# How Does Human Capital Affect Investing? Evidence from University Endowments*

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**Abstract**

We examine the links between human capital and endowment investing. Harnessing detailed information on university endowments, we find that higher asset allocations to alternative assets accompany higher levels of human capital in the endowment's investment process. Moreover, high levels of human capital are linked to larger returns, even on a risk-adjusted basis. The improved investment outcomes arise because endowments capture higher returns that can accompany alternative assets, select or have access to high performing managers, and minimize fees by accessing funds directly rather than through funds of funds. Our measures of human capital include expertise in alternatives on governing bodies, the presence of a chief investment officer and the size of the investment staff. We also find that a university board's professional networks are linked to higher allocations to private equity. Finally, we conduct a novel survey of endowments and confirm that human capital is central in facilitating alternative investments.

**Keywords:** Endowments, Human Capital, Private Equity, Returns, Venture Capital.

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University endowments spend billions of dollars a year to support higher education in the United States. Rather than rely on investments in public securities such as stocks and bonds to fund this spending, many (and especially large) endowments have substantial allocations to "alternative" assets, such as hedge funds, private equity, or venture capital. One explanation for the shift to alternative assets is the opportunity to earn higher risk-adjusted returns by capturing illiquidity premia and the diversification potential that accompany private assets. Another potential opportunity in alternatives stems from active management to identify and access high performing managers, since private markets are less efficient than public markets due to frictions in trading and obtaining information. Given their mission and profile, endowments may be well positioned to bear illiquidity and to invest with top performing managers in private assets based on expertise, links to alumni, long time horizons and few constraints on investment choices [Gilbert and Hrdlicka (2015); Hansmann (1990); Tobin (1974)].

These arguments undergird the *"endowment model"* (often called the Yale model due to its development there by David Swensen [Swensen (2009)]) which has been adopted by many university endowments. Despite these possible benefits, active management and investing in alternative assets comes with frictions and costs. Investments in many alternatives are illiquid, not easily scaled, and have high search and monitoring costs. An endowment needs considerable expertise to make successful investments in these areas. In an open letter in 2016, Warren Buffett challenged the endowment model. Yale responded:

> In advocating the adoption of a passive indexing strategy, Buffett provides sound investment advice for the vast majority of individuals and institutions that are unable (or unwilling) to commit the resources (human and financial) necessary for active management success. Yet, Buffett's advice is not appropriate for the cohort of endowments that possess the capabilities to pursue successful active management programs. The fabulous returns generated by the top performers result from long-standing commitments to sound investment principles implemented by top-

notch investment teams under the oversight of world-class governance bodies (Yale Endowment Annual Report, 2017).

This paper provides the first study of the role of human capital in the investment management of university endowments by examining effects on asset allocations and resulting returns. To measure human capital, we look at the professional backgrounds of endowment investment committee members, whether there is a chief investment officer (CIO) and the size of the in-house professional investment team. These provide broad measures of the skills, knowledge, and experience that the endowment uses in the investment process. We pay particular attention to alternative assets (hedge funds, private equity and venture capital) which play a large role in the "endowment model" and may require specialized expertise for investing. In addition, we construct a measure of the professional networks of university trustee boards. These networks can augment the endowment's human capital and may be especially important in private assets that are more difficult to access and navigate. Paralleling our large-scale empirical analysis, we conduct a novel survey of endowments, asking specific questions about the roles of human capital in the investment process.

Our analysis uncovers several features of university endowment investments.

First, we document the substantial shift to alternative assets which is especially pronounced for larger endowments (first described by Healey and Hardy (1997) and Lerner et al. (2008)). For endowments with assets above one billion dollars, the average allocation to alternatives is almost fifty percent.

Second, we show that large university endowments, on average, have strong investment returns, much higher than smaller funds. Moreover, this effect is not simply due to taking on higher levels of risk; large endowment portfolios have higher returns per unit risk as expressed in higher Sharpe ratios. We also find that endowments, on average, outperform benchmarks based on their asset allocation weights, suggesting that they generate extra returns from active management. Overall, our results suggest that, on average, large endowments have earned higher total returns due to investing in alternative assets. Part of the return increase

is due to harvesting higher returns in an asset class (e.g., a liquidity premium in alternative assets) and part may be due to active management within an asset class.

Third, we show notable differences across endowments in terms of the human capital used in the investment process. We find that more investment committee expertise in alternative assets goes along with higher allocations to those assets. This effect is true even after controlling for endowment size. Moreover, the nature of expertise appears granular; expertise in hedge funds matters for allocations to hedge funds, whereas expertise in private equity or venture capital matters most for those specific areas. Consistent with this pattern, we find that having a CIO and a larger internal investment staff are positively linked to allocations to private equity and venture capital, both of which involve complexities such as managing capital calls and dealing with illiquidity. For hedge funds, however, the presence of a CIO or larger investment teams are not linked to allocations. These findings across hedge funds, private equity, and venture capital are consistent with the relative difficulty of managing and accessing these alternative asset classes. These results support the critical role an endowment's human capital in supporting an investment strategy which includes alternative assets. Related to this, we learn from a survey respondent:[1] *"We seek at least one member with demonstrated experience in alternative investments."* Another respondent identifies expertise as a constraint: *"I would like to have more expertise in investments on the committee. We are a small liberal arts college, with many lawyers, and no investment professionals, on the Board of Trustees."*

Fourth, in addition to human capital, we find that professional networks of board members matter, especially for allocations to private equity and venture capital. This is consistent with being able to overcome restrictions or barriers to investing in funds that might otherwise be difficult or impossible to access. Our survey corroborates the empirical findings, where privileged access to restricted funds might arise from business connections. For example, responses to our survey reveal: *"Some members have network connections with leading fund*

[1]To complement our empirical findings, we conduct a survey of endowment boards and managers for 132 institutions across the United States. Section 5 describes our methodology and findings.

*managers...(which) helped the endowment gain larger allocations in capacity constrained funds...(these funds) have been top performers in the portfolio."* Similarly, *"Several members are proactive in suggesting potential managers for investment...(these managers) are closed or highly sought after."*

Fifth, the returns experienced by endowments are related to the level of human capital in the investment area. In addition to being linked to asset allocations, human capital leads to higher "selection" returns within alternative assets, that is, extra returns having controlled for benchmarks of average performance in an asset class. This is consistent with an enhanced ability to identify better investment opportunities, and/or perform continuing due diligence on existing and potential managers. The importance of human capital emerges even after controlling for endowment size and is particularly notable in private equity. This is consistent with the importance of access to high performing private equity partnerships.

Sixth, we provide evidence on specific parts of the investment process. We find that human capital affects how endowments navigate choices between accessing funds directly rather than through funds of funds. Endowments with more human capital resident in their investment committees and professional staffs are more likely to use direct funds to invest in alternative assets, rather than funds of funds which have an additional layer of intermediation and fees. This is consistent with an increased ability to understand, oversee, and access direct funds. Having more human capital also reduces the use of external consultants, thus avoiding those fees.

Lastly, to provide additional insights on how allocations and performance are linked to human capital and networks, we conduct a survey of endowments to mitigate endogeneity concerns and dig further into the investment process. The 132 responding institutions collectively represent almost 20% of university endowments represented in the NACUBO-Commonfund data, and manage more than 60% of total market value as of 2015. About three-fifths of the respondents are CIOs, CFOs, or senior investment directors. Our survey reveals a number of key features consistent with a direct effect of human capital from the

investment committee on asset allocation and, ultimately, on performance. First, more that 90 percent of respondents said the investment committee of the board was very important in setting the strategic asset allocation; the corresponding figure was over 70 percent for tactical asset allocation. Second, more than 70 percent of respondents agree that the committee has historically had a positive impact on investment returns. Third, more than 80 percent consider the role of the committee as crucial for the fund's investment process. In addition, our survey reveals that participants in the investment process (e.g. senior staff of endowments) benefit from more knowledgeable and better-connected governance bodies, citing more frequent recommendations of and access to alternative investment funds, especially those that might be restricted or closed. Overall, these findings provide direct evidence from leading endowments that confirm a prominent role for human capital and networks, and partially alleviate econometric concerns related to endogeneity.

Overall, our results indicate that endowments likely benefit from talented investment teams and from seeking out investment experts to serve on governing bodies. The potential benefits seem highest in areas such as private equity and venture capital, where investments are often harder to analyze and access.

# 1 University Endowments and Past Research

University endowments make headlines every year when they report asset allocations and returns. On behalf of their schools, these endowments in the U.S. collectively manage about 640 billion dollars (2020 NACUBO-TIAA Study of Endowments) and annually spend 4 to 5 percent of this aggregate wealth on, among other things, scholarships for students, support for faculty, and investments in infrastructure for teaching and research. The investment performance of endowments is thus vital for the future of what schools strive to accomplish.

Summary data from NACUBO record high cumulative returns for the very largest endowments over the last three decades. As displayed in Figure 1, a dollar invested in the

set of the very largest endowments (as classified by NACUBO) in 1987 would have grown to almost 20 dollars by 2020. This is notably higher than the wealth generated by other size categories of endowments or a passive strategy of investing in stocks (60%) and bonds (40%). Such patterns undergird the strong interest in the endowment model adopted by some universities.[2]

University endowments provide an especially good laboratory for research on institutional investing and are often viewed as innovators in investment management. They typically have a long-term (infinite) investment horizon, few restrictions on asset choice, and favorable tax status which may reduce frictions. Moreover, endowment decisions are likely to be less influenced by external political forces or other constraints facing many large institutional investors such as public pension funds.

We study the role of human capital in the investment management of university endowments by examining effects on asset allocations and resulting returns. To measure human capital, we look at the professional backgrounds of endowment investment committee members, whether there is a chief investment officer (CIO) and the size of the in-house professional investment team. These provide broad measures of the skills, knowledge, and experience that the endowment uses in the investment process. We pay particular attention to alternative assets (hedge funds, private equity and venture capital) which play a large role in the "endowment model" and may require specialized expertise for investing.

Research on investments in public markets suggest that human capital and expertise can improve investment results. Studying institutional asset managers for public equities, Chaudhuri et al. (2020) find that investment products managed by firms in which PhDs play a key role deliver better performance. Moreover, higher talented PhDs (as proxied by publication record) deliver even better investment results. Bodnaruk and Simonov (2015) find that mutual fund managers with financial expertise do not outperform, but they do

[2]These cumulative returns for the very large endowments correspond to an average annual return of 9.8% compared to 8.7% for the large category, 8.0% for medium and 7.5% for small. As explained in the data section of this paper, we have detailed endowment-specific information beginning in 2004. The data in Figure 1 come from aggregate reports issued annually by NACUBO.

better in stocks for which they have an information advantage. Given the complexity of investing in alternative assets versus public equities, human capital may play an even larger role; however, data for research on alternative assets are more limited.[3]

Earlier research suggests that endowments do have an edge in alternative investing and suggest a link to human capital and networks. Lerner et al. (2008) find that large endowments' shift towards alternative investments was accompanied by higher returns, and conclude that top endowments have superior ability to select and access managers. They caution, however, against a simple mimicking strategy of higher allocations to private equity since success may depend on an endowment having the ability to select and access high performing funds. Sensoy et al. (2014) also document that endowments enjoyed superior returns in private equity over the 1991-1998 period. After 1998, however, the authors find that other institutional limited partners do just as well and attribute this erosion of endowments' advantage to a maturation of the private equity industry. Cavagnaro et al. (2019) report that more institutional investors (limited partner investors in private equity) do consistently better or worse (relative to median returns) than can be explained without the presence of differential skill among the private equity managers. Li et al. (2011) study the importance of human capital in hedge funds and document that manager characteristics, such as education and career concerns, lead to higher risk adjusted returns, more inflows and fewer risks.

In contrast, research on pensions uncovers potential negative effects of human capital (or the lack thereof) on investing. Andonov et al. (2018) find that the lack of financial experience on the board of a pension fund contributes to poor investment performance. Moreover, pensions whose boards have a high fraction of government officials have lower returns within investment categories, such as real estate and venture capital, likely due to political pressures favoring certain (sub-optimal) investments.

Academic research on endowment portfolio performance is limited [Barber and Wang (2013); Brown et al. (2010)]. Studying the 1991-2011 period, Barber and Wang (2013)

[3] Gompers et al. (2009), Krishnan et al. (2011), and Sørensen (2007) study the link between VC specialization and experience, and investment outcomes and firm success.

conclude that university endowments do not exhibit any ability to beat high level benchmarks through selection or timing skills. They conclude that "elite" institutions (e.g. Ivy League and high SAT level schools) benefit from higher returns on alternative assets (e.g. due to high allocations) but do not earn any extra returns over and above private asset benchmarks. Barber and Wang (2013) do not, however, develop specific measures of human capital and networks.[4]

More recently, there is a growing literature on non-profit endowments taking advantage of IRS data (filed in form 990). Dahiya and Yermack (2020) and Lo et al. (2020) study investment returns of non-profits in the United States. Since IRS data only begin in 2009, these studies are constrained to using information only after the financial crisis rather than a fuller sweep of experience as shown in Figure 1. Moreover, they do not investigate how human capital affects investing. Binfarè and Harris (2020) use IRS data to study compensation contracts of investment officers and how sensitive they are to endowment performance.

The focus of this paper is on how an endowment's human capital affects asset allocations and returns, particularly decisions about alternative assets. Schools have adopted different plans for governing and managing endowments but most share some common features. The typical governance structure includes a Board of Trustees that specifies spending policies, broader fund objectives, and delegates responsibilities. Responsibilities are often given to an investment committee, often a subset of the larger trustee board, which sets investment policy and risk limits. In turn, the investment committee often further delegates investment and operational power to a management staff. For larger endowments, the investment committee may delegate substantial discretion to a full-time staff that includes a Chief Investment Officer (CIO) and a range of investment professionals. These professionals and dedicated teams often improve due diligence of prospective managers and leverage expertise within each distinct asset class (e.g. director of private equity, director of absolute return strategies).

[4]While not directly addressing endowment performance, there is limited research on the impact of financial and income shocks on endowment spending and asset allocation [see, for example, Brown et al. (2014); Dimmock (2012); Rosen and Sappington (2016)].

In small endowments, there may be few or no professional staff with investment expertise, and the investment committee itself remains closely involved with details of the investment process, often working with a consultant. Endowments typically create an Investment Policy Statement codifying key features of endowment policy.[5]

# 2 Data Sources and Endowment Characteristics

## 2.1 Data Sources

Data on returns, allocations, and human capital come from comprehensive annual surveys of higher education endowments by the National Association of College and University Business Officers (NACUBO).[6] We have surveys for the years 2004 through 2015, thus including data from both before and after the financial crisis (missing from some earlier research and studies relying on IRS data). NACUBO provides an individual endowment's overall annual net return and details on its asset allocation. The vast majority of endowments report asset allocations at a granular level. Most, however, only report returns at the overall portfolio level.

In addition, NACUBO reports an array of data such as the endowment's size, spending rate, and whether it is public or private. Our measures of human capital include the expertise in alternative investments brought by investment committee, whether the endowment employs a CIO and the size of its internal investment team.

To supplement NACUBO data, we use BoardEx which identifies individuals by name (which NACUBO does not). This allows us to measure professional networks of University Trustee boards. BoardEx covers comprehensive biographical data on business leaders (from top

[5] A number of surveys and analysis of governance structures are available from industry sources, including NACUBO, Cambridge Associates, and the Greenwich Roundtable. Some universities set up the endowment as a separate management company with its own separate board. Some have blended models that outsource staff responsibilities to another firm which has a Chief Investment Officer and professional staff.

[6] NACUBO and the Commonfund Institute joined forces in 2009 to create a single, comprehensive annual study of higher education endowments (NCSE).

executives to mid- level managers). We identify individuals (including trustees) associated with nonprofit organizations.[7] Network measures are based on connections to individuals through current or past employment, educational experience or social history through organizations. For instance, if an individual had at one time worked for Carlyle (a leading private equity firm), the individual would be matched with all individuals in BoardEx who had worked for Carlyle at the same time. We match NACUBO and BoardEx to create a panel of 878 endowments (6,677 endowment-year observations) over the 2004-2015 period. To develop measures at the endowment level we aggregate across individuals that serve in governance roles at the endowment in that year.

BoardEx data also allow us to develop more granular measures of expertise in alternative assets (in hedge funds, private equity and venture capital) based on employment history. For instance, if BoardEx identifies an individual as having worked for a venture capital fund that person would be classified as having expertise in alternatives and within that category as having venture capital expertise. NACUBO only identifies "significant expertise in alternative assets". The Appendix provides additional detail.

While our measures from BoardEx cover the vast majority of endowments in NACUBO, a potential concern is that analysis which requires BoardEx data will be on a sample that is not representative of endowments generally.[8] However, we find that endowments for which we can develop a network measure represent over four fifths of the aggregate market value covered by NACUBO.

Our analysis uses net returns from NACUBO to evaluate investment performance. As a check, we compare these returns to those estimated from IRS data as filed in Schedule D of a non-profit's 990 form.[9] As in Dahiya and Yermack (2020), we compute total net returns in a given fiscal year and compare these to the self-reported return figures from NACUBO.[10]

[7] We collect information on 31,413 individuals across 878 endowments over the 2004-2015 period.

[8] We thank Veronika K. Pool, discussant at the 2019 Western Finance Association Meetings, for bringing these issues to our attention.

[9] Organizations exempt from income tax report under section 501(c), 527, or 4947(a)(1) of the Internal Revenue Code.

[10] Matching the IRS data and NACUBO leads to an 85% overlap between the two sources.

For the overlapping years in the samples, we find a time-series correlation of 0.92 and no statistically significant differences in returns between the two sources. Means and standard deviations also do not differ for subsets of endowments partitioned by size.

## 2.2 Endowment Characteristics

NACUBO data illustrate key features of the endowment landscape: large differences among schools in assets under management, investment patterns and returns. A few endowments have assets above $10 billion but the simple average across the NACUBO sample is just below $500 million, and the median figure is around $91 million. Figure 2 displays asset allocations to alternative assets accompanying adoption of the endowment model by many universities. Larger endowments tilt their allocation toward alternative strategies, investing about half of their assets in alternatives, while smaller endowments allocate only about one fifth. Smaller endowments have increased allocations to alternatives steadily over time but still have much smaller allocations than larger funds.

Table 1 provides more detailed information on endowment characteristics. Panel A emphasizes the large role endowments play in university life: the average endowment spends 4.46% of assets annually and funds 9.83% of the school's budget. The figures also show the differences in size across endowments. While the mean endowment size is $498 million, three fourths of endowments have assets less than $288 million. Panel B provides more detail behind the asset allocation trends seen in Figure 2 and the differences between large and small endowments. The "average" endowment allocation to domestic equity is 36.3% and about one fourth is alternative investments (23.6%). If the figures are weighted by dollars, the last column of Panel B shows only about one fifth of total endowment dollars (19.6%) are in domestic equity and almost half (48.3%) are in alternatives. This large difference between the weighted and simple average reflects the role of big endowments which have large allocations to alternatives.

Panel C of Table 1 and Figure 3 provide insights on endowment returns. Figure 3 plots

average returns for three size groups of endowments. The difference in returns between large and small endowments is striking: large funds outperform their smaller peers by over 2 percent annually. This is consistent with the data shown in Figure 1 over a much larger sweep of history. Large endowments clearly have higher returns than do smaller endowments. As shown in the first row of Panel C, the average endowment return is 7.42% which rises to 9.73% on an asset weighted basis due to the higher returns of large endowments. Panel C also presents Sharpe ratios measuring returns per unit risk (as described in the Appendix). The Sharpe ratio of 0.82 on an asset weighted basis is higher than the simple average of 0.59, suggesting that the higher returns of larger endowments are not simply the result of taking on higher portfolio risks. We caution, however, that measures of portfolio risk are notoriously difficult when private assets are involved. Quoted values for private assets are often stale, may be measured with substantial error and can present a "smoothed" version of the actual risk in the asset class. As described in the Appendix, we take explicit steps to adjust risk measures for these features but acknowledge their limitations.

Finally, Panel D of Table 1 summarizes measures of human capital along with other information on the size of the investment committee and endowment networks (as measured by trustees' professional connections). As expected, the data display quite different situations across endowments. Backgrounds for an "average" endowment show that 31 percent of investment committee members have experience in alternatives. The quartile figures portray a more complex story and stark differences across endowment size; on a dollar-weighted basis, 47 percent of investment committees have experience in alternatives. A comparison of simple and dollar-weighted averages also shows that large endowments tend to have larger networks, larger investment committees, bigger professional staff and are more likely to have a full-time CIO. Strikingly, while less than one in five endowments has a CIO, dollar weighted figures show that almost two-thirds of all endowment assets are managed using a full-time CIO.

# 3 Human Capital and Asset Allocations

To investigate endowments' asset allocations we use a pooled regression with fixed effects. The dependent variable is the allocation to an asset class (e.g. alternative assets) by a given endowment in a given year expressed as a percentage of total assets. We cluster standard errors at the endowment level to allow for correlation in the error term over time for a given fund. For an endowment in a given year, human capital measures include the fraction of the investment committee members with expertise in alternative assets, the presence of a full-time CIO (0/1 dummy coded 1 if there is a CIO), and the size of the in-house professional staff managing the endowment. Having a CIO and a large professional staff adds in-house expertise and is likely related to a different division of responsibilities between the governing body and staff such as setting investment policy, due diligence on managers, monitoring, and portfolio construction. We also include the size of the investment committee and the size of the school's network.

In some specifications we include controls for the market value of the endowment. Endowment size captures the role of scale in the ability to invest in asset classes not easily accessible to smaller funds. Fixed effects are assigned based on time (fiscal year), location and whether the school is public or private (0/1 dummy coded 1 if public). Year fixed effects control for market–wide shocks to all institutions in a given fiscal year. A public/private dummy captures potentially different roles for governing bodies, different risk limits, and different constraints on asset classes. The fixed effect for an endowment's location captures factors which may influence endowment behavior such as the proximity to investment opportunities and investment talent. Location fixed effects group endowments into deciles based on the minimum distance of their headquarters to Boston, Chicago, New York City, or San Francisco [Dahiya and Yermack (2020)].

Table 2 examines allocations to alternative assets. The significant positive coefficients on the range of human capital variables document their strong link to higher allocations to

alternatives. Even when we control for size and whether the endowment is public or private, regressions (2) and (3) show significant positive effects of alternatives expertise, investment committee size, the presence of a CIO and a larger in-house investment team. Size is also significantly positively linked to alternative allocations, whereas public schools have lower allocations likely reflecting different risk limits, constraints on asset classes, or background risk. When we add networks, regression (4) shows they also have a significant positive effect on allocations to alternatives. Coefficients on other variables in regression (4) are quite similar to those when networks are not included and remain significant, again signaling the importance of different dimensions of human capital. The modest drop in the significance of coefficients for investment team size and the public/private dummy is likely due, at least in part, from the reduction in sample size since we require BoardEx data to measure networks. The results in Table 2 show that human capital residing in an endowment's governing bodies and professional staff is strongly linked to higher allocations to alternatives. This is true even when controlling for size and is consistent with the skill and infrastructure necessary to deal with asset classes that are more difficult to access, create liquidity issues, and are harder to evaluate and manage than traditional public assets.

To illustrate impacts, we calculate the implied increase in the allocation to alternatives associated with a one standard deviation increase in a human capital variable. For a one standard deviation increase in the proportion of alternative specialists on the investment committee, the increase in allocation is 2.93 percent. Looking at the size of the in-house team (network), the increase in allocation is 1.04 (1.63) percent. Moreover, the presence of a CIO is associated with an almost 3.50 percent increase in allocation to alternatives. Taken together, these effects show that expertise resident in both the governing bodies and in in-house investment teams goes hand-in-hand with moves to alternative assets. These links are consistent with the increased complexity of analyzing and accessing alternative assets compared to public markets. Not surprisingly, the increased allocations to alternatives signaled in Table 2 are mirrored by reductions in allocations to public equity and debt as

shown in the Appendix (see Table A.1).

We also investigate whether human capital in governing bodies is more important for allocations to alternatives if the endowment did not have a full-time CIO. In these situations, the investment committee typically has a larger role in portfolio management and its expertise, as well as the school's network, may be even more important for allocations to alternative assets. As shown in Table A.2 in the Appendix, we repeat our regressions on partitions of the sample based on the presence of a CIO. We find highly significant coefficients on alternative expertise in both subsets of endowments. The coefficients are similar in magnitude to those shown in Table 2 and signal the importance of this expertise across all endowments. There are some interesting differences comparing results from the subsamples. Estimates based on endowments with a CIO, show even more significant roles for the size of the investment committee and investment team even when we control for endowment size. This is consistent with these attributes being combined in an "endowment model" of investing. We also find for endowments that do have a CIO, the regression coefficient on the public/private dummy is not significantly different from zero whereas it is highly significant for the sample without a CIO. This pattern suggests that the constraints and political issues that face many public institutions are not in place for others. Moreover, the coefficients suggest that networks matter most for endowments without a CIO, likely signaling the enhanced importance of these contacts in those situations.

An endowment's human capital and allocations to alternatives are almost certainly determined simultaneously and involve feedback loops. For instance, having alternatives expertise on an investment committee increases the capacity to navigate and access alternative assets and thus make them more attractive as investments. In turn, higher allocations create incentives to have expertise on the investment committee to oversee, help access and provide insights on those investments. As we report later in the paper, our survey of endowment staff and investment committee members (see Section 5 for details) reveals exactly this type of back and forth interaction between expertise and allocations.

The simultaneity of human capital and allocations to alternatives naturally raises estimation issues related to endogeneity.[11] The joint determination of human capital and allocations is complex, however we conduct a series of additional tests to sharpen our understating of the strong positive correlation between human capital measures and allocations. We are particularly interested in the link between investment committee members expertise in alternatives and allocations to alternatives, given survey evidence (detailed later) that committee members may be an important resource in areas such as private equity and venture capital.

As a first test, Table 3 considers the sample of endowments that had a zero allocation to alternatives at some point over the sample period.[12] In the first three columns, the dependent variable takes a value of one if the endowment has a positive allocation to alternatives, zero otherwise; the independent variable for alternative expertise takes a value of one if alternative experts sit on the investment committee in the previous period, zero otherwise. Columns (1) to (3) suggest that endowments with some alternative expertise on their investment committee are 14 to 20 percent more likely to be investing in alternative investments in the following period. This finding suggests that expertise is not simply caused by higher allocations but is part of a more complicated process. Column (4) takes a slightly different approach, in which the dependent variable is 1 if it is the first year the endowment has an allocation to alternatives, 0 otherwise; the alternative expertise variable is 1 if the prior year is the first time the endowment has an alternative expert on the committee, 0 otherwise. The results show that when expertise in alternatives is first added to the committee, there is an 8 percent higher likelihood that the endowment decides to invest in alternative assets in the following year. Since only about 3 percent of the observations in column (4) have a CIO, the results suggest that the decision to invest in alternatives is influenced by the governing body

[11] One standard approach to the issue is stymied by the lack of obvious instrumental variables. Factors that affect the pool of human capital in alternatives (e.g. quality of institution as measured by academic scores) likely also have direct effects on allocation (e.g. GPs seeking prestige investors).

[12] 409 unique endowments had a zero allocation to alternatives at some point over the sample period. 313 of these unique endowments also had available information about their investment committees.

rather than simply reflecting views of professional staff.

As a second test, we estimate regressions from Table 2 but using endowment fixed effects to capture time-invariant unobserved differences in endowments that may impact expertise and allocations. These model specifications effectively look at within endowment variation in allocations as a function of human capital. As reported in Table A.3 in the Appendix, these regressions show a significant positive coefficients on alternatives expertise and on the size of the investment team. The results also hold true when using lagged measure of independent variables. Thus, as human capital changes in the endowment so do allocations.

We also estimate specifications controlling for other time-varying endowment characteristics that might be related to allocations or expertise. In the Appendix (see Table A.4), we confirm the positive effect of the human capital variables on allocation to alternatives remains even after we control for the amount of gifts and donor contributions to the endowment, the proportion of investment committee members that are non-trustees, and the percentage of the institution's budget covered by spending from the endowment. The human capital effects also hold if we use a zero-one dummy for whether the school is in the Ivy League.[13]

Taken together, our results suggest that the human capital embedded in an endowment's investment process is not simply the result of decisions about allocations but is part of a larger evolution of an investment process over time. Our survey results illustrate some of these more nuanced patterns.

So far we have used investment committee expertise across a spectrum of alternative investments as reported by NACUBO. But subsets of alternatives can be quite different in terms of their liquidity, investment thesis and investment horizon (e.g. hedge funds versus private equity versus venture capital). Table 4 explores the effects of expertise and networks

[13]To address concerns about the endogeneity of networks, we estimate a two-stage least squares (2SLS) regression using the number of separate industries in which trustees work as an instrument for the network measure [Faleye et al. (2014)]. While the number of industries is highly correlated with the number of connections (high F-statistic in the first stage), there is no ex-ante reason to believe that asset allocations to alternatives would be linked to trustee exposure across industry sectors in terms of executive or board positions held. The Online Appendix shows that we still find a positive and significant relationship between networks and allocations to venture capital and private equity.

more thoroughly by looking separately at allocations to hedge funds, private equity, and venture capital rather than lumping them together. To explore this variation, we use granular measures of expertise specific to the sub-asset classes developed from BoardEx data (see the Appendix for a detailed description of our data and sample construction).

The first three columns of Table 4 focus on hedge funds whose assets are mostly public securities, unlike the private companies held by private equity and venture capital funds. We first introduce measures of human capital and then add other variables in subsequent specifications. The regressions show that types of expertise in alternatives are not equal in how they affect allocations. For instance, controlling for all variables in column (3), hedge fund expertise remains significantly positively linked to hedge fund allocations, but this is not true for expertise in private equity or venture capital. We also note that for hedge funds the presence of a CIO or a larger internal staff are not significant nor is our measure of network. We will return to these patterns after considering allocations to private equity and venture capital.

Columns (4) through (6) of Table 4 look at private equity. Once we control for all human capital characteristics, the results in column (4) show that private equity expertise is statistically significant and positively linked to allocations to private equity. On the other hand, expertise in hedge funds or venture capital is not. The findings also show a significant positive coefficient on all the other human capital variables. Columns (5) and (6) shows that the size of the endowment is significant as are the presence of a CIO and large networks. Notably for private equity, public institutions have lower allocation than their private counterparts even after we control for all other variables.

The last three columns of Table 4 examine venture capital. When all variables including size are included, columns (8) and (9) show a significant positive effect of venture capital expertise. Moreover, all of the other human capital variables have significant coefficients except for expertise in hedge funds and private equity.

Table 4 shows that the nature of expertise related to allocations appears tailored to each of

the three subsets of alternatives. For hedge fund allocations, expertise in hedge funds matters. Similarly, experience in venture capital is linked to higher venture capital allocations, and private equity expertise matters in private equity. These patterns suggest that expertise does not readily travel across alternative asset classes; rather, investment expertise has elements unique to the particulars of the type of investment.

The results also reveal interesting patterns in the effect of networks, and the presence of a CIO and investment staff on allocations. While the size of the network and the presence of a CIO are significantly positively related to allocations to venture capital and private equity, this is not the case for hedge funds. The size of the investment team seems to matter most for venture capital allocations. These patterns across hedge funds, venture capital, and private equity are consistent with the relative difficulty of managing and accessing these alternative asset classes. Recent trends in hedge fund investing show that allocations to hedge funds have increased across all endowments reflecting easier (and possibly cheaper) access to hedge fund managers. In contrast, private equity investments involve managing capital calls, substantial illiquidity, and assessing management teams who actively manage operating assets (companies). Venture capital shares the complexity of private equity with the added challenges of the increased riskiness related to new businesses and sometimes restricted access to high performing funds. Our results suggest that having a CIO and board networks is more important in navigating and accessing the more complex arrangements with private equity and venture capital funds, as compared to hedge fund investing.

Because some endowments (often with smaller amounts of assets) have little or no exposure to hedge funds, private equity, and venture capital, we also perform regressions using only endowments that have a positive allocation to the three relevant asset groupings. We also estimate Tobit regressions, as asset allocation shares are bounded between 0 and 1. Results from all these alternative model specifications are qualitatively similar to those reported in the main text (see the Online Appendix).

Overall, our results on allocation choices show important roles for the human capital

embedded in an endowment's investment process and governance. These results are true even after controlling for the size of the endowment. Thus, it is not simply scale that seems at work as larger endowments allocate more to alternative assets. In a subsequent section, we explore possible channels for these effects including evidence from a survey we conduct.

# 4 Human Capital and Investment Performance

Table 5 shows endowment net returns and three risk-adjusted performance measures. Sharpe ratios measure portfolio returns per unit risk. As described in the Appendix, we adjust for smoothing in reported returns that can mask risks, especially for alternative assets [Getmansky et al. (2004)]. The third column shows alphas estimated using the four-factor model of Carhart (1997), using a minimum of six observations per endowment. The final column reports "selection" returns; these estimate the ability to invest with high performing managers and are calculated as the endowment's return minus a benchmark obtained by multiplying its actual allocation weights times index returns for each asset class.

Our primary focus is on the striking gaps between the investment performance of different sized endowments. Echoing Figure 3 shown earlier, column (1) of Table 5 displays that larger endowments have substantially higher returns than their smaller counterparts over the sample period. Moreover, larger endowments also outperform small endowments on each of the three risk adjusted metrics. Thus the "average" endowment figures mask the true landscape of endowment performance. The patterns in Table 5 are consistent with larger endowments gaining return advantages from both allocation and selection decisions. Higher allocations to alternatives may allow harvesting illiquidity premia from an asset class. In addition, endowments appear to have some "selection" ability to earn extra returns from investing with good managers within an asset class, and this is especially true for large endowments. Our analysis will explore human capital explanations for these gaps.

While not the primary focus of our analysis, Table 5 also includes a hypothetical passive

strategy of avoiding alternative assets and having investment spread across domestic equity (50%), fixed income (30%) and international equity (20%). $t$-statistics are calculated to test the difference between endowment groupings and the 50/30/20 portfolio, while $p$-values for the estimates of four-factor alphas are computed following the bootstrap methodology of Kosowski et al. (2006).[14]

All three size groupings of endowments have returns in excess of the simple passive strategy, and large and medium size endowments earn total returns that are statistically different from the passive strategy. The Sharpe ratios in column (2) suggest that this outperformance is also true on a risk-adjusted basis. All three size groupings of endowments have higher Sharpe ratios than the passive benchmark. The large endowments' average of 0.77 is the highest and is statistically greater than the passive strategy's Sharpe ratio of 0.44 at the 5% level of significance.

Four-factor alphas indicate that large and medium sized endowments earned average four-factor alphas of about 211 and 53 basis points per annum, respectively. Since large endowments in aggregate manage the vast majority of all assets, these figures imply an average outperformance of about 2.3% when measured on an asset-weighted basis, even though the "average" endowment has a negative alpha.[15, 16]

These patterns in the comparisons to passive strategies in part differ from those in recent work [Dahiya and Yermack (2020); Lo et al. (2020)] using IRS data who report endowment underperformance based on four-factor alphas. The source of the difference is largely driven

[14] We also compute alphas for the 50/30/20 passive strategy and find negative but insignificant estimates. Cremers et al. (2020, 2013) explore the idea that standard factor models may produce alphas even for passive benchmarks and that funds with a benchmark discrepancy tend to be riskier than their prospectus benchmarks.

[15] As noted earlier we found NACUBO and IRS data produce similar return estimates when measured over the same time period. If we use our data only beginning in the 2009 fiscal year, (which more closely match the time period of Dahiya and Yermack (2020) and Lo et al. (2020)), we estimate four-factor alphas of about -1.4% and -0.12% on an equal and asset-weighted basis, respectively.

[16] To alleviate concerns about the cross-sectional dependence among returns of endowments of similar size, we also compute four-factor alphas by regressing the time series of the equal- and asset-weighted endowment returns in each size-bucket on the four factors. We find alphas of 2.51% and 3.43% on an equal- and asset-weighted basis for endowments with more than $1 billion in total assets ($p$-values 0.09 and 0.05, respectively).

by the fact that IRS data begin in 2009 and are thus restricted to the years after the financial crisis. These more recent years have experienced especially robust returns on public equities but lower returns for absolute return strategies such as hedge funds. Our data include years both before and after the crisis and thus we suspect are likely to be more representative of longer term performance over market cycles as shown in Figure 1.

To investigate the effects of human capital on performance, we apply our earlier regression approach to total returns and Sharpe ratios. The first two columns of Table 6 show significant positive effects of human capital on returns, particularly the presence of a CIO and in-house investment team. Once size is included, the coefficient on the presence of a CIO retains a positive and significant coefficient. Looking at Sharpe ratios, the presence of a CIO is also associated with better risk adjusted performance: institutions that hire a CIO have Sharpe ratios that are about 0.04 larger than those that do not, even controlling for all other variables. Alternatives expertise on the investment committee is also positively linked to Sharpe ratios but is only marginally significant when endowment size is introduced as shown in regression 8. The results are essentially unchanged if we use granular measures of alternative expertise (hedge fund, private equity and venture capital) instead of the broader alternatives category. Overall, the results in Table 6 suggest endowment net investment performance benefits from human capital especially the presence of a CIO even controlling for endowment size.

Table 7 examines performance measured by four-factor alphas. The alpha for each endowment is regressed against the time-series average of other variables except for the CIO and public/private dummies. The results are consistent with a positive impact of human capital on performance. With all variables included, the last column shows significant positive coefficients for both the presence of a CIO and the size of the in-house investment team. These two elements epitomize how many larger funds execute on the endowment model for investing. Interestingly, the coefficient on endowment size is not significantly different from zero. These conclusions hold and our results are essentially unchanged if we use granular measures of alternative expertise (hedge fund, private equity and venture capital) instead of

the broader alternatives category.

We also estimate regressions on selection returns (regressions not reported) using the same approach as for total returns and Sharpe ratios. There were no significant coefficients except on endowment size which was again positively related to performance. Repeating the analysis using granular measures of expertise yields qualitatively similar conclusions; once we control for endowment size no other variable have significant coefficients. These results on selection returns suggest that a primary driver of performance goes through the allocation process. Moreover, to the extent that there are selection skills, they appear largely related to endowment size. We note however that for alternative assets, there is typically not a traded diversified index such as for public equities. Thus even attaining the performance of the benchmark can be difficult. For instance, if an endowment tries to access private equity using funds of funds for diversification, the extra layer of fees will reduce the return below an index based on direct investing [Harris et al. (2018)]. We return to funds of funds later in the paper.

Ideally, we could analyze selection using returns for specific asset classes. Unfortunately, most endowments do not report these and those that do may not be representative of the larger universe. If we require information on the return for the alternatives portfolio of an endowment (versus the entire portfolio), our sample size drops by well over half and even more if we require the return on a sub-asset class such as private equity or venture capital. As shown in the Online Appendix, we explore situations when we can calculate an "alternative selection return" (endowment's return on alternatives minus the allocation weighted average of benchmarks for each alternative subset). Alternate selection is higher for larger endowments but alternative expertise and other human capital variables are not once we control for size. If we use granular measures of expertise, alternative selection appears positively associated with expertise in private equity as well as size, but no other variables are significant. While this result is suggestive of a selection benefit of having private equity expertise on the governing body, the data limitations prevent drawing strong conclusions.[17]

[17] Gredil (2020) shows that some private equity GPs may have important private information about companies and limited partners can benefit substantially by delegating to those managers.

For a smaller set of endowments, we have reported returns on a specific alternative program (e.g. the net return on its private equity). We find that endowments with a CIO have significantly higher returns on their private equity and venture capital programs. The size of the internal investment staff is also associated with higher net returns in private equity (Table A.5). This is again suggestive evidence of the important role played by internal investment professionals in navigating investments in illiquid assets which require extensive due-diligence, monitoring, and manager selection. However, we are unable draw strong conclusions given the significant reduction in sample size and the likely selection issues that arise.

To summarize, the findings of Sections 3 and 4 suggest that higher levels of human capital embedded in an endowment's investment process has coincided with shifts in allocation towards alternatives and has helped endowments reap the benefits of higher expected return in illiquid assets. This is mostly true for large endowments which have higher levels of human capital on their investment teams and governing bodies.

# 5 Channels of Effect on the Investment Process

We examine possible channels by which the endowment's investment process benefits from internal investment teams, and the financial expertise and networks resident in governing bodies.

## 5.1 Use of Funds and Consultants

One potential benefit of more sophisticated investment teams, alternatives expertise and networks would be the avoidance of extra fees associated with using consultants and additional layers of financial intermediation. For instance, investments in direct private equity funds (which own private companies) are illiquid, relatively undiversified, not easily scaled, and have high search and monitoring costs. Given the costs and frictions in direct fund investment, funds of funds (FoFs) provide a second level of intermediation with specialized expertise and

services for investing in direct funds. But these benefits come at the cost of additional fees paid to FoFs, less transparency, and increased delegation. In alternative assets such as private equity, FoF fees can be substantial, unlike the low-cost alternatives for index funds in public securities [see Harris et al. (2018); Lerner et al. (2007)]. Andonov (2020) finds that large investors rely less on intermediaries when delegating investment management in alternatives, pay lower fees, and obtain higher returns. One of our survey respondent reveals: *"For many years, the board was very conservative and only supported traditional stock/bond portfolios. We recently obtained exceptions to issuing pubic request for proposal (RFPs) to hire investment managers, which will greatly benefit the endowment program over the long-term. We used fund-of-funds for alternatives in the past due to RFP requirement and limited internal staffing, but are now implementing a direct investment program for alternatives (private strategies) in order to minimize fees."*

We suspect that an endowment with extensive expertise and networks would be better able to navigate direct fund investing in alternative assets and hence avoid the extra fees from FoFs. To examine this possibility, we take advantage of NACUBO data which reports the number of separate direct funds and FoFs an endowment uses. The data include all public market and alternative strategies as well as the count for alternatives separately. Unfortunately, NACUBO does not segment the alternative category into more granular subsets such as private equity and venture capital. We regress the percentage of all funds used (separately for alternative direct funds and FoFs in alternatives) on human capital and other variables and show results in Table 8.[18] The first regression shows that the share of alternative direct funds is positively and significantly related to expertise in alternatives on the investment committee, the presence of a CIO, the size of an in-house investment team and market value. For example, having a CIO is associated with about a 9 percent larger share of direct alternative funds used, even after controlling for all other variables. This is

[18]Results are robust to different econometric specifications such as a negative binomial, Poisson, and a simple OLS where we use the natural logarithm of one plus the number of funds used.

consistent with the role of CIOs in facilitating direct investments and co-investments.[19] A larger in-house investment team is also associated with greater use of direct investment, as the complex nature of alternative assets requires a more sophisticated investment staff to monitor and select new investments. The second regression splits out expertise in a granular fashion and suggests that the effect of expertise in venture capital and private equity is most pronounced on the use of direct funds.

The third and fourth regressions use FoFs as the dependent variable and show that in-house investment teams and a CIO allow endowments to rely less on alternative FoFs. The effect of expertise in alternatives on the use of FoFs appears related to private equity and venture capital, not the broader alternatives expertise measure which includes hedge funds. In regression 4, the coefficients on expertise in VC and PE are negatively related to the use of FoFs (significant at the 10% level for PE). Moreover, the effects of having a large investment staff and a hiring a CIO go hand-in-hand with fewer FoFs.

The results in Table 8 support our conjecture: more expertise seems to give endowments an edge in accessing direct funds.[20] This, in turn, relieves the need to invest in FoFs and pay the extra fees that FoFs charge. The finding that expertise in VC and PE matters more in the regressions is consistent with needed skills to navigate investing in these non-marketable assets compared to marketable alternatives such as hedge funds.

Another effect of having human capital resident in the endowment is reduced reliance on external consultants. That reduction will save fees; moreover, the patterns in where the reductions take place may shed light on channels of effect in the investment process. To further examine this idea we use NACUBO data on an endowment's use of external consultants segmented into areas of work: asset allocation, manager selection, policy review, and performance attribution. The dependent variables take a value of 1 if an endowment

[19] Braun et al. (2020) argue that co-investments lack, or have significantly reduced, fees and carry. As a result, co-investments lower the average cost of investing in private markets and increase the potential for higher net returns.

[20] In "Pioneering Portfolio Management", David Swensen says: "Unfortunately, the shortcut of using a fund of funds, instead of an internal investment team, leads down a path of suboptimal results..." [Swensen (2009, pg 309)].

uses external consultants in each of these areas, zero otherwise.

Regressions in Table 9 show that having a CIO and a larger investment team reduce the use of consultants in all four areas. This suggests a broad effect of human capital throughout the investment process. The effect of alternative expertise on the investment committee shows up for asset allocation and policy review but not manager selection and performance attribution. These patterns suggest that expertise on the investment committee plays a critical role in broad policy decisions that such a committee is charged with.

## 5.2 Survey Evidence

Because identification of a causal effect of expertise and networks on alternative asset allocations and performance is challenging, we conduct a novel survey of endowment investment committees and managers in addition to the econometric approaches explored above. The survey confirms the prominent role investment committees play in the investment process. The 132 responding institutions represent almost 20 percent of university endowments represented in the NACUBO-Commonfund data, and collectively manage more than 60 percent of total market value as of 2015. About three-fifths of the respondents are CIOs, CFOs, or senior investment directors. Over a third of the respondents had 15 or more years of service with the current endowment fund, and over 70 percent of respondents had five or more years of service. We ask a variety of questions (both quantitative and qualitative) related to the investment process.

Overwhelmingly, respondents identify that expertise on the investment committee was useful for the endowment. When asked about the following statement, "the fund's investment process and decisions benefit substantially from the expertise of the committee," 83 percent somewhat or strongly agreed and almost half strongly agreed. Moreover, committee members with investment management experience play a key role; over 71 percent of respondents somewhat or strongly agreed with the statement, "investment committee members with the most investment management experience have a large influence on committee decisions and

interactions with investment staff." Less than 10 percent disagreed (the remainder neither agreed nor disagreed). Our survey also confirmed the crucial role that IC members play in an endowment's asset allocation. 90 percent of respondents said the committee was important in setting the fund's strategic asset allocation policy, with over 70 percent strongly agreeing. For two-thirds of the endowments, the committee was also important in determining tactical asset allocation (e.g., specific allocations within a policy range).

Turning to manager selection, the survey revealed a range of approaches with nuances related to individual circumstances. In terms of a formal process, 66 percent report that the IC approves managers, but in only 27 percent of cases did the IC interview them. More typically, the IC, based on recommendations made by consultants or staff, approves who conducts the interviews. In some (typically larger) endowments, staff has full discretion to hire managers, often within guidelines. Most respondents agree that the investment committee is not involved in the day-to-day investment management process. This is especially true for larger endowments with full time staff. Yet, there is substantial interaction with staff. Asked the question "how often do committee members interact with senior investment staff (including CIO) outside of regularly scheduled meetings?", over 60 percent of respondents reported that it happened once or more a month; 47 percent cited one to three times monthly, 10 percent said four to nine times, and four percent said more than ten times monthly. Further, the larger the fund, the more frequent this interaction. Endowments with one to three interactions per month had median assets of $286 million, compared to only $60 million for those with less than one interaction per month. Almost all respondents (93.5%) felt that the level of interaction was appropriate and none thought it too much. 6% of respondents consider the level of interaction as too little.

In tandem with the formal committee process for manager selection, many endowments report roles for investment committee (IC) members in making recommendations. When asked the question, "how often do committee members provide information on potential investment recommendations to the investment staff and leave it up to staff to do due diligence

and make decisions?", only 22 percent responded "never." 43 percent responded "rarely," 30 percent "occasionally," and 6 percent "frequently." Most of the time, IC members only provide a recommendation and leave discretion to follow the recommendation. 74 percent responded that IC members never make recommendations that staff is mandated to accept.

Another channel through which IC members affect the investment process is via networks and connections. 56 percent of respondents reported the "committee members facilitate access to investment opportunities that would otherwise be difficult to identify or undertake (e.g., closed or restricted funds)." This help with access is fairly infrequent, however. 34 percent said it happened rarely (less than once a year) and only four percent said it happened more than twice a year.

Overall, our survey shows that members of endowments' governing bodies affect the investment process through a number of channels. In addition to formal policies on asset allocation determined by a board, IC members (especially those with investment expertise) provide advice and contacts for many endowments. This includes roles in manager selection as well as in establishing contacts with funds that may be hard to access. Such closed or restricted funds are most prevalent in alternative assets such as venture capital or private equity. This contribution of expertise is consistent with our prior empirical findings on asset allocation and the use of funds of funds in alternative assets. We note, however, that there is considerable variation across endowments, often related to size.

# 6 Conclusions

University endowments provide an especially good laboratory to study how human capital in investment management affects choices made by and returns to an institutional investor. These endowments often have the institutional flexibility to pursue fairly unrestricted investment opportunities, have a favorable tax status which reduces frictions in investing, and have a long term investment horizon. Moreover, endowments are likely to be less affected

by external political influence and other constraints facing other institutional investors.

We find notable differences across endowments in the human capital and networks resident in their staffs and governing bodies. Moreover, these differences affect endowment choices regarding asset allocations; more expertise in alternative assets goes with higher allocations to these assets. These effects are concentrated in alternative assets (such as venture capital, private equity, and hedge funds) to which many endowments have large allocations. Since alternative assets, by their very nature, are likely harder to analyze, manage and access than traded public securities, there is an enhanced role for expertise and networks in alternative assets.

The nature of relevant expertise appears to be geared to subsets of alternative assets. Expertise in hedge funds matters for allocations to hedge funds but it is expertise in private equity that matters for private equity and expertise in venture capital that matters for venture capital. Consistent with this pattern, we find that having a CIO is positively linked to allocations in private equity and venture capital, both of which involve complexities such as managing capital calls and dealing with illiquidity. These findings suggest that some elements of expertise do not readily travel across different types of alternative assets but are unique to the type of investment. This has broad implications for forming governing bodies and creating staff capabilities for endowments.

Our findings on networks also highlight complexities of investing in some types of assets. We find that connections to investment professionals matter especially for allocations to private equity and venture capital. This is consistent with networks helping facilitate ways to overcome restrictions or barriers to investing in funds that might otherwise be difficult or impossible to access.

Finally, beyond effects on allocation, we document that human capital is associated with better performance for an endowment's portfolio. The improved investment performance comes through a number of channels: capturing higher returns that can accompany alternative assets in general, greater ability to select or have access to high performing managers, and

being able to use direct funds rather than funds of funds which impose an extra layer of fees.

Our results suggest that endowments directly benefit from having experts in alternative assets serving on boards, as well as more specialized skills within endowment investment teams. The potential benefits seem highest in areas such as private equity and venture capital.

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**Figure 1: Cumulative Endowment Value by Endowment Size, 1987-2020**

This figure shows the cumulative value of 1 dollar invested in U.S. university endowments in 1987 over time. For the years 1988 to 1997, very large endowments have more than $400 million of total assets, large between $100 million and $400 million, medium between $25 million and $100 million, small less than $25 million. For the years 1998 to 1999, very large endowments have more than $1 billion of total assets, large between $300 million and $1 billion, medium between $75 million and $300 million, small less than $75 million. For the years 2000 to 2020, very large endowments have more than $1 billion of total assets, large between $500 million and $1 billion, medium between $100 million and $500 million, small less than $100 million. The 60/40 portfolio allocates 60% to domestic equity and 40% to fixed income. The 60% allocation to equity uses to the S&P 500, while the 40% allocation to fixed income refers to the Shearson Lehman Hutton Govt./Corp. Index (SLH) for the years 1988 to 1989, the Lehman Brothers Govt./Corp. Index (LB) for the years 1990 to 2008, and the Barclays Aggregate Bond Index for the years 2009 to 2020. Data comes from the NACUBO-TIAA Study of Endowments (Public Tables).

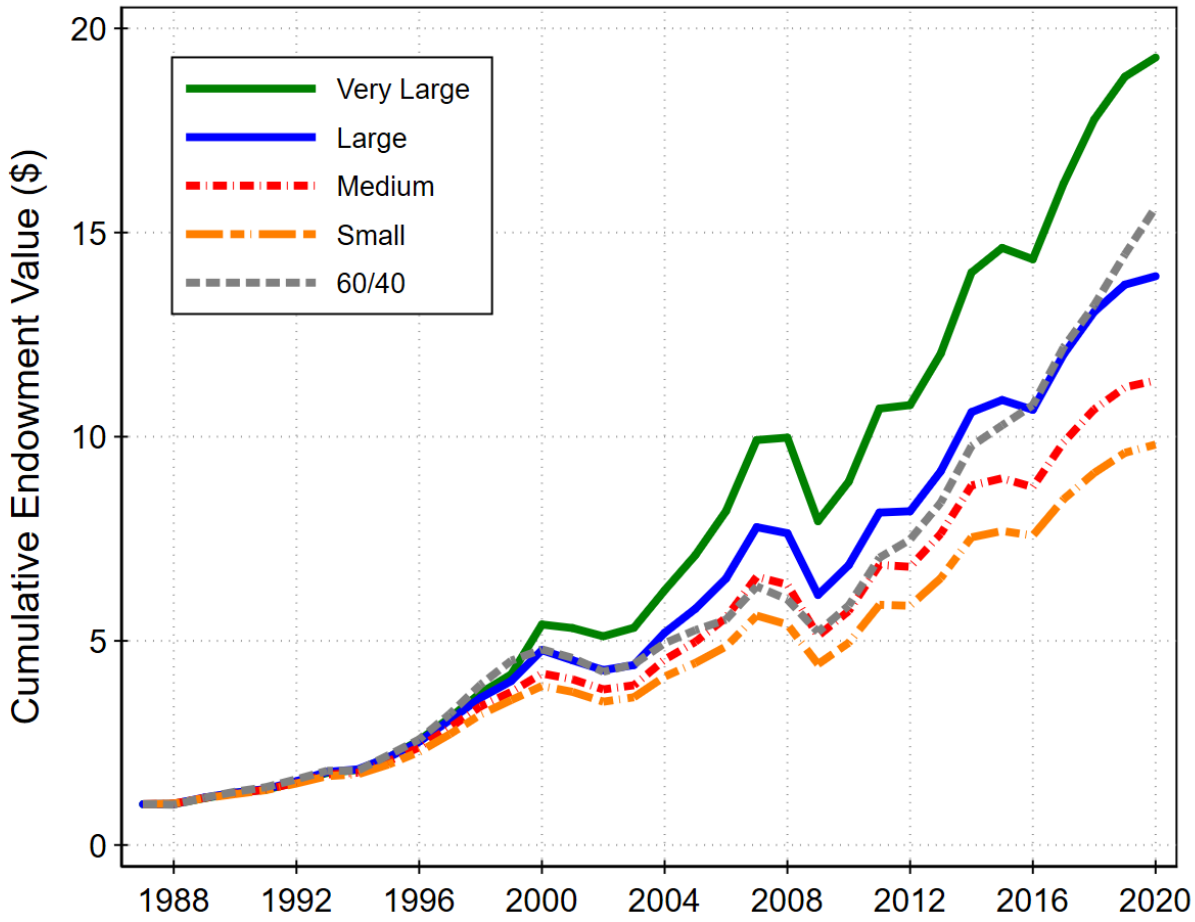

**Figure 2: Asset Allocations to Alternative Investments by Endowment Size**
This figure shows the proportion of total assets allocated to alternative investments for U.S. university endowments from 2004 to 2015 by size. These includes real estate, private equity, venture capital funds, commodities, and hedge funds. Large endowments have more than $1 billion of total assets, medium between $250 million and $1 billion, small less than $250 million.

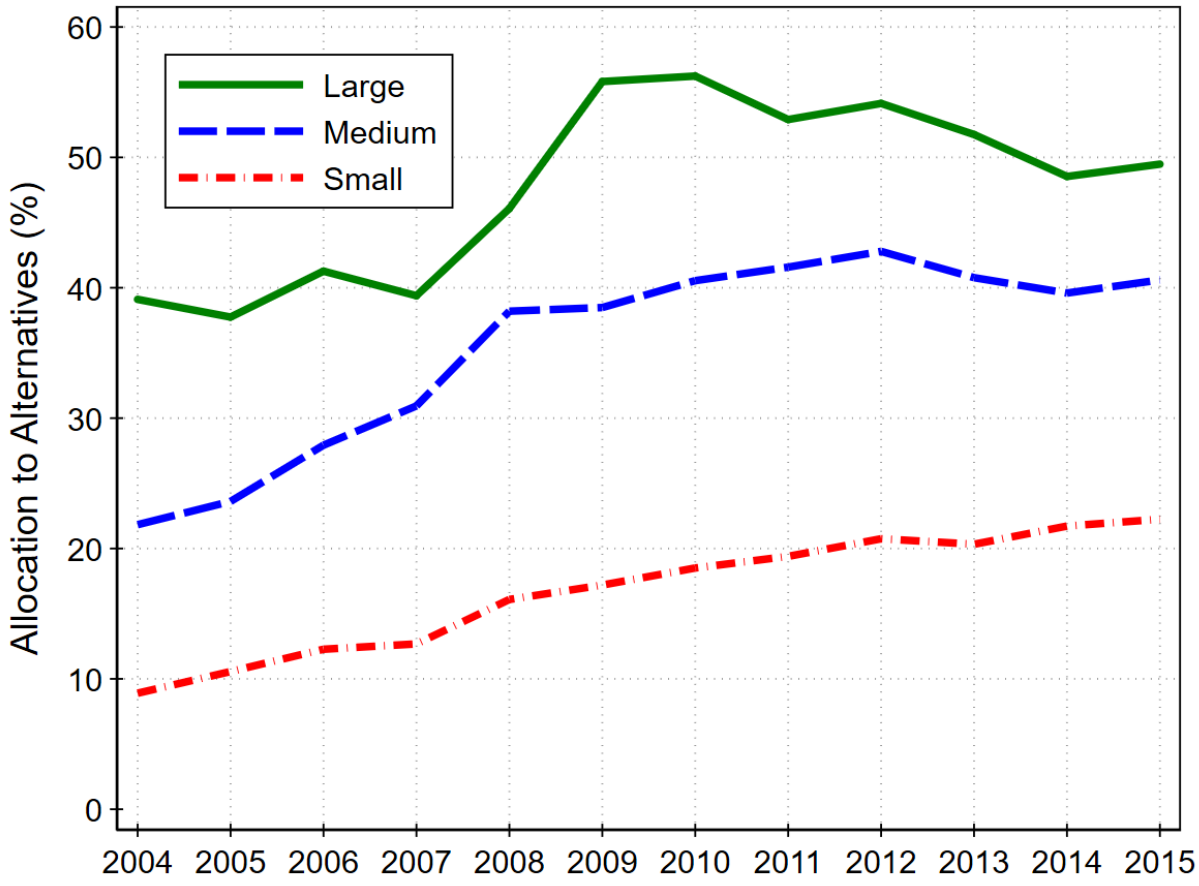

**Figure 3: Endowment Average Annual Return by Endowment Size**

This figure shows the average annual net return (in %) for U.S. university endowments from 2004 to 2015 as reported to NACUBO. Large endowments have more than $1 billion of total assets, medium between $250 million and $1 billion, small less than $250 million. The dotted red line depicts the annual net return for the average endowment.

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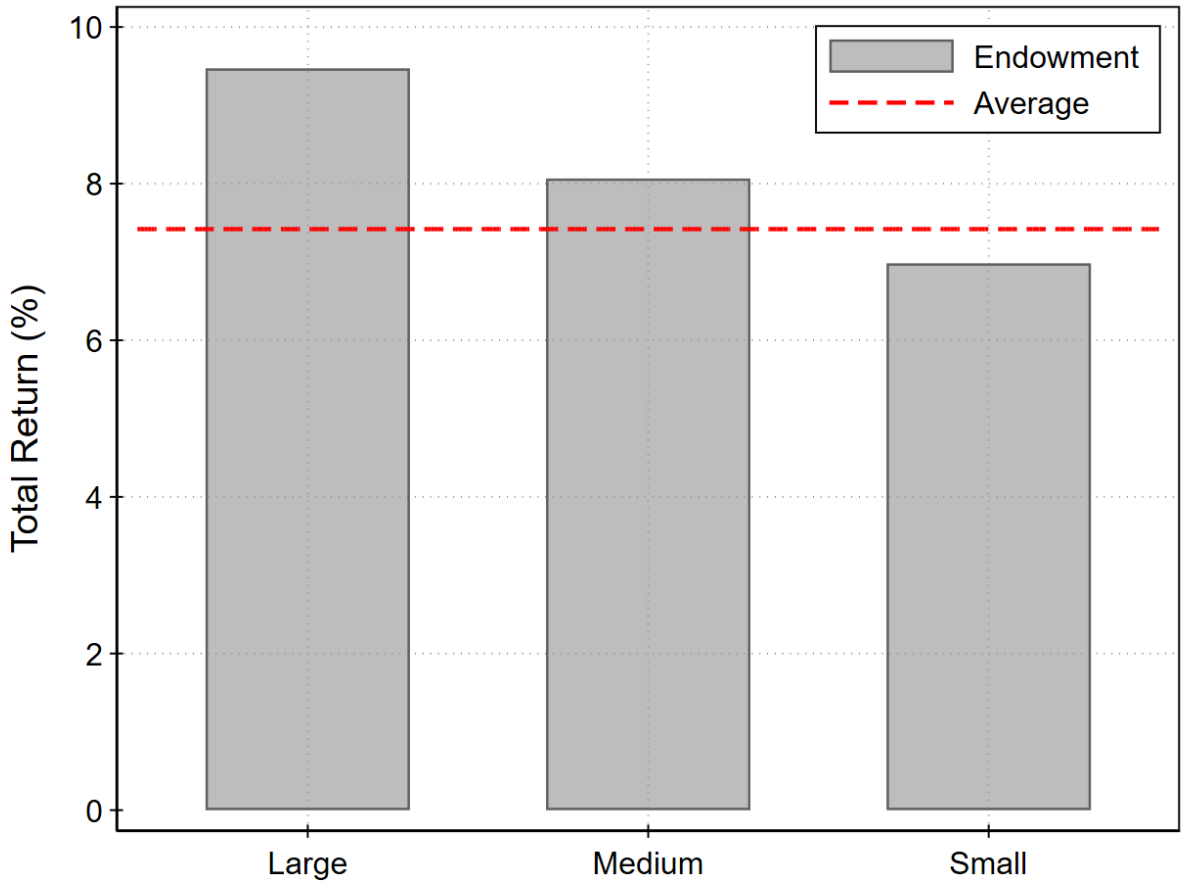

**Table 1: Summary Statistics for Endowments**

This table reports summary statistics for university endowments. Entries summarize data points across all endowments and years and report the number (N) of data points, mean value, standard deviation, percentile values ($25^{\text{th}}$, $50^{\text{th}}$ and $75^{\text{th}}$), and the asset weighted mean (weighted by the dollar ($) value of the endowment). Market Value is total endowment assets (in millions of dollars, $M). Contributions are total gifts and bequests as a percentage of the endowment market value. Distributions are the total spending from the endowment as a percentage of the institution's annual budget (or its total assets). Total net return is an annual figure in percent. Portfolio standard deviation is estimated as the standard deviation of the endowment portfolio return using actual weights and benchmark index variances and co-variances adjusted for illiquidity as explained in the Appendix. The adjusted-Sharpe ratio is the difference between the endowment annual net return and the annualized 30-day U.S. Treasury bill rate divided by the portfolio standard deviation. Panel D shows investment committee size, trustee networks, and investment committee expertise in alternative investments, i.e., the fraction of observations with relevant experience in alternative investments. Chief Investment Officer (CIO) represents the fraction of endowment-year observations that have a CIO, while investment team is the full-time equivalent number of investment professionals.

| | N | Mean | SD | P25 | P50 | P75 | Mean$^{\$w}$ |
|---|---|---|---|---|---|---|---|
| Panel A: Endowment Characteristics | | | | | | | |
| Market Value ($M) | 8522 | 498.20 | 1,951.10 | 33.80 | 90.90 | 288.55 | 8,138.37 |
| Contributions (% of Value) | 8000 | 3.52 | 6.28 | 0.94 | 2.14 | 4.23 | 1.73 |
| Distributions (% of Value) | 8255 | 4.46 | 2.09 | 3.82 | 4.50 | 5.00 | 4.76 |
| Distributions (% of Budget) | 6661 | 9.83 | 16.54 | 1.00 | 3.80 | 10.52 | 17.93 |
| Panel B: Asset Allocation (% of Total Assets) | | | | | | | |
| Domestic Equity | 8522 | 36.28 | 17.40 | 22.91 | 34.30 | 49.10 | 19.61 |
| Fixed Income | 8522 | 19.25 | 10.96 | 11.78 | 18.00 | 25.40 | 11.17 |
| Alternative Strategies | 8522 | 23.60 | 19.68 | 6.40 | 20.70 | 36.65 | 48.26 |
| Hedge Funds | 6635 | 15.62 | 12.04 | 6.50 | 14.82 | 22.90 | 21.87 |
| Private Equity | 6635 | 4.36 | 5.69 | 0.00 | 2.50 | 6.90 | 10.55 |
| Venture Capital | 6635 | 1.58 | 2.84 | 0.00 | 0.00 | 2.10 | 3.88 |
| Panel C: Investment Returns and Risk | | | | | | | |
| Net Return (% Annual) | 8205 | 7.42 | 11.31 | 1.04 | 10.68 | 15.50 | 9.73 |
| St. Deviation (% Annual) | 6635 | 10.89 | 1.79 | 9.90 | 10.89 | 11.95 | 10.77 |
| Adjusted-Sharpe Ratio | 6521 | 0.59 | 1.40 | 0.06 | 0.85 | 1.33 | 0.82 |
| Panel D: Human Capital and Expertise | | | | | | | |
| *Human Capital*: | | | | | | | |
| Alternative Expertise | 6287 | 0.31 | 0.27 | 0.10 | 0.25 | 0.44 | 0.47 |
| Chief Investment Officer | 8459 | 0.17 | 0.38 | 0.00 | 0.00 | 0.00 | 0.66 |
| Investment Team | 8258 | 1.56 | 5.54 | 0.20 | 0.50 | 1.20 | 16.54 |
| Investment Committee Size | 8248 | 8.09 | 3.41 | 6.00 | 8.00 | 10.00 | 9.49 |
| Networks | 6512 | 293.23 | 209.16 | 138.95 | 260.22 | 399.74 | 458.96 |

**Table 2: Allocation to Alternative Investments and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between the share of assets allocated to alternative investments, and some university endowment-specific variables. Independent variables are the proportion of investment committee members with experience in alternative investments, whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, whether the institution is public or private, the natural logarithm of total assets, and the de-trended measure of networks. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarters to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *Human Capital*: | | | | |
| Alternative Expertise | 0.16*** | 0.16*** | 0.12*** | 0.11*** |
| | (0.02) | (0.02) | (0.02) | (0.02) |
| Chief Investment Officer | 8.54*** | 8.06*** | 3.81*** | 3.49** |
| | (1.33) | (1.32) | (1.29) | (1.48) |
| Investment Team | 10.17*** | 9.56*** | 1.82** | 1.63* |
| | (0.78) | (0.78) | (0.73) | (0.84) |
| Investment Committee Size | | 6.82*** | 2.53** | 3.05** |
| | | (1.10) | (1.06) | (1.22) |
| Public | | -3.88*** | -2.44*** | -1.88* |
| | | (0.97) | (0.91) | (1.10) |
| Market Value | | | 6.03*** | 5.96*** |
| | | | (0.33) | (0.41) |
| Networks | | | | 1.63*** |
| | | | | (0.59) |
| Location Fixed Effects | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.38 | 0.41 | 0.51 | 0.50 |
| Observations | 6132 | 6132 | 6132 | 4722 |

**Table 3: Propensity to Invest in Alternative Assets**

This table reports OLS regression coefficients and standard errors of the relationship between the propensity to invest in alternatives, and some university endowment-specific variables. For columns (1)-(3) the dependent variable takes a value of one if the endowment has a positive allocation to its alternative investment program, zero otherwise; the independent variable for alternative expertise takes a value of one if alternative experts sit on the investment committee in the previous period, zero otherwise. In column (4) the dependent variable is 1 if it is the first year the endowment has an allocation to alternatives, 0 otherwise; the alternative expertise variable is 1 if the prior year is the first time the endowment has an alternative expert on the committee, 0 otherwise. All other controls of Table 2 are included and lagged. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarters to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | Alts$_t$ (0/1) | | | $1^{st}$ Time Alts$_t$ (0/1) |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| Alternative Expertise$_{t-1}$ (0/1) | 0.18*** | 0.14*** | 0.20*** | |
| | (0.04) | (0.04) | (0.05) | |
| $1^{st}$ Time Alternative Expertise$_{t-1}$ (0/1) | | | | 0.08** |
| | | | | (0.04) |
| Public | -0.10** | -0.07 | -0.05 | 0.03 |
| | (0.04) | (0.05) | (0.05) | (0.03) |
| Investment Committee Size | | 0.03 | 0.04 | -0.07** |
| | | (0.05) | (0.05) | (0.03) |
| Chief Investment Officer | | 0.19*** | 0.21*** | -0.04 |
| | | (0.06) | (0.05) | (0.04) |
| Investment Team | | 0.02 | 0.05 | -0.03 |
| | | (0.05) | (0.06) | (0.05) |
| Market Value | | 0.11*** | 0.09*** | 0.03*** |
| | | (0.02) | (0.02) | (0.01) |
| Networks | | | -0.02 | 0.01 |
| | | | (0.02) | (0.01) |
| Location Fixed Effects | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.10 | 0.19 | 0.19 | 0.04 |
| Observations | 1332 | 1299 | 960 | 683 |

**Table 4: Allocation to Alternatives (Breakdown) and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between the share of assets allocated to hedge funds, private equity, or venture capital, and some university endowment specific variables. Independent variables are the proportion of trustees with experience in hedge funds, private equity, venture capital, whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, whether the institution is public or private, the natural logarithm of total assets, and the de-trended measure of networks. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarters to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | Hedge Funds | | | Private Equity | | | Venture Capital | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| *Human Capital*: | | | | | | | | | |
| Hedge Funds Expertise | 0.29*** | 0.26*** | 0.30*** | 0.04 | 0.02 | 0.02 | -0.00 | -0.00 | -0.01 |
| | (0.08) | (0.07) | (0.07) | (0.03) | (0.03) | (0.03) | (0.01) | (0.01) | (0.01) |
| Private Equity Expertise | 0.15*** | 0.06 | 0.03 | 0.09*** | 0.04 | 0.02 | 0.03** | 0.02 | 0.01 |
| | (0.05) | (0.05) | (0.05) | (0.03) | (0.03) | (0.03) | (0.01) | (0.01) | (0.01) |
| Venture Capital Expertise | 0.05 | 0.02 | 0.04 | 0.01 | -0.00 | 0.00 | 0.03*** | 0.03*** | 0.03*** |
| | (0.04) | (0.04) | (0.04) | (0.02) | (0.02) | (0.02) | (0.01) | (0.01) | (0.01) |
| Chief Investment Officer | 2.24** | 0.30 | 0.25 | 2.20*** | 1.30*** | 1.26** | 1.41*** | 1.26*** | 1.27*** |
| | (0.94) | (1.00) | (1.00) | (0.48) | (0.50) | (0.50) | (0.29) | (0.30) | (0.30) |
| Investment Team | 3.62*** | 0.05 | 0.06 | 2.32*** | 0.57* | 0.42 | 1.06*** | 0.76*** | 0.72*** |
| | (0.54) | (0.61) | (0.62) | (0.33) | (0.34) | (0.34) | (0.19) | (0.22) | (0.22) |
| Public | | 0.03 | 0.08 | | -1.00*** | -0.94*** | | -0.32 | -0.27 |
| | | (0.81) | (0.82) | | (0.34) | (0.34) | | (0.21) | (0.21) |
| Market Value | | 2.95*** | 2.81*** | | 1.47*** | 1.45*** | | 0.25** | 0.24** |
| | | (0.34) | (0.35) | | (0.17) | (0.18) | | (0.10) | (0.10) |
| Networks | | | 0.54 | | | 0.64*** | | | 0.19** |
| | | | (0.43) | | | (0.19) | | | (0.09) |
| Location Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.16 | 0.21 | 0.21 | 0.23 | 0.28 | 0.29 | 0.22 | 0.23 | 0.23 |
| Observations | 5121 | 5121 | 5036 | 5121 | 5121 | 5036 | 5121 | 5121 | 5036 |

**Table 5: Investment Returns and Risk for Endowments**

This table reports mean values and $t$-statistics for annual total net returns, the adjusted-Sharpe ratio, and the selection component. It also reports means and $p$-values of alphas applying a four-factor model following Carhart (1997). The adjusted-Sharpe ratio is the difference between the endowment annual net return and the annualized 30-day U.S. Treasury bill rate divided by the portfolio standard deviation. Portfolio standard deviation is estimated as the standard deviation of the endowment portfolio return using actual weights and benchmark index variances and covariances adjusted for illiquidity as explained in the appendix. Data on returns and weights are from NACUBO and cover the years 2004-2015. The selection component of returns is the return above the return calculated using the actual weights multiplied by the benchmark return. The four-factor model estimates for each endowment require a minimum of six return observations. Large funds have total assets greater than $1 billion, medium funds between $1 billion and $250 millions, and small funds have less than $250 millions. For asset class benchmark returns we use public equity (SP500), fixed income (JP Morgan Bond Index), International Equity (MSCI ACWI), Real Estate (NCREIF), Hedge Funds (HFRI), Private Equity (Cambridge Associates PE), Venture Capital (Cambridge Associates VC), Commodities (GSCI) and Cash (30-day treasury bill). $t$-statistics are calculated to test the difference between endowment groupings and the 50/30/20 portfolio, with standard errors adjusted for clustering at the year level. $p$-values for the average four-factor alphas are calculated following the bootstrap methodology of Kosowski et al. (2006). Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | Total Return | Adj.-SR | Carhart (1997)'s $\alpha$ | Selection |
|---|---|---|---|---|
| | Mean (%) - [$t$-stat] | Mean - [$t$-stat] | Mean (%) - [$p$-value] | Mean (%) - [$t$-stat] |
| 50/30/20 | 6.56 | 0.44 | -1.35 | 0.00 |
| | - | - | [0.25] | - |
| All Endowments | 7.42 | 0.59 | -0.15*** | 0.91 |
| | [1.47] | [1.76] | [0.01] | [1.73] |
| Large Endowments | 9.37** | 0.77** | 2.11*** | 1.52** |
| (≥$1 billion) | [2.57] | [3.02] | [0.00] | [2.80] |
| Medium Endowments | 8.04* | 0.61* | 0.53*** | 0.97 |
| | [1.96] | [2.11] | [0.00] | [1.74] |
| Small Endowments | 7.02 | 0.55 | -0.62*** | 0.80 |
| (≤$250 million) | [1.06] | [1.36] | [0.00] | [1.52] |

**Table 6: Total Return, Adjusted-Sharpe Ratio and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between the total net return and adjusted-Sharpe ratio, and some university endowment-specific variables. The adjusted-Sharpe ratio is the difference between the endowment annual net return and the annualized 30-day U.S. Treasury bill rate divided by the portfolio standard deviation. Portfolio standard deviation is estimated as the standard deviation of the endowment portfolio return using actual weights and benchmark index variances and co-variances adjusted for illiquidity as explained in the Appendix. Independent variables are the proportion of investment committee members with experience in alternative investments, whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, whether the institution is public or private, the natural logarithm of total assets, and the de-trended measure of networks. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarters to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | Total Return | | | | Sharpe Ratio | | | |
|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| *Human Capital*: | | | | | | | | |
| Alternative Expertise | 0.25 | 0.26 | 0.05 | 0.19 | 0.04* | 0.04* | 0.02 | 0.04* |
| | (0.21) | (0.21) | (0.21) | (0.23) | (0.02) | (0.02) | (0.02) | (0.02) |
| Chief Investment Officer | 0.63*** | 0.61*** | 0.37** | 0.47*** | 0.06*** | 0.06*** | 0.04** | 0.04** |
| | (0.16) | (0.16) | (0.16) | (0.17) | (0.01) | (0.01) | (0.02) | (0.02) |
| Investment Team | 0.46*** | 0.43*** | -0.01 | 0.07 | 0.05*** | 0.05*** | 0.01 | 0.01 |
| | (0.11) | (0.11) | (0.13) | (0.14) | (0.01) | (0.01) | (0.01) | (0.01) |
| Investment Committee Size | | 0.29** | 0.07 | 0.04 | | 0.02 | 0.01 | 0.01 |
| | | (0.13) | (0.13) | (0.14) | | (0.01) | (0.01) | (0.02) |
| Public | | -0.14 | -0.07 | 0.05 | | -0.01 | -0.01 | 0.00 |
| | | (0.11) | (0.11) | (0.13) | | (0.01) | (0.01) | (0.01) |
| Market Value | | | 0.34*** | 0.35*** | | | 0.03*** | 0.04*** |
| | | | (0.05) | (0.07) | | | (0.01) | (0.01) |
| Networks | | | | -0.05 | | | | -0.01 |
| | | | | (0.07) | | | | (0.01) |
| Location Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.91 | 0.91 | 0.91 | 0.91 | 0.92 | 0.92 | 0.92 | 0.92 |
| Observations | 5944 | 5944 | 5944 | 4594 | 4920 | 4920 | 4920 | 3873 |

**Table 7: Four-Factor Alphas and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between the four-factor alpha of each endowment and some university endowment-specific variables. The four-factor model is estimated following Carhart (1997) for endowments with a minimum of six return observations. Observations are weighted by the number of observations used to compute risk-adjusted returns. Independent variables are the proportion of investment committee members with experience in alternative investments, whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, whether the institution is public or private, the natural logarithm of total assets, and the detrended measure of networks. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *Human Capital*: | | | | |
| Alternative Expertise | 0.01 | 0.01 | 0.00 | 0.00 |
| | (0.00) | (0.00) | (0.00) | (0.01) |
| Chief Investment Officer | 0.97*** | 0.96*** | 0.95*** | 0.89*** |
| | (0.28) | (0.28) | (0.28) | (0.32) |
| Investment Team | 0.92*** | 0.91*** | 0.83*** | 0.80** |
| | (0.21) | (0.21) | (0.28) | (0.32) |
| Investment Committee Size | | 0.04 | 0.01 | -0.10 |
| | | (0.24) | (0.24) | (0.26) |
| Public | | | -0.46*** | -0.31 |
| | | | (0.18) | (0.21) |
| Market Value | | | 0.07 | 0.11 |
| | | | (0.11) | (0.13) |
| Networks | | | | 0.09 |
| | | | | (0.15) |
| Adj-$R^2$ | 0.12 | 0.12 | 0.12 | 0.12 |
| Observations | 750 | 750 | 750 | 597 |

**Table 8: Use of Funds and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between the share of direct alternative funds and alternative funds of funds used (as a percentage of total funds used), and some university endowment-specific variables. Independent variables are the proportion of investment committee members with experience in alternative investments (or the more granular measure of expertise), whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, whether the institution is public or private, the natural logarithm of total assets, and the de-trended measure of networks. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarters to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | Direct Alternatives | | Funds of Funds | |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *Human Capital*: | | | | |
| Alternative Expertise | 0.09*** | | 0.00 | |
| | (0.02) | | (0.01) | |
| Hedge Fund Expertise | | 0.18 | | 0.11 |
| | | (0.11) | | (0.08) |
| Private Equity Expertise | | 0.13 | | -0.10* |
| | | (0.09) | | (0.05) |
| Venture Capital Expertise | | 0.16*** | | -0.04 |
| | | (0.05) | | (0.04) |
| Chief Investment Officer | 0.09*** | 0.09*** | -0.02** | -0.03*** |
| | (0.02) | (0.02) | (0.01) | (0.01) |
| Investment Team | 0.06*** | 0.07*** | -0.05*** | -0.06*** |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Investment Committee Size | 0.02 | | 0.01 | |
| | (0.02) | | (0.01) | |
| Public | 0.01 | -0.00 | -0.01 | -0.01 |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Market Value | 0.10*** | 0.09*** | 0.01*** | 0.02*** |
| | (0.01) | (0.01) | (0.00) | (0.00) |
| Networks | 0.01 | 0.00 | -0.00 | -0.00 |
| | (0.01) | (0.01) | (0.01) | (0.00) |
| Location Fixed Effects | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.56 | 0.56 | 0.06 | 0.06 |
| Observations | 4296 | 5543 | 4296 | 5543 |

**Table 9: Use of External Consultants and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between whether the endowment uses a consultant for asset allocation, manager selection, policy review, or performance attribution, and some university endowment-specific variables. Independent variables are the proportion of investment committee members with experience in alternative investments, whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, whether the institution is public or private, the natural logarithm of total assets, and the de-trended measure of networks. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarters to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | Asset Allocation | Manager Selection | Policy Review | Performance Attribution |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| *Human Capital*: | | | | |
| Alternative Expertise | -0.12** | -0.05 | -0.11** | -0.01 |
| | (0.05) | (0.05) | (0.06) | (0.05) |
| Chief Investment Officer | -0.13*** | -0.15*** | -0.10* | -0.09** |
| | (0.05) | (0.05) | (0.05) | (0.05) |
| Investment Team | -0.27*** | -0.29*** | -0.27*** | -0.30*** |
| | (0.04) | (0.04) | (0.04) | (0.04) |
| Investment Committee Size | 0.04 | 0.05 | 0.07* | 0.05 |
| | (0.04) | (0.04) | (0.04) | (0.04) |
| Public | -0.01 | -0.02 | 0.02 | -0.02 |
| | (0.03) | (0.03) | (0.03) | (0.03) |
| Market Value | 0.12*** | 0.14*** | 0.11*** | 0.12*** |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Networks | -0.01 | -0.01 | -0.00 | -0.01 |
| | (0.01) | (0.01) | (0.02) | (0.01) |
| Location Fixed Effects | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.13 | 0.15 | 0.11 | 0.13 |
| Observations | 3712 | 3712 | 3712 | 3712 |

# Appendix

## Data, Sample Construction, and Risk Measurement

### Measures of Expertise and Networks

To construct more granular measures of expertise and networks we draw on data from BoardEx. NACUBO reports on university endowments including returns and asset allocations, investment staff, and spending. However, NACUBO does not include names of the individuals that sit on the investment committee.

We build a bridge between BoardEx and NACUBO data, and we identify 878 distinct endowments (out of the 1154 funds covered by NACUBO over the 2004–2015 period). Matching BoardEx and NACUBO data creates a listing of individual names associated with each endowment for each year. BoardEx includes comprehensive biographical data on business leaders (from top executives and board directors to mid-level managers) and supplies a wide range of variables on each person's individual profile, employment history, education, awards, and affiliations with nonprofit organizations. BoardEx variables include name, age, date of birth, gender, nationality, education (including degrees and award dates), professional certifications (such as CPA), employment history (current and past, including board positions and industry sector), recognitions (such as prizes awarded), and other activities (such as roles in nonprofits, clubs and other organizations). While BoardEx does not directly disaggregate experience into subcategories of alternative assets (e.g., venture capital, private equity, hedge funds), we are able to create these granular classifications based on specific company names recorded in BoardEx's history of an individual. BoardEx classifies the sector of a company under FTSE international classification (ICB).[21] We augment it with the more granular disaggregation of the finance sector. We use the full universe of funds covered by Preqin to classify firms into private equity (expansion/late stage, growth, buyout, turnaround, and

[21] Industry Classification Benchmark (ICB) is a globally recognized standard, operated and managed by FTSE Russell for categorizing companies and securities across four levels of classification. See FTSE Russell.

secondaries), and venture capital (general venture, early stage, seed, and start-up), while we use Morningstar for hedge funds. For instance, if BoardEx recorded that an individual worked for Sequoia Capital (a venture capital firm), we code that individual as having expertise in venture capital. Similarly, an individual that worked for Bridgewater Associates LP would be coded as having expertise in hedge funds. In addition, we investigated each instance in which BoardEx used the category of "Specialty and other finance". This category frequently includes affiliations to hedge funds, venture capital funds or private equity funds which we could then code into our more granular scheme. The result of this process is a set of codes identifying whether each individual has expertise in venture capital, in hedge funds or in private equity.

We also develop network measures. For each individual, we search BoardEx to find the number of persons with whom the individual shares a common employment, educational, or social history. Following Faleye et al. (2014), we measure four different types of connections: past employment, current employment, education and other activities. Past employment is the sum of all first order connections through past employment. For instance, if a trustee for Ohio State had at one time worked for Microsoft, the trustee would be matched with all individuals in BoardEx who had worked for Microsoft at the same time. Current employment is the sum of all first order connections through current employment. Education is the sum of all first order connections through higher education.[22] The fourth measure is the sum of all first order connections through other organizations such as social clubs, charities, or other nonprofits. To account for time trends, we first regress the count of all connections on a time trend. We then use the residuals to create a de-trended network measure which is absolute value of the sample minimum plus the natural logarithm of one plus the residual.[23]

While BoardEx does not designate whether a person sits on the endowment's investment committee, we believe from spot checks that there is very high correlation between investment

[22] We follow Cohen et al. (2008) and consider individuals who graduated from the same school, within 2 years, and with a similar type of degree

[23] See Faleye et al. (2014).

expertise and connections for the trustee group (which we do know from BoardEx) and the investment committee, especially when it comes to alternative assets. NACUBO data reveals that over two thirds of all endowment investment committees are composed entirely of trustees; and, that even large endowments (greater than $1 billion) typically have few non-trustee members (median value of 1.0 across large endowments).

As a robustness check, we collect data on individuals from GuideStar, which provides information on nonprofit organizations, including the individual names and titles of trustees and officers, collected from copies of Form 990 filed with the IRS. Data from Guidestar is only available from 2007 and on a smaller sample of 579 endowments. Since an endowment's governing board tends to be quite stable over time, our granular measures of expertise and networks are typically fairly constant over the years. As part of our analysis, we also assumed that 2007 values would also be true for earlier years. The empirical findings from this assumption are similar to those using the 2007-2015 period and change none of our conclusions.

**Risk Measures and Sharpe Ratios**

A portfolio's Sharpe Ratio for time $t$ is the portfolio's excess return (over and above a risk free rate) per unit of risk and is defined as:

$$SR_t = \frac{R_t - R_t^f}{SD_t} \tag{1}$$

where $R_t$ is the portfolio total annual net return (from NACUBO), $R^f$ is the risk-free rate (30-day Treasury-bill from CRSP) and $SD$ is the portfolio return's standard deviation. While the returns are readily observable, we must estimate the standard deviation. Since we have a limited time series of annual data for any endowment and endowment asset allocations change over time, we base our standard deviation estimates on returns to benchmark indices, weighted by actual endowment allocations, with adjustments to account for stale and asynchronous

prices on illiquid assets. These adjustment effectively increase the estimated standard deviations and correlations of illiquid assets. Specifically, we compute a variance-covariance matrix based on our benchmark indices for each asset class using quarterly data for the period 1995-2015. We follow Getmansky et al. (2004) in adjusting risk estimates and generalize their approach to cover multiple categories of illiquid assets. We use lags of up to four quarters in the estimation. We have a total of eight indices: three for liquid asset classes (SP500, JP Morgan Bond Index and MSCI ACWI), and five for illiquid assets (NCREIF, HFRI, GSCI, VC Cambridge and PE Cambridge). We compute an endowment's standard deviation (at time $t$) by applying the endowment's asset weights to the estimated variance-covariance matrix from the benchmark indices. An important element of our adjustments is to better reflect the risk of illiquid assets. For instance, after our adjustments the implied beta of venture capital (versus the SP500 index) is 1.55 and its standard deviation is .39 (over twice that of the SP500). Without adjustments, the venture capital beta would appear well below one. When we compute variances and covariances on a rolling window basis during the two decade period, untabulated results show no substantive differences in Sharpe ratios compared to our main specification which uses the entire period for risk estimation.

As an alternative measure of outperformance, we estimate a four-factor model following Carhart (1997) and Fama and French (1993). For each endowment with a minimum of 6 return observations, we run

$$R_{it} - R_{ft} = \alpha_i + b_i \cdot MKTRF_t + s_i \cdot SMB_t + h_i \cdot HML_t + m_i \cdot MOM_t + \varepsilon_{it} \qquad (2)$$

where $MKTRF_t$ is the excess return on the market portfolio, and $SMB_t$, $HML_t$, $MOM_t$ are size, value, and momentum factors. Data come from the Fama-French Portfolios and Factors library of WRDS.

## Survey of Endowments

In fall of 2017, we conducted a survey of endowment boards and managers to investigate the role of governance and expertise in endowment investing. We sent emails to 793 endowments using contact information we could find from NACUBO and other sources. Recipients were informed that results would be utilized as part of a research effort undertaken analyzing the role of endowment governance and investment committees. They were also guaranteed that the underlying data obtained in the survey would only be available to full-time academic researchers, that only aggregated data and results of analysis would be publicly reported, and that no individuals or institutions would be identified in any reported results. In addition to selecting specific answers (e.g. Strong agree, agree, etc.) on many questions, the survey provided opportunity for open ended comments. We received responses from 132 endowments (response rate of 17%). Key results of the survey are mentioned in the text. In addition the Online Appendix includes more detailed breakouts of information on the role of boards in the investment process.

## Robustness Tests

This section reports a series of robustness tests we conduct. Our general findings on the roles of expertise and networks are similar across all robustness tests. The complete set of results can be found in the Online Appendix.

**Alternative model specifications.** We confirm our findings regarding the role of expertise in asset allocation decisions, investment performance, and use of funds by replicating our main results with the following modifications: (1) use the natural logarithm on one plus the number of members with expertise in various asset classes, rather than the proportion; (2) estimate Tobit regressions for asset allocation weights, as those are bounded between 0 and 1; (3) estimate negative binomial regressions for the use of direct funds, as the number of funds is a count variable and highly skewed.

**Dynamically controlling for size.** We run our baseline model by dynamically controlling for the market value of the endowment. Each year, we form deciles based on the size of the endowment and interact them with year dummies. Year × Size Deciles control for size-specific shocks to endowments in a given year.[24]

**Alternative expertise classification based on BoardEx.** We use a measure of alternative expertise at the Board of Trustee level from BoardEx. Results are qualitatively and quantitatively similar to our baseline findings using NACUBO data at the investment committee level.

[24]We thank an anonymous referee for the suggestion.

**Figure A.1: Asset Allocations to Specific Alternative Investments by Endowment Size**
This figure shows the proportion of total assets allocated to hedge funds, private equity, venture capital and commodities for U.S. university endowments from 2004 to 2015 by size. Large endowments have more than $1 billion of total assets, medium between $250 million and $1 billion, small less than $250 million.

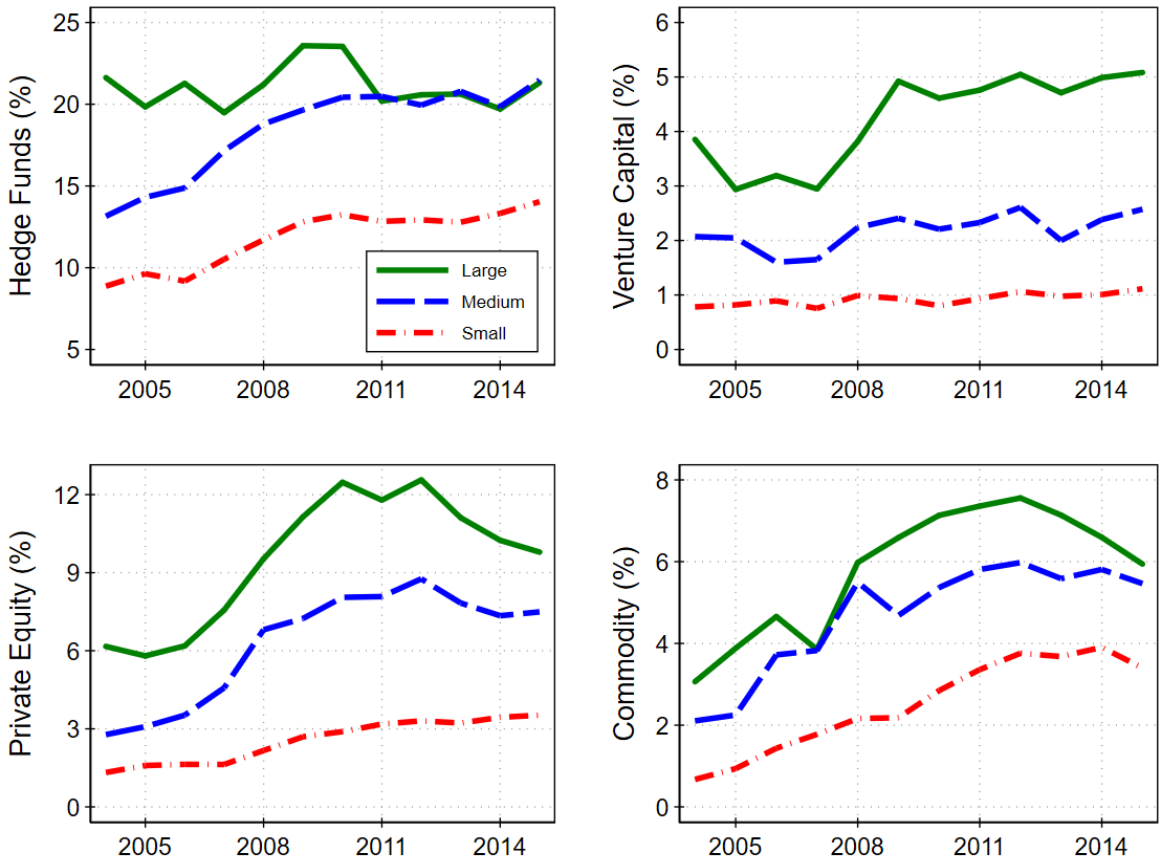

**Table A.1: Allocation to Public Assets and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between the share of assets allocated to domestic equity and fixed income, and some university endowment-specific variables. Independent variables are the proportion of investment committee members with experience in alternative investments, whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, whether the institution is public or private, the natural logarithm of total assets, and the de-trended measure of networks. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarter to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | Domestic Equity | | | Fixed Income | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Human Capital*: | | | | | | |
| Alternative Expertise | -0.11*** | -0.08*** | -0.07*** | -0.06*** | -0.04*** | -0.04*** |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) |
| Chief Investment Officer | -5.85*** | -1.97** | -1.94* | -3.47*** | -1.28* | -1.38* |
| | (0.99) | (0.95) | (1.07) | (0.67) | (0.66) | (0.75) |
| Investment Team | -7.05*** | -0.21 | -0.33 | -3.26*** | 0.63 | 0.86 |
| | (0.60) | (0.59) | (0.67) | (0.46) | (0.48) | (0.56) |
| Investment Committee Size | | -2.07** | -2.69*** | | -1.88*** | -2.05** |
| | | (0.87) | (1.01) | | (0.70) | (0.84) |
| Public | | 1.67** | 0.62 | | 2.92*** | 2.62*** |
| | | (0.76) | (0.93) | | (0.53) | (0.65) |
| Market Value | | -4.93*** | -4.70*** | | -2.80*** | -2.73*** |
| | | (0.30) | (0.37) | | (0.20) | (0.26) |
| Networks | | | -0.81* | | | -0.57* |
| | | | (0.44) | | | (0.34) |
| Location Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.33 | 0.44 | 0.42 | 0.17 | 0.29 | 0.27 |
| Observations | 6132 | 6132 | 4722 | 6132 | 6132 | 4722 |

**Table A.2: CIO vs Non CIO**

This table reports OLS regression coefficients and standard errors of the relationship between the share of assets allocated to alternative investments, and some university endowment-specific variables. Independent variables are the proportion of investment committee members with experience in alternative investments, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, whether the institution is public or private, the natural logarithm of total assets, and the de-trended measure of networks. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarter to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | CIO | | | No CIO | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| *Human Capital*: | | | | | | |
| Alternative Expertise | 0.15*** | 0.14*** | 0.12*** | 0.16*** | 0.11*** | 0.10*** |
| | (0.03) | (0.03) | (0.03) | (0.02) | (0.02) | (0.02) |
| Investment Team | 10.12*** | 4.37*** | 4.24*** | 11.30*** | 1.22 | 1.38 |
| | (1.11) | (1.44) | (1.61) | (1.11) | (1.05) | (1.25) |
| Investment Committee Size | | 6.39** | 7.50*** | | 1.68 | 2.20* |
| | | (2.54) | (2.84) | | (1.12) | (1.31) |
| Public | | -0.91 | -0.20 | | -2.62*** | -2.10* |
| | | (2.07) | (2.58) | | (0.95) | (1.16) |
| Market Value | | 4.07*** | 4.02*** | | 6.36*** | 6.29*** |
| | | (0.95) | (1.13) | | (0.36) | (0.44) |
| Networks | | | 0.17 | | | 1.88*** |
| | | | (1.36) | | | (0.63) |
| Location Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.38 | 0.44 | 0.44 | 0.22 | 0.40 | 0.39 |
| Observations | 1105 | 1105 | 897 | 5027 | 5027 | 3825 |

**Table A.3: Allocation to Alternatives and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between the share of assets allocated to alternative investments, and some university endowment-specific variables. Independent variables are the proportion of investment committee members with experience in alternative investments, whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, the natural logarithm of total assets, and the de-trended measure of networks. Year and endowment fund fixed effects are included. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| *Human Capital*: | | | | |
| Alternative Expertise | 0.03*** | 0.03*** | 0.03*** | 0.03** |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Chief Investment Officer | 1.32 | 1.31 | 1.29 | 1.42 |
| | (0.90) | (0.90) | (0.90) | (0.95) |
| Investment Team | 1.43*** | 1.44*** | 1.42*** | 1.29** |
| | (0.52) | (0.52) | (0.52) | (0.58) |
| Investment Committee Size | | -0.52 | -0.52 | -0.45 |
| | | (0.75) | (0.75) | (0.86) |
| Market Value | | | 0.62 | 0.05 |
| | | | (1.04) | (1.27) |
| Networks | | | | 0.19 |
| | | | | (0.47) |
| Fund Fixed Effects | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.86 | 0.86 | 0.86 | 0.86 |
| Observations | 6027 | 6027 | 6027 | 4653 |

**Table A.4: Allocation to Alternatives and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between the share of assets allocated to alternative investments, and some university endowment-specific variables. Independent variables are the proportion of investment committee members with experience in alternative investments, whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, whether the institution is public or private, the natural logarithm of total assets, total gifts and donor contributions as a percentage of endowment assets, distributions as a percentage of the institution's budget, the proportion of investment committee members that are non-trustees, and whether the institution is in the Ivy League. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarter to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| *Human Capital:* | | | | | |
| Alternative Expertise | 0.12*** | 0.11*** | 0.12*** | 0.12*** | 0.11*** |
| | (0.02) | (0.01) | (0.02) | (0.02) | (0.02) |
| Chief Investment Officer | 3.88*** | 2.76** | 2.45* | 3.81*** | 2.30 |
| | (1.33) | (1.33) | (1.37) | (1.29) | (1.41) |
| Investment Team | 1.69** | 2.24*** | 2.22** | 1.86** | 2.24** |
| | (0.76) | (0.79) | (0.98) | (0.72) | (1.05) |
| Investment Committee Size | 2.67** | 2.96*** | 2.72** | 2.53** | 2.98** |
| | (1.09) | (1.14) | (1.26) | (1.06) | (1.30) |
| Public | -2.24** | -3.63*** | -2.23** | -2.45*** | -3.72*** |
| | (0.95) | (0.98) | (1.02) | (0.91) | (1.09) |
| Market Value | 6.12*** | 5.95*** | 6.59*** | 6.04*** | 6.25*** |
| | (0.34) | (0.38) | (0.42) | (0.33) | (0.47) |
| Gifts (% Market Value) | -0.01 | | | | -0.02 |
| | (0.07) | | | | (0.09) |
| Distributions (% of Budget) | | 0.11*** | | | 0.12*** |
| | | (0.03) | | | (0.04) |
| Non-Trustees | | | 0.01 | | 0.02 |
| | | | (0.02) | | (0.02) |
| Ivy League | | | | -2.74 | 1.67 |
| | | | | (4.67) | (1.81) |
| Location Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.51 | 0.52 | 0.49 | 0.51 | 0.50 |
| Observations | 5759 | 4827 | 4652 | 6132 | 3977 |

**Table A.5: Total Return for Alternatives and Human Capital**

This table reports OLS regression coefficients and standard errors of the relationship between the total net return for the hedge funds, private equity, and venture capital allocation, and some university endowment-specific variables. Independent variables are the proportion of investment committee members with experience in alternative investments, whether the endowment uses a CIO, the natural logarithm of the full-time equivalent number of investment professionals at the endowment, investment committee size, whether the institution is public or private, the natural logarithm of total assets, and the de-trended measure of networks. Year and location fixed effects are included. Location fixed effects group endowments into deciles based on the minimum distance of their headquarter to Boston, Chicago, New York City, or San Francisco. Standard errors are adjusted for clustering at the endowment level. Significance levels are denoted by a ***, **, and *, which corresponds to the 1%, 5%, and 10% levels, respectively.

| | Hedge Funds | | | Private Equity | | | Venture Capital | | |
|---|---|---|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) |
| *Human Capital*: | | | | | | | | | |
| Alternative Expertise | 0.02*** | 0.02*** | 0.02*** | 0.00 | 0.00 | 0.00 | 0.00 | -0.00 | -0.00 |
| | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.01) | (0.02) |
| Chief Investment Officer | -0.09 | -0.23 | -0.20 | 1.81*** | 1.81*** | 1.78** | 3.33*** | 3.38*** | 2.65** |
| | (0.32) | (0.32) | (0.36) | (0.63) | (0.65) | (0.75) | (1.18) | (1.14) | (1.25) |
| Investment Team | 0.49** | -0.00 | -0.20 | 0.99** | 0.97* | 1.10* | 0.80 | 1.00 | 0.87 |
| | (0.24) | (0.34) | (0.38) | (0.40) | (0.50) | (0.58) | (0.81) | (0.89) | (0.96) |
| Investment Committee Size | | -0.18 | 0.10 | | -0.28 | -0.11 | | 1.91* | 2.57** |
| | | (0.39) | (0.46) | | (0.70) | (0.76) | | (1.09) | (1.19) |
| Public | | 0.36 | 0.85** | | -0.16 | 0.09 | | -2.63*** | -3.51*** |
| | | (0.28) | (0.36) | | (0.53) | (0.69) | | (0.91) | (1.05) |
| Market Value | | 0.36** | 0.32* | | 0.04 | -0.15 | | -0.08 | 0.33 |
| | | (0.18) | (0.19) | | (0.32) | (0.36) | | (0.51) | (0.60) |
| Networks | | | 0.23 | | | 0.60* | | | -0.10 |
| | | | (0.18) | | | (0.32) | | | (0.59) |
| Location Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Year Fixed Effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Adj-$R^2$ | 0.60 | 0.60 | 0.58 | 0.63 | 0.63 | 0.63 | 0.47 | 0.48 | 0.48 |
| Observations | 2346 | 2346 | 1901 | 1651 | 1651 | 1323 | 1052 | 1052 | 834 |

**Table A.6: Benchmark Indices**

This table reports summary statistics for the asset class benchmark indices. Entries summarize data points across time and report the standard deviation, covariance with the SP500, and the implied beta. For asset class benchmark returns we use public equity (SP500), fixed income (JP Morgan Bond Index), International Equity (MSCI ACWI), Real Estate (NCREIF), Hedge Funds (HFRI), Private Equity (Cambridge Associates PE), Venture Capital (Cambridge Associates VC), Commodities (GSCI). Annualized Standard deviations and covariances of illiquid asset are adjusted following Getmansky et al. (2004), using quarterly data from 1995 to 2015.

| Asset Class | Index | $\sigma$ | cov(Asset, SP500) | Implied $\beta$ |
|---|---|---|---|---|
| Panel A: Liquid Assets | | | | |
| Domestic Equity | S&P 500 | 0.167 | 0.028 | 1.000 |
| Fixed Income | JP Morgan Bond Index | 0.064 | -0.001 | -0.039 |
| International Equity | MSCI ACWI | 0.188 | 0.027 | 0.976 |
| Panel B: Illiquid Assets | | | | |
| Real Estate | NCREIF | 0.082 | 0.006 | 0.227 |
| Hedge Funds | HFRI | 0.092 | 0.014 | 0.516 |
| Commodities | GSCI | 0.247 | 0.015 | 0.557 |
| Venture Capital | VC Cambridge | 0.393 | 0.043 | 1.552 |
| Private Equity | PE Cambridge | 0.144 | 0.027 | 0.968 |

**Table A.7: Variable Definitions**

| Variable | Definition | Data Source |
|---|---|---|
| | Panel A: Endowment Characteristics | |
| Market Value | Total endowment assets at fiscal year end. This includes true endowment, term endoment, quasi-endowment and funds held in trust | NACUBO, NCSE |
| Contributions (% of Value) | Total individual gifts and bequests, either restricted or unrestricted by donor as a percentage of the institution's assets | NACUBO, NCSE |
| Distributions (% of Value) | Percentage of the institution's assets distributed for spending during the fiscal year | NACUBO, NCSE |
| Distributions (% of Budget) | Percentage of the institution's operating budget funded from the endowment during the fiscal year | NACUBO, NCSE |
| | Panel B: Asset Allocation (% of Total Assets) | |
| Domestic Equity | Percentage of the endowment's assets allocated to domestic equity. This includes active, index (passive /enhanced), Commonfund Multi-strategy equity fund and other equity funds | NACUBO, NCSE |
| Fixed Income | Percentage of the endowment's assets allocated to fixed income. This includes domestic (U.S.) active and passive, investment grade and non-investment grade bonds, international (non U.S.), emerging markets (active or passive), Commonfund Multi-strategy Bond Fund and other bond funds | NACUBO, NCSE |
| Alternative Strategies | Percentage of the endowment's assets allocated to alternative strategies. This includes hedge funds, private equity, venture capital, real estate and commodities | NACUBO, NCSE |
| Hedge Funds | Percentage of the endowment's assets allocated to hedge funds. This includes absolute return strategies, market neutral, long/short, 130/30, event driven and derivatives | NACUBO, NCSE |
| Private Equity | Percentage of the endowment's assets allocated to private equity. This includes LBO's, mezzanine, M&A, international private equity | NACUBO, NCSE |
| Venture Capital | Percentage of the endowment's assets allocated to venture capital | NACUBO, NCSE |
| | Panel C: Investment Returns and Risk | |
| Portfolio Total Return | Net annualized total return of the endowment's investable assets | NACUBO, NCSE |
| Portfolio Standard Deviation | Portfolio standard deviation is estimated as the standard deviation of the endowment portfolio return using actual weights and benchmark index variances and co-variances adjusted for illiquidity | NACUBO, NCSE, CRSP, Bloomberg |
| Adjusted-Sharpe Ratio | The Adjusted-Sharpe Ratio is the difference between the endowment annual net return and the annualized 30 day U.S. Treasury bill rate divided by the portfolio standard deviation | NACUBO, NCSE, CRSP, Bloomberg |
| | Panel D: Governance and Expertise | |
| Alternatives | Proportion of investment committee members with experience in alternative investments | NACUBO, NCSE |
| Hedge Funds | Proportion of board of trustee members with experience in hedge funds | BoardEx |
| Private Equity | Proportion of board of trustee members with experience in private equity | BoardEx |
| Venture Capital | Proportion of board of trustee members with experience in venture capital | BoardEx |
| Chief Investment Officer | A dummy that takes a value of one if the endowment hires a Chief Investment Officer (CIO), zero otherwise | NCSE |
| Investment Team | Full-time equivalent (FTE) staff employed in the investment management area of the endowment | NACUBO, NCSE |
| Investment Committee Size | Total number of investment committee members | NACUBO, NCSE |
| Network | Total connections via past and current employment, education and other activities, of board of trustee members | BoardEx |