the standard deviation of the residual in a model allowing for a non-zero alpha.For exposition, we annualize alphas and tracking errors in all of our tables. We find that asset manager funds exhibit a market-adjusted gross alpha of 119 basis points annually, with a t-statistic of 3.19, and a net alpha of 72 basis points, with a t-statistic of 1.93.

Which asset classes account for the positive performance? The rows of Panel B report the net alphas and portfolio weights by year and asset class. The bottom row reports how the asset classes each contribute to add up to the 119 basis points. The alpha contribution comes from global equity (43 basis points), U.S. equity (36 basis points), U.S. fixed income (19 basis points), followed by global fixed income and hedge funds, both contributing 12 basis points. The decomposition also indicates that positive alpha is partly driven by timing (i.e., having greater weights invested in asset classes that performed well during that period). We can quantify the timing contribution. If asset manager funds invested with the average weights across the asset classes (i.e., did not dynamically adjust the asset class portfolio weights), gross alpha would have been 82 basis points. Hence, 37 basis points ($119 - 82 = 37$) of alpha is due to timing across asset classes. Finally, the far right column of Panel B reports the time

[11] In our analysis, we use the following broad asset class benchmarks: Russell 3000 (U.S. public equity), MSCI World ex U.S. Index (global public equity), Barclays Capital U.S. Aggregate Index (U.S. fixed income), Barclays Capital Global Aggregate Index (global fixed income), and HFRX Aggregate Index (hedge funds). For asset blends, we create a composite index that puts a 40% weight on the MSCI World Index and 60% weight on the Barclays Capital Global Aggregate Index, based on the asset blend that Vanguard uses to benchmark its institutional balanced index fund (VBAIX). Table 8 provides return statistics for the benchmarks and the Consultant's funds mapped to the asset class.

series of gross alpha. Figure 2 plots these annual estimates along with by-year alphas from one-factor model regressions. We find that asset managers' returns relative to the market varies over time, but particular time anomalies in our short panel do not appear to account for the results.

Given that asset managers funds earn positive alpha in a sample that encompasses over 13% of the total worldwide investable assets,[12] the adding-up constraint arguments of Sharpe (1991) imply that the rest of the market must earn negative gross alphas relative to the market. If we assume that there is no selection bias in our data relative to the aggregate managed institutional capital in the Pensions & Investments surveys, we can extrapolate our estimates to approximately 29% of worldwide investable assets. The market clearing calculation suggests that if asset manager funds return a positive 119 basis points gross over the index, everyone else must return a gross 49 basis points *below* the index.[13]

We can convert this gross alpha into dollars. Maintaining the assumption that the Consultant's database is representative of the Pensions & Investments sample, asset manager funds collectively earn \$432 billion per year from the rest of the market. Of this amount, \$172 billion accrues to asset managers in fees and \$260 billion accrues to institutions. In terms of the dollar value added measure of Berk and Binsbergen (2015), the average asset manager fund generates \$150,000 in value-added per month, which is similar to the estimates of Berk and Binsbergen (2015) for retail equity mutual funds (\$140,000 per month). Our result together with the finding that retail mutual funds' gross alphas are close to zero (Fama and French 2010) suggest that asset managers earn positive alphas at the expense of non-delegated institutional and individual investors.

[12]With the exception of hedge funds, these investments represent long positions.

[13]The market clearing constraint is that the average investor holds the market. This constraint implies that $w_{\text{asset managers}}\hat{\alpha}_{\text{asset managers}} + (1 - w_{\text{asset managers}})\hat{\alpha}_{\text{everyone else}} \equiv 0$. We use this condition to get the estimate of $\hat{\alpha}_{\text{everyone else}} = -49$ basis points.

3.2 Performance

As discussed by Goyal and Wahal (2008) and Jenkinson, Jones and Martinez (2014), institutions typically construct their portfolios through a two-step process. Institutions first determine their strategy-level policy allocations by optimizing over strategy-level risk and return. Investment officers then fulfill strategy policy allocations either "in house" or by issuing an investment mandate to an external manager. Because overall portfolio risk is typically incorporated in the first-step determination of strategy allocations, institutions appraise fund performance only relative to a single factor, the strategy benchmark. Fund performance is typically reported in two dimensions—net alpha and tracking error estimated in a strategy-level factor model.[14]

3.2.1 Asset class benchmarked performance

To place any strategy-level benchmark results in context, we first evaluate performance relative to broad asset class benchmarks. We regress monthly fund returns in excess of the one-month Treasury bill on the excess return of each benchmark. We estimate these regressions separately for funds' gross and net returns. Our prior was that institutions investing in asset manager funds likely have longer investment horizons than retail investors and are thus willing to hold more market exposure (i.e., betas higher than one in the traditional CAPM sense). Thus, we expected that the 119 basis points gross alpha from above would decline in a factor model of performance. The data did not support our prior. Table 6 reports that the overall (row 1) beta is less than one (0.88). Asset manager funds exhibit gross and net alphas of 199 basis points and 152 basis points.

These estimates do not, however, reflect performance from the viewpoint of an institutional investor

[14]Note that our focus on a single factor is also consistent with the findings of Barber, Huang, and Odean (2015) and Berk and Binsbergen (2015), who find that mutual fund flows respond to a single factor model rather than a model-free benchmarks or a multi-factor models.

because the benchmark is not at the strategy level. The use of broad asset class benchmarks inflates the tracking error, which, at 7.9%, remains well above the median pension fund tracking error of 5.9% reported by Del Guercio and Tkac (2002). Moreover, the by-asset class estimates on rows 2–7 suggest that the large overall alpha could come from the poor performance of the global fixed income benchmark, and from hedge funds and asset blends for which the benchmarks may not measure asset class performance as accurately as those used for the other asset classes. In contrast, for both U.S. equities and U.S. fixed income, the beta is close to one, and the alphas are positive and significant, but smaller at 93 to 95 basis points.

We can compare these broad market results to those of Lewellen (2011) and Busse, Goyal, and Wahal (2010). Using aggregate U.S. institutions holdings of U.S. public equities available in 13-F quarterly filings, Lewellen (2011) finds an institutional, insignificant gross alpha of 32 basis points (annualized) in a market model. In U.S. equity asset manager funds, Busse, Goyal, and Wahal (2010) estimate a gross alpha for U.S. equities of 64 basis points per year. Busse et al.'s (2010) estimate is not statistically significant, which may be driven by differences in sample period and their use of quarterly rather than monthly data. Lewellen's lower estimate may be due to the non-delegated holdings of institutions, that are not included in our sample or that of Busse et al. (2010).

3.2.2 Strategy benchmarked performance

The Consultant's database classifies the asset manager funds into 235 granular strategy classes (e.g., Australian equities is a strategy class under the broad asset class of global public equity). In addition, the database includes a strategy-level benchmark for each fund. The Consultant sets the benchmarks based on the suggestion of the asset manager, auditing each strategy to ensure that the proposed benchmark is appropriate for the fund. We evaluate performance using the modal benchmark in the strategy class. If the benchmark chosen has less than 10% coverage of funds in the strategy, we instead use the benchmark covering the most assets under management in the strategy. We list the 235 strategies and their benchmarks in Table A4.

Panel A of Table 7 reports the estimate of asset manager fund performance from the viewpoint of an institutional investor; namely, performance in a strategy-level single factor model. We find a gross alpha of 96 basis points (t-statistic = 3.67) and a net alpha of 49 basis points (t-statistic = 1.87). In this estimation, the precision of benchmarking improves materially, especially in the global asset classes. The asset pricing model's explanatory power increases from 64.5% (Table 6) to 75.7% (Table 7) when we replace broad asset class benchmarks with strategy-level benchmarks. Tracking error falls to 5.92%, which is almost identical to the Del Guercio and Tkac (2002) estimate for pension funds and in line with Petäjistö (2013)'s estimate for moderately active retail mutual funds.[15]

Our beta estimate remains less than one, at 0.88. Thus, asset manager funds achieve performance with lower strategy-level risk. To draw more insight into this result, Table 8 reports raw returns, standard deviations, and Sharpe ratios for the funds, the broad asset class benchmarks, and the strategy-level benchmarks. The statistics are value-weighted to reflect the investments of the asset manager funds. Focusing on the last row, we show that the strategy-level indices in equity and fixed income have a higher Sharpe ratio (0.26) over the period than that of the broad asset class indices (0.18). Asset managers implement strategies that have higher Sharpe ratios than the market which may account for some of the 119 basis points in aggregate gross alpha. The bottom row of Table 8 shows that although asset manager funds look almost identical to strategy indices in terms of standard deviation (10.33 versus 10.36), they achieve a higher return (5.23 versus 4.83). This pattern holds for each of the public equity

[15] Petäjistö (2013) reports an average tracking error of 7.1% for actively managed retail mutual funds. He also estimates tracking errors by fund type, finding a tracking error of 15.8% for concentrated mutual funds, 10.4% for factor bets, 8.4% for stock pickers, 5.9% for moderately active funds, and 3.5% for closet indexers.

and fixed income asset classes reported on the other rows of Table 8. These results together with those in Table 7—which shows that asset manager funds outperform their strategy benchmarks—suggest that asset manager funds may outperform their strategy benchmarks by taking risks *outside* those captured by the specific strategy.

3.2.3 Robustness: Benchmarking and sample selection

The estimates in Table 7 suggest that specific benchmarks or samples do not drive our results. First, the top row of Panel B shows that our results are similar when we restrict the sample to the four public equity and fixed income asset classes. We implement this restriction because both asset blends and hedge funds represent mixtures of strategies—e.g., macro strategies and long-short strategies—and may therefore be more difficult to represent by a single benchmark. However, the estimates on the first row show that the alpha decreases by a modest 10 basis points, from 96 basis points to 86 basis points when we exclude these difficult-to-benchmark asset classes.

Second, the estimates for the public equity and fixed income asset classes also suggest that, on average, the strategy benchmarks are appropriate. If asset managers suggested inappropriate benchmarks—and the consultant did not discover this through its audits—then the average asset manager fund's beta against the strategy benchmark should be low. The first row of Panel B, however, shows that the value-weighted asset manager fund has a beta of 0.94, making it unlikely that asset manager fund outperformance is due to benchmark or strategy class gerrymandering.

The results in Panel B of Table 7 also suggest that the asset manager fund outperformance is not due to selective coverage of our data. The second row of Panel B limits the sample to those funds that enter the platform within a year after they are started. This restriction is potentially important because it restricts the analysis to funds with minimal amount of backfilling. Although we remove all backfilled data throughout this study, it is still plausible that established and successful funds are systematically different from new funds. For this restricted sample, however, the alpha only marginally attenuates to an estimate of 0.82 (t-statistic of 2.95).

The third row of Panel B restricts the sample to post-2006. We use this cutoff for two reasons. First, the consultant's coverage, as a fraction of Pensions & Investments total AUM, is higher after this data and, second, this part of the sample captures all of the crisis period. The alpha estimate remains at 0.87 (t-statistic of 2.41) for this sample.

Finally, the bottom row of Panel B restricts the sample to asset managers who report performance for funds representing at least 85% of their total institutional assets under management (i.e., the variable "coverage" from Table 2 is greater than 85%, which is the 75th percentile threshold). For this restricted sample, we find higher gross and net alphas than those presented in Panel A. Contrary to managers only reporting for funds displaying good performance, we find an increase in performance for managers with higher levels of reporting, consistent with the results presented in Panel B of Table 2.

3.3 Sharpe (1992) analysis

Given our performance results, we turn to the question of how asset managers generate positive net alpha relative to strategy benchmarks. To answer this question, we implement a Sharpe (1992) model which decomposes fund returns into loadings on tradable indices. In modern language, this framework allows us to test, first, whether *tactical beta* or *smart beta* exposures explain what asset managers are doing to achieve positive net alpha and, second, whether, and at what indifference cost, institutions could have replicated asset manager returns by managing assets in-house.

3.3.1 Estimating mimicking portfolios for asset manager funds from tradable factors

We implement the Sharpe analysis as follows. We first gather a set of 19 tradable factors (i.e., those with tradable indices) including the broad asset class benchmark, which varies by fund. The 19 factors start with the 12 original factors of Sharpe (1992), but with modifications to reflect changes in market weights since the original paper (e.g., replacing Japanese market indices with that of emerging markets). We then augment the list to map to factors studied in the finance literature across asset classes. For U.S. equity, we include size and value factors, which have statistical power in predicting the cross-section of stock returns (Fama and French 1992) and explain the majority of variation in actively managed U.S. equity mutual fund returns (Fama and French 2010). For global equity, we include indices of European equities and emerging markets. For U.S. fixed income, we include indices to span differences both in riskiness and maturity, including indices of government fixed income of different maturities, corporation investment grade bonds, and mortgage-backed securities. These indexes are close to those that Blake, Elton, and Gruber (1993) use to measure the performance of U.S. bond mutual funds. The global fixed income factors capture returns on government and corporate bonds both in Europe and emerging markets. Finally, our choices of hedge fund indices are motivated by Fung and Hsieh (2004). Their equity and bond factors are already part (or combinations) of the factors that we used for other asset classes. We augment the list with infrastructure, commodity, carry, and momentum indices to replace Fung and Hsieh's (2004) "look back straddles" on bond futures, currency futures, and commodity futures. The following table lists the original factors used by Sharpe (1992) and those used in our analysis.

Asset class	Sharpe (1992)	Our implementation
U.S. public equity	Sharpe/BARRA Value Stock	**Russell 3000**
	Sharpe/BARRA Growth Stock	S&P 500/Citigroup Value
	Sharpe/BARRA Medium Capitalization Stock	S&P 500/Citigroup Growth
	Sharpe/BARRA Small Capitalization Stock	S&P 400 Midcap
		S&P 600 Small Cap
Global public equity	FTA Euro-Pacific ex Japan	**MSCI World**
	FTA Japan	S&P Europe BMI
		MSCI Emerging Markets Free Float
U.S. fixed income	Salomon Brothers' 90-day Treasury Bill	**Barclays Capital U.S. Aggregate**
	Lehman Brothers' Intermediate Government Bond	U.S. 3 month T-Bill
	Lehman Brothers' Long-term Government Bond	Barclays U.S. Intermediate Government
	Lehman Brothers' Corporate Bond	Barclays Capital U.S. Long Government
	Lehman Brothers' Mortgage-Backed Securities	Barclays Capital U.S. Corporate Investment Grade
		Barclays Capital U.S. Mortgage-Backed Securities
Global fixed income	Salomon Brothers' Non-U.S. Government Bond	**Barclays Capital Global Aggregate**
		Barclays Capital Euro Aggregate Government
		Barclays Capital Euro Aggregate Corporate
		JP Morgan EMBI Global Diversified Index
Hedge funds		**HFRX Absolute Return**
		UBS Global Infrastructure & Utilities
		Dow Jones UBS Commodity
		DBCR Carry Total Return
		DBCR Momentum Total Return

For each fund, we regress monthly returns against the 19 factors using data up to month $t-1$. We constrain the regression slopes to be non-negative and sum to one, following Sharpe (1992). We then use the estimated loadings to construct a dynamic mimicking style portfolio for each fund. Because we constrain the loadings to sum to one for each fund, they can be interpreted as portfolio weights.[16] A benefit of the Sharpe methodology is that the non-negative weights yield clean inferences about fund exposures (Sharpe 1992). Panel A of Table 9 presents the factor weight estimates, where we have estimated the weights fund-by-fund and taken value-weighted averages by broad asset class. For example, the average weight on the Russell 3000 (the broad asset class benchmark) for U.S. public equity funds is 9.8%. The remaining rows present the deviations from the benchmark; i.e., the average U.S. public equity fund holds a 27.9% weight in the S&P 500/Citigroup Value benchmark.

[16] We also estimated the regressions with only the constraint that the coefficients sum to less than or equal to one. For this specification, the weights sum to 0.99.

The second step of the Sharpe analysis is to assess whether the factor loadings captured in the mimicking style portfolio are the source of the positive asset manager fund performance. We estimate the factor loadings using rolling historical data to ensure that our second step performance measurement is out-of-sample.[17] For each fund-month, we calculate the fund's return in excess of the style portfolio. Panel B of Table 9 reports monthly value-weighted averages of excess returns over the mimicking style portfolio for each broad asset class. t-statistics associated with these estimates are the time-series averages of these return differences. We find that gross asset manager fund returns are statistically indistinguishable from the mimicking portfolio, across all asset classes and for each broad asset class individually. The excess return estimate for all asset classes is -0.17 with a t-statistic of 0.47. Statistically and economically, the mimicking portfolio entirely accounts for the positive fund performance that we documented in Tables 6 and 7. This is consistent with our inference from comparisons of Sharpe ratios in Table 8; asset manager funds achieve outperformance by exchanging lower strategy-risk for higher other risks (tactical factor risk) that outperform benchmarks.

This result raises the question of interpretation. Does this performance represent skill? Our inference is akin to Berk and Binsbergen (2015), who consider the proper benchmarking of mutual funds. If internal management by the client cannot reproduce a tactical exposure in an asset class, then these authors suggest that we should attribute that exposure loading to a value-added activity that the fund provides its clients. Cochrane (2011) offers a similar interpretation:

> "I tried telling a hedge fund manager, "You don't have alpha. Your returns can be replicated with a value-growth, momentum, currency and term carry, and short-vol strategy." He said, "Exotic beta is my alpha. I understand those systematic factors and know how to trade

[17]In Table A5 of the Appendix, we present similar results when we estimate the Sharpe model using a jackknife procedure in which we use the full sample except for month t, or in which we exclude observations that are from six months before through six months after month t.

them. My clients don't." He has a point. How many investors have even thought through their exposures to carry-trade or short-volatility... To an investor who has not heard of it and holds the market index, a new factor is alpha. And that alpha has nothing to do with informational inefficiency."

Cochrane (2011)

3.3.2 Do investors pay more for successful tactical betas?

Do the fees that investors pay represent compensation for the tactical factor exposures? If so, we would expect fees in the cross section of asset manager funds to correlate positively with the performance of the fund's style portfolio. Investors may also pay for "skill" that is not captured by the factor exposures (the gross fund return residual after subtracting out the return on the style portfolio). Table 10 presents regressions that estimate the relation between fees and these two return components. Panel A presents panel estimates, which include month-asset class fixed effects. This panel form allows us to estimate the marginal effect of return components on fees within asset class-month. In order to ensure that the return components obtained from the Sharpe analysis are pre-determined regressors, we measure fees as of the end of the sample period—either in June 2012 or when the strategy disappears. Given that the fee observation is the same throughout the panel for each fund, we cluster the standard errors at the fund-level.

Panel A of Table 10 shows that fees positively and significantly correlate with the returns on the style portfolio and the residual component. The coefficient on the style portfolio for the all asset classes specification is 5.35 (t-statistic = 5.57). To put this magnitude in context, the mean of the dependent variable is 60.0 basis points of fees, similar to the equal-weighted average fees we report in Table 4. A one-standard deviation higher mimicking style portfolio return (4.07 basis points) associates with a fee that is higher by: 12 months $*$ 0.0535 $*$ 4.07 = 2.61 basis points; i.e., a 4.2% higher fee relative to the baseline mean fee. Note that we also find a positive significant coefficient for the residual return component. However, the marginal effect of this correlate is much lower. Using the same calculation, a one-standard deviation higher residual return (1.99 basis points) associates with only a 0.48 basis points higher fee. Noteworthy, however, is that the significance of the residual return component is being driven by fixed income asset classes. In global fixed income, for instance, a one standard deviation higher residual return associates with a 1.5% higher fee than the mean for that asset class. Both return measures correlate positively with fees for hedge funds, possibly due to the multi-dimensional factor exposures that hedge funds may take over-and-above our factors.

As an alternative to the panel specification in Panel A, we estimate cross-sectional regressions with observation per fund. We first run panel regressions (separately) of style returns and residual returns on month-asset class fixed effects. The independent variables in our collapsed specification is the time series average of these style and residual returns, purged of the month-asset class effect. We find robust evidence that investors (in equity asset classes and hedge funds) pay for tactical factor exposures. A one-standard deviation higher return on the style portfolio translates into fees that are larger by 2.42 basis points. The residual component only matters in global fixed income. In sum, our estimates suggest that asset manager funds charge fees, and investors pay fees, primarily for performance generated through tactical factor exposures, especially for equity strategies.

3.3.3 "In-house" implementation of factor index loadings

The results from the Sharpe analysis raise the question of whether institutional investors could do as well as asset manager funds by implementing factor loading portfolios in-house. To address this question, we discard our asset manager data and construct rolling optimal portfolios using only historical data on tradable factor indices. We first use the standard algorithm, treating the factor indices as the assets, to generate mean variance (MV) efficient portfolios separately for each of five asset classes.[18] We implement this optimization using data up to month $t-1$, and then calculate the return on the optimal portfolio for month t. To aggregate across asset classes, we apply the month $t-1$ asset class weights observed in asset managers fund data for month t returns.

We then implement two modifications to the mean-variance algorithm, following the literature, to generate more stable and simpler-to-implement optimal portfolios that avoid extreme short or long positions in factors.[19] The first simpler portfolio forces the covariance matrix to be diagonal to eliminate extreme loadings based on covariances and sets any negative estimated risk premiums to zero. The second simpler portfolio is a mean variance portfolio with short-sale constraints imposed in the optimization.[20]

The results for this analysis are presented in Table 11. Panel A presents the gross and net performance along with the implied Sharpe ratios for asset manager funds. Over the 2000–2012 period, asset manager funds earned 5.02% in gross returns with a standard deviation of 9.78% (Sharpe ratio = 0.292). Panel A then presents gross performance for the replicating portfolios. The standard MV portfolio exhibits a lower Sharpe ratio, 0.142, than asset manager funds. However, the simpler adjusted MV portfolios have higher Sharpe ratios than the actual asset manager portfolios: MV analysis with a diagonal covariance matrix, 0.359, and MV analysis with short-sale constraint, 0.331.

In the final column of Panel A of Table 11, we report the cost that would make an institution indif-

[18]We drop asset blends because of this asset class's heterogenous composition.

[19]For a discussion of the measurement error issues associated with the standard mean-variance solution, see DeMiguel, Garlappi, and Uppal (2009).

[20]A third simpler portfolio applies a $1/N$ rule of investing proportionally across assets, which in our specification is factors DeMiguel, Garlappi, and Uppal (2009). The count of factors is somewhat ad hoc. The original $1/N$ implementation envisioned a space of assets (e.g, all stocks or all geographies) that span the space of investments. Any results in the $1/N$ specification would be necessarily sensitive to, for instance, adding or subtracting an index, and thus we do not use this algorithm.

ferent in Sharpe ratio terms between implementing the MV portfolio and delegating to asset managers. That is, the indifference cost solves for *cost* in :

$$\frac{r_{\text{gross replicating}} - r_f - \text{cost}}{\sigma_{\text{gross replicating}}} = \frac{r_{\text{net asset manager}} - r_f}{\sigma_{\text{net asset manager}}}. \tag{1}$$

Focusing on the diagonal MV portfolio, we find that institutions would be indifferent between delegating and managing assets in-house if the cost of managing assets in-house was 73.1 basis points.

This 73.1 basis points must cover both administrative costs and trading fees. In terms of administrative costs, Dyck and Pomorski (2012) find that large pension funds incur approximately 12 basis points in non-trading costs to administer their portfolios. To provide an estimate of the trading costs, we gather historical institutional mutual fund and ETF fee data from CRSP and Bloomberg covering the factors of the replication. We present the time series averages of these series in Panel C of Table 11. Using these series, we simulate the cost of implementing the replication for four different trading fee estimates: Quartile 1, Median, and Quartile 3 of the institutional mutual funds, sorted by cost, and the end-of-the-period ETFs. Panel B of Table 11 reports these results. Investing in the diagonal MV factor portfolio at the trading cost of the median institutional mutual would have cost 86.5 basis points in fees. Investing at the lower-cost Quartile 1 level of trading fees would have cost 65.1 basis points. If we compare the indifference cost for the diagonal MV portfolio rule (73.1 basis points from Panel A) with the sum of the institutional mutual fund fee and the estimate of administrative costs for the Quartile 1 institutional mutual fund (65.1 + 12 = 77.1 basis points), it appears that an investor would be indifferent between managing assets in-house and delegating assets. At any higher cost of the mutual funds, the investor would likely prefer delegating.

Importantly, Panel B of Table 11 shows that even the Quartile 1 trading-cost estimate is high relative to end-of-period ETF fees. Although many ETFs were not available over the full sample period (the ETF inception dates are included in Panel C), we present a replication using the end-of-period fees for ETFs. The first row of Panel B reports that at today's ETF prices, the portfolio would have cost only 26.4 basis points, thus tilting the preference away from delegating to asset managers toward investing in-house. The introduction of liquid, low cost ETFs is likely eroding the comparative advantage of asset managers.

This analysis is subject to several caveats. First, we assume that the necessary liquidity is available for the ETFs, index funds, and institutional mutual funds that an institution would use to replicate. Second, we assume that all institutions faced the same trading costs. Third, we assume that institutions are sophisticated. Institutions must know from finance research which factors could be used to improve performance, and they have to know how to implement the required loadings in real time. These caveats favor delegation via asset managers. Put differently, those institutions that are less sophisticated or who receive other (non-fee based) benefits from asset managers may choose delegation over in-house management.

4 Conclusion

In this paper, we have provided new facts about the investment vehicles institutions use to delegate assets. Over the period 2000-2012, institutional investors delegated an average of $36 trillion (29% of worldwide investable assets) to asset managers, paying an annual cost of $172 billion per year, or 47 basis points per investment dollar. In return, asset managers pool a small number of clients wanting similar strategy exposures into actively-managed funds that outperform strategy benchmarks by 96 basis points gross, or 49 basis points net of fees. We trace this outperformance to systematic deviations from the asset-class benchmarks in a factor loading model of Sharpe (1992). The asset manager industry is therefore not just a passive pass-through entity that institutions use to implement strategy mandates.

An understanding of delegation is relevant on many dimensions. Delegation is relevant for asset pricing. For example, Adrian, Etula, and Muir (2014) show that intermediaries who price assets, not households. We provide evidence on the factors that lead institutions to delegate to intermediaries. Delegation is important in the ongoing debate about whether intermediation contributes to systemic risk (Jopson 2015). We characterize the delegation process and provide evidence on costs and benefits. More work needs to delve into the asset flows to begin to understand implications to the size of the industry. Delegation is also relevant for understanding who pays for financial intermediation through fees and returns. We find that the average intermediated institutional dollar's return exceeded that of the market by 119 basis points between 2000 and 2012. This estimate implies that the average non-institutional or non-intermediated dollar—that is, investments made through retail mutual funds or directly by individuals or institutions—had 49 basis points lower return than the market *even before* fees. These estimates have implications for the debates on intermediary skill and the relative performance of active and passive management, as well as for discussions of regulatory oversight of intermediation.

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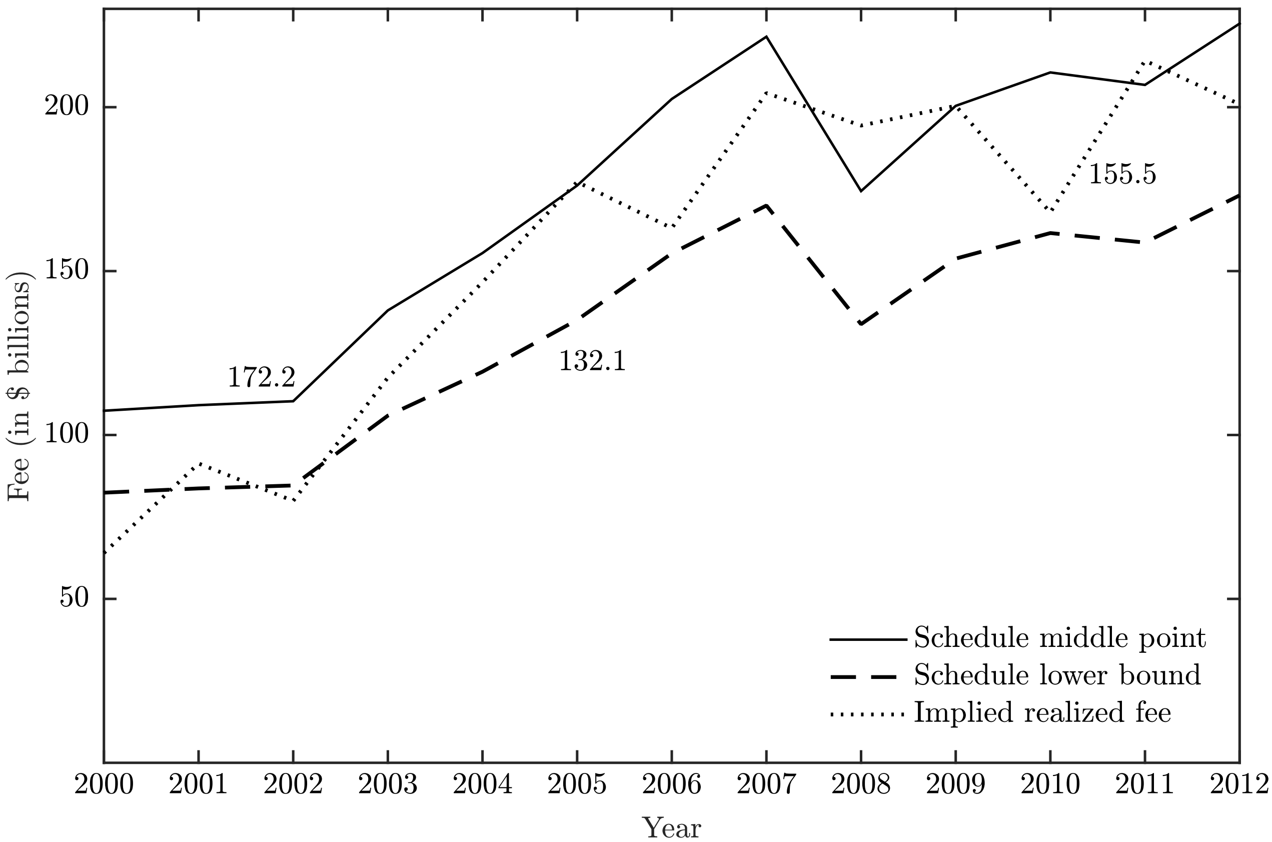

Figure 1: **Aggregate fees paid by institutions to asset managers.** This figure presents aggregate fee estimates based on information available in the Consultant's database. The estimates are value-weighted average fees in the Consultant's database multiplied by total institutional assets under management. Line "Schedule middle point" assumes that the average dollar in each fund pays the median fee listed on that fund's fee schedule and "Schedule lower bound" uses the lowest fee from each fee schedule. "Implied realized fee" is estimated using data on funds that report returns both gross and net of fees. We annualize the monthly return difference, take the value-weighted average, and then re-weight asset classes so that each asset class's weight matches that in the full database. The numbers represent the average annual fees over the sample period for the three sets of estimates.

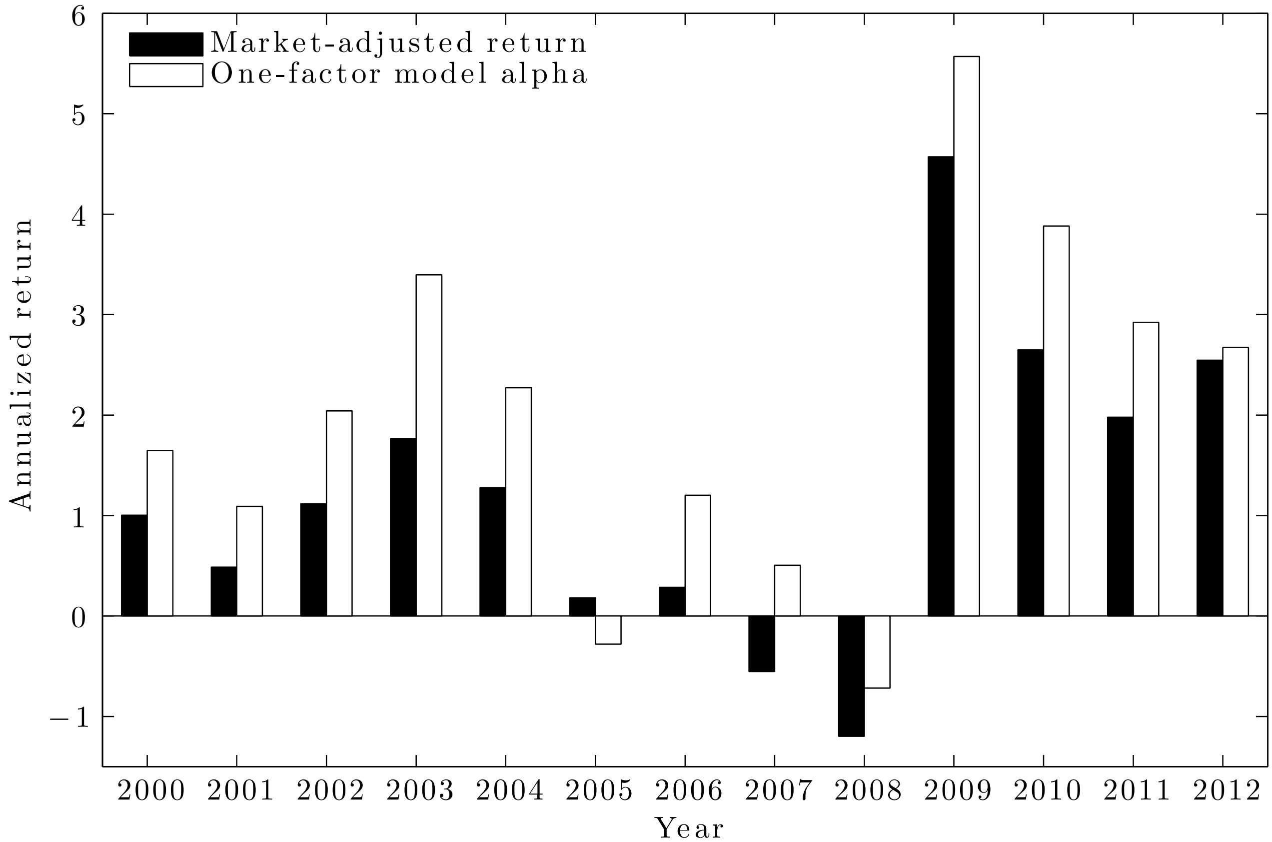

Figure 2: **Performance of the average intermediated dollar over the asset-class benchmark.** This figure reports the annual value-weighted returns and one-factor alphas over the asset-class benchmark across all funds in the Consultant's database from January 2000 through June 2012.

Table 1: Assets under management ($ in billions)

This table presents descriptive statistics for the Pensions & Investments surveys, our estimates of worldwide investable assets, and the Consultant's database. Panel A presents the annual total institutional assets under management and the number of asset managers in the Pensions & Investments surveys, and our estimates of worldwide investable assets. For descriptions of the Pensions & Investments surveys and our estimates of worldwide investable assets, see the Appendix. Panel B presents the total assets under management in the Consultant's database, the percentage of Pensions & Investments assets that show up in the Consultant's database, the number of managers in the Consultant's database, the assets in the Consultant's database with matching return information (column "Raw"), and the assets in the database excluding observations generated before a strategy was first added to the Consultant's database (column "Without backfill"). The Consultant's data cover the period 2000–2012.

Panel A: Pensions & Investments surveys and worldwide investable assets

	Pensions & Investments		Worldwide investable assets	
Year	AUM	Number of managers	Total	% held by asset managers
2000	22,659	898	78,884	28.7%
2001	23,028	906	75,512	30.5%
2002	23,275	900	76,603	30.4%
2003	29,134	940	93,933	31.0%
2004	32,815	909	108,514	30.2%
2005	37,165	946	116,104	32.0%
2006	42,751	949	134,293	31.8%
2007	46,759	941	157,057	29.8%
2008	36,809	890	134,650	27.3%
2009	42,294	886	152,190	27.8%
2010	44,443	879	164,610	27.0%
2011	43,643	848	164,709	26.5%
2012	47,603	852	174,786	27.2%
Average	36,337	687	125,526	29.3%

Panel B: Consultant's database

	AUM		Number	AUM with returns	
Year	Total	% of P&I	of managers	Raw	Without backfill
2000	6,759	29.8%	579	5,708	3,275
2001	7,048	30.6%	722	5,899	3,955
2002	7,367	31.7%	840	6,409	4,479
2003	10,096	34.7%	1004	8,615	6,556
2004	11,837	36.1%	1120	10,541	8,408
2005	13,310	35.8%	1213	12,234	9,744
2006	16,377	38.3%	1398	15,305	12,640
2007	29,174	62.4%	1596	26,237	22,962
2008	23,126	62.8%	1758	19,487	17,101
2009	26,693	63.1%	1864	22,702	20,812
2010	27,999	63.0%	2011	24,767	23,184
2011	27,501	63.0%	2067	24,612	23,579
2012†	27,944	58.7%	1974	24,959	24,598
Average	18,095	46.9%	1,396	15,960	13,946

† Year 2012 Consultant assets as of June 2012.

Table 2: Selection bias tests

This table presents tests of selection bias in the Consultant's database. Panel A compares asset class weights in the Consultant's database with asset class weights in the Pensions & Investments Money Manager Directory survey. The Pensions & Investments Money Manager Directory survey reports annually the fraction of U.S. tax exempt assets in equities, fixed income, cash, and other. We match managers across the Pensions & Investments Money Manager Directory and the Consultant's database, and then compute the asset class weights in both. Panel A reports average value-weighted asset allocations in the Consultant's database and the Pensions & Investments Money Manager Directory survey. We use annual data from year 2000 through 2012. Panel B examines the relation between performance and selective coverage in the Consultant's database. We define *coverage* as the percentage of assets that the manager reports to the Consultant's database by publishing the returns on the underlying strategies. We report estimates from ordinary least squares panel regressions of percentage returns on coverage. The unit of observation is a fund-month with N = 1,226,824. Standard errors are clustered by 32,165 month-by-strategy clusters. A coefficient estimate of 0.001 indicates that a percentage point increase in coverage is associated with a 0.1 basis point per month increase in returns.

Panel A: Value-weighted asset class weights in the Consultant's database and Pensions & Investments

Asset class	Consultant	Pensions and Investments
Equity	55.1%	52.3%
Fixed Income	27.3%	32.4%
Cash	7.6%	7.2%
Other	10.0%	8.2%

Panel B: Regressions of returns (%) on coverage

Independent variable	Dependent variable: Net return		Net return minus benchmark	
Coverage (%)	0.00285	0.00085	0.00072	0.00085
	(1.41)	(6.22)	(3.22)	(6.22)
Month × Strategy FE	No	Yes	No	Yes
Adjusted R^2	0.04%	0.04%	0.01%	0.01%

Table 3: Summary of fund characteristics by asset class

This table presents descriptive statistics for the funds in the Consultant's database across all assets classes (Panel A) and by asset class (Panel B). We compute time-series averages of the characteristics in the first column (assets under management in millions of USD, number of clients, AUM per client in millions of USD, and age) and then report the standard deviations and the percentiles of the resulting distribution. N_{managers} is the total number of managers over the sample period who offer at least one fund in the asset class. N_{funds} is the total number of funds that exist in the asset class at any point during the sample period. % alive is the fraction of funds that exist as of June 2012. "2012 AUM" is the total assets under management in each asset class (excluding cash) as of June 2012. The Consultant's data cover the period from January 2000 through June 2012.

Panel A: All asset classes (millions of USD)

			Percentiles				
	Mean	SD	25	50	75		
Assets under management	1,619.7	7,307.6	73.2	285.3	1,030.5	N_{managers}	3,272
Clients	201.1	4,833.8	1.6	5.8	23.1	N_{funds}	22,289
AUM per client	258.2	1,494.1	9.6	48.4	176.6	% alive	70.7%
Age	9.8	7.6	4.5	7.7	13.0	2012 AUM	22,413,097

Panel B: Fund characteristics by asset class (millions of USD)

			Percentiles				
Asset class	Mean	SD	25	50	75		
U.S. public equity							
Assets under management	1,201.2	5,042.6	50.3	241.2	833.9	N_{managers}	1,236
Clients	261.7	4,928.0	2.0	7.2	29.0	N_{funds}	5,022
AUM per client	142.3	595.2	3.6	23.5	92.9	% alive	66.5%
Age	11.1	8.2	5.5	9.0	14.3	2012 AUM	4,296,070
Global public equity							
Assets under management	1,401.9	3,940.7	81.6	309.0	1,109.5	N_{managers}	1,088
Clients	363.4	7,702.4	1.0	4.0	14.3	N_{funds}	6,360
AUM per client	262.7	1,254.4	18.4	79.7	205.2	% alive	74.3%
Age	9.3	7.5	4.4	7.2	12.5	2012 AUM	4,582,825
U.S. fixed income							
Assets under management	2,730.9	10,756.1	147.9	481.3	1,933.3	N_{managers}	594
Clients	48.0	258.6	2.3	7.7	22.5	N_{funds}	2,239
AUM per client	258.2	790.6	20.1	74.2	229.3	% alive	72.7%
Age	12.9	8.3	6.7	11.6	17.0	2012 AUM	5,397,754
Global fixed income							
Assets under management	3,019.4	14,536.7	155.2	541.9	1,909.0	N_{managers}	440
Clients	34.9	219.6	1.0	4.0	14.7	N_{funds}	2,509
AUM per client	571.9	3,458.2	45.9	151.5	361.1	% alive	76.0%
Age	9.3	7.3	4.4	7.7	12.2	2012 AUM	5,239,259
Asset blends							
Assets under management	1,928.1	5,780.9	54.9	256.3	1,083.9	N_{managers}	638
Clients	187.6	2,310.5	1.0	7.0	46.5	N_{funds}	1,819
AUM per client	343.7	1,657.3	4.8	27.1	144.4	% alive	71.6%
Age	11.5	9.3	4.4	8.9	16.0	2012 AUM	1,516,924
Hedge funds							
Assets under management	941.0	4,852.9	49.3	158.4	558.9	N_{managers}	1,553
Clients	57.9	393.3	1.0	7.4	36.0	N_{funds}	4,340
AUM per client	203.5	984.0	5.0	21.4	102.8	% alive	65.7%
Age	7.0	5.0	3.5	5.7	9.1	2012 AUM	1,380,265

Table 4: Fees by asset class and client size

This table presents descriptive statistics for the fee data in the Consultant's database. Panel A reports the distributions of fund fees across all asset classes and by asset class. The fees reported in this table are the middle point fees reported on each fund's fee schedule. Panel B sorts funds based on the assets under management per client and reports the fee distributions for seven categories that range from less than one million dollars in assets to over one billion dollars in assets per client.

Panel A: Distribution of fund fees (bps) by asset class

	Average			Percentiles		
Asset class	VW	EW	SD	25	50	75
All	47.4	62.1	36.4	36.6	33.9	57.3
Public Equities: U.S.	49.6	63.1	38.8	27.2	46.9	63.4
Public Equities: Global	58.4	68.4	45.9	30.5	50.7	64.2
Fixed Income: U.S.	28.9	29.7	20.9	15.1	21.0	26.8
Fixed Income: Global	32.0	36.2	24.7	22.6	22.9	29.6
Asset Blends	40.1	55.9	30.5	32.4	35.5	49.5
Hedge Funds	91.0	112.3	63.8	42.7	96.8	106.8

Panel B: Distribution of fund fees (bps) by client size

	Average			Percentiles		
AUM per client	VW	EW	SD	25	50	75
$<$ \$1 million	66.7	84.3	41.1	57.5	75.0	100.0
\$1–\$5	79.9	87.3	51.4	52.9	77.3	103.1
\$5–\$10	78.4	80.7	47.7	45.0	75.0	100.0
\$10–\$50	60.2	72.5	45.6	40.0	65.0	91.9
\$50–\$250	49.0	60.7	36.8	35.0	55.5	78.0
\$250–\$1000	38.8	58.5	41.0	30.0	50.0	75.0
$>$ \$1000	37.7	59.8	43.5	27.0	50.0	77.5

Table 5: Fund returns

This table compares fund returns against broad asset-class and strategy level benchmarks. Panel A reports market-adjusted returns, which are computed by subtracting from each fund's gross or net return, the return earned by the corresponding broad asset-class benchmark. These six benchmarks are listed in Table A3. Panel B presents the annual gross alphas and weights against the asset-class level benchmarks. These 235 strategies listed in Table A4. We define for each fund i and month t a residual $e_{it} = r_{it} - r_{it}^B$, where r_{it}^B is the return on the broad asset class or strategy. We then estimate a value-weighted panel regression of these residuals against a constant, clustering the errors by month. The weights in this regression are proportional to each fund's assets under management and they are scaled to sum up to one within each month. Tracking error estimates are obtained from value-weighted regressions of e_{it}^2s on a constant. Alphas and tracking errors are annualized. Information ratio (IR) is the annualized net alpha divided by the tracking error. The Consultant's data cover the period from January 2000 through June 2012.

Panel A: Overall market-adjusted returns

Year	Gross returns $\hat{\alpha}$	Gross returns $t(\hat{\alpha})$	Gross returns Tracking error	Net returns $\hat{\alpha}$	Net returns $t(\hat{\alpha})$	Information ratio
All	1.19	3.19	8.72%	0.72	1.93	0.08

Panel B: Market-adjusted returns and asset-class weights by year

	Annualized gross alphas						Annual portfolio weights						Total
	Public equity		Fixed income		Asset	Hedge	Public equity		Fixed income		Asset	Hedge	gross
Year	U.S.	Global	U.S.	Global	blends	funds	U.S.	Global	U.S.	Global	blends	funds	alpha
2000	4.37	−4.49	−1.54	5.52	8.52	−10.74	0.48	0.16	0.26	0.01	0.06	0.04	1.10
2001	2.90	−4.56	−0.36	5.07	5.25	−8.82	0.41	0.19	0.28	0.02	0.07	0.03	0.39
2002	0.12	9.57	−1.43	−7.16	−3.76	−3.89	0.36	0.21	0.29	0.03	0.08	0.04	0.97
2003	1.53	7.52	3.08	−5.38	−11.93	−5.65	0.32	0.23	0.29	0.05	0.07	0.04	1.74
2004	1.56	3.50	1.53	−2.28	−4.98	0.37	0.31	0.26	0.24	0.07	0.07	0.05	1.25
2005	2.18	−8.36	0.93	12.65	4.95	4.76	0.30	0.28	0.21	0.08	0.07	0.07	0.16
2006	−1.12	4.11	0.92	−3.14	−5.21	−3.25	0.27	0.31	0.18	0.09	0.06	0.09	0.25
2007	0.36	2.72	−1.00	−6.39	−4.15	−5.29	0.26	0.32	0.17	0.10	0.05	0.09	−0.56
2008	1.01	1.95	−7.28	−9.67	13.95	2.83	0.20	0.29	0.17	0.18	0.06	0.10	−1.09
2009	0.42	1.96	8.53	6.89	−8.06	12.90	0.18	0.24	0.22	0.20	0.07	0.10	4.55
2010	0.55	5.00	2.50	1.10	−2.59	9.51	0.17	0.24	0.20	0.25	0.06	0.08	2.71
2011	−2.02	1.17	0.87	4.87	1.83	6.77	0.17	0.24	0.21	0.24	0.06	0.08	1.91
2012	−2.23	1.19	4.61	6.29	−2.87	3.67	0.17	0.22	0.23	0.25	0.07	0.07	2.54
Average	0.86	1.66	0.72	0.42	−0.61	0.11	0.28	0.24	0.23	0.12	0.06	0.07	0.82

$$\text{Contribution of asset class } a = \sum_{t=2000}^{2012} \text{portfolio weight}_{at} \times \text{gross alpha}_{at} \Big/ \sum_{t=2000}^{2012} \text{portfolio weight}$$

Total	0.36	0.43	0.19	0.12	−0.05	0.12							1.19

Table 6: Evaluating fund returns against broad market indexes

This table presents gross and net alphas from single-factor models that use the six broad asset class benchmarks, which are listed in Table A3. We first estimate fund-by-fund regressions of net and gross returns against benchmarks and collect $e_{it} = \hat{\alpha}_i + \hat{\varepsilon}_{it}$. We then estimate value-weighted panel regressions of these residuals against a constant, clustering the standard errors by month. The weights in this regression are proportional to each fund's assets under management and they are scaled to sum up to one within each month. Betas and R^2s reported are obtained by estimating similar value-weighted regressions with the fund-specific betas and R^2s as the dependent variables. Tracking error estimates are obtained from value-weighted regressions of e_{it}^2s on a constant. Alphas and tracking errors are annualized. Information ratio (IR) is the annualized net alpha divided by the tracking error. The Consultant's data cover the period from January 2000 through June 2012.

	Gross returns					Net returns		
Asset class	$\hat{\alpha}$	$t(\hat{\alpha})$	Tracking error	$\hat{\beta}$	R^2	$\hat{\alpha}$	$t(\hat{\alpha})$	IR
All	1.99	4.44	7.87%	0.88	64.5%	1.52	3.39	0.19
U.S. public equity	0.93	1.84	8.02%	1.00	85.6%	0.43	0.86	0.05
Global public equity	1.73	1.34	9.36%	1.05	77.1%	1.15	0.89	0.12
U.S. fixed income	0.95	1.86	4.07%	0.97	64.3%	0.66	1.30	0.16
Global fixed income	4.39	4.71	6.71%	0.44	32.8%	4.08	4.37	0.61
Asset blends	2.30	3.21	5.22%	0.54	47.0%	1.92	2.69	0.37
Hedge funds	2.22	2.64	7.91%	0.55	13.5%	1.31	1.56	0.17

Table 7: Evaluating fund returns against strategy-specific benchmarks

This table presents gross and net alphas from single-factor models that use use the 235 strategies, which are listed in Table A4. Panel A reports the estimates by asset class. Panel B reports estimates based on alternative samples for robustness. The first row in Panel B presents results when the sample is limited to the public equity and fixed income broad asset classes. The second row limits the sample to funds for which the manager entered no more than one year of historical data at the initiation of coverage. The third row presents results for the post-2006 data and the final row limits the sample to asset managers that report performance for funds that represent at least 85% of their total assets under management. We first estimate fund-by-fund regressions of net and gross returns against benchmarks and collect $e_{it} = \hat{\alpha}_i + \hat{\varepsilon}_{it}$. We then estimate value-weighted panel regressions of these residuals against a constant, clustering the standard errors by month. The weights in this regression are proportional to each fund's assets under management and they are scaled to sum up to one within each month. Betas and R^2s reported are obtained by estimating similar value-weighted regressions with the fund-specific betas and R^2s as the dependent variables. Tracking error estimates are obtained from value-weighted regressions of e_{it}^2s on a constant. Alphas and tracking errors are annualized. Information ratio (IR) is the annualized net alpha divided by the tracking error. The Consultant's data cover the period from January 2000 through June 2012.

Panel A: Single-factor model regressions against strategy benchmarks

	Gross returns					Net returns		
Asset class	$\hat{\alpha}$	$t(\hat{\alpha})$	Tracking error	$\hat{\beta}$	R^2	$\hat{\alpha}$	$t(\hat{\alpha})$	IR
All	0.96	3.67	5.92%	0.88	75.7%	0.49	1.87	0.08
U.S. public equity	0.39	0.97	6.25%	0.98	89.8%	−0.10	−0.25	−0.02
Global public equity	0.58	1.26	6.02%	0.96	90.3%	0.00	0.01	0.00
U.S. fixed income	1.36	6.59	2.93%	0.84	73.5%	1.07	5.19	0.36
Global fixed income	1.29	3.15	4.92%	0.95	69.2%	0.97	2.37	0.20
Asset blends	1.37	1.42	6.67%	0.51	39.0%	1.00	1.03	0.15
Hedge funds	1.60	2.55	7.38%	0.41	23.2%	0.69	1.10	0.09

Panel B: Robustness

	Gross returns					Net returns		
Sample or specification	$\hat{\alpha}$	$t(\hat{\alpha})$	Tracking error	$\hat{\beta}$	R^2	$\hat{\alpha}$	$t(\hat{\alpha})$	IR
Public equity and fixed income	0.86	3.35	5.62%	0.94	82.3%	0.42	1.63	0.07
At most one year of historical data	0.82	2.95	5.70%	0.87	77.2%	0.35	1.26	0.06
Only post-2006 data	0.87	2.41	5.84%	0.88	73.6%	0.39	1.08	0.07
Coverage $\geq$ 85%	1.22	3.76	5.43%	0.91	78.3%	0.69	2.13	0.13

Table 8: Average returns and standard deviations for asset manager funds, broad asset class benchmarks, and strategy-specific benchmarks

This table reports average returns and standard deviations for asset managers funds, broad asset class benchmarks, and strategy-specific benchmarks. The estimates are reported by asset class. The return on the strategy-specific benchmark is the value-weighted average of all the strategies within each asset class, with the weights proportion to asset manager funds' AUMs. The last row examines the performance of equity and fixed income asset classes.

	Asset managers			Asset-class benchmark			Strategy benchmark		
Asset class	Average return	SD	Sharpe ratio	Average return	SD	Sharpe ratio	Average return	SD	Sharpe ratio
U.S. public equity	4.46	16.69	0.14	3.62	16.68	0.09	4.23	16.54	0.12
Global public equity	4.01	16.87	0.11	2.31	15.57	0.01	3.67	17.30	0.09
U.S. fixed income	7.10	3.90	1.26	6.36	3.61	1.16	6.83	4.22	1.10
Global fixed income	7.03	4.85	1.00	6.65	8.58	0.52	6.02	4.61	0.83
Asset blends	3.77	6.72	0.24	4.44	11.07	0.21	5.76	7.20	0.50
Hedge funds	2.72	3.53	0.16	2.54	3.50	0.11	4.32	6.63	0.32
1-month T-bill				2.17	0.63				
All	4.93	9.51	0.29	3.74	9.12	0.17	4.74	9.56	0.27
All except asset blends and hedge funds	5.23	10.33	0.30	3.95	9.64	0.18	4.83	10.36	0.26

Table 9: Sharpe analysis

This table reports estimates from an analysis that compares fund returns with returns on mimicking portfolios constructed from 19 tactical factors. We implement this analysis using a modified version of Sharpe's (1992) approach. For each fund i-month t, we regress the strategy returns against 19 tactical factors using data up to month $t-1$. The first tactical factor ("1. Asset-class benchmark" in Panel A) is the strategy's broad asset class benchmark, which are listed in Table A3. The remaining 18 tactical factors, which are listed in Panel A, are common across strategies. The regression slopes are constrained to be non-negative and to sum up to one. We use the resulting slope estimates to compute the return on strategy i's style portfolio in month t and define a residual $e_{it} = r_{it} - r_{it}^{B}$, where r_{it}^{B} is the return on the style portfolio. We then estimate a value-weighted panel regression of these residuals against a constant, clustering the errors by month. The weights in this regression are proportional to each fund's assets under management and they are scaled to sum up to one within each month. Panel A reports the average weights by asset class. Panel B reports gross and net alphas, tracking errors, and information ratios for the funds by asset class. The tracking error and Sharpe weight estimates are obtained from value-weighted regressions of e_{it}^{2}s and the first-stage weights on a constant. The Consultant's data cover the period from January 2000 through June 2012.

Panel A: Sharpe weights ($w_1 + \cdots + w_{19} = 100\%$)

Factors	All	Asset Class: U.S. public equity	Global public equity	U.S. fixed income	Global fixed income	Asset blends	Hedge funds
Asset-class benchmark	16.9						
Russell 3000		9.8					
MSCI World			19.2				
Barclays Capital U.S. Aggregate				25.0			
Barclays Capital Global Aggregate					26.1		
60% * MSCI World + 40% * Barclays Global Aggr.						3.8	
HFRX Absolute Return							13.4
Equity: US							
S&P 500/Citigroup Value	9.7	27.9	3.6	0.6	0.7	10.0	1.0
S&P 500/Citigroup Growth	8.9	22.9	7.7	0.5	0.6	8.7	1.6
S&P 400 Midcap	3.4	10.5	1.8	0.5	0.3	2.1	0.7
S&P Small Cap	5.5	14.6	3.2	0.9	1.6	1.6	0.9
Equity: Global							
S&P Europe BMI	9.3	1.8	32.0	0.6	1.2	6.1	3.6
MSCI Emerging Market Free Float Adjusted Index	6.4	3.5	18.1	1.1	1.4	4.3	2.7
FI: US							
U.S. 3 Month T-Bill	8.3	0.5	0.7	6.7	14.2	35.7	44.3
Barclays Capital US Intermediate Govt	4.0	0.2	0.3	11.6	5.7	3.4	4.5
Barclays Capital US Long Govt	4.5	0.6	1.8	8.4	11.8	2.7	2.2
Barclays Capital US Corporate Investment Grade	7.3	0.2	1.0	22.2	9.3	2.5	2.0
Barclays Capital US Mortgage Backed Securities	4.4	0.3	0.8	14.5	2.8	4.5	2.1
FI: Global							
Barclays Capital Euro Aggregate Govt	1.0	0.2	0.6	0.2	4.1	1.6	1.1
Barclays Capital Euro Aggregate Corporate	1.1	0.4	0.9	0.4	1.8	3.0	2.0
JP Morgan EMBI Global Diversified	2.7	0.8	1.2	3.8	11.1	2.2	1.2
Hedge Funds							
UBS Global Infrastructure & Utilities	1.5	2.2	2.1	0.3	0.8	1.8	1.2
Dow Jones UBS Commodity Index Total Return	2.0	1.9	3.4	0.7	1.7	2.1	3.6
DBCR Carry Total Return	1.8	1.2	0.8	1.4	3.3	2.4	4.8
DBCR Momentum Total Return	1.3	0.5	0.8	0.6	1.4	1.7	7.3
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Panel B: Excess returns over the mimicking portfolio

	Gross returns				Net returns		
Asset class	Excess return	t(Excess return)	Tracking error	R^2	Excess return	t(Excess return)	IR
All	−0.17	−0.47	5.87%	82.9%	−0.63	−1.76	−0.11
U.S. public equity	−0.46	−1.02	5.70%	90.1%	−0.95	−2.11	−0.17
Global public equity	−0.93	−1.28	7.16%	85.9%	−1.51	−2.07	−0.21
U.S. fixed income	0.48	1.25	3.02%	70.6%	0.19	0.50	0.06
Global fixed income	0.73	1.09	4.99%	60.4%	0.41	0.62	0.08
Asset blends	0.19	0.38	4.23%	78.9%	−0.19	−0.38	−0.04
Hedge funds	−0.20	−0.26	7.60%	21.1%	−1.11	−1.38	−0.15

Table 10: Regressions of fees on style-portfolio and residual returns

This table presents regressions that measure the relation between before-fee performance and fees. The unit of observation is a month-fund pair. We report estimates from regressions of monthly fees ($\times 100$) on the return on the style portfolio and the residual return. These return-component estimates are from Table 9's Sharpe analysis. Panel A presents panel regressions with monthly returns. These regressions include month-asset class fixed effects and standard errors are clustered at the fund-level. Panel B presents cross sectional regressions with one observation per fund. We generate each fund's observation by first running separate panel regressions of style return and the residual return on month-asset class fixed effects. The residuals from these regressions represent abnormal performance after removing variation across asset classes and months. For each fund, we then take averages of these adjusted style and residual returns. The Consultant's data cover the period from January 2000 through June 2012.

Panel A: Panel regressions by asset class

Dependent variable:	Fees						
Sample set:	All asset manager fund-month observations						
In asset class:	All	Public equity		Fixed income		Asset	Hedge
		U.S.	Global	U.S.	Global	Blends	Funds
Style portfolio return	5.35	10.28	5.02	1.06	2.51	2.08	2.61
	(5.57)	(4.18)	(3.62)	(0.68)	(1.22)	(1.13)	(2.01)
Residual return	2.00	1.34	1.17	2.98	2.93	−0.02	5.83
	(3.43)	(1.12)	(2.53)	(2.40)	(2.38)	(−0.01)	(2.62)
Month-asset class FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	738,004	238,716	207,665	107,395	80,289	41,673	62,266
Adjusted R^2	0.1%	0.3%	0.1%	0.0%	0.1%	0.0%	0.1%

Panel B: Cross-sectional regressions by asset class

Dependent variable:	Fees						
Sample set:	Asset manager fund						
In asset class:	All	Public equity		Fixed income		Asset	Hedge
		U.S.	Global	U.S.	Global	Blends	Funds
Style portfolio return	0.51	1.19	0.40	0.15	0.26	0.33	0.57
	(3.62)	(2.99)	(1.56)	(0.44)	(0.65)	(1.20)	(2.99)
Residual return	0.01	0.07	−0.15	−0.10	0.44	−0.38	0.24
	(0.16)	(0.58)	(−1.09)	(−0.72)	(1.66)	(−0.51)	(1.21)
N	12,164	3,468	3,469	1,540	1,370	727	1,590
Adjusted R^2	0.5%	2.3%	0.4%	0.1%	0.7%	0.4%	0.4%

Table 11: Replicating asset managers

This table reports Sharpe ratios of alternative portfolios constructed from tradeable indexes listed in Table 7. The first method uses the standard mean-variance optimization algorithm of Markowitz (1952). The second method first diagonalizes the covariance matrix and constrains the estimated risk premiums to be nonnegative. The third method imposes short-sale constraints. We estimate the means and covariances using all available historical data for each index up to month $t-1$. We construct the replicating portfolio separately within each asset class, and then use these weights together with the asset-class weights observed in the asset-manager data to compute the return on the replicating portfolio in month t. Panel A reports the Sharpe ratios of asset managers and these replicating portfolios. Column "Indifference cost (bps)" is the cost that equates the Sharpe ratio of the replicating portfolio with the asset managers' Sharpe ratio. Panel B reports the cost of holding the replicating portfolio, constructed using the diagonal-covariance method, using four alternative assumptions about fees. The detailed fees are reported in Panel C. Expense ratios and fees are reported in basis points. Entries of "NA" denote that the data are not available.

Panel A: Sharpe ratios and indifference costs of replicating portfolios

	Average return	SD	Sharpe ratio	Indifference cost (bps)
Asset managers				
Gross return	5.02%	9.78%	0.292	
Net return	4.55%	9.78%	0.243	
Replicating portfolio, gross return				
Standard MV portfolio	4.12%	13.71%	0.142	−205.2
MV portfolio with diagonal covariance matrix	6.07%	10.85%	0.359	73.1
MV portfolio with short-sale constraints	5.81%	10.99%	0.331	43.3

Panel B: Cost (bps) of investing the replicating portfolio using the actual fees of the vehicle over the period

Vehicle	Fee
End-of-sample ETFs	26.4
Institutional mutual funds	
Quartile 1	65.1
Median	86.5
Quartile 3	109.6

Panel C: Fees used in the replicating portfolios

	ETFs			Institutional mutual funds			Fee
Benchmark	Expense ratio	Ticker	Start date	Q1	Median	Q3	used in replication
S&P 500/Citigroup Value	15	SPYV	9/29/00	70	91	112	91
S&P 500/Citigroup Growth	15	SPYG	9/29/00	80	97	122	97
S&P 400 Midcap	15	IVOO	9/9/10	70	95	115.5	95
S&P Small Cap	15	SLY	11/15/05	85	109	135	109
S&P Europe BMI	12	VGK	3/10/05	54.5	88	129	88
MSCI Emerging Market Free Float Adjusted	67	EEM	4/11/03	102	139	166	139
U.S. 3 Month T-Bill	14	BIL	5/30/07	16	26	45	26
Barclays Capital US Intermediate Govt	20	GVI	1/5/07	51	66	83	66
Barclays Capital US Long Govt	12	VGLT	11/24/09	20	43	67	43
Barclays Capital US Corporate Investment Grade	15	LQD	7/26/02	55	70	92	70
Barclays Capital US Mortgage Backed Securities	32	MBG	1/15/09	49	65	80	65
Barclays Capital Euro Aggregate Gov	15	GOVY	5/23/11	NA	NA	NA	15
Barclays Capital Euro Aggregate Corporate	20	IBCX	3/17/03	NA	NA	NA	20
JP Morgan EMBI Global Diversified	40	EMB	12/19/07	84	97	112	97
HFRX Absolute Return	60	HFRX	3/18/11	NA	NA	NA	60
UBS Global Infrastructure & Utilities	48	IGF	12/12/07	61	88	113	88
Dow Jones UBS Commodity Index Total Return	50	DJCI	10/29/09	77	95	122	95
DBCR Carry Total Return	65	ICI	1/31/08	40	55	87	55
DBCR Momentum Total Return	NA	NA	NA	40	55	87	55

Appendix

In this Appendix, we describe the methodology that we use to estimate worldwide investable assets and total institutional assets held by asset managers.

Worldwide investable assets

In this section, we describe how we estimate total worldwide investable assets, which represent the sum of six broad investable asset classes: real estate, outstanding government bonds, outstanding bonds issued by banks and financial corporations, outstanding bonds issued by non-financial corporations, private equity, and public equity. Table A1 presents annual estimates of worldwide investable assets by the six broad asset classes. Our estimate of worldwide investable assets for 2012 is \$173 trillion. If we extrapolate Philippon's (2015) estimates of U.S. investable assets, we obtain a similar estimate of \$175 trillion in worldwide investable assets for 2012.

For real estate, we estimate the worldwide value of commercial real estate. To do so, we follow the methodology used by Prudential Real Estate Investors (PREI) in the report "A Bird's Eye View of Global Real Estate Markets: 2010 Update." Their methodology uses GDP per capita to capture country-level economic development and estimates the size of a country's commercial real estate market based on GDP. They select a time-varying threshold and assume that the value of commercial real estate above this threshold is 45% of total GDP. The threshold starts in 2000 at \$20,000 in per capita GDP and then adjusts annually by the U.S. inflation rate. For countries with per capita GDP below the threshold in a given year, PREI calculates the value of the country's commercial real estate market as:

$$\text{Value of commercial real estate} = 45\% \times \text{GDP} \times (\text{GDP per capita / Threshold})^{1/3}.$$

To estimate the worldwide size of the government, financial, and corporate bond sectors, we use the Bank for International Settlements' debt securities statistics provided in Table 18 of the Bank's Quarterly Reviews. These statistics present total debt securities by both residence of issuer and classification of user (non-financial corporations, general government, and financial corporations).[1] We then aggregate the country-level data by year. For private equity, we use Preqin's "2014 Private Equity Performance Monitor Report." The report provides annual estimates of assets under management held by private equity funds worldwide and these estimates include both cash held by funds ("dry powder") and unrealized portfolio values. For our estimates of the size of world's public equity markets, we use the World Bank's estimates of the market capitalization of listed companies[2]

Total institutional assets held by asset managers

In our analysis, we supplement the Consultant's database with data from Pensions & Investments, which carries out annual surveys of the asset management industry. In this section, we describe the Pensions & Investments surveys and how we use the surveys to construct our estimates of total institutional assets under management held worldwide by asset managers, which are presented in the first column of Panel A of Table 1.

We use two Pensions & Investments surveys. The first survey is the Pensions & Investments Towers Watson World 500, which is an annual survey of the assets under management (retail and institutional) held by the world's 500 largest money managers. The second survey is the Pensions & Investments Money Manager Directory, which provides more detailed data for U.S. based money managers including total assets under management, institutional assets under management, and broad asset allocations (equity, fixed income, cash, and other) for U.S. tax exempt institutional assets.

[1] The data are available at `https://www.bis.org/statistics/hanx18.csv`.
[2] The data are available at `http://data.worldbank.org/indicator/CM.MKT.LCAP.CD`.

Table A2 provides descriptive statistics for these surveys and describes how we construct our estimate of total worldwide institutional assets held by asset managers. Column (1) presents annual total worldwide assets under management (retail and institutional assets) based on the Pensions & Investments Towers Watson World 500 survey and column (2) presents total assets under management (retail and institutional assets) for the U.S. based asset managers covered in the Pensions & Investments Money Manager Directory survey. The totals presented in these two columns include both retail and institutional assets. In column (3), we therefore present total institutional assets held by U.S. based asset managers. As shown in column (4), over the sample period, institutional assets held by U.S. based asset managers range from 63% to 69% of total assets.

To estimate the worldwide size of the institutional segment, we extrapolate based on the institutional asset percentages for the U.S. based asset managers. We first create a union of managers who show up on either the Pensions & Investments Towers Watson 500 survey or the Pensions & Investments Money Manager Directory survey.[3] Column (5) presents total assets under management (retail and institutional) for the managers in the union of the two surveys. These totals are very close to the totals based on the Towers Watson 500 survey, implying that the top 500 managers control the vast majority of assets. We next scale the total assets presented in column (5) by the percent institutional assets held by U.S. based managers presented in column (4). Column (6) presents these estimates of worldwide institutional assets under management. We present these estimates in the first column of Panel A of Table 1.

[3]Missing in this union are non-U.S. based asset managers who are smaller than the cutoff for the Pensions & Investments Towers Watson World 500. Given the close estimates of the top 500 with the intersection with U.S. based managers, this missing category does not appear large.

Table A1: Estimates of worldwide investable assets ($ in billions)

This table presents annual estimates of worldwide investable assets by asset class and in aggregate. We use the following sources to estimate the worldwide investable assets by asset class: real estate, Prudential Real Estate Investors; government bonds, the Bank for International Settlements; corporate bonds, the Bank for International Settlements; private equity, Peqin; public equity, the World Bank.

Year	Real estate	Govt. bonds	Financial bonds	Corporate bonds	Private equity	Public equity	Total
2000	13,249	13,578	14,613	4,788	716	31,940	78,884
2001	13,085	13,210	15,927	4,924	751	27,614	75,512
2002	13,625	15,361	18,386	5,216	767	23,248	76,603
2003	15,373	18,686	21,808	5,540	870	31,657	93,933
2004	17,312	21,750	25,091	5,727	963	37,671	108,514
2005	18,641	21,205	26,913	5,413	1,238	42,694	116,104
2006	20,100	22,600	31,426	5,801	1,704	52,663	134,293
2007	22,667	24,852	37,077	6,437	2,276	63,748	157,057
2008	24,770	28,055	38,298	6,757	2,279	34,491	134,650
2009	23,104	32,187	40,199	7,535	2,480	46,685	152,190
2010	25,251	36,686	38,434	8,102	2,776	53,361	164,610
2011	28,005	39,745	37,866	8,565	3,036	45,876	163,093
2012	28,481	41,181	37,799	9,380	3,273	52,452	172,566

Table A2: Total institutional assets held by asset managers ($ in millions)

This table presents how we estimate total institutional assets held by asset managers. To do so, we use two Pensions & Investments surveys: Towers Watson and the Money Manager Directory. Towers Watson provides the total assets under management (retail and institutional) held by the world's 500 largest asset managers, which are presented in the first column. The Money Manager Directory provides total assets under management (retail and institutional) and institutional assets under management for U.S. asset managers, which are presented in the second and third columns. We create a union of these two surveys and then use the ratio institutional to total assets for U.S. asset managers to extrapolate total worldwide institutional assets held by asset managers, which is presented in the last column.

	Towers Watson	Money Manager Directory			Union	
	Total AUM	Total AUM	Institutional AUM	Institutional %	Total AUM	Institutional AUM
2000	35,332,692	20,192,354	12,805,136	63%	35,731,108	22,659,156
2001	35,268,184	20,896,204	13,481,972	65%	35,691,676	23,027,827
2002	35,553,632	20,371,588	13,192,112	65%	35,942,336	23,275,325
2003	43,198,300	24,965,260	16,622,492	67%	43,756,688	29,134,293
2004	48,814,404	28,726,436	19,072,168	66%	49,425,676	32,814,889
2005	53,697,920	31,701,564	21,643,876	68%	54,436,644	37,165,989
2006	63,744,624	37,344,564	24,708,774	66%	64,613,496	42,751,075
2007	69,490,032	41,645,204	27,621,568	66%	70,498,968	46,759,095
2008	53,281,724	31,414,800	21,459,676	68%	53,883,952	36,808,515
2009	61,964,252	37,957,556	25,607,218	67%	62,692,876	42,294,350
2010	64,710,808	43,089,043	29,233,620	68%	65,507,248	44,443,178
2011	63,090,376	42,591,797	29,157,459	68%	63,752,352	43,643,534
2012	68,295,592	46,757,542	32,237,746	69%	69,043,736	47,603,324

Table A3: Broad asset classes in the Consultant's database and their benchmarks

This table presents the annual average returns and standard deviation of returns for both the asset manager funds in the six broad asset classes and the benchmarks used in Table 5 to evaluate funds performance.

	Consultant's database		Benchmark		
Asset class	Average return	SD	Name	Return	SD
U.S. public equity	4.46	16.69	Russell 3000	3.29	16.66
Global public equity	4.01	16.87	MSCI World ex U.S.	2.03	15.55
U.S. fixed income	7.10	3.90	Barclays Capital U.S. Aggregate	6.29	3.60
Global fixed income	7.03	4.85	Barclays Capital Global ex U.S. Aggregate	6.36	8.61
Asset blends	3.77	6.72	60% * MSCI World	4.08	11.10
			+ 40% * Barclays Capital Global Aggregate		
Hedge funds	2.72	3.53	HFRX Absolute Return	2.56	3.49

Table A4: Strategies in the Consultant's database and their benchmarks

Strategy name	Number of funds	Average return	Benchmark	Average return
U.S. public equities				
All Cap Core	145	3.478	Russell 3000	3.624
All Cap Growth	90	1.750	Russell 3000 Growth	1.326
All Cap Index Based	18	3.071	Russell 3000	3.624
All Cap Value	88	7.841	Russell 3000 Value	5.799
Canada Core	145	9.141	S&P/TSX 60	9.319
Canada Growth Biased	57	9.209	MSCI Canada Growth	9.241
Canada Income Oriented	38	9.226	S&P/TSX Income Trust	16.536
Canada International Equity Targeted Volatility	2	12.153	MSCI AC World Minimum Volatility CAD	9.924
Canada Passive Equity	32	10.248	S&P/TSX Composite	8.953
Canada Small Cap Equity	79	11.045	MSCI Canada Small Cap	8.668
Canada Socially Responsible	16	8.390	Jantzi Social	8.381
Canada Total Equity	85	7.267	S&P/TSX Composite	7.614
Canada Value Biased	74	10.200	MSCI Canada Value	8.902
Large Cap Core	738	2.693	S&P 500	3.003
Large Cap Growth	575	0.674	S&P 500/Citigroup Growth	1.851
Large Cap Index Based	199	3.691	S&P 500	3.003
Large Cap Value	573	5.741	S&P 500/Citigroup Value	4.225
Other	215	3.097	Russell 3000	3.624
Mid Cap Core	114	7.753	Russell Midcap	8.308
Mid Cap Growth	172	4.332	Russell Midcap Growth	4.810
Mid Cap Index Based	34	9.146	Russell Midcap	8.308
Mid Cap Value	142	8.806	Russell Midcap Value	10.336
Small Cap Core	220	7.815	S&P 600 Small Cap	9.919
Small Cap Growth	295	4.812	S&P SmallCap 600/Citigroup Growth	8.836
Small Cap Index Based	46	7.647	S&P U.S. SmallCap	4.847
Small Cap Micro	75	8.872	Russell Microcap	7.482
Small Cap Value	292	10.701	S&P SmallCap 600/Citigroup Value	10.798
SMID Cap Core	82	8.881	S&P 400 MidCap (50%) S&P 600 Small Cap (50%)	9.651
SMID Cap Growth	123	2.879	S&P MidCap 400/Citigroup Growth (50%) S&P SmallCap 600/Citigroup Growth (50%)	8.370
SMID Cap Value	102	10.491	Russell Midcap Value	10.336
Socially Responsible	88	3.006	Jantzi Social	5.683
Global public equity				
Asia ASEAN Equity	47	9.305	MSCI South East Asia	16.632
Asia ex Japan Equity	151	9.288	MSCI AC Asia (Free) ex Japan	8.460
Asia Greater China Equity	67	14.940	MSCI Golden Dragon	14.415
Asia Pacific Basin Equity Passive	19	13.812	MSCI AC Asia Pacific (Free)	7.101
Asia/Pacific Small Cap Equity	20	14.427	MSCI AC Asia Pacific ex Japan Smallcap	10.506
Asian Emerging Markets Equity	26	14.630	MSCI EM ASIA	13.117
Australia Equity	323	6.319	S&P Australia BMI	7.517
Australia Equity (Socially Responsible)	23	7.673	Jantzi Social	8.714
Australia Passive Equity	22	7.639	S&P Australia BMI	8.368
Australia Small Company Equity	71	10.992	S&P/ASX Emerging Companies	9.153
BRIC Equity	57	18.493	MSCI BRIC	18.952
China Equity (offshore)	38	18.339	MSCI China (USD)	21.955
Eastern European Equity	47	13.001	MSCI EM Eastern Europe	12.704
EMEA Equity	36	15.095	MSCI EM Eastern Europe	11.393
Emerging Markets Equity	305	10.425	MSCI EM Net	13.491
Emerging Markets Equity Other	59	11.189	MSCI EM Net	13.491
Equity Sectors Consumer Goods	13	7.250	MSCI World	0.239
Equity Sectors Other	17	8.440	MSCI AC WORLD	6.396
Europe Eurozone Equity	171	2.866	MSCI EMU	2.293
Europe ex UK Equity	157	5.536	MSCI Europe ex UK	4.376
Europe ex UK Equity - Passive	15	6.506	MSCI Europe ex UK	6.066
Europe inc UK Equity	382	3.237	S&P Europe BMI	5.115
Europe inc UK Equity - Passive	12	7.484	S&P Europe BMI	7.188
Europe Nordic Equity	33	-0.295	MSCI Nordic	-0.363
Europe Norway Equity	45	1.865	MSCI Norway	7.139
Europe Small Cap Equity	101	5.104	MSCI Europe Small Cap	7.271
Europe Sweden Equity	31	5.119	MSCI Sweden	5.748
Flexible Equity	54	0.682	MSCI World	3.124
German Equity	20	3.301	DAX	3.392

Strategy name	Number of funds	Average return	Benchmark	Average return
Global Equity - Core	631	2.162	MSCI World	3.124
Global Equity - Growth	152	0.799	MSCI World Growth	1.511
Global Equity - Passive	76	0.485	MSCI World	4.620
Global Equity - Value	204	5.472	MSCI World Value	4.642
Global Small Cap Equity	57	4.298	MSCI World Small Cap Index	7.241
Gold & Precious Metals	15	26.160	S&P GSCI Precious Metals Total Return	18.662
Health/Biotech	23	7.069	S&P Healthcare Equip. Sel	11.058
HK ORSO	58	4.342	Hang Seng TR Index	14.895
Hong Kong Equity	34	16.241	FTSE MPF Hong Kong	13.880
Indian Equity	54	18.632	MSCI India	19.357
International Equity Global Equity Sustainability	7	13.433	MSCI EM	1.307
International Equity Global Equity Sustainability	167	4.177	MSCI World ESG	-0.790
International Equity Global Equity Sustainability	4	3.273	MSCI World ESG	13.184
International Equity Targeted Volatility	20	4.019	MSCI World Minimum Volatility	5.128
International Equity World ex Japan Equity	116	2.163	MSCI World	5.078
Japan Equity	417	-2.203	MSCI Japan	-0.776
Japan Passive Equity	28	1.558	MSCI Japan	4.033
Japan Small Cap Equity	55	3.918	MSCI Kokusai All Cap	0.506
Korea Equity	23	7.165	MSCI Korea	10.515
Latin American Equity	40	14.914	MSCI Latin America	17.001
Mixed UK/Non-UK Equity	27	7.111	FTSE All Share	3.412
Natural Resources	45	13.364	S&P Global Natural Resources SK	-8.928
New Zealand Equity	46	8.466	NZX 50 (40 prior to 1 Oct 2003)	7.223
Other	75	3.733	MSCI World	3.124
Pacific Basin ex Japan Equity	149	9.582	MSCI Pacific ex Japan	10.736
Pacific Basin inc Japan Equity	85	3.406	MSCI Pacific	2.106
Singapore Equity	17	9.995	MSCI Singapore	10.676
Swiss Equity	67	7.061	MSCI Switzerland	6.886
Technology	24	0.602	MSCI AC World: Sector: Information Technology	-1.176
UK All Cap	309	4.248	MSCI UK	3.971
UK Passive Equity	44	5.292	MSCI UK	4.610
UK Small Cap	50	8.059	Hoare Govett Smaller Companies	7.954
UK Socially Responsible	15	4.235	MSCI World ESG	-0.790
World ex US/EAFE Equity - Core	341	2.759	MSCI EAFE	3.425
World ex US/EAFE Equity - Growth	142	1.873	MSCI EAFE Growth	1.629
World ex US/EAFE Equity - Passive	52	3.384	MSCI EAFE	3.425
World ex US/EAFE Equity - Value	146	6.757	MSCI EAFE Value	5.183
World ex US/EAFE Small Cap Equity	78	7.134	MSCI EAFE Small Cap	7.925
U.S. fixed income				
Bank/Leveraged Loans	58	5.876	S&P/LSTA US Leveraged Loan 100 Index Price	0.257
Cana Short-Term	13	4.514	DEX Short Term	4.586
Canada Core Plus	34	6.301	DEX Long Term	8.111
Canada Credit	23	7.371	DEX Universe Corporate	6.739
Canada Long-Term	32	8.323	DEX Long Term	8.474
Canada Other	65	8.411	DEX Long Term	8.837
Canada Passive	33	7.362	DEX Universe Bond	6.254
Canada Universe	152	6.626	DEX Universe Bond	6.584
Convertible	47	3.746	Barclays Capital US High Yield Composite	7.982
Core Investment Grade	399	6.330	Barclays Capital US Corporate Inv Grade	7.045
Core Opportunistic	158	6.793	Barclays Capital US Aggregate	6.362
Credit	65	6.734	Barclays Capital US Universal	6.495
Credit - Long Duration	34	7.881	Barclays Capital US Long Credit	7.322
Fixed Income Private Debt	12	12.101	Preqin Buyout	12.907
Government	66	7.050	Barclays Capital US Govt/Credit	6.466
High Yield	174	7.053	Barclays Capital US High Yield Composite	7.982
Index Based	98	6.526	Barclays Capital US TIPS	8.002
Intermediate	242	6.001	Barclays Capital US Intermediate Aggregate	5.954
Liability Driven Investment	29	7.895	Barclays Capital US Corporate Inv Grade	7.489
Long Duration	81	9.947	Barclays Capital US Long Credit	8.910
Mortgage Backed	96	8.377	Barclays Capital US Mortgage Backed Securities	6.199
Municipal	113	5.109	SPDR Nuveen Barclays Capital Municipal Bond Fund ETF	2.106
Other	111	6.030	Barclays Capital US Aggregate	6.362
Socially Responsible	9	6.387	Barclays Capital US Universal	6.343
TIPS/Inflation Linked Bonds	65	7.853	Barclays Capital US TIPS	7.363

Strategy name	Number of funds	Average return	Benchmark	Average return
Global fixed income				
Asia ex Japan Bonds	24	3.967	Barclays Capital Non-Japan Asia USD Credit	7.125
Asia Singapore Bond	22	3.579	Singapore iBoxx ABF Bond Index	3.978
Asian Bonds	55	6.821	JP Morgan Asia Credit Index JACI	7.646
Australia Credit	18	6.440	UBS Credit	6.366
Australia Diversified	26	7.146	UBS Composite Bond	6.339
Australia Enhanced Index	14	6.404	UBS Composite Bond	6.339
Australia Fixed Income	72	6.329	UBS Composite Bond	6.325
Australia Inflation Linked Bonds	21	6.797	UBS Inflation	7.131
Australia Passive	11	6.319	UBS Composite Bond	6.310
Australia Short Duration - High Income	48	6.236	BofAML Global High Yield	11.314
Denmark Fixed Income	13	6.291	OMRX Bond	5.485
Emerging Markets Debt	144	12.038	JP Morgan EMBI Global Diversified	10.939
Emerging Markets Debt - Corporate	24	22.167	BofA Merrill Lynch Emerging Markets Corporate	16.161
Emerging Markets Debt - Local Currency	70	11.115	JPMorgan Government Bond Index - Emerging Markets	11.576
Europe Sweden Fixed Income	10	7.016	OMRX Bond	5.242
Eurozone Bank Loans	11	-6.005	S&P European Leveraged Loan Index	3.716
Eurozone Govt	97	7.610	Barclays Capital Euro Aggregate Gov	5.019
Eurozone Govt & Non-Govt	133	4.525	Barclays Capital Euro Aggregate Credit	4.941
Eurozone High Yield	48	4.653	BofAML Euro High Yield Index	7.368
Eurozone Inflation-Linked Bonds	22	3.045	Barclays Capital Euro inflation linked bond indices	3.316
Eurozone Non-Govt	113	4.577	Barclays Capital Euro Aggregate Corporate	5.045
Eurozone Other	24	2.732	Barclays Capital Euro Aggregate Credit	4.321
Eurozone Passive	25	4.651	Barclays Capital Euro Aggregate Credit	4.270
Global Broad Market/Aggregate	165	5.997	Barclays Capital Global Aggregate	6.416
Global Convertibles	54	3.715	UBS Global Convertible Index	7.503
Global Credit	84	6.273	Barclays Capital Global Aggregate	5.650
Global High Yield	71	8.234	BofAML Global High Yield	9.092
Global Inflation-Linked Bonds	45	5.887	Barclays Global Inflation Linked Index	6.185
Global Passive	34	7.442	Barclays Capital Global Aggregate	6.806
Global Sovereign	187	7.115	JP Morgan GBI Global	6.750
Hong Kong Dollar Bond	18	3.547	HSBC Hong Kong Bond	4.533
International Fixed Other	12	7.822	Barclays Capital Global Aggregate	6.033
International Multi-asset Fixed Other	8	8.564	Barclays Capital Global Aggregate	5.268
Japan Fixed Income	101	0.542	Nikko BPI Composite	1.458
New Zealand Fixed Income	15	7.140	UBS Composite Bond	6.535
Other	37	3.633	Barclays Capital Global Aggregate	6.416
Swiss Fixed Income	44	3.531	Swiss Bond Index Total Return	2.519
UK Core Plus	69	6.899	BofAML Non Gilts AAA Rated	6.006
UK Europe Other	1	9.200	BofAML Non Gilts 10+ Year	12.144
UK Govt & Non-Govt	62	6.868	BofAML Non Gilts AAA Rated	6.094
UK Index Linked Gilts	48	7.027	FTSE Gilts ILG All Stocks	6.947
UK Non-Govt	81	6.690	BofAML Non Gilts All Stocks	6.161
UK Passive Fixed Income	39	7.471	BofAML Non Gilts	5.603
UK Govt	71	6.408	FTSE Gilts All Stocks	6.241
Unconstrained Bond	46	7.712	Barclays Capital Global Aggregate	5.510
World ex Japan	83	4.119	Barclays Capital Global Aggregate	6.492
World ex US	51	7.673	Barclays Capital Global ex US	6.648
Asset blends				
Asia Other	35	7.173	FTSE EPRA/NAREIT Global ex US EUR (25%) FTSE AW Asia Pacific ex Japan (50%) Barclays Capital Non-Japan Asia USD Credit (25%)	10.934
Australia Multi-Sector Balanced	61	6.425	S&P Australia BMI (50%) UBS Composite Bond (50%)	7.421
Australia Capital Stable	30	3.464	S&P Australia BMI (33%) UBS Composite Bond (67%)	5.634
Canada Balanced	148	5.913	MSCI Canada (50%) DEX Long Term (50%)	8.708
Canada Balanced/Multi-Asset	198	6.626	MSCI Canada (50%) DEX Long Term (50%)	9.391
Canada Balanced/Target Risk	106	5.675	MSCI Canada (50%) DEX Long Term (50%)	8.500
Canada Domestic Balanced	27	6.553	MSCI Canada (50%) DEX Long Term (50%)	8.500
Canada Other	25	8.328	REALpac/IPD Canada Quarterly Property (25%) MSCI Canada (50%) DEX Long Term (25%)	6.423

Strategy name	Number of funds	Average return	Benchmark	Average return
Emerging Markets Other	48	12.861	MSCI EM Small Cap (50%)	9.137
			JP Morgan EMBI+ (25%)	
			FTSE EPRA/NAREIT Global ex US EUR (25%)	
Eurozone Balanced	12	1.160	Pictet LPP-60 plus	2.899
Europe Other	111	0.369	Pictet LPP-60 plus	1.827
International Multi-asset Diversified Beta	30	6.315	Citigroup World Broad Investment Grade (33%)	3.396
			MSCI World (67%)	
International Multi-asset Diversified Growth	67	3.808	Citigroup World Broad Investment Grade (33%)	3.986
			MSCI World (67%)	
International Multi-asset Global Balanced	151	3.902	Citigroup World Broad Investment Grade (50%)	3.536
			MSCI World (50%)	
International Multi-asset Other	29	1.249	Citigroup World Broad Investment Grade (50%)	3.628
			MSCI World (50%)	
Japan Other	56	1.128	Nikko BPI Composite (50%)	2.257
			MSCI Japan (50%)	
New Zealand Managed Funds	30	5.351	UBS Composite Bond (33%)	7.213
			NZX 50 (40 prior to 1 Oct 2003) (67%)	
Other	61	7.577	MSCI World ESG	-0.790
Swiss Balanced/Multi-Asset	35	3.572	Pictet LPP-60 plus	5.487
UK Europe Other	19	-14.460	BofAML Non Gilts 10+ Year	7.646
UK Balanced/Multi-Asset	67	4.773	BofAML Non Gilts 10+ Year (50%)	6.688
			FTSE A All Stocks (DS) (50%)	
UK Liability Driven Investment	22	9.759	FTSE A All Stocks (DS)	6.349
US Balanced	259	3.612	Barclays Capital US Corporate Inv Grade (50%)	5.335
			Russell 3000 (50%)	
US Other	39	3.714	NCREIF Property (25%)	5.587
			Barclays Capital US Corporate Inv Grade (25%)	
			Russell 3000 (50%)	
US Stable Value	45	4.434	Barclays Capital US Corporate Inv Grade (67%)	6.115
			S&P 500/Citigroup Value (33%)	
US Lifecycle Funds	90	2.842	Barclays Capital US Corporate Inv Grade (50%)	5.941
			Russell 3000 (50%)	
Hedge funds				
Absolute Return	49	5.863	HFRX Absolute Return	0.078
Convertible Arbitrage	35	7.341	HFRI RV: Fixed Income-Convertible Arbitrage	5.606
Credit Long/Short	62	0.229	HFRI RV: Fixed Income-Corporate	4.936
Credit Opportunity	144	4.679	HFRI ED: Private Issue/Regulation D	4.504
Directional Long-Short Equity - Europe	71	2.353	HFRX Market Directional	3.311
Directional Long-Short Equity - International/Global	178	4.493	HFRX Market Directional	2.928
Directional Long-Short Equity - Japan	38	3.936	HFRX Market Directional	0.765
Directional Long-Short Equity - US	188	2.010	HFRX Market Directional	3.855
Distressed Debt	112	9.403	HFRI ED: Distressed/Restructuring	8.098
Event Driven	94	6.573	HFRX Event Driven	4.332
Fund of Hedge Funds - Commodities	38	4.318	HFRI EH: Energy/Basic Materials	7.931
Fund of Hedge Funds - Event Driven and Credit	31	3.913	HFRX Event Driven	1.897
Fund of Hedge Funds - Long-Short Equity	99	4.454	HFRX Market Directional	3.137
Fund of Hedge Funds - Macro and Managed Futures	46	5.456	HFRX Macro	1.215
Fund of Hedge Funds - Multistrategy	929	3.464	HFRI Fund of Funds Composite	3.360
Fund of Hedge Funds - Other	303	2.851	HFRI Fund of Funds Composite	3.204
Long Short Market Neutral Asia	64	6.343	HFRI Equity Hedge (Total)	4.347
Long Short Market Neutral Australia	35	8.529	HFRI Equity Hedge (Total)	6.125
Long Short Market Neutral Canada	18	3.027	HFRI Equity Hedge (Total)	4.980
Long Short Market Neutral Emerging Mkts	36	6.004	HFRI Equity Hedge (Total)	5.520
Long Short Market Neutral Other	62	9.196	HFRI Equity Hedge (Total)	4.332
Long Short Market Neutral UK	34	6.800	HFRI Equity Hedge (Total)	5.873
Market Neutral Equity - Europe	44	1.936	HFRX Equity Market Neutral	-0.527
Market Neutral Equity - International	57	3.889	HFRX Equity Market Neutral	-0.340
Market Neutral Equity - Japan	32	2.168	HFRX Equity Market Neutral	1.162
Market Neutral Equity - US	118	1.490	HFRX Equity Market Neutral	1.162
Multistrategy Funds - Directional	112	2.882	HFRI RV: Multi-Strategy	5.075
Multistrategy Funds - Market Neutral	129	4.932	HFRX Equity Market Neutral	-0.279
Other	338	3.482	HFRI Fund of Funds Composite	3.246
Other Alternatives Risk Reducing	47	3.069	Dow Jones CS Hedge Risk Arbitrage	4.317
Replication Strategies	16	-1.401	HFRI Relative Value (Total)	4.710
Trading Strategies - Active Currency	278	-0.597	HFRX Macro	4.192
Trading Strategies - Commodities Long-Short	71	13.743	HFRI EH: Energy/Basic Materials	2.502
Trading Strategies - Fundamental Macro	236	1.778	HFRX Macro	3.713
Trading Strategies - Macro Rates	29	5.017	HFRX Macro	0.724
Trading Strategies - Managed Futures	118	7.410	Dow Jones CS Hedge Managed Futures	6.182
Volatility Arbitrage	32	5.881	HFRX Volatility Index	1.627

Table A5: Sharpe analysis: Alternative specifications

This table reports estimates from an analysis that compares fund returns with returns on mimicking portfolios constructed from 19 tactical factors. In Table 9, we construct the style portfolio by using data for all months except month t. Panel A in this table constructs the style portfolio using data that exclude six months both before and after month t. Panel B constructs the style portfolio using data only up to month $t-1$. We report gross and net alphas, tracking errors, and information ratios for the funds by asset class.

Panel A: Exclude month-t return observation (jackknife)

	Gross returns				Net returns		
Asset class	$\hat{\alpha}$	$t(\hat{\alpha})$	Tracking error	R^2	$\hat{\alpha}$	$t(\hat{\alpha})$	IR
All	−0.24	−0.72	6.28%	81.7%	−0.71	−2.12	−0.11
U.S. public equity	−0.56	−1.38	6.57%	87.8%	−1.06	−2.58	−0.16
Global public equity	−1.20	−1.66	7.35%	85.2%	−1.77	−2.46	−0.24
U.S. fixed income	0.53	1.60	2.94%	72.6%	0.25	0.74	0.08
Global fixed income	0.89	1.47	4.80%	63.4%	0.57	0.94	0.12
Asset blends	0.38	0.82	4.34%	78.1%	0.01	0.02	0.00
Hedge funds	−1.02	−1.34	7.35%	23.8%	−1.93	−2.54	−0.26

Panel B: Exclude return observations in window $[t-6, t+6]$

All	−0.29	−0.87	6.47%	80.6%	−0.75	−2.30	−0.12
U.S. public equity	−0.61	−1.55	6.85%	86.7%	−1.11	−2.79	−0.16
Global public equity	−1.33	−1.79	7.47%	84.7%	−1.90	−2.57	−0.25
U.S. fixed income	0.56	1.63	2.95%	72.0%	0.27	0.79	0.09
Global fixed income	0.96	1.54	4.89%	62.7%	0.64	1.03	0.13
Asset blends	0.37	0.75	4.59%	75.6%	−0.01	−0.01	0.00
Hedge funds	−1.07	−1.31	7.61%	17.9%	−1.98	−2.43	−0.26