Do (Some) University Endowments earn Alpha?

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Comments Welcome

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Abstract

Using data from 1991 to 2010, we analyze the returns earned by educational endowments using simple style attribution models pioneered by Sharpe (1992). When we restrict the attribution model to public stock (US and International Stock) and bond benchmarks (US Bond), we document the average endowment earns an alpha close to zero, the public stock/bond benchmarks explain 99% of the time-series variation in the return of the average endowment, and the attribution model yields sensible estimates of the typical stock bond allocations (roughly 60% stock and 40% bonds). There is intriguing evidence of performance persistence. Elite institutions and top-performing endowments earn reliably positive alphas relative to these simple public stock/bond benchmarks of 2-4% per annum. Average allocations to alternative investments explain all of documented superior performance. When we add indexes for hedge funds and private equity to our attribution model, the estimated alphas for elite institutions and top-performing endowments move into negative territory, ranging form 0 to -1.9% (albeit generally unreliably negative). These results indicate that the average asset allocation of elite institutions and top-performing funds is the single most important determinant of their superior returns during the last 20 years. We argue the results are not consistent with manager selection or market timing (or tactical asset allocation) generating alpha for investors.

Educational institutions hold billions of dollars in endowment funds. As of June 2010, the top five educational endowments (Harvard, Yale, Stanford, Princeton, and The University of Texas) collectively managed $87 billion, while all educational endowments managed in excess of $350 billion.[1] While these funds are often critical to the funding of educational institutions, we know very little about the performance of endowments. Our lack of knowledge regarding the performance of endowments is remarkable given the legendary performance of some institutions, most notably the Yale endowment. David Swensen, the long-time manager of the Yale endowment, has long advocated the so-called "endowment model"[2] of investing popularized in his 2000 book, "Pioneering Portfolio Management." Following the principles that he espouses, the Yale endowment earned double-digit returns for over a decade through 2008 before dropping by 24.5% for the year ending June 2009.

Yale was not the only elite institution hit hard by the market woes of 2009. Harvard and Stanford also saw the value of their endowments drop by more than 20%. Many universities, which relied heavily on endowment funding for ongoing operational expenses, were forced to take immediate action. Elite schools, like Princeton and Harvard, were forced to slash spending in the wake of steep losses.[3] The large losses incurred by many elite endowments in 2009 caused many to question the ability of the endowment model employed by many elite institutions to deliver superior returns.

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[1] See http://www.nacubo.org/Research/NACUBO_Endowment_Study/Public_NCSE_Tables_.html , Table: All US and Canadian Insitutions Listed by Fiscal Year Endowment Market Value and Percentage Change in Market Value from FY 2010 to FY 2009.

[2] The endowment model, sometimes referred to as the Yale model, is generally attributed to David Swensen and Dean Takahashi, who have been senior managers of Yale's endowment for many years. The model generally calls for diversifying a portfolio across broad asset classes including alternative investments like hedge funds and private equity.

[3] Philips, Michael, "The Not-So-Rich Elite," Newsweek, August 18, 2009. See also Brown, Dimmock, Kang, and Weisbenner (2010) for systematic evidence on the relation between endowment returns and operating performance.

In this paper, we shed light on the strong returns (and sharp correction) experienced by many endowments. To do so, we analyze endowment returns for a large set of institutions over the two decades ending in June 2010. We address three questions: (1) Does the average endowment earn an abnormal return (alpha) relative to standard benchmarks? (2) Do elite institutions earn alpha? (3) Is there evidence of performance persistence in endowment returns?

To answer these questions, we employ a simple asset class attribution model pioneered by Sharpe (1992). We begin the analysis with a simple two- and three-factor attribution model that use easily replicated benchmarks that track public stock and bond markets. The two-factor model employs benchmarks for publicly traded US stocks and US bonds. The first factor is the return on the S&P 500 and the second is the return on the Barclays Capital Aggregate Bond Index. The three-factor model adds a benchmark for international stocks using the Morgan Stanley Capital Index excluding the US.

The simple two-factor model explains 94% of the time-series variation in the return of the average endowment and yields an estimated alpha of merely 6 bps per year. The estimated loadings on the stock and bond factors are 59% and 41%, which are quite reasonable given the emphasis placed on the 60/40 stock/bond portfolio as a typical benchmark against which many endowments evaluate performance. The three-factor model (i.e., adding international stocks) explains 99% of the time-series variation in the return of the average endowment and yields an estimated alpha of 48 bps, which is also unreliably different from zero. Thus, we find no evidence that the average endowment is able to deliver alpha.

The performance of the average endowment masks interesting cross-sectional variation in the performance of endowments. In one analysis, we sort endowments into deciles based on performance in year t-1 and analyze performance in year t. Using the two- or three-factor models, there is strong evidence of performance persistence. The top performance decile earns two- and three-factor alphas of 2.3% and 2.6% (t=1.93 and 3.05, respectively), while the bottom performance decile earns annual alphas of -1.6% and -1.4% (t=-1.74 and -1.87, respectively). The spread in returns between the top and bottom performance deciles of 3.9 to 4.0% is reliably positive (t=3.42 and 3.52, respectively).

In a second analysis, we focus on the returns earned by elite institutions. Relative to the two- and three-factor models, Ivy League schools earn alphas of 3.2% and 4.0% (t=1.98 and 3.81). We also analyze the returns of the 30 non-Ivy League schools with top SAT math scores for incoming freshman. These institutions also deliver strong two- and three-factor alphas of 1.9% and 2.5% (t=1.38 and 2.76). The spread in returns between Ivy League (or Top-SAT schools) and other institutions is reliably positive.

To dig deeper into the revealed performance spreads, we introduce benchmarks related to two alternative asset classes popular at many endowments: hedge funds and private equity.[4] For a hedge fund benchmark, we use the Hedge Fund Research Fund-Weighted Composite Index (HFRI). For a private equity benchmark, we use the Cambridge Associates US Private Equity Index. The inclusion of these additional asset classes delivers sensible factor loadings. For example, the average endowment has estimated loadings on the alternative asset classes of 22%, while elite institutions have allocations of 50-60%. These estimated allocations are in line with the average allocations reported by the Commonfund Benchmark Study (2009, Figure 2.7, p.39). Large endowments (over $1 billion, which are generally enjoyed by elite institutions), have average allocations of 46% to alternative strategies, while small endowments (less than $50 million) have average allocations between 8 and 17% to the alternative strategies.

[4] The Commonfund-NACUBO survey defines alternative investments as private equity, marketable alternative strategies (i.e., hedge funds), venture capital, real estate and natural resources. Of these categories, private equity and hedge funds represent almost 80% of all alternative investments (see Commonfund Benchmarks Study (2009), figure 2.11, p.42).

When alternative asset classes (private equity and hedge funds) are added to our three-factor attribution model (US Stocks, US Bonds, International Stocks), the top performance decile, Ivy League schools, and Top-SAT schools fail to deliver alpha (with point estimates of -41 bps, 2 bps, and -1.2%, respectively). None of the estimated alphas are reliably different from zero. Thus, the intriguing evidence of superior returns among the top performing and elite institution is completely explained by their asset allocation decisions.

The fact that the average allocations to asset classes explains the returns for top performing and elite institutions provides insights into the mechanism used to generate the strong returns earned by these endowments. Specifically, these results suggest that manager selection and dynamic (or tactical) asset allocation do not generate alpha for top performing and elite institutions. There are two ways in which an endowment can generate an alpha relative to asset class benchmarks. First, endowments might pick superior managers within an asset class and the returns earned within an asset class will beat benchmark returns. Thus, superior manager selection can generate a positive alpha. Second, endowments might dynamically allocate investments across asset classes, overweighting (or underweighting) an asset class in anticipation of good (or bad) asset class returns—a form of market timing. Successful dynamic asset allocation (or market timing) would also deliver a positive alpha. Our results suggest that endowments fail to earn alpha from manager selection or dynamic asset allocation. Rather, high average allocations to alternative asset classes explain the documented cross-sectional variation in performance.

These conclusions rest on two assumptions underlying our analysis. First, our benchmark model must include relevant asset classes. We believe we can make a solid case that we have included the relevant asset classes. We choose the five asset classes (US Stock, US Bond, International Stock, Private Equity, and Hedge Funds) as endowments report the largest allocations to these asset classes. Moreover, our empirically estimated factor loadings dovetail neatly with average reported allocations. In addition, we show that to overturn our finding of negligible alphas relative to the benchmarks employed, the omitted asset class must deliver a low (or high) average return that is unrelated to the included factors and is weighted heavily by endowments. If the included asset class returns explain the return of the omitted asset class, then the factor loadings of the included asset classes will be biased, but the alpha estimates will not. Consider two extreme cases: an asset class with a high unexplained return relative to the included asset class returns and an asset class with a low unexplained return. A high-return omitted asset class with a heavy weight would move alphas into positive territory, while a low-return omitted asset class with a heavy weight would move alphas into negative territory. In robustness checks, we consider other asset classes that would be likely to move our alpha estimates (i.e., T-Bills and venture capital); the basic results are unaffected by inclusion of these additional asset classes because the estimated allocations to these asset classes are small.

Second, we implicitly assume the benchmarks themselves do not represent alpha. It is easy to argue the public stock and bond benchmarks do not represent alpha since it is easy to replicate the returns earned on the indexes. This is not the case for the private equity and hedge fund benchmarks. Thus, it is possible that the indexes themselves deliver alpha relative to easily replicated benchmarks. In auxiliary analyses, we analyze the performance of the private equity and hedge fund benchmarks. We document that, once we account for the stale pricing issue inherent in private equity valuations, the private equity benchmark fails to deliver an alpha relative to the Fama-French three-factor model, which employs publicly traded benchmarks related to market, size, and book-to-market factors. Thus, it is hard to argue the private equity allocations of endowments deliver alpha. In contrast, the hedge fund benchmark delivers an impressive annual alpha of 5% relative to the Fama-French three-factor model. Nonetheless, the estimated hedge fund allocations are at most 25% (for Ivy League schools) and thus would add, at most, 1.25% (5% x .25) to the estimated alpha of Ivy League schools. We believe this is a generous accounting as the risks inherent in hedge fund investments are unlikely to be accounted for well by standard asset pricing models. As Stulz (2007) forcefully points out, many hedge funds might deploy strategies that are akin to selling earthquake insurance. Such strategies would deliver high returns in virtually all periods… until the earthquake hits.

Our paper is not the first to study endowment returns. Lerner, Schoarr, and Wang (2008) present intriguing descriptive statistics that suggest endowments earn strong returns relative to asset class benchmarks. They do not estimate alphas relative to attribution models and focus more on providing a broad description of university endowments. They conclude (p.222) "…much remains to be understood about the sources of their performance, whether they can continue to succeed and whether the approaches of the successful endowment manager can be generalized to the broader investment community."

Brown, Garlappi, and Tiu (2010) analyze the returns to endowments using a similar dataset to that employed in this study. They use reported asset allocation weights for endowments and benchmark returns to analyze the strategic asset allocation, tactical asset allocation, and security selection decision using the method introduced by Brinson et al. (1986). As do we, they show the average endowment earns a negligible alpha. They present only a limited analysis of the predictable cross-sectional variation in performance (comparing the returns of active endowments to passive endowments) and do not analyze the returns to elite institutions, a main focus of the present study.

Lerner, Schoar, and Wongsunwai (2007) analyze the returns within one asset class – private equity – and document educational endowments enjoy the highest rates of return using a sample of 838 funds raised between 1991 and 1998. At first blush, this finding might seem to contradict our finding that manager selection by endowments does not generate alpha. However, two points are worth emphasizing. First, Lerner et al. (2007) base their conclusions on internal rate of return calculations and make only rudimentary adjustments for risk. Second, the private equity benchmark we use includes investments that might be closed to new investors and *still* fails to deliver an alpha relative to standard asset pricing benchmarks. Thus, the benchmark alpha of zero might represent a best-case scenario for endowments. Many endowments that fail to gain access to the best private equity funds might, in fact, be generating a *negative* alpha for their institutions. This seems plausible given the high fees charged by private equity firms. We find some evidence consistent with this conjecture, as the worst performing endowments have estimated alphas ranging from -1.4 to -3.2% (with associated t-statistics ranging from -1.44 to -3.18).

I. Data and Methods

A. Endowment Returns Data

We use data from a combination of the National Association of College and University Business Officers (NACUBO) Endowment Study and the NACUBO-Commonfund Study of Endowments (NCSE). NACUBO provides endowment returns from 1991 to 2008. In 2009, Commonfund and NACUBO began jointly publishing a study of endowment returns. The dataset contains the institution, year, and endowment return (through June of each reporting year).

The data are virtually free of survivorship bias, as data are not backfilled. Some survivorship bias is possible if institutions close in a particular year and closing is related to endowment performance. While this is a huge issue for the study of mutual funds, where performance and fund closure are related, we doubt that it is a big issue here as most educational institutions (and their endowments) are quite enduring.

One concern regarding these data is the voluntary nature of reporting. If institutions are reluctant to publicize poor performance, they may refrain from reporting in below-par years and the reported returns would overestimate the performance of endowments. A strategic reporting bias (if any) will cause our returns to be overstated. Ultimately, we find no evidence of superior investment returns relative to asset class benchmarks. Thus, the presence of any reporting bias that favors strong returns would only strengthen this conclusion.

To investigate whether reporting bias is material, we conduct two tests. First, we compare the returns of institutions with reporting gaps and to those without gaps in reporting. If some institutions are diligent about reporting, while others are strategic (i.e., choose not to report in poor years) we would expect institutions with gaps in reporting to have higher average returns. In Table 1, we compare the returns of those with gaps to those with no gaps (columns two to four of Table 1). This analysis suggests that the reporting bias is small as the difference in returns between diligent reporters and those with gaps is, on average, an economically small 29 basis points per year with diligent reporters earning stronger returns.

Second, we compare the returns of first time reporters to repeat institutions. If institutions are strategic in their reporting, we would expect first-time reporters to have systematically higher return than continuing reporters. We show the difference in returns between the first-time reporters and other institutions in Table 1. Though there are differences between the two groups, the first-time reporters tend to have lower rather than higher returns.

As a final (untabulated) analysis, we compare the returns of the 279 endowments that report in all 20 years of our sample period to all endowments. These consistent reporters earn average annual returns that are 50 bps greater than all institutions.

Taken together, the above tests suggest the reporting biases in the data are not economically large. Furthermore, much of our analysis focuses on Ivy League schools (which report in all years) and Top-SAT schools (which report in 96% of all years).

B. Elite Institutions

Much of our analysis focuses on the returns earned by elite institutions. We identify two groups of elite institutions. The first group is the eight Ivy League schools (Brown, Columbia, Cornell, Dartmouth, Harvard, Princeton, Penn, and Yale). The second group consists of top-SAT schools outside the Ivy League. Our first ranking of schools takes place in 1991, and we update the ranking every five years (in 1996, 2001, and 2006). Rankings are based on the 75th percentile of math SAT scores for incoming freshman. A total of 46 schools make the top-30 rankings in one of the four ranking years. The rankings are generally quite stable: 16 schools make the top 30 in all four ranking periods, and an additional 9 schools make the top 30 in three of the four ranking periods (see the Appendix for details and a list of top-SAT schools). In the end, we carve the universe of endowments into three groups: Ivy League Schools, Top-SAT Schools outside the Ivy League, and the remaining institutions.

In Table 2, we present descriptive statistics on the returns earned by each of these groups and all endowments. The number of reporting institutions has generally increased over time and peaked in 2010 with 817 reporting endowments. Not surprisingly, average endowment returns have tracked market conditions with downturns during the bull market of 2000-2001 and the more recent downturn in 2009.

Consistent with endowment folklore, we find the elite institutions earn superior returns. Ivy League schools earn 11.49% per year. Top-SAT schools (excluding the Ivy League) earn 10.23% per year, while other institutions earn 8.17% per year. Ivy League schools enjoy a performance edge of 3.32 percentage points per year ($p<.01$), while Top-SAT schools enjoy a performance edge of 2.05 percentage points ($p<.02$).

C. Performance Persistence

In addition to rankings based on the prominence of schools, we construct quintiles based on the returns earned by endowments in each year and update the quintiles annually. To analyze the extreme performers, we further split the bottom quintile into two groups corresponding to the bottom two performance deciles (labeled 1A (Lo) and 1B). The top quintile is similarly into two groups (labeled 5A and 5B (Hi)).

In Table 3, we present descriptive statistics on the returns earned by each of these performance groups. We lose data for 1991 as we require data in prior years to sort on performance. The results provide strong evidence of performance persistence in endowment returns. Returns are monotonically increasing from the bottom performance decile (1A) to the top performance decile (5B). The top performance decile outperforms the bottom decile by 4.05 percentage points per year and one can comfortably reject the null hypothesis of equal returns ($p<.01$). Similarly, the penultimate extreme deciles (1B vs. 5A) have a return spread of 1.81 percentage points per year ($p<.02$).

D. Attribution Analysis

How do elite institutions and top performing endowments generate superior returns? To answer this question, we conduct a simple attribution analysis as described in (Sharpe (1992)). For discussion purposes, consider a two-factor model (e.g., US stocks and US bonds). (In our empirical analysis, we consider five factors: US equities, US bonds, International Equities, Private Equity, and Hedge Funds.) The simple two-factor model with US stocks (R_{st}) and US bonds (R_{bt}) is represented by the following annual time-series regression:

$$R_{pt} = \alpha + \beta_s R_{st} + \beta_b R_{bt} + \varepsilon_t, \quad (1)$$

subject to the constraint that the $\beta_s + \beta_b = 1$. In our main analysis, we do not constrain coefficients to be nonnegative, but empirically this constraint would not be binding. The coefficients on the factors can be interpreted as the two-factor portfolio that best approximates the portfolio return (R_{pt}). The intercept (α) of the regression provides an estimate of the abnormal return relative to the factor-mimicking portfolio. A positive alpha indicates the endowment manager has generated superior returns relative to the factor-mimicking portfolio.

There are three distinct mechanisms that would allow a manager to deliver superior returns relative to the simple two-factor model. First, endowments may identify superior investments within a particular asset class. Consider an endowment manager who invests solely in US equities and US bonds. She might generate superior returns by identifying managers who beat their benchmarks in these two asset classes. Assuming superior manager selection, a two-factor style analysis (US stocks and US bonds) would yield reliably positive alphas.

Second, endowments may have market timing ability. For example, a manager may solely invest in US equities and bonds, but is able to time these allocations by overweighting equities prior to bull markets. Assuming timing ability, a two-factor style analysis (US stocks and bonds) for this manager would also yield reliably positive alphas.

Third, endowments may strategically allocate to alternative investments (e.g., private equity and hedge funds), but the allocations are static. If the superior returns are generated from this strategic asset allocation, the endowment manager would generate positive alphas relative to a two-factor style analysis (US Stocks and US bonds), but the performance edge would disappear when we include reasonable benchmarks for the alternative asset classes.

To estimate the performance of endowments, we consider five benchmarks that are broadly considered important in the investments of endowments: US Stocks, US Bonds, International Stocks, Hedge Funds, and Private Equity. The indexes used for each asset class are presented in Table 4. We calculate annual returns from July to June, beginning in June 1991 and ending in June 2010, to correspond with the June reporting by endowments.

The public stock and bond indexes delivered returns ranging from 6.6% (international stocks) to 9% (S&P 500). The alternative asset class benchmarks delivered impressive returns of 15.2% (private equity) and 12.1% (hedge funds). In the next section, we consider whether the strong returns on these alternative asset classes can be explained by standard asset pricing models.

E. Performance of Alternative Asset Classes

The public stock (S&P 500 and MSCI ACWI-exUS) and public bond (Barclays Aggregate) are widely used benchmarks that merely track returns in these markets. Thus, it is difficult to argue that these asset classes generate alpha.

Hedge funds and private equity are different. Indeed, the raison d'etre for hedge funds is arguably the identification of alpha. Private equity funds might similarly identify investment strategies that deliver strong returns. Even if hedge fund and private equity fund managers identify investments that earn superior returns, this alone is not a sufficient condition to generate superior returns for those who invest in them. Fund managers would be able to charge high fees for their superior skill and investors would arguably be left with zero net-of-fee alphas, as in Berk and Green (2004). Indeed, many hedge funds and private equity funds charge high fees (often 2% of AUM and 20% bonus above a benchmark return). In summary, for endowments to enjoy the alpha-generating abilities of hedge funds or private equity, two conditions must hold. First, the funds must be able to identify alpha. Second, they must charge fees that are not so high as to completely offset the alpha-generating abilities of fund managers.

Whether hedge funds generate alpha is the subject of ongoing research. Ibbotson and Chen (2005) analyze the returns to over 3,500 hedge funds and conclude the net-of-fee alpha of the funds is 3.7% per year. Kosowski, Naik, and Teo (2007) conclude the average alpha across hedge funds is 42 bps per month (albeit statistically insignificant). However, funds in the top performance bracket earn impressive monthly alphas in excess of 1 percent per month. Jagannathan, Malakhov, and Novikov (2010) document similar performance persistence in hedge funds. Fung, Hsieh, Naik, and Ramadorai (2008) analyze the returns on funds-of-funds and document alphas are not reliably positive across the three subperiods they analyze. In reviewing this work, Stulz (2007, p.186) concludes that "hedge funds have a nonnegative alpha net of fees on average." Put another way, hedge fund managers earn at least their compensation on average. Stulz also issues an admonition that the evidence of performance persistence may be misleading as many hedge funds may employ strategies that are akin to selling earthquake insurance. He concludes (p.187): "A hedge fund that implements a strategy akin to selling earthquake insurance and whose risk is not captured well by commonly used risk factors will have a significant positive alpha – until the earthquake hits."

Several studies analyze the returns to private equity. Kaplan and Schoar (2005) analyze fund-level data and document the net-of-fee returns of private equity funds (both venture capital and buyout) approximately equal the return on the S&P 500, while Ljunqvist and Richardson (2003) using a different sample find returns that are 5.7% higher than a simulated investment in the S&P 500 with the same time schedule. Jones and Rhodes-Kropf (2003) use general partner value estimates (rather than realized returns) to estimate quarterly private equity returns and document annual alphas of 72 bps for buyout funds. Phalippous and Gottschalg (2009) use a dataset similar to Kaplan and Schoar (2005), but argue reasonable adjustments to the data to reflect the nature of reporting biases leads to lower estimates of returns. In reviewing these (and other) studies, Metrick and Yasuda (2011) conclude: "The evidence on whether venture capital and buyout funds achieve excess performance is mixed." They attribute the mixed results to the poor estimation of the risk characteristics inherent in the funds, stale reporting, and, in the case of buyouts, the lack of an adjustment for the leverage employed.

As a preliminary analysis, we consider whether the benchmark indexes that we employ generate alphas relative to standard asset pricing models. To do so, we estimate the alphas on the alternative asset classes using the Fama-French three-factor model (Fama and French (1993)). The three factors are a market risk premium (R_{mt} – R_{ft}), a size factor (SMB), and a book-to-market factor (HML). All factors are from Ken French's online data library. We regress the returns on the hedge fund (or private equity) index less the riskfree rate on the three factors. Hedge fund returns are monthly returns, while private equity returns are quarterly returns. Both hedge funds and private equity are arguably illiquid asset classes. To correct for this stale pricing issue in the estimation of alphas, we use lagged independent variables.

The results for hedge funds are presented in Table 5. The baseline regression (with no lags) generates a low, but reliably positive beta (0.33) and size coefficient (0.17). More importantly, the annualized alpha is an impressive 5.6% per annum. As in Asness, Krail, and Liew (2001), we include three lags of the monthly factor returns to correct the alphas for stale pricing. Including lagged factors does increase the market and size loadings (an indication that stale pricing is an issue with the hedge fund return series), but puts only a small dent in the estimated alpha, which is now 5.1% per annum. The loadings on the lagged market, size, and value factors are all reliably nonzero with $p<.01$ (though the change in the book-to-market factor is economically small). (Asness, Krail, and Liew (2001) document the index alphas are indistinguishable from zero for the period 1994 to 2000, but this result appears to be period specific.) Consistent with the research reviewed previously and summarized by Stulz (2007), these results indicate the hedge funds generate impressive returns.

The results for private equity are presented in Table 6. The baseline regression (with no lags) generate low but reliably positive market beta (0.37) and impressive alphas. However, stale pricing is a severe issue for private equity returns. The regressions with 8 quarterly lags generate much large summed loadings on the market and size factors. The sum of the lagged coefficients on the market risk premium and size factor are reliably positive (in both cases, $p<.01$), while the sum of the lagged coefficients on the book-to-market factor is not reliably positive ($p=.86$). These results indicate private equity investments have above average market betas and a strong tilt toward small stocks. More importantly, after correcting for the stale pricing inherent in private equity investments the estimated alphas are no longer reliably positive. These results jive well with the conclusions of Metrick and Yasuda (2011). In short, the insignificant alpha on the private equity portfolio makes it difficult to argue the returns earned by tilting toward private equity represent alpha.

In light of this preliminary analysis, allocations to hedge funds could arguably be considered alpha generating, while allocations to private equity cannot. We discuss this issue in detail when we present the results of our attribution analysis.

II. Results

A. Average Endowment

In Table 7, we present the results of our attribution analysis for the average endowment. We present results of four models: (1) US Stock and US Bond, (2) US Stock, US Bond, and International Stock, (3) US Stock, US Bond, Hedge Fund, and Private Equity, and (4) US Stock, US Bond, International Stock, Hedge Fund, and Private Equity. The dependent variable in all models is the average annual returns on all reporting endowments. In robustness tests, we consider alternative asset classes (e.g., US Treasury bills or Venture Capital) and results are qualitatively similar to those reported in this section.

In each model, the slope coefficients are constrained to sum to one and, thus, can be interpreted as portfolio weights. Recall we do not constrain coefficients to be positive. The simple two-factor model explains 94% of the time-series variation in the returns to endowments and yields sensible portfolio weights of 59% equity, 41% bonds. Many endowments use a 60/40 stock/bond portfolio as a typical benchmark (see, for example, the Harvard Management Endowment Report, October 2010), so it is reassuring that the simple two-factor model yields weights close to the typical benchmark weights.

When we add other asset classes (international stocks, hedge funds, and private equity) as independent variables in our attribution analysis (models 2 to 4), the R-squared values range from 98 to 99%. Nonetheless, in all models US stocks and US Bonds are the most important factors determining the time-series variation in the average endowment returns (note the large t-statistics for these asset classes in all models). In the full model (model 4), the alternative asset classes (hedge funds and private equity) are marginally significant with weights of 12% (hedge funds) and 10% (private equity).

Regardless of the model, endowment alphas are not impressive. Relative to a two-factor model with just US Stocks and US bonds, the average endowment earns an alpha that is indistinguishable from zero (6 bps per year, t=0.07). Thus, the average endowment could easily match the returns earned on their investments by indexing. When alternative asset classes are included, the estimated alphas are negative (and at times reliably so).

Recall that of the five asset classes considered, only hedge funds could arguably be considered an alpha-generating asset class (with approximately 5% annual alphas relative to standard asset pricing models, see Table 5). Thus, the 12-19% hedge fund allocation could arguably deliver an alpha of 60 bps (.12 x 5%) to 95 bps (.19 x 5%) annually. These returns are not sufficient to overturn the conclusion that the alphas are indistinguishable from zero in the models that include a hedge fund factor. More importantly, a simple 60/40 stock/bond allocation would have delivered similar rates of return.

In summary, there is little evidence that the average endowment is able to generate reliably positive alphas. On one level, this is good news as most endowments allocate assets to investment managers who charge high fees. These results suggest that, on average, endowments are able to recover these fees. We now turn to the question of whether some subgroups are able to earn superior alphas.

B. Performance Persistence

Table 8 presents the attribution analysis for the bottom decile (Panel A), top decile (Panel B), and the spread in returns between the top and bottom decile (Panel C). Recall that we identify the performance decile in year t and measure performance in year t+1. Consider first the performance of the bottom decile (Panel A). In all models, these funds earn negative alphas ranging from -1.4% (model 2) to -3.2% (model 3) annually and the alphas are reliably negative in two of the four models.

The pattern for the top decile of performance is quite different. Relative to a simple two-factor model, the top decile earns an alpha of 2.29% (t=1.93). When international stocks are added to the attribution model, the alpha is even more impressive 2.58% (t=3.05).[5] However, as models three and four make clear, the superior returns earned by the top decile can be traced to their heavy allocation to hedge funds and private equity. For example, in model 4, the estimated weights on hedge funds and private equity are 21% and 27%, respectively, and the alpha becomes -0.41% (albeit not reliably negative). (Again, the revealed hedge fund allocations of 21% and 24% are not sufficient to overturn the conclusion that alphas for the top performance decile are indistinguishable from zero.) Thus, the superior returns earned by the top decile of endowments can be entirely traced to their relatively large allocation to the alternative asset classes.

In Panel C, the dependent variable is the return on the top decile less the bottom decile and the slope coefficients are constrained to sum to zero. The spread between the top and bottom deciles is consistently positive, but the spread diminishes substantially when we introduce the alternative asset classes. Note also

[5] The increase in the alpha when we add international stocks to the attribution model can be traced to the fact that international stocks are an important asset class (i.e., estimated coefficients are reliably positive) and international stocks earned, on average, lower returns than US stocks and bonds (see Table 5). We discuss the issue of omitted asset classes in detail later.

the relatively large increase in the R-squareds as alternative asset benchmarks are added to the attribution model.

In combination, these results indicate that the rather impressive spread in returns of 3.5% annually between the top and bottom deciles that we document in Table 2 can be explained largely by the different asset allocation decisions of the top and bottom decile of endowments.

C. Elite Institutions

In Table 9, we present results for Ivy League schools (Panel A), Top-SAT schools (Panel B), and all other schools (Panel C). Relative to our baseline models with merely public stock and bond benchmarks (models 1 and 2), the Ivy League endowments generate impressive alphas of 3.2 to 4.0% (t=1.98 and 3.81, respectively). However, these strong alphas are eroded when we include alternative asset classes in our attribution analysis and are indistinguishable from zero when both hedge funds and private equity are included as independent variables.

The Top-SAT schools (recall we exclude Ivy League schools) earn strong alphas relative to the public equity and public bond models, though not as impressive as the Ivy League schools. In this case, the alphas are completely explained by models that include both hedge fund and private equity benchmarks (models 3 and 4), and the latter models generate negative alphas.

The other schools, not surprisingly, generate alphas that are very similar to the full sample results. In Panel D, we compare the returns earned by Ivy League schools to returns earned by other schools. Models that include the alternative asset classes (hedge funds and private equity) explain nearly 80% of the time-series variation in the return spread between Ivy League and other schools. The difference in the alphas of Ivy League schools and other schools, albeit positive 82 bps, is no longer reliably different from zero. In Panel E, we compare Top-SAT schools to other schools and find qualitatively similar results.

In combination, these results indicate the strong returns earned by top-performing endowments, Ivy League schools, and Top-SAT schools are explained by their allocation to alternative asset classes, notably hedge funds and private equity, which are relatively small factors in explaining the returns of the average endowment. More importantly, alphas on top-performing funds, Ivy League schools, and Top-SAT schools are indistinguishable from other schools once we account for the differing asset allocation decisions.

The Ivy League and Top-SAT schools have large loadings on the hedge fund and private equity factors. The hedge fund allocations could arguably be considered alpha-generating (see Table 5). Nonetheless the estimated hedge fund allocations are never sufficiently large to overturn the conclusion that the endowment returns are not reliably different from zero. While the private equity allocations are also large, it is difficult to argue these are alpha-generating allocations given the negligible alpha earned by the index (see Table 6).

III. Robustness

A. Subperiod Analysis

To test the robustness of our conclusions, we split our subperiod into two equal 10-year periods. We reestimate the regressions presented in tables 8 and 9 by subperiod. Of course, we lose power given we only have ten observations of annual returns within each sample period. Nonetheless, the results are quite supportive of our main conclusions. We find no evidence that the elite institutions (Ivy League or Top-SAT schools) or the top performance decile earn reliably positive returns. In fact, using the full five-factor attribution analysis, all estimated alphas are negative within each subperiod (albeit not reliably so) for Ivy League, Top-SAT, and the top performance decile.

B. Omitted Asset Classes

One concern that readers may have is that we have omitted a relevant asset class. To understand the impact of an omitted asset class on our analysis, consider a portfolio that is a linear combination of n asset classes and earns no alpha relative to the allocation:

$$R_{pt} = \sum_{i=1}^{n} \beta_i R_{it} + \varepsilon_t, \tag{2}$$

where R_{pt} is the portfolio return in period t and R_{it} are the returns on the n asset classes, and β_i represents the allocation to asset class i (and β_is sum to one). The error term (or the portfolio's tracking error relative to the asset classes) is measured by ε.

Assume the researcher omits the nth factor and estimates a constrained regression ($\beta'_{i\,i}$s sum to one) of the portfolio return (R_{pt}) on n-1 factor (i.e., the nth factor is omitted from the regression):

$$R_{pt} = \alpha + \sum_{i=1}^{n-1} \beta'_i R_{it} + \varepsilon_t, \tag{3}$$

The nature of the bias in the estimated alpha from equation (3) can be understood by considering a secondary regression of the return on the nth asset class on the remaining n-1 asset class returns:

$$R_{nt} = \alpha_O + \sum_{i=1}^{n-1} \gamma_i R_{it} + \nu_t, \tag{4}$$

Where the n-1 γ parameters sum to one in order to preserve the linear constrain that βs sum to one in equation (2). Substituting from the secondary regression (4) for R_{nt} on the right-hand side of the true model (2) and taking expectations allow us to derive the bias resulting from the estimated regression (3).

The bias will be a function of the return of the omitted asset class relative to the n-1 included factors (α_O) and the actual allocation to the omitted asset class (β_n):

$$E(\alpha) = \beta_n \alpha_O. \tag{5}$$

If the omitted asset class generates no alpha relative to the included asset classes, the (i.e., $\alpha_O = 0$) then the estimated alpha is unbiased. Similarly, if the omitted asset class has no allocation (i.e., $\beta_n = 0$) then the estimated alpha is unbiased.

To understand the nature of the potential bias, consider an omitted asset class with returns that are independent of the included asset classes. If the asset class generates low average returns relative to the included asset class, then $\alpha_O < 0$. If this low-return asset class is omitted from the regression in equation (3) and has a positive weight in the portfolio ($\beta_n > 0$), the estimated alpha will be negative (i.e., downwardly biased relative to the true alpha of zero). Similarly, if the omitted asset class generates high returns unrelated to the included asset classes, the alpha will be positive (i.e., upwardly biased).

International stocks are an important asset class in many endowment funds. Thus, in our two-factor attribution model with US Stocks and Bonds, we are excluding an important asset class for many endowments. In all of our estimated models (for average endowment, extreme performance deciles, Ivy League, Top-SAT, and Other schools), the estimated alphas increase when we add international stocks to our attribution analysis. The change in the alpha (albeit small) can be traced to the low return on international stocks (6.6%) relative to US stocks and bonds (9.0 and 7.2%, respectively) and the heavy allocation of many endowments to international stocks.[6]

Note the R-Squared of the estimated model (3) will be downwardly biased if the omitted factor explains important time-series variation in the portfolio return. Thus, a symptom of an omitted variable problem would be low R-Squareds in our attribution model. Since all models that include five factors generate R-Squared values ranging from 95 to 99% and we have included the asset classes that

[6] To be precise, the alpha of the international stocks estimated using the constrained regression of equation 4 is the relevant variable for considering the bias. The estimate alpha is -2.0% (t=-0.62).

endowments list as their most important investments, it seems unlikely that there is a severe omitted variable issue.[7]

Nonetheless, to investigate the possibility that an omitted asset class is biasing our results, we also estimate models that include returns on one-month T-Bills as a sixth factor as T-Bills earn a low 3.7% annual return during our sample period. In all models that include T-Bills as an additional factor, the estimated alphas do not change materially (by at most a 26 basis point reduction in the estimated alpha earned by the Ivy League schools). The loadings on the T-bill factor are economically small and never statistically significant.

Similarly, we estimate models included the Cambridge Associates Venture Capital Index as the index earns an impressive annual return of 23.3% during our sample period. The loadings on the Venture Capital index are quite small, with the largest estimated loading being 3.8% (for Ivy League schools). The inclusion of the additional asset class does not materially affect the estimated alphas.

IV. Conclusion

We analyze the returns of hundreds of educational endowments over the 20-year period ending in 2010 using a simple attribution model that includes benchmarks related to US Stock, US Bonds, International Stock, Private Equity, and Hedge Funds. When we restrict the attribution model to public stock (US and International Stock) and bond benchmarks (US Bond), we document the average endowment earns an alpha close to zero, the public stock/bond benchmarks explain 99% of the time-series variation in the return of the average endowment, and the

[7] The R-squared of the estimated regression in (3) will be lower than the R-squared of the true model in (1) as a function of the asset allocation of the omitted asset class and the error component of regression (2): $\beta_n \text{var}(v_t) / \text{var}(R_{pt})$.

attribution model yields sensible estimates of the typical stock bond allocations (roughly 60% stock and 40% bonds).

There is intriguing evidence of performance persistence. Elite institutions and top-performing endowments earn reliably positive alphas relative to these simple public stock/bond benchmarks of 2-4% per annum.

Average allocations to alternative investments explain all of documented superior performance. When we add indexes for hedge funds and private equity to our attribution model, the estimated alphas for elite institutions and top-performing endowments move into negative territory, ranging form 0 to -1.9% (albeit generally unreliably negative). These results indicate that the average asset allocation of elite institutions and top-performing funds is the single most important determinant of their superior returns during the last 20 years. We argue the results are not consistent with manager selection or market timing (or tactical asset allocation) generating alpha for investors, which would appear as alphas relative to the benchmark returns.

Clearly, the public stock and bond benchmarks do not represent alpha-generating asset classes. However, one might argue the alternative investment strategies themselves represent alpha. There are two points to make about this possibility. First, in theory, it is difficult to envision a market equilibrium where alternative strategies generate a return that is not compensation for risk. If managerial talent is the scarce resource, asset managers (i.e., hedge fund and private equity firms) should demand compensation equal to their ability to generate superior returns leaving investors no better (or worse) off. Second, in practice, there is mixed evidence that the high returns earned by alternative investments represent alpha. Private equity does not appear to generate alpha. Though the benchmark we use for private equity generates high returns (over 15% per year during our sample period), it fails to deliver an alpha relative to standard asset pricing models once we account for the stale pricing issue that plagues private equity valuations. In contrast, the hedge fund index we employ delivers an impressive alpha during our sample period of 5% per annum. Nonetheless, the estimated allocations to hedge funds would deliver at most an additional 1.25% per year in alpha if we consider the hedge fund return alpha. We believe this is a generous accounting given the observation that many hedge funds employ strategies that are akin to selling earthquake insurance, delivering strong results… until the earthquake hits.

David Swensen (2009, p.48) summarizes the challenge facing endowment management well:

> In spite of the daunting obstacles to active management success, the overwhelming majority of market participants choose to play a loser's game. Like the residents of Lake Wobegon who all believe their children to be above average, nearly all investors believe their active strategies will produce superior results. The harsh reality of the negative-sum game dictates that, in aggregate, active managers lose to the market by the amount it costs to play in the form of management fees, trading commissions, and dealer spread. Wall Street's share of the pie defines the amount of performance drag experienced by would-be market beaters.

The vast majority of endowments choose to play the loser's game with mixed results. In aggregate, endowments allocate 85% of their public equity portfolio to active management[8] – markets in which it is notoriously difficult to beat public indexes. Hefty allocations to hedge funds and private equity also generate large fees for asset managers. There is no doubt that endowments make these allocations hoping for benchmark-beating returns.

There is both good news and bad news in our analysis. The good news is that our results indicate that the fees paid by endowments do not result in systematically low returns relative to benchmarks as we find limited evidence of negative alphas. The average endowment, elite institutions, and top-performing institutions earn

[8] The Commonfund Benchmarks Study (2009) reports (p.40) "…active strategies accounted for 85% of domestic equity assets."

alphas close to zero in models that include alternative strategy benchmarks. The strongest evidence of subpar performance comes from the bottom-performing endowments, which earn alphas ranging from -1.4% to -3.2% (albeit statistical significance of these results depend on the model employed). The bad news is that the investment managers do not appear to share the fruits of their labor with those whose money they manage. While the managers appear to earn sufficient returns to cover their fees, there is no evidence that endowments – even the endowments of elite institutions – are able to beat benchmark returns.

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Table 1: Tests for Reporting Bias in Endowment Returns

The table reports the mean annual percentage returns across endowments. The left-hand side of the table splits all endowments into two groups: endowments with continuous reporting after the first year (no gaps) and those with gaps in reporting between first and last reporting year (gaps). The right-hand side of the table splits all endowments into first-time reporters (first year) and repeats reporters (other years).

	Returns for Institutions with Reporting Gaps v. Institutions with No Reporting Gaps				Returns for Institutions in First Year of Reporting v. Other Years			
Year	No Gaps	Gaps	Diff (No Gap - Gap)	% with Gaps	Other Years	First Year	Diff (Other - First)	% First Year
1991	7.34	7.44	-0.10	8.67	--	--	--	--
1992	13.25	13.43	-0.18	8.77	13.31	12.41	0.90	5.21
1993	13.47	13.37	0.10	8.83	13.53	12.12	1.41	5.19
1994	3.00	2.72	0.28	9.05	2.95	3.50	-0.55	3.27
1995	15.37	15.71	-0.34	9.16	15.54	12.28	3.26	4.10
1996	16.93	16.78	0.15	9.15	16.95	15.74	1.21	2.58
1997	20.38	20.24	0.14	10.07	20.38	19.81	0.57	2.52
1998	17.85	17.63	0.22	10.44	17.92	14.92	3.00	2.89
1999	10.88	10.20	0.68	12.26	11.01	10.07	0.94	22.45
2000	12.18	10.61	1.57	12.07	12.20	7.76	4.44	4.46
2001	-3.59	-2.91	-0.68	12.48	-3.47	-5.01	1.54	4.05
2002	-6.25	-6.13	-0.12	12.92	-6.21	-6.71	0.50	5.42
2003	3.17	2.97	0.20	12.57	3.07	4.39	-1.32	6.14
2004	15.43	13.70	1.73	12.45	15.30	14.57	0.73	3.47
2005	9.31	9.26	0.05	12.32	9.37	7.60	1.77	3.22
2006	10.79	10.42	0.37	12.41	10.82	8.45	2.37	2.59
2007	17.38	15.82	1.56	12.45	17.26	15.71	1.55	1.87
2008	-2.93	-3.55	0.62	12.38	-2.98	-3.80	0.82	0.80
2009	-18.77	-18.13	-0.64	10.14	-18.98	-17.88	-1.10	21.86
2010	11.90	11.80	0.10	9.67	11.96	10.77	1.19	6.12
Mean	8.35	8.07	0.29	10.91	8.42	7.19	1.22	5.70
Std. Error	2.21	2.15	0.15		2.34	2.18	0.32	

Table 2: Descriptive Statistics on Educational Endowment Returns

The table reports the mean annual percentage returns across endowments. The left-hand side of the table presents descriptive statistics for all endowments. The right-hand side of the table partitions the endowment universe into (1) Ivy League schools (Ivy), (2) Top-30 SAT schools outside the Ivy League, and (3) other institutions.

	All Endowments						Elite Institutions v. Others Mean Return		
Year	N	Mean	Std. Dev.	P25	Median	P75	Ivy	Top-SAT	Others
1991	346	7.35	3.52	5.60	7.50	9.20	3.55	7.65	7.42
1992	365	13.27	3.24	11.60	13.20	15.00	14.51	14.86	13.10
1993	384	13.46	4.37	11.00	13.65	16.00	16.54	13.98	13.35
1994	397	2.97	3.03	1.00	2.90	4.60	7.18	4.27	2.78
1995	415	15.40	4.13	13.20	15.40	17.30	15.49	16.77	15.30
1996	425	16.92	4.17	15.00	16.80	18.90	21.15	19.87	16.63
1997	435	20.37	4.72	17.90	20.30	22.70	20.95	21.04	20.31
1998	445	17.83	4.41	15.30	18.00	20.20	17.68	19.10	17.75
1999	577	10.79	4.73	8.20	10.70	13.30	12.24	12.56	10.68
2000	600	12.00	9.97	6.20	9.95	15.45	26.69	24.55	11.14
2001	564	-3.53	6.33	-7.15	-3.70	0.10	1.46	-5.83	-3.48
2002	601	-6.24	4.45	-8.70	-6.30	-3.80	-1.53	-6.29	-6.30
2003	643	3.15	3.08	1.60	3.00	4.60	6.24	2.80	3.13
2004	665	15.28	4.05	13.50	15.90	17.70	17.72	17.25	15.15
2005	683	9.31	3.31	7.50	9.00	10.90	15.75	13.56	9.03
2006	707	10.75	3.45	8.50	10.90	13.00	16.92	15.12	10.49
2007	723	17.23	3.83	15.50	17.50	19.10	23.79	21.85	16.95
2008	728	-2.99	4.03	-5.80	-3.30	-0.70	3.29	0.45	-3.21
2009	793	-18.73	5.30	-21.70	-19.10	-16.40	-21.99	-21.21	-18.60
2010	817	11.89	3.33	10.20	12.10	13.73	12.16	12.24	11.87
Mean		8.32	4.37	5.92	8.22	10.54	11.49	10.23	8.17
Std. Error		2.20	0.35	2.26	2.23	2.19	2.47	2.59	2.19

Table 3: Performance Persistence of University Endowments

Educational endowments are sorted into quintiles based on performance in each year. The bottom and top quintiles are split in half (into portfolios 1a and 1b for the bottom quintile and portfolios 5a and 5b for the top quintile). The table presents the annual percentage returns for each partition in the year following ranking.

	Endowment Returns sorted by Prior Year Performance								
Year	1a (Lo)	1b	2	3	4	5a	5b (Hi)	5a - 1b	5b - 1a
1992	12.89	13.44	13.61	12.58	13.09	12.81	15.54	-0.63	2.65
1993	10.03	11.67	12.96	14.38	14.62	14.77	15.19	3.10	5.16
1994	2.43	2.09	2.36	3.32	3.30	3.63	3.39	1.55	0.96
1995	17.64	15.51	15.79	15.46	15.22	13.60	15.46	-1.91	-2.18
1996	12.89	15.54	16.29	17.28	17.22	18.85	20.70	3.31	7.81
1997	14.77	19.57	19.96	20.36	21.17	22.25	24.50	2.68	9.73
1998	14.56	16.24	17.69	17.45	18.13	20.02	21.98	3.77	7.42
1999	8.45	10.16	10.16	11.36	11.88	12.12	12.68	1.96	4.23
2000	8.16	8.44	11.50	10.63	12.38	16.37	20.29	7.93	12.14
2001	0.80	-0.25	-1.92	-4.67	-4.41	-6.05	-6.95	-5.79	-7.75
2002	-10.79	-8.06	-7.23	-6.30	-5.54	-3.82	-1.03	4.24	9.76
2003	2.31	2.50	2.72	2.69	3.45	3.51	4.69	1.01	2.38
2004	15.59	15.42	15.76	15.44	15.19	15.26	13.88	-0.16	-1.71
2005	6.36	7.16	9.02	9.33	10.37	11.31	11.47	4.15	5.12
2006	7.12	9.00	9.65	10.45	11.89	12.93	15.69	3.93	8.57
2007	12.45	15.32	16.44	17.42	18.58	19.53	20.75	4.22	8.30
2008	-3.36	-3.98	-3.87	-3.45	-2.86	-2.61	0.68	1.37	4.04
2009	-19.58	-19.64	-19.16	-18.11	-19.63	-19.13	-18.82	0.51	0.76
2010	11.53	12.24	12.13	12.22	12.44	11.43	11.17	-0.81	-0.36
Mean	6.54	7.49	8.10	8.31	8.76	9.30	10.59	1.81	4.05
Std. Error	2.19	2.28	2.33	2.33	2.40	2.46	2.55	0.68	1.15

Table 4: Benchmark Description and Returns*, 1991-2010

Provider	Asset Class	Index Description	Mean	Std. Dev.
S&P 500 Index	US Stock	Cap-weighted return on S&P 500	9.0%	16.8%
Barclays Capital Aggregate Bond Index	US Bond	Cap-weighted return on treasury securities, government agency bonds, mortgage-backed bonds, corporate bonds, and international bonds traded in the US.	7.2%	4.4%
MSCI ACWI ex-US Index	International Stock	Cap-weighted return on publicly trade stocks in more than 20 developed and 20 emerging markets.	6.6%	17.0%
Cambridge Private Equity Index	Private Equity	Dollar-weighted return, net of fees, to limited partnerships covering more than 800 private equity investments in 2010.	15.2%	16.1%
HFR Aggregate Index	Hedge Funds	Equally weighted return, net of all fees, across more than 2,000 hedge funds in 2010 (minimum $50 million in AUM or 12-month track record).	12.1%	9.2%

* Annual returns from July to June, beginning in June 1991 and ending in June 2010.

Table 5: Alphas on Hedge Fund Benchmark, April 1990 to December 2010

The independent variable is the HFRI fund composite monthly return. The independent variables are the Fama-French market, size, and book-to-market factors. In the regression with lags, each factor is lagged through 3 months (L to L3). Annualized Alpha is monthly alpha times 12.

	Baseline Regression (No Lags)		Regression with Lags		
VARIABLES	Coef.	t-stat	Coef.	t-stat	Summed Coef.
mktrf	0.33	21.97	0.32	22.35	0.41
L.mktrf			0.06	4.19	
L2.mktrf			0.04	2.51	
L3.mktrf			-0.01	-0.85	
smb	0.17	8.45	0.15	7.59	0.21
L.smb			0.04	1.76	
L2.smb			0.01	0.52	
L3.smb			0.01	0.67	
hml	-0.02	-1.06	-0.05	-2.46	-0.06
L.hml			0.01	0.30	
L2.hml			0.00	-0.11	
L3.hml			-0.01	-0.44	
Alpha (annualized)	5.63	7.13	5.12	6.75	
Observations	249		249		
Adjusted R-squared	0.747		0.778		

Table 6: Alphas on Private Equity Benchmark, 1986.Q2 to 2010.Q4

The independent variable is the quarterly CRA private equity quarterly return. The independent variables are the Fama-French market, size, and book-to-market factors. In the regression with lags, each factor is lagged through 8 quarters (L to L8). Annualized Alpha is quarterly alpha times 4.

	Baseline Regression (No Lags)		Regression with Lags		
VARIABLES	Coef.	t-stat	Coef.	t-stat	Summed Coef.
mktrf	0.37	8.02	0.37	8.42	1.11
L.mktrf			0.11	2.47	
L2.mktrf			0.13	3.04	
L3.mktrf			0.06	1.42	
L4.mktrf			0.16	3.50	
L5.mktrf			0.04	0.77	
L6.mktrf			0.09	1.83	
L7.mktrf			0.06	1.15	
L8.mktrf			0.10	1.94	
smb	0.02	0.24	0.11	1.48	0.92
L.smb			0.20	2.57	
L2.smb			0.14	1.78	
L3.smb			0.11	1.54	
L4.smb			-0.06	-0.77	
L5.smb			0.24	2.91	
L6.smb			0.01	0.15	
L7.smb			0.18	2.22	
L8.smb			-0.01	-0.15	
hml	-0.04	-0.73	-0.06	-0.86	-0.09
L.hml			-0.17	-2.55	
L2.hml			0.04	0.59	
L3.hml			-0.03	-0.54	
L4.hml			-0.03	-0.42	
L5.hml			0.05	0.83	
L6.hml			0.02	0.24	
L7.hml			0.12	1.79	
L8.hml			-0.02	-0.28	
Annualized Alpha	6.82	4.55	1.36	0.78	
Observations	99		99		
Adjusted R-squared	0.467		0.640		

Table 7: Attribution Model Results for Average Endowment Returns, 1991-2010

The table reports the intercept (alpha) and estimated loadings for four attribution models that use various combinations of benchmark returns: (1) US Stock, US Bonds, (2) US Stock, US Bond, International Stock, (3) US Stock, US Bond, Hedge Fund, and Private Equity, and (4) US Stock, US Bond, International Stock, Hedge Fund, and Private Equity. In all models, estimated coefficients are constrained to sum to one.

	Coefficients (Weights)					*t*-statistics						
Alpha	US Stock	US Bond	Non-US Stock	Hedge Fund	Private Equity	Alpha	US Stock	US Bond	Non-US Stock	Hedge Fund	Private Equity	R2
0.06%	0.59	0.41				0.07	12.64***	8.91***				94%
0.48%	0.42	0.37	0.21			1.16	12.46***	14.97***	7.09***			99%
-2.05%	0.33	0.28		0.19	0.21	-3.85***	7.07***	6.16***		2.64**	4.08***	98%
-0.82%	0.36	0.31	0.12	0.12	0.10	-1.27	8.74***	7.73***	2.70**	1.77*	1.69	99%

Table 8: Attribution Model Results for Extreme Deciles of Past Performance, 1992-2010

The table reports the intercept (alpha) and estimated loadings for four attribution models that use various combinations of benchmark returns: (1) US Stock, US Bonds, (2) US Stock, US Bond, International Stock, (3) US Stock, US Bond, Hedge Fund, and Private Equity, and (4) US Stock, US Bond, International Stock, Hedge Fund, and Private Equity. In panels A and B (panel C), estimated coefficients are constrained to sum to one (zero).

Coefficients						*t*-statistics						
Alpha	US Stock	US Bond	Non-US Stock	Hedge Fund	Private Equity	Alpha	US Stock	US Bond	Non-US Stock	Hedge Fund	Private Equity	R2
Panel A: Bottom Decile												
-1.59%	0.53	0.47				-1.74	10.10***	8.92***				92%
-1.40%	0.40	0.43	0.17			-1.87*	6.58***	9.69***	3.09***			95%
-3.18%	0.35	0.36		0.16	0.14	-3.13***	4.05***	4.34***		1.20	1.40	94%
-1.96%	0.37	0.39	0.13	0.07	0.03	-1.44	4.34***	4.64***	1.33	0.53	0.23	95%
Panel B: Top Decile												
2.29%	0.62	0.38				1.93*	9.03***	5.61***				90%
2.58%	0.41	0.33	0.26			3.05***	6.03***	6.48***	4.20***			95%
-0.86%	0.25	0.20		0.24	0.31	-1.01	3.45***	2.88**		2.14**	3.80***	97%
-0.41%	0.26	0.21	0.05	0.21	0.27	-0.34	3.41***	2.85**	0.56	1.65	2.47**	97%
Panel C: Top - Bottom												
3.88%	0.09	-0.09				3.42***	1.31	-1.31				30%
3.98%	0.01	-0.11	0.09			3.52***	0.16	-1.56	1.10			39%
2.32%	-0.10	-0.16		0.08	0.18	1.69	-0.84	-1.42		0.46	1.34	51%
1.55%	-0.11	-0.18	-0.08	0.13	0.24	0.81	-0.93	-1.50	-0.59	0.66	1.38	53%

Table 9: Attribution Model Results for Ivy League, Top-SAT, and Other Endowments, 1991-2010

The table reports the intercept (alpha) and estimated loadings for four attribution models that use various combinations of benchmark returns: (1) US Stock, US Bonds, (2) US Stock, US Bond, International Stock, (3) US Stock, US Bond, Hedge Fund, and Private Equity, and (4) US Stock, US Bond, International Stock, Hedge Fund, and Private Equity. In panels A to C (panel D and E), estimated coefficients are constrained to sum to one (zero).

Table 9, cont'd

Coefficients						*t*-statistics						
Alpha	US Stock	US Bond	Non-US Stock	Hedge Fund	Private Equity	Alpha	US Stock	US Bond	Non-US Stock	Hedge Fund	Private Equity	R2
Panel A: Ivy												
3.23%	0.58	0.42				1.98*	6.06***	4.35***				78%
4.02%	0.27	0.34	0.39			3.81***	3.12***	5.32***	5.19***			92%
-1.17%	0.04	0.17		0.32	0.48	-1.10	0.40	1.83*		2.29**	4.66***	95%
0.02%	0.06	0.20	0.12	0.25	0.37	0.01	0.66	2.09*	1.11	1.67	2.68**	95%
Panel B: Top-SAT Schools (ex. Ivy)												
1.86%	0.65	0.35				1.38	8.13***	4.43***				87%
2.49%	0.39	0.29	0.32			2.76**	5.33***	5.29***	4.91***			95%
-1.85%	0.19	0.14		0.27	0.40	-2.22**	2.58**	2.01*		2.44**	5.05***	97%
-1.23%	0.20	0.16	0.06	0.23	0.35	-1.02	2.64**	2.10*	0.73	1.91*	3.15***	97%
Panel C: Others												
-0.09%	0.58	0.42				-0.11	13.06***	9.33***				95%
0.32%	0.42	0.38	0.20			0.81	13.17***	15.92***	7.18***			99%
-2.08%	0.34	0.29		0.18	0.20	-3.90***	7.27***	6.36***		2.50**	3.85***	98%
-0.80%	0.37	0.32	0.13	0.10	0.08	-1.27	9.16***	8.19***	2.84**	1.61	1.45	99%
Panel D: Ivy – Others												
3.32%	0.00	0.00				3.38***	-0.02	0.02				0%
3.70%	-0.15	-0.04	0.19			4.68***	-2.37**	-0.80	3.36***			63%
0.91%	-0.30	-0.12		0.15	0.28	1.16	-4.40***	-1.84*		1.41	3.71***	79%
0.82%	-0.30	-0.13	-0.01	0.15	0.29	0.71	-4.16***	-1.74	-0.11	1.30	2.71**	79%
Panel E: Top-SAT Schools (ex. Ivy) – Others												
1.94%	0.06	-0.06				2.64**	1.48	-1.48				33%
2.17%	-0.03	-0.09	0.12			3.31***	-0.53	-2.23**	2.47**			59%
0.23%	-0.15	-0.15		0.09	0.21	0.36	-2.74**	-2.73**		1.10	3.41***	79%
-0.42%	-0.17	-0.16	-0.06	0.13	0.26	-0.47	-2.91**	-2.92**	-1.03	1.42	3.20***	80%

Appendix: Top SAT Schools (Excluding Ivy League)

Schools are ranked based on the 75th percentile of Math SAT scores in 1991, 1996, 2001, and 2006. Data for 1991 and 1996 are from College Board. Data for 2001 and 2006 are from the Integrated Postsecondary Education Data System (IPEDS, available online at http://nces.ed.gov/ipeds/). For 1991 and 1996, schools with less than 200 freshmen are not ranked. For 2001 and 2006, schools with less than 1000 total students are not ranked.

	Ranking Year			
Institution	1991	1996	2001	2006
Amherst College	--	750	750	760
Bowdoin College	--	710	--	730
Brandeis University	--	710	720	--
California Institute of Technology	780	800	800	800
Carleton College	710	720	720	740
Carnegie Mellon University	730	750	760	780
Case Western Reserve University	710	740	730	--
Claremont McKenna College	700	710	720	730
Colgate University	710	--	--	--
Cooper Union	760	--	--	--
Davidson College	730	710	--	--
Duke University	740	750	--	790
Emory University	--	720	740	740
Georgetown University	--	710	730	740
Georgia Tech	710	730	730	--
Grinnell College	--	710	--	730
Haverford College	710	720	720	740
Illinois Institute of Technology	--	720	740	--
Johns Hopkins University	730	740	760	760
Lawrence University	--	710	--	--
Massachusetts Institute of Technology	780	790	800	800
Michigan Technological University	--	--	--	770
Middlebury College	--	--	--	740
Northwestern University	710	720	750	760
Pomona College	740	740	760	760
Reed College	710	--	--	--
Rensselaer Polytechnic Institute	720	710	720	740
Rice University	750	780	770	770
Rose-Hulman Institute of Technology	730	730	720	--
Stanford University	750	760	780	780
Swarthmore College	720	730	760	760
Tufts University	--	--	--	740
University of California-Los Angeles	--	--	720	--
University of California, Berkeley	720	730	740	740
University of Chicago	720	720	740	780

Cont'd

Appendix: Top SAT Schools (Excluding Ivy League) Cont'd

	Ranking Year			
Institution	1991	1996	2001	2006
University of Iowa	--	790	--	--
University of Michigan	700	--	721	--
University of Notre Dame	720	--	730	760
University of Southern California	--	--	--	740
University of Virginia	700	--	720	--
Vanderbilt University	--	--	--	740
Wake Forest University	700	--	--	--
Washington and Lee University	710	--	--	--
Washington University in St Louis	--	--	740	780
Wesleyan University	730	--	720	740
Williams College	730	750	750	760