Asset manager funds*

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Abstract

Institutional investors paid asset managers average annual fees of $172 billion over 2000–2012. The magnitude of these fees raises the question of why institutions delegate rather than manage assets in-house. Over this period, the funds offered by asset managers to institutions earned annual market-adjusted returns of 119 basis points before fees and 72 basis points after fees. This outperformance does not materially erode when we adjust for risk using a single-factor model with strategy-level benchmarks. Hence, the average dollar of everyone else had a negative alpha and the average annual transfer from everyone else to institutional funds was $432 billion. When we evaluate performance using a multi-factor model based on Sharpe (1992), the positive gross and net alphas disappear. This result suggests that asset managers generated their outperformance through factor exposures. Institutions could have replicated asset manager performance using ETFs and institutional mutual funds at today's prices, suggesting that liquid, low cost ETFs are eroding asset manager's comparative advantage.

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1 Introduction

When retail investors delegate their investments, they typically do so through retail mutual funds. When institutional investors delegate, however, they overwhelmingly bypass institutional mutual funds and instead delegate into 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. Unlike retail mutual funds, which are registered investment vehicles subject to mandatory disclosure under the 1940 Investment Company Act, asset manager funds do not fall under such rules. Hence, a lack of data has hindered research on this sector, a situation that has not changed since being pointed out as far back as Lakonishok, Shleifer, and Vishny (1992).

To shed light on the holdings and performance of these investment vehicles, we obtained fund-specific data for the 2000–2012 period from a global consultant. This database contains quarterly assets, monthly returns, and fee structures for over 22,000 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. These segregated accounts are often created as "shadows" of the asset manager funds that are marketed via the database. 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 concerning the holdings and performance of asset manager funds. 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 is split between asset blends (7%) and intermediated 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 allows us to measure dollar fees globally and across asset classes. 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, our estimates indicate that asset manager funds are not passive vehicles; in fact, they are active to the same extent as a typical retail mutual fund. Given the size of the asset manager fund market, our findings imply that the literature on active management may have overlooked two-thirds of actively managed capital in forming its conclusions on active management.

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 delegated assets 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 implies, via an adding-up constraint, that the 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 (French 2008), 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 incorporated at a higher level, institutions appraise fund performance along two dimensions—net alpha and the tracking error—both relative to the strategy benchmark in a single-factor model. We find that the average asset manager fund earns a strategy-level *net* annual

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

alpha of 49 basis points (t-statistic of 1.87).

The positive performance result is consistent with the the delegating institutions being sophisticated investors (Del Guercio and Tkac 2002). The revealed preference of sophisticated institutional investors to delegate a large percentage of their assets, in turn, suggests that asset manager funds offered attractive investment opportunities. Most studies that examine the performance of institutions do not, however, find outperformance.[2] For example, using 13-F filings of U.S. institutional equity holdings, Lewellen (2011) finds that institutions 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, respectively. The unit of observation in these aforementioned studies is usually an institution, rather than an investment vehicle, 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 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. Busse, Goyal, and Wahal (2010) document a positive market-adjusted gross alpha of 64 basis points per year against broad asset class benchmarks, in line with our estimates for this asset class.

Sixth, our detailed data allow us to infer, in the spirit of Barber, Huang, and Odean (2015) and Berk and Binsbergen (2015a), how asset managers achieve their positive net alphas. Following the marketing language used by asset managers, which speaks of smart betas or tactical factors,[3] we

[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).

[3]See, for example, Blitz (2013), Towers Watson (2013), and Jacobs and Levy (2014). Moreover, the employees of

implement a multi-factor model based on Sharpe (1992). Following Sharpe (1992), we estimate fund-level factor loadings and form dynamic mimicking portfolios. We follow Sharpe (1992) in choosing 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 only this mimicking portfolio, we find gross alphas for asset manager funds that are statistically and economically close to zero. 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 we examine cross sectional variation in fund fees, we find that institutions pay higher fees for more successful factor loadings.

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 (2015b), 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 factor portfolios to obtain their within-asset class exposures, they would have obtained the same or slightly higher Sharpe ratio. 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 managers.

Our findings contribute to several literatures. As mentioned above, we contribute to the literature on institutional performance, including prior studies of asset managers (Bange, Khang, and Miller 2008;

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.

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). Related, we contribute to 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) examine pension fund sponsors' decisions to hire or fire an asset manager. They find that plan sponsors' returns would have been no different if they had stayed with the asset managers that they fired. Our results complement these studies. 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 United States 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 of 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]

[4] Barber, Lee, Liu, and Odean (2009) estimate that commissions cost individual investors 0.7% of GDP in Taiwan.

Our findings also relate to the literature on active versus passive fund management (Jensen 1968; Malkiel 1995; Gruber 1996; Carhart 1997; Kosowski, Timmerman, Wermers, and White 2006). 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). However, this argument relies on actively managed capital adding up to the market and therefore ignores the potential for heterogeneous performance among actively managed funds (Berk and Binsbergen 2015b). We show that one group of active investors, institutional delegated investors, may profit at the expense of non-delegated investors.

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.

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.

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 receive less attention when the Consultant makes recommendations to its clients. The Consultant keeps "dead" funds in the database to guard against a survivorship bias.

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.[5] Total institutional assets increased from $22.6 trillion in 2000 to over $47 trillion in 2012. The next column shows that the number of asset managers ranges from 595 in 2012 to 748 in 2003. 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 that institutional assets held by asset managers remained relatively constant over the sample period at approximately 26% of worldwide investable assets.

[5] 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.

Panel B of Table 1 compares the coverage of the Consultant's database with our estimates of the size of the sector based on the Pensions & Investments surveys. The Consultant's total assets cover 31% of institutional assets under management in 2000, and rise to approximately 60% for 2007 and thereafter. In 2012, for example, institutional assets under management in the Consultant's database are $26 trillion, which represented 56% of total institutional assets according to Pensions & Investments. The next 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 with the managers included in the Pensions & Investments surveys, 88% of the asset managers covered in the Pensions & Investments surveys are included in the Consultant's database (column 4).

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.

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 accounts, which are not open to investment by other institutional clients. 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.[6]

[6] Ang, Ayala, and Goetzmann (2014) make a similar point with respect to the beliefs of endowments about the

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, 10.5% of the manager-level assets under management included in the database lack corresponding returns. Second, even when the database includes returns, we remove backfilled data. In particular, we know the date when an asset manager fund was first added to the Consultant's database. Data from prior to this date can suffer from incubation and survivorship biases. We therefore exclude them throughout our analysis. The total institutional assets under management for funds with returns and without backfill are, on average, 72% of the full series, and become similar to assets under management in the database without these restrictions later in the sample period.

2.2 Selection and survivorship bias tests

Even though the missing funds are likely not open for investment, our sample is not the universe of asset manager funds. Hence, we test for selection bias in the database. We begin by noting again that the Consultant records a "creation date" for each asset manager fund on which we filter, focusing only on returns generated after the creation date, thereby ensuring that our tests are free of survivorship concerns.

The more pressing 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) to address selection. 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 who responds to

performance of alternative investments.

their annual survey. 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. Any differences are likely due to differences between non-U.S. and U.S. asset allocations.

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*. 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. To implement this test, we estimate regressions that include interactions of strategy and month fixed effects to absorb strategy-level performance and cluster standard errors at the month-strategy level. 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 performance. Although we find that higher levels of coverage are associated with higher returns, the economic magnitude of the effect is small. Among the four specifications, the largest effect is that a one percentage point increase in coverage is associated with less than a 0.3 basis point increase in monthly returns.

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 two fee parameters per asset manager fund: (i) the baseline fee for assets under management and (ii) discounts available at different asset thresholds. For example, a particular U.S. fixed income-long duration strategy 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 fee data 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 have likely come 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 (as if they are getting more scale pricing 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 few in number, given that the $50 million threshold is a high hurdle at a fund level, assuming that investors diversify across funds and strategies. 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 on average over the period.

2.4 Holdings statistics at asset manager fund level

Our data start with a total of 44,643 asset manager funds over the period 2000–2012. 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. In the analysis from here forward, we drop funds classified as either cash or other/alternatives, because these classes are relatively small and either represent short-term allocations (the cash holdings) or heterogeneous investment strategies that make benchmarking infeasible (other/alternatives).

After we remove the cash and other/alternatives, remove backfilled returns, and remove 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 AUM for this 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 descriptive statistics of asset manager fund characteristics (AUM, clients, AUM per client, and age). We report the mean, standard deviation, and quartile statistics for each characteristic. The statistics are panel-averaged cross-sections, in the sense that we calculate time series averages for each fund, and then we 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. Clients per fund are also skewed with the average fund having 177 clients, while the median fund has only six clients. Similarly, the median fund has $48.4 million per client. 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 in billions of U.S. dollars 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 both held \$1.5 trillion and \$1.4 trillion as of 2012.

Moving to the main columns, we consider the per-fund-statistics. Here we see differences between fixed income and equity mandates. On average, the largest funds are in both fixed income classes (\$2.7 billion in assets under management for U.S. and \$3.0 billion for global), followed by asset blends (\$1.9 billion), both types of equity (\$1.2 billion for U.S. and \$1.4 billion for global), and finally hedge funds (\$941 million). Assets under management per client (the mandates) are also larger for fixed income funds than for equities. The average (median) per client investment in a U.S. fixed income fund is \$258 (\$74) million, whereas the average (median) U.S. public equity investment per client is \$142 (\$23.5) million.

2.5 Fees at the asset manager fund level

We next examine fee distributions by asset class and assets under management per client. Panel A of Table 4 reports that the mean fee is 62.1 basis points on an equal-weighted basis. The mean fee on a value-weighted basis is 47.4 basis points, which corresponds with the *fee schedule middle point estimate* presented in Figure 1. 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 equities have medians that are similar to those for U.S. fixed income and public equity, but more right-skewed distributions and thus larger means. Hedge funds have the largest fees. The value-weighted mean hedge fund fee is 91 basis points and the median is 106.8 basis points.[7]

A natural question arises of who pays these fees. Although we do not observe the clients in each fund, we can examine the distribution of fees conditional on the fund's assets per client. These conditional distributions provide insight into the price breaks that larger clients receive. Panel B of Table 4 presents these conditional distributions. In general, throughout the percentiles, 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.[8] Beyond the negotiating power held by large investors, asset managers take into account additional factors that can 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 delegated management.[9] Consistent with asset managers' bargaining power increasing in client size, we find in section 3.4 that smaller clients' fees are less sensitive to fund performance.

Our fee estimates are consistent with those reported in both the press and academic research. For example, Zweig (2015) reports that CalPERS paid 48 basis points on asset manager fees in 2012. Coles, Suay, and Woodbury (2000) describe the scaling of fees 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.

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

[8] The small allocations are likely to be in institutional mutual funds, which can cause a slight non-monotonicity in pricing.

[9] 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 Performance 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.[10] 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.

The rows of Panel B report the net alphas and portfolio weights by year and asset class. The bottom row presents the contributions of the asset classes to the 119 basis points (i.e., sum of the market-adjusted performance per year times the annual weight of that asset class in the portfolio of funds). The alphas are the highest in global equity, U.S. equities, and U.S. fixed income. This decomposition 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

[10] 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 A3 of the Appendix provides return statistics for the benchmarks and the Consultant's funds mapped to the asset class.

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

The adding-up constraint (Sharpe 1991) implies that the rest of the market must earn negative gross alphas relative to the market. Our estimation encompasses over 13% of the total worldwide investable assets. With the exception of hedge funds, these investments represent long positions. If we assume that there is no selection bias in our data relative to the full set of institutional capital delegated to asset manager funds, we can extrapolate our estimates to approximately 27% of worldwide investable assets based on the Pensions & Investments surveys. Thus, a simple 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 44 basis points *below* the index.[11]

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 (2015b), the average asset manager fund generates $150,000 in potential value-added per month, similar to the calculations of Berk and Binsbergen (2015b) for mutual funds ($140,000 per month). These results together suggest that asset managers' outperformance is to the detriment of non-delegated institutional and individual investors.

[11] 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 $\hat{\alpha}_{\text{everyone else}} = -44$ basis points.

3.2 Risk-adjusted performance

3.2.1 Broad asset class market factor model

Before presenting our preferred strategy-level benchmarking, 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 market. 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 were expecting that the 119 basis points gross alpha from above would decline in a factor model of performance. The data did not support our prior. Panel A of 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.

We do not think that these estimates best reflect performance from the view of an institution for several reasons. Although the tracking error declines relative to the market-adjusted model, it remains 7.9%, 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 broad asset class benchmarks are not well-specified. 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 moderate at 93 to 95 basis points.

Before proceeding, we pause to compare our broad market/CAPM results for U.S. equities to those reported in 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 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 finding may be due to the non-delegated holdings of institutions (which perhaps underperform according to our adding-up exercise), that are not included in our sample or that of Busse et al. (2010) or to differences in the institutions represented in U.S. filing data from those using asset manager funds. We do not view any of this evidence as conflicting, but a part of the broader picture of understanding the incidence of returns.

3.2.2 Strategy-level factor model: Preferred estimates of performance

The Consultant's database classifies the asset manager funds into granular strategy classes within each broad asset class (e.g., Australian equities is a strategy class under global public equities). In addition, the database includes a strategy-level benchmark for each fund that has been reviewed by the Consultant's researchers. To evaluate performance, we use the modal benchmark covering funds in the same strategy unless the benchmark chosen has less than 10% coverage of all asset manager funds in the strategy, in which case we use the benchmark covering the most assets under management in the strategy. We list the 234 strategies and their benchmarks in Table A4.

Panel B of Table 6 reports the strategy-level market-adjusted returns and strategy-level one-factor model alphas. Standard errors are again clustered by month, and alphas and tracking errors are annualized. The gross alpha in the market factor model is 96 basis points (t-statistic = 3.67), and the net alpha is 49 basis points (t-statistic = 1.87). These are our preferred estimates of gross and net alphas for fund performance from the viewpoint of the institutional investor. Asset manager funds outperform their mandate benchmarks by 96 basis points.

We make two observations about the model fit. The precision of benchmarking improves materially, especially for non-U.S. asset classes. The overall R^2 increases from 64.5% in the broad market model to 75.7% at strategy-level benchmarking. Importantly, the R^2 in the asset classes that we thought were imprecisely specified in Panel A of Table 6 are now much larger, and the betas for the global products are close to one. The exception is U.S. fixed income. The other dimension that institutions use to evaluate performance is tracking error. Tracking error falls to 5.9%, which is almost identical to the Del Guercio and Tkac (2002) estimate for pension funds. This level of tracking error is also in line, interestingly, with Petäjistö (2013)'s estimate for moderately active retail mutual funds.[12]

Panel C assesses robustness by using alternative samples. The benchmarks in this panel are the 235 strategy-level benchmarks that we use in Panel B. In row 1, we first drop asset blends and hedge funds from the analysis. Asset blends are a mixture of exposures across asset classes, and we could not garner with sufficient precision the weights that apply across funds. Likewise, hedge funds are a mixture of strategies within a style (e.g., macro strategies and long-short strategies). In both cases, funds' betas against strategy-level benchmarks are lower than those against broad asset class benchmarks. Thus, although we know the AUM for these two asset classes is small from Table 3, we want to ensure our performance results are not driven by these asset classes. Row 1 show that the alpha decreases by only 10 basis points, from 96 basis points to 86 basis points, when we exclude these asset classes. Tracking errors decline implying that the model grows more precise to the fund data.

In row 2, we restrict the sample to funds for which managers provided no more than one year historical data at the initiation of coverage. For this restricted sample, the alphas and t-statistics

[12] Petäjistö (2013) estimates for actively managed retail mutual funds (average tracking error of 7.1%). 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, and 3.5% for closet indexers.

attenuate, but remain similar in magnitude to those presented in Panel B. In row 3, we restrict the sample to post-2006 data, when the consultant's coverage of the P&I universe of AUM in delegated funds increases to close to two-thirds. We find a positive and significant gross alpha. Noise increases in this smaller sample making the precision of the net alpha lower, but the magnitudes are very close to Panel B. Finally, in row 4, we restrict the sample to asset managers that report performance for funds representing at least 85% of their total institutional assets under management (i.e. the variable coverage from our Table 2 is greater than 85%, the 75th percentile threshold). For this very restricted sample, we find higher gross and net alphas than those presented in Panel B. Contrary to a story of managers reporting only 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 The source of performance: Sharpe analysis

In the prior sections, we documented that actively managed asset manager funds outperform. What are asset managers doing to generate this outperformance? We next use the methodology of Sharpe (1992) to decompose asset manager funds' strategies into exposures against tradable indexes. We also use this framework to address how and at what cost institutions could have circumvented asset managers by managing assets in-house.

Sharpe (1992) formulates a method to estimate loadings across factors. The intuition behind Sharpe's approach is to select a set of factors and estimate fund-level dynamic loadings of fund returns on these factors. To interpret these estimated loadings as portfolio weights, the Sharpe analysis constrains the loadings to (1) be non-negative and (2) sum to one. In our implementation, we restrict the factors to be tradable indices. The estimated loadings therefore give the weights that institutions, in practice, could have used to construct a "copy-cat" version of each fund. The benefit of the Sharpe methodology over unconstrained factor models is that the non-negative weights yield cleaner inferences about fund exposures and offer an interpretation of performance that is more in line with the stated activity of money managers (Sharpe 1992). In modern language, this framework measures whether *tactical beta* exposures explain what asset managers are doing to achieve positive net alpha.

To implement our analysis, we augment Sharpe's original list of tactical factors. The following list describes the original factors used by (Sharpe 1992) and those used in our analysis below.

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

This list starts with the 12 factors used by Sharpe. We make several additions and modifications to reflect changes in the market weights since the original paper. The U.S. equity indexes, which capture size and value dimensions, are important for 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). The global equity indexes capture funds' holdings of European equities and emerging markets. The U.S. fixed income factors capture differences both in riskiness—the indexes represent Treasuries, corporations, and mortgage-backed securities—and maturity. 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 indexes 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, and we use infrastructure, commodity index, carry, and momentum indices to replace Fung and Hsieh's (2004) "look back straddles" on bond futures, currency futures, and commodity futures. All of the indexes in the Sharpe analysis are tradable; that is, their returns (gross of fees) could be replicated via an ETF, index fund, or institutional mutual fund.

We implement the Sharpe analysis as follows. For each fund, we regress the strategy returns against 19 factors using data up to month $t-1$. The first tactical factor ("Asset-class benchmark") is the strategy's broad asset class benchmark. The remaining 18 tactical factors are those given above. The regression slopes are constrained to be non-negative and sum to one. Panel A of Table 7 presents the estimates of the weights on the tactical factors. Our estimation is fund-by-fund and then we take the averages of the weights. The first row presents the average weight on the broad asset class benchmark. For example, the average weight on the Russell 3000 for U.S. public equity funds is 9.8%. The remaining rows present the deviations from the benchmark. For example, the average

U.S. public equity fund holds a 27.9% weight in the S&P 500/Citigroup Value benchmark. Overall, the weights appear sensibly distributed across the benchmarks. We use the resulting slope estimates to compute the return on strategy i's mimicking style portfolio in month t. By estimating the model using historical data, we ensure that our performance measurement is out-of-sample.[13]

For each strategy-month, we calculate the fund's return in excess of the style portfolio and then compute monthly value-weighted averages for each broad asset class. The gross and net alphas and the t-statistics associated with these estimates are the time-series averages of these return differences. We estimate tracking errors by running a value-weighted regression of the squared differences between the strategy and mimicking-portfolio returns on a constant. Alphas and tracking errors are annualized. We compare Sharpe weights by value-weighting the average regression slope estimates obtained from the first-stage regressions. These weights sum up to 100% within each asset class.[14]

Panel B of Table 7 presents the alphas and tracking errors from the tactical factor models. Our main take-aways are as follows. First, asset classes have some natural residual risk properties that neither a tactical beta model nor a granular benchmark market model can attenuate. The tracking errors imply that the tactical factors do not fully capture the funds' investment strategies. Some of these deviations might be noise while others could represent skill (or lack thereof).

Second, as for the alphas, we find little evidence of abnormal performance on a gross returns basis in the tactical beta analysis, which contrasts with the positive alpha results shown previously. Across the rows, the overall gross return is basically zero. On a net return basis, asset manager funds can deliver negative performance, especially in public equities and hedge funds. Weighted across asset

[13]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.

[14]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.

classes, the overall net performance of asset manager funds is negative. In our estimates, we do not, however, account for the costs associated with holding the factors. (We discuss these costs below.) Hence, the "true" net performance relative to the mimicking funds is probably closer to zero than what we show here.

Overall, we can attribute the market-model alpha of the average fund to the tactical factors. The funds deviate systematically from the broad asset class and they deviate in directions that enhance returns. This result raises the question of interpretation. Does this performance represent skill? Asset managers implemented these deviations prior to observing the returns, that is, without knowing that these particular deviations would be profitable in the 2000–2012 sample period.

These results are similar in spirit to Berk and Binsbergen (2015b), 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. In our analysis, clients *could*, in theory, replicate these funds by trading a particular basket of these benchmarks. Cochrane (2011), however, offers an interpretation of the word *could*:

> "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 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)

Together, these results paint the following picture. Asset managers offer clients exposures to tactical factors. Once performance is adjusted to reflect the return on the tactical factors, the funds offer zero alpha on a gross return basis.

3.4 Paying for tactical beta: Fee results

We next measure the correlation between fund fees and tactical beta exposures. The intuition behind our test is simple. The fees that investors pay could represent compensation for the tactical factor exposures that (investors perceive) managers provide. 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. That is, investors would compensate asset managers for offering profitable exposures against tactical factors. The alternative is that investors pay for "skill" that is not captured by the tactical beta exposures. Under this alternative, investors purge tactical factors from the reported fund returns and pay fees that are proportional to the unexplained measure of performance. We therefore examine revealed preferences, by measuring the extent to which investors pay for the return on the style portfolio rather than for the residual-return component.

We implement this fee-tactical factor analysis by measuring how fees correlate with two components of performance: the gross return on the style portfolio from the Sharpe analysis (i.e., the returns from exposures to the tactical factors) and everything else (i.e., alpha), which is calculated as the difference between the fund's gross return and the return on the style portfolio. We measure fees as of the end of the sample period—either in June 2012 or when the strategy disappears—so the return components obtained from the Sharpe analysis are pre-determined regressors.

Table 8 presents three sets of regressions that examine the relation between fees and these two return components. Panel A presents panel regressions with monthly returns. These regressions include month-asset class fixed effects. The estimates therefore measure the marginal effect of within asset class-and-within month variation in the two components of performance on fees. Given that the fee observation is the same throughout the panel for each fund, we cluster the standard errors at the fund-level. In aggregate, fees positively and significantly correlate with the returns on the style portfolio and the residual component. However, the slope on the style portfolio component is more than twice that of the residual-return component, and the t-statistics on these return components are 5.57 and 3.43. Our estimates of how much investors pay for tactical factor exposures are, however, lower bounds given that we do not know all of the underlying factors. Moreover, the residual component can capture the performance of factors that we do not include in the analysis.

The asset-class specific estimates reveal some variation in these correlations. For example, the style component has higher coefficients and t-statistics for the equity strategies. In contrast, only the residual return component is significantly associated with fees within U.S. and global fixed income, and both return measures are positively associated with fees for hedge funds. This hedge-fund result is noteworthy. As we discussed above, the significance of the residual-return component implies that investors could pay hedge fund managers for providing exposures to factors that we do not include in our analysis. Our list of tactical factors, for example, does not include the returns earned through low-volatility trades, and, in our analysis, the residual return therefore captures the returns that hedge funds earn by trading any such omitted factors.

As an alternative to the panel specification in Panel A, we estimate cross-sectional regressions with one observation per fund. We generate each fund's observation by first running separate panel regressions of style returns and the residual returns 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 results for the cross-section approach are presented in Panel B. Overall, the estimates are similar to those presented in Panel A.

The results in Table 8 do not support the view that investors on average pay asset managers for the "unexplained" part of performance; that is, for the component of alpha that cannot be traced to tactical factors. Instead, our estimates suggest that fees are higher—or, rather, investors are willing to pay higher fees—for performance that is gained through tactical factor exposures, especially for equity strategies.

3.5 "In-house" replication of asset manager funds

The results from the Sharpe analysis raise the question of whether institutional investors could replicate the returns of asset manager funds if they were to manage capital in house. Put differently, do institutional investors need asset managers or could they generate such outperformance on their own? To address this question, we start from the factors that we use in the Sharpe analysis and assume that they are tradable at a cost. Because of their heterogeneous composition, we drop asset blends from this analysis. We use historical data to find optimal portfolios for the remaining five broad asset classes, and then generate an estimate of net returns on replicating portfolios that weight the asset classes using the same weights as asset managers. We do so under the assumption that institutions, not asset managers, determine these broad asset class allocations. We next compare our estimate of net returns on this replicating portfolio with the net returns that the asset managers generate.

This analysis is subject to several caveats. First, we only take into account the direct costs (i.e., fees) that an institution would incur if it tried to replicate asset managers. We do not take into account costs such as management time and additional employees that would be required to implement such a replication. Second, we assume that the necessary liquidity is available for the ETFs, index funds, and institutional mutual funds that an institution would use to replicate. Third, we assume that all institutions faced the same trading costs. Fourth, we assume that institutions are sophisticated. Sophistication has many layers. Institutions must know from finance research to load portfolio weight on factors within the asset classes to improve performance. They must know the list of factors. Moreover, they must be able in real time to estimate the optimal portfolio for each of the five asset classes using data up to that point in time.

We first use the standard algorithm to generate mean variance efficient portfolios. We then implement two simple modifications to the mean-variance algorithm following the literature to keep the optimal portfolio from taking extreme short or long positions in factors, which would result in a portfolio that is worse than the portfolio that we obtain with this simplified approach.[15] We first make the covariance matrix diagonal to eliminate extreme loadings based on covariances and set any negative estimated risk premiums to zero, which ensure that all weights are now positive as well. The third method finds the optimal portfolio numerically after imposing short-sale constraints. In addition, we follow DeMiguel, Garlappi, and Uppal (2009) and generate portfolios based on the $1/N$ rule, which equally weights each index within a broad asset class. Although DeMiguel, Garlappi, and Uppal (2009) find that this rule does not perform well with individual assets (i.e., when idiosyncratic volatility is high), it typically performs well when used on portfolios. For each method, we calculate the optimal portfolio for each asset class using data up to month $t-1$. We then calculate the return on the optimal

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

portfolio for month t. To find the total replication portfolio, we use the month $t-1$ weights for asset managers to get the weights for the replication portfolio for month t.

The results for this analysis are presented in Table 9. Panel A starts by presenting the gross and net performance along with the implied Sharpe ratios for asset manager funds. Asset manager funds earned 5.02% in gross returns with a standard deviation of 9.78% (Sharpe ratio = 0.292) and net returns of 4.55% (Sharpe Ratio = 0.243). Panel A then presents gross performance for the replicating portfolios. Except for the standard MV portfolio, the other replicating portfolios have higher Sharpe ratios than the actual asset manager portfolios: $1/N$, 0.424; MV analysis with a diagonal covariance matrix, 0.359; MV analysis with short-sale constraint, 0.331.

In the final column of Panel A of Table 9, we report the indifference cost of implementing the replicating portfolios, which is the total cost (fees plus internal costs) that would make an institution indifferent in Sharpe ratio terms between delegating to asset managers and implementing the replication. We calculate it as the cost that equates the Sharpe ratio of the replicating portfolio with the net-of-fees Sharpe ratio of asset managers. That is, it is *cost* in

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

Focusing on the simple $1/N$ strategy, we find that institutions would be indifferent between delegating and managing assets in-house if the cost of managing assets in-house was 135 basis points. This 135 basis points must cover both administrative and trading costs (e.g., fees).

In terms of administrative costs, Dyck and Pomorski (2012) find that large pension funds incur approximately 12 basis points in costs to administer their portfolios. To provide estimates of trading costs that institutions would incur to manage assets in-house, we obtain historical institutional mutual fund and ETF fees from CRSP and Bloomberg. Panel B presents management expense ratios for the $1/N$ portfolio rule. The first row presents ETF fees and the rows Quartile 1, Median, and Quartile 3 present fees from a simple sort of the fees charged by institutional mutual funds during the sample period. For example, the median institutional mutual charged 82.8 basis points. This estimate is high based on today's standards—the first row shows that the average ETF charged 26.3 basis points at the end of the sample.

If we compare the indifference cost for the $1/N$ portfolio rule (135 basis points) with the sum of the median institutional mutual fund fee and the estimate of administrative costs ($83 + 12 = 95$ basis points), it appears that managing assets in-house dominates delegating assets. In Panel C, we present the fees and inception dates for ETFs based on the benchmarks used in the replication analysis along with the distributions of fees for the institutional mutual funds that track the benchmarks. There are several important points in this table. First, many of the ETFs were not available over the full sample period. Second, several of the benchmarks used in the analysis lack institutional mutual funds. Third, these estimates do not take into account any additional indirect costs (beyond the 12 basis points discussed by Dyck and Pomorski (2012)) that an institution would incur if it brought assets in-house. Fourth, the analysis assumes that there was sufficient liquidity in ETFs and institutional mutual funds to bring assets in-house. Fifth, the analysis excludes any non-performance related services or benefits that asset managers provide to institutional investors.

Given these caveats, it appears that asset managers price their services so that institutions are close to indifferent between delegating versus managing capital on their own. Moreover, the results suggest that asset managers would be preferred by less sophisticated institutions or by institutions that receive other (non-fee based) benefits from asset managers. Moreover, the introduction of liquid, low cost ETFs is likely eroding the comparative advantage of asset managers.

4 Conclusion

Although there is extensive academic research on the costs and benefits of financial intermediation in terms of individual trading and mutual funds, there is limited research on the funds offered by asset managers to pension funds, endowments, and other institutions. Yet, asset managers intermediated \$47 trillion in 2012 on behalf of institutional investors, representing 27% of worldwide investable assets. Our aggregate fee estimates suggest that investors paid asset managers at least \$177 billion in 2012.

We measure the extent to which asset manager funds outperform the market, and find that the average intermediated dollar outperformed the market on a gross basis by 119 basis points per year from January 2000 through June 2012. This estimate implies that the average non-institutional or non-intermediated dollar—that is, investments made by retail mutual funds, individuals, or direct investments made by institutional investors—underperformed the market by 44 basis points *before* fees. We trace this outperformance to systematic deviations from the asset-class benchmarks. When we estimate tactical beta loadings based on Sharpe (1992), the performance of these factors explains away asset managers' alphas. Investors, therefore, appear to pay asset managers for tactical loadings. Our analysis of the correlations between fees and return components supports this interpretation. Namely, institutional investors pay higher fees to asset managers for providing "good" factor exposures.

Overall, we provide micro-foundations for securities intermediation at the institutional-level. These micro-foundations provide insight into the drivers of asset delegation. These drivers are relevant on several dimensions. First, 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. Second, there is an ongoing debate about whether this level of intermediation contributes to systemic risk. For example, the Financial Stability Board is evaluating whether large asset managers such as Blackrock should be identified as "systemically important" (Jopson 2015). We provide evidence on the size, performance, and the source of performance of this sector, which will inform future research on whether asset managers contribute to systemic risk.

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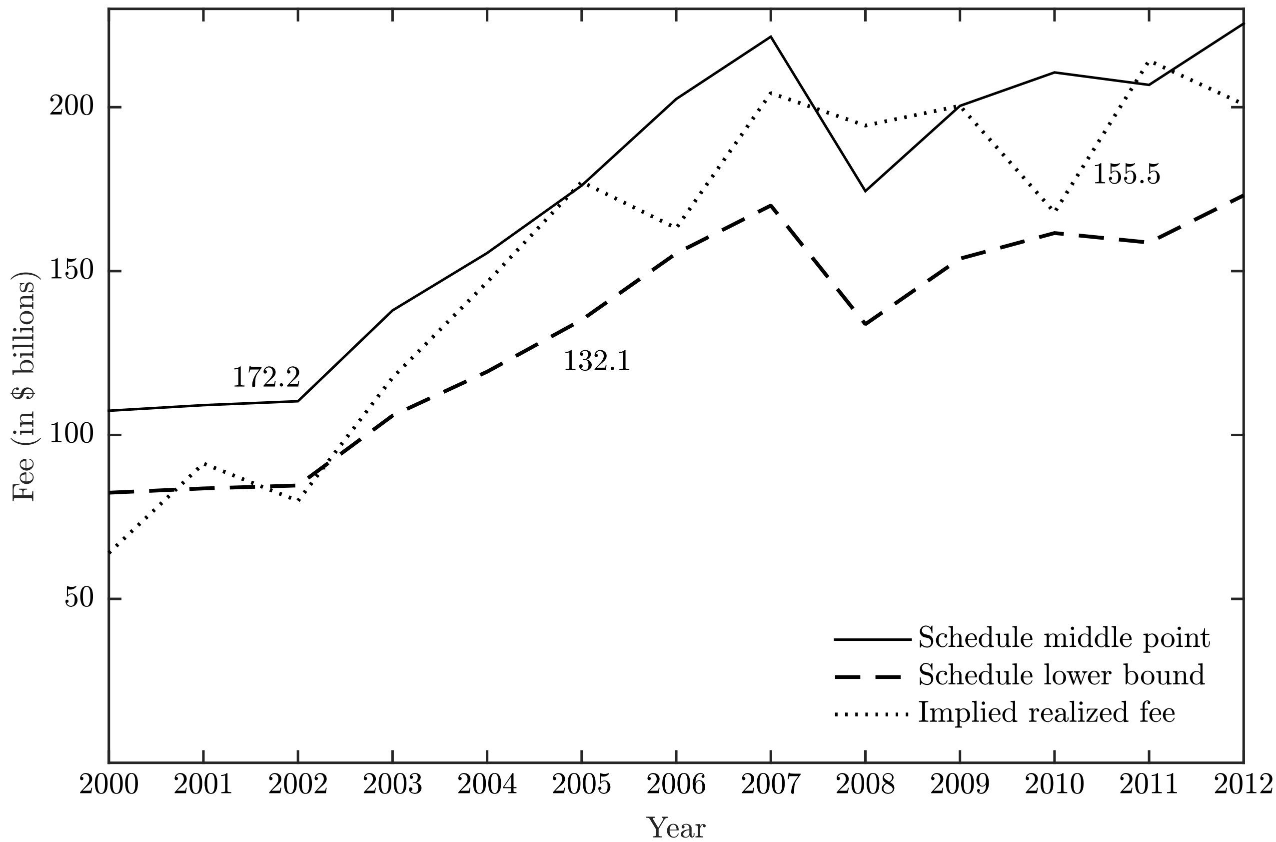

Figure 1: **Aggregate fees paid by institutions to asset managers.** This figure presents aggregate fee estimates based on information available in the Consultant's database. The estimates are value-weighted average fees in the Consultant's database multiplied by total institutional assets under management. 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.

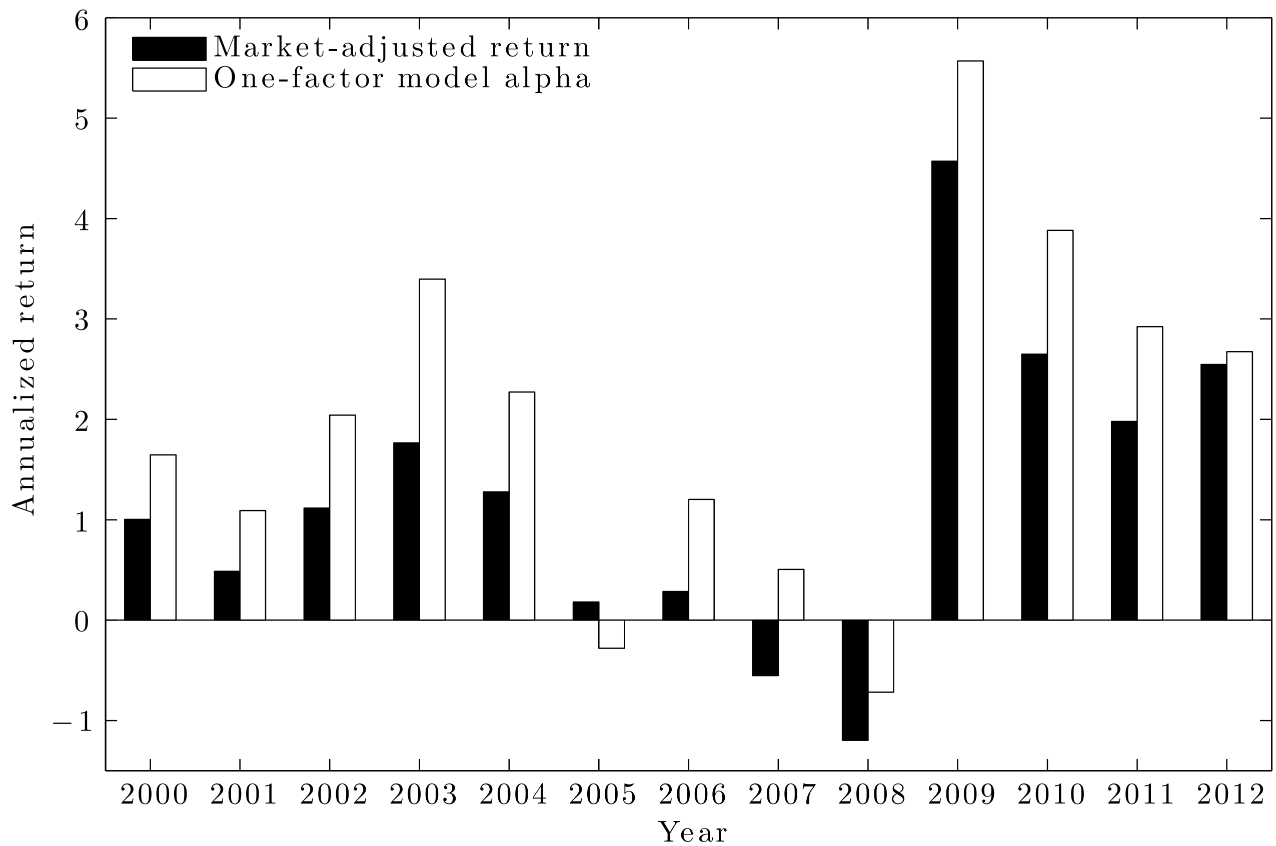

Figure 2: **Performance of the average intermediated dollar over the asset-class benchmark.** This figure reports the annual value-weighted returns and one-factor alphas over the asset-class benchmark across all funds in the Consultant's database from January 2000 through June 2012.

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 fraction of managers in the Pensions & Investments surveys included 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: Worldwide investable assets and Pensions & Investments surveys

	Pensions & Investments		Worldwide investable assets	
Year	AUM	Number of managers	Total	% held by asset managers
2000	22,659	718	78,884	28.7%
2001	23,028	727	75,512	30.5%
2002	23,275	723	76,603	30.4%
2003	29,134	748	93,933	31.0%
2004	32,815	715	108,514	30.2%
2005	37,165	723	116,104	32.0%
2006	42,751	720	134,293	31.8%
2007	46,759	704	157,057	29.8%
2008	36,809	671	134,650	27.3%
2009	42,294	646	152,190	27.8%
2010	44,443	633	164,610	27.0%
2011	43,643	610	164,709	26.5%
2012	47,603	595	174,786	27.2%

Panel B: Consultant's database

	AUM		Number of managers		AUM with returns	
Year	Total	% of P&I	Total	% of P&I	Raw	Without backfill
2000	6,759	29.8%	579	85.4%	5,708	3,275
2001	7,048	30.6%	722	84.9%	5,899	3,955
2002	7,367	31.7%	840	84.9%	6,409	4,479
2003	10,096	34.7%	1004	86.0%	8,615	6,556
2004	11,837	36.1%	1120	86.3%	10,541	8,408
2005	13,310	35.8%	1213	86.8%	12,234	9,744
2006	16,377	38.3%	1398	86.2%	15,305	12,640
2007	29,174	62.4%	1596	86.9%	26,237	22,962
2008	23,126	62.8%	1758	87.2%	19,487	17,101
2009	26,693	63.1%	1864	86.1%	22,702	20,812
2010	27,999	63.0%	2011	87.3%	24,767	23,184
2011	27,501	63.0%	2067	87.6%	24,612	23,579
2012†	27,944	58.7%	1974	88.2%	24,959	24,598

† 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 that the largest asset managers invest 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 billions of USD) 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	22,413.1

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

Asset class	Mean	SD	Percentiles 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	4,296.1
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	4,582.8
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	5,397.8
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	5,239.3
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	1,516.9
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	1,380.3

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 by asset class

	Average			Percentiles		
Asset class	EW	VW	SD	25	50	75
All	62.1	47.4	10.6	33.9	57.3	81.9
U.S. public equity	63.1	49.6	7.9	46.9	63.4	80.0
Global public equity	68.4	58.4	8.8	50.7	64.2	81.1
U.S. fixed income	29.7	28.9	4.4	21.0	26.8	35.1
Global fixed income	36.2	32.0	6.5	22.9	29.6	44.3
Asset blends	55.9	40.1	9.4	35.5	49.5	70.1
Hedge funds	112.3	91.0	12.3	96.8	106.8	133.2

Panel B: Distribution of fund fees by client size

	Average			Percentiles		
AUM per client	EW	VW	SD	25	50	75
$<$ \$1 million	84.3	66.7	11.9	57.5	75.0	100.0
\$1–\$5	87.3	79.9	14.8	52.9	77.3	103.1
\$5–\$10	80.7	78.4	13.8	45.0	75.0	100.0
\$10–\$50	72.5	60.2	13.2	40.0	65.0	91.9
\$50–\$250	60.7	49.0	10.6	35.0	55.5	78.0
\$250–\$1000	58.5	38.8	11.8	30.0	50.0	75.0
$>$ \$1000	59.8	37.7	12.5	27.0	50.0	77.5

Table 5: Evaluating fund performance

This table evaluates fund performance 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}^{2}s 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

	Gross returns			Net returns		
Year	$\hat{\alpha}$	$t(\hat{\alpha})$	Tracking error	$\hat{\alpha}$	$t(\hat{\alpha})$	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						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
Total	0.36	0.43	0.19	0.12	−0.05	0.12							1.19

Table 6: Evaluating fund performance using single-factor models

This table evaluates fund performance against single-factor models that use the broad asset class and strategy level benchmarks. Panel A presents gross and net alphas from single-factor models that use the six broad asset class benchmarks, which are listed in Table A3. Panel B presents gross and net alphas from single-factor models that use the 235 strategies, which are listed in Table A4. Panel C presents gross and net alphas from models that use the 235 strategies based on alternative samples to address selection bias. The first two 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 manager 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 that are specific to the broad asset classes and strategies collecting $e_{it} = \hat{\alpha}_i + \hat{\varepsilon}_{it}$. 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 broad-market indexes

	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

Panel B: 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 C: Alternative samples and specifications

	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
No more than 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 7: 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}^2s 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 ($w_1 + \cdots + w_{19} = 100\%$)

		Asset Class					
Factors	All	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: Alphas, tracking errors, and information ratios

	Gross returns				Net returns		
Asset class	$\hat{\alpha}$	$t(\hat{\alpha})$	Tracking error	R^2	$\hat{\alpha}$	$t(\hat{\alpha})$	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 8: 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 7'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	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)
Gross return	2.00	1.34	1.17	2.98	2.93	−0.02	5.83
− style portfolio	(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	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)
Gross return	0.01	0.07	−0.15	−0.10	0.44	−0.38	0.24
− style portfolio	(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 9: Replicating asset managers

This table reports Sharpe ratios of alternative portfolios constructed from tradeable indexes listed in Table 7. We use the mean-variance analysis methodology and the 1/N rule of DeMiguel, Garlappi, and Uppal (2009). The first method uses the standard mean-variance optimization algorithm of Markowitz (1952) after diagonalizing the covariance matrix and constraining the estimated risk premiums to be nonnegative. The second method imposes short-sale constraints. The third method is the 1/N rule that allocates the equal amount into each asset. 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 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				
$1/N$ portfolio rule	6.51%	10.23%	0.424	135.0
Standard MV analysis	4.12%	13.71%	0.142	−205.2
MV analysis with diagonal covariance matrix	6.07%	10.85%	0.359	73.1
MV analysis with short-sale constraints	5.81%	10.99%	0.331	43.3

Panel B: Management expense ratio of the $1/N$ portfolio rule (bps)

Vehicle	Fee
End-of-sample ETFs	26.3
Institutional mutual funds	
Quartile 1	61.6
Median	82.8
Quartile 3	105.6

Panel C: Fees used in the replicating portfolios

Benchmark	ETFs Expense ratio	ETFs Ticker	ETFs Start date	Institutional mutual funds Q1	Institutional mutual funds Median	Institutional mutual funds Q3	Fee 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 + 40% * Barclays Capital Global Aggregate	4.08	11.10
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 U.K.	4.376
Europe ex UK Equity - Passive	15	6.506	MSCI Europe ex U.K.	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
U.K. All Cap	309	4.248	MSCI U.K.	3.971
U.K. Passive Equity	44	5.292	MSCI U.K.	4.610
U.K. Small Cap	50	8.059	Hoare Govett Smaller Companies	7.954
U.K. 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 U.S. 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 U.S. High Yield Composite	7.982
Core Investment Grade	399	6.330	Barclays Capital U.S. Corporate Inv Grade	7.045
Core Opportunistic	158	6.793	Barclays Capital U.S. Aggregate	6.362
Credit	65	6.734	Barclays Capital U.S. Universal	6.495
Credit - Long Duration	34	7.881	Barclays Capital U.S. Long Credit	7.322
Fixed Income Private Debt	12	12.101	Preqin Buyout	12.907
Government	66	7.050	Barclays Capital U.S. Govt/Credit	6.466
High Yield	174	7.053	Barclays Capital U.S. High Yield Composite	7.982
Index Based	98	6.526	Barclays Capital U.S. TIPS	8.002
Intermediate	242	6.001	Barclays Capital U.S. Intermediate Aggregate	5.954
Liability Driven Investment	29	7.895	Barclays Capital U.S. Corporate Inv Grade	7.489
Long Duration	81	9.947	Barclays Capital U.S. Long Credit	8.910
Mortgage Backed	87	6.326	Barclays Capital U.S. 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 U.S. Aggregate	6.362
Real Estate Other	9	27.777	FTSE EPRA/NAREIT Global ex U.S. EUR	2.603
Socially Responsible	9	6.387	Barclays Capital U.S. Universal	6.343
TIPS/Inflation Linked Bonds	65	7.853	Barclays Capital U.S. 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 Diversifiied	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
U.K. Core Plus	69	6.899	BofAML Non Gilts AAA Rated	6.006
U.K. Europe Other	1	9.200	BofAML Non Gilts 10+ Year	12.144
U.K. Govt & Non-Govt	62	6.868	BofAML Non Gilts AAA Rated	6.094
U.K. Index Linked Gilts	48	7.027	FTSE Gilts ILG All Stocks	6.947
U.K. Non-Govt	81	6.690	BofAML Non Gilts All Stocks	6.161
U.K. Passive Fixed Income	39	7.471	BofAML Non Gilts	5.603
U.K. 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 U.S.	51	7.673	Barclays Capital Global ex U.S.	6.648
Asset blends				
Asia Other	35	7.173	FTSE EPRA/NAREIT Global ex U.S. 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%) JP Morgan EMBI+ (25%) FTSE EPRA/NAREIT Global ex U.S. EUR (25%)	9.137
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%) MSCI World (67%)	3.396
International Multi-asset Diversified Growth	67	3.808	Citigroup World Broad Investment Grade (33%) MSCI World (67%)	3.986
International Multi-asset Global Balanced	151	3.902	Citigroup World Broad Investment Grade (50%) MSCI World (50%)	3.536
International Multi-asset Other	29	1.249	Citigroup World Broad Investment Grade (50%) MSCI World (50%)	3.628
Japan Other	56	1.128	Nikko BPI Composite (50%) MSCI Japan (50%)	2.257
New Zealand Managed Funds	30	5.351	UBS Composite Bond (33%) NZX 50 (40 prior to 1 Oct 2003) (67%)	7.213
Other	61	7.577	MSCI World ESG	-0.790
Swiss Balanced/Multi-Asset	35	3.572	Pictet LPP-60 plus	5.487
U.K. Europe Other	19	-14.460	BofAML Non Gilts 10+ Year	7.646
U.K. Balanced/Multi-Asset	67	4.773	BofAML Non Gilts 10+ Year (50%) FTSE A All Stocks (DS) (50%)	6.688
U.K. Liability Driven Investment	22	9.759	FTSE A All Stocks (DS)	6.349
U.S. Balanced	259	3.612	Barclays Capital U.S. Corporate Inv Grade (50%) Russell 3000 (50%)	5.335
U.S. Other	39	3.714	NCREIF Property (25%) Barclays Capital U.S. Corporate Inv Grade (25%) Russell 3000 (50%)	5.587
U.S. Stable Value	45	4.434	Barclays Capital U.S. Corporate Inv Grade (67%) S&P 500/Citigroup Value (33%)	6.115
U.S. Lifecycle Funds	90	2.842	Barclays Capital U.S. Corporate Inv Grade (50%) Russell 3000 (50%)	5.941
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 - U.S.	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 U.K.	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 - U.S.	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 20 tactical factors. In Table 7, 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