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Investment Returns and Distribution Policies of Non-Profit Endowment Funds

Finance Working Paper N° 582/2017
March 2020

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Abstract

We present the first estimates of investment returns and distribution rates for U.S. non-profit endowment funds, based on a comprehensive sample of 29,892 organizations drawn from Internal Revenue Service filings for 2009-2017, a period that saw a sharp drop followed by a lengthy appreciation in public equity values. Non-profit endowments badly underperform market benchmarks during our sample period. Holding a zero investment portfolio (long endowment and short 60-40 mix of U.S. equity and Treasury bond indexes) generates a mean negative 3.61 annual return. Regression estimates in four-factor models find statistically significant alphas of -1.12% per year. Smaller endowments have less negative alphas than larger endowments, but all size classes significantly underperform. Distribution ratios are conservative, well below the funds' long-run returns. Donors increase contributions when endowment returns are strong, with an elasticity of about 0.18 between net-of-market investment returns and new donations.

Keywords: non-profit endowments, institutional investors

JEL Classifications: G11, G35, L31

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Investment Returns and Distribution Policies of Non-Profit Endowment Funds

I. Introduction

Endowment funds are repositories for gifts and operating surpluses generated by non-profit organizations. Often described by their parent organizations as "nest eggs" or "rainy day funds," endowments invest in stocks, bonds, and alternative asset classes such as hedge funds and private equity, and they pay income to their parents to subsidize operating costs and capital expenditures. In recent decades, many endowments have grown rapidly due to an influx of gifts as well as riskier investment policies that have increased their returns. Probably the best-known example is Yale University, which in 2019 reported having grown to $30.3 billion with an annualized return of 11.4% per year over the prior 20 years.[1] The exponential growth of Yale's and other high-profile universities' endowments has led to scrutiny of the objective functions of their parent organizations[2] and, as of 2018, a new 1.4% federal income tax on a portion of their profits.

Yet little is known about the overall size, performance, and use of endowments in the non-profit sector. The small number of papers on endowment returns have typically focused

[1] https://news.yale.edu/2019/09/27/investment-return-57-brings-yale-endowment-value-303-billion. The same source indicated that annual endowment distributions currently represent more than one-third of Yale's net revenue, indicating the vital role its endowment plays in supporting the university's operating and capital budgets.

[2] "There is an old joke that describes Harvard as a $37 billion hedge fund with a university attached." Barry Ritholtz, "The Day Harvard Stopped Being a Hedge Fund," *Bloomberg View*, January 26, 2017.

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only on funds that support major colleges and universities. These studies all rely on self-reported information from voluntary samples that take no account of selection bias or survivorship bias. The best known study, Lerner, Schoar and Wang (2008), uses annual data from the National Association of College and University Business Officers (NACUBO). The NACUBO source is also used by Brown, Garlappi and Tiu (2007), Barber and Wang (2013), and several other papers, and while it continues to publish annual surveys, the size of NACUBO's voluntary opt-in sample peaked in 2010 at 850 institutions and fell to 774 by 2019. Cejnek, Franz, Randl and Stoughton (2014) provide a literature review of the extensive academic and trade research into the university endowment sector, which seems to have crowded all other non-profit endowment research to the sidelines.

This paper presents a comprehensive survey of endowment returns and distribution policies for the period 2009-2017 in all U.S. non-profit sectors. We use data provided by non-profit organizations in annual Form 990 filings with the Internal Revenue Service (IRS), and our extraction of data from these filings yields a sample of 197,177 annual endowment observations reported by 29,892 organizations in all non-profit sectors. This yields a much larger and broader sample than earlier research focused on higher education; within the universe of non-profits that file with the IRS, colleges and universities account for 6% of the observations and 54% of the assets.

Overall the funds in our study earn negative abnormal investment returns. The median annual investment return for endowments is 4.84% between 2009-2017. Weighting our observations by the time periods in which they occur, the benchmark returns on ten-year Treasury bonds are 4.03% per year and the equity market index returns 12.81% per year over the same measurement periods. The median endowment fund under-performs a 60-40 combination

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of the equity and Treasury bond market indexes by about 3.45 percentage points annually, and the mean difference is almost the same at 3.61 basis points. On a risk-adjusted basis, we use the standard Fama-French-Carhart four factor model to estimate alphas of -1.12% for our entire sample, statistically significantly below the 1% level, with the lowest alpha estimates applying to the largest size cohorts.

These poor investment results largely agree with those realized by other investor classes, which typically exhibit zero or negative alpha estimates in standard performance attribution regression models. See, e.g., the well known research into mutual funds by Fama and French (2010), individual investors by Barber and Odean (2000), hedge funds by Brown, Goetzmann, and Ibbotson (1999), and private equity by Franzoni, Nowak, and Phalippou (2012), among many other performance measurement studies.

We study the distribution policies of non-profit endowments to their parent organizations, which resemble the shareholder dividend policies that are an important research topic in corporate finance. We find that most endowments have conservative distribution policies that imply payouts below their long-run expected returns, and well below the actual returns realized during the sample period for our study. These cautious distribution policies would tend to cause endowments to grow without limit over time. The smallest endowment funds make no payouts at all in most years, implying that organizations seek to grow them to a critical mass before tapping them as a permanent funding source. For the largest endowments, those with asset values above $100 million, distributions occur almost every year, with mean and median distribution rates near 4.5%, which appears to have become a heuristic that enjoys wide acceptance in the non-profit sector without much theoretical justification.

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The remainder of this paper is organized as follows. Section II presents a description of the data. Section III analyzes endowment funds' investment returns, and Section IV analyzes their distribution policies. Section V studies whether donations to parent organizations respond positively to good investment returns in endowments. Section VI concludes the paper.

II. Data description

Our data come from Form 990, a document filed annually with the IRS by most non-profit operating organizations in the U.S.[3] Since 2008, Part V of Schedule D for Form 990 has required those organizations with endowment funds to provide annual data including the fund balance at the beginning of the year, contributions, distributions, administrative expenses, and net investment earnings. These data are a matter of public record, but obtaining them for a large sample of organizations has been impractical up to now, because online databases of information from Form 990 filings such as Guidestar have all omitted coverage of this schedule.

We use Form 990 data that has been posted by the IRS since 2016 on Amazon Web Services (AWS) as a result of a lawsuit filed by Carl Malamud, an advocate for transparency in the nonprofit sector.[4] The website hosts annual schema of all electronic Form 990 filings beginning in 2011. The electronic filing requirements have been phased in gradually since 2006, and we believe our sample, especially in the most recent years, covers substantially all of the private endowment assets in the United States for operating charities. However, a major

[3] Form 990 must be filed by non-profits with gross receipts over $200,000 or total assets over $500,000. Smaller organizations may file Form 990-EZ, which excludes the endowment data used in this study. In practice these smaller organizations are unlikely to maintain endowments.

[4] The data are downloadable by the public from https://registry.opendata.aws/irs990/, although we found that considerable effort is required to parse the files, extract the relevant variables, and clean the data before it is suitable for large-sample research. A description of Malamud's successful federal lawsuit to compel the IRS to disclose the data in this way can be found at https://sunlightfoundation.com/2016/06/16/irs-opens-up-form-990-data-ushering-nonprofit-sector-into-the-age-of-transparency/.

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exception occurs for churches and religious organizations, which generally do not file financial disclosure forms with government regulators due to the constitutional principle of separation of church and state.[5] Our sample will also exclude certain endowment funds connected to public universities, which may be managed by state governments that do not file with the IRS, and it will also exclude endowments of private grant-making foundations such as the Ford Foundation or Gates Foundation, which report separately to the IRS on Form 990-PF.

We create our sample by downloading all available data on the AWS website, which had grown to more than 1.7 million organization-year observations by February 2020. As described more completely in Appendix 1, we first remove duplicate observations and then add additional observations based on the availability of up to four years of lagged historical data in the IRS's endowment table. We then drop more than 1.5 million observations for years in which organizations do not report having endowments, leaving a candidate sample of 219,647 observations. To organize our dataset in calendar time, we assign each filing to the year that includes the final month of its chosen fiscal year.[6]

Starting with our candidate sample, we apply a series of data screens to identify problem observations with incomplete or inconsistent data. In some cases, we are able to cure the problems by looking ahead to future years' filings, since four years of lagged historical data are

[5] It is not clear how large religious organizations' endowment funds might be, but it is possible they are much smaller than those in sectors such as higher education. The Roman Catholic Archdiocese of New York, surely one of the wealthiest religious non-profits in the U.S., voluntarily publishes excerpts form audited financial reports each year on its website at https://archny.org/financial-reports. For the most recent period ended August 31, 2018, the Archdiocese reported unrestricted net assets (presumably subsuming its several endowment funds) of $87 million and additional restricted net assets of $139 million. These totals are orders of magnitude below the fund balances held by major research universities. The most significant wealth of religious organizations may be held in real estate and fine art rather than financial investments. Endowment assets may also be held by individual parishes and not consolidated into the balance sheets of central administrative entities such as dioceses and archdioceses.

[6] Unlike for-profit companies that tend to have fiscal years coinciding with the calendar and ending in December, the most common fiscal year-end for non-profits is June 30, which is used by 42% of all observations in the sample. An additional 39% have December fiscal years, and the other 19% are scattered among the remaining ten calendar months.

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typically available and some organizations will correct prior years' errors. We lose 36,167 observations for which the endowment asset values are reported as missing or zero, or the annual investment gain/loss is reported as missing. Some of these cases may represent years in which new endowments are launched or complete liquidations occur. In 99 cases organizations file Form 990 for an irregular fiscal year reporting period of less than 360 or more than 370 days, and we drop these observations. We eliminate 6,693 observations that represent two or more organizations sharing the same endowment fund and simultaneously reporting it on Form 990, to avoid double-counting the same endowment two or more times in the sample. We increase the sample by backfilling 46,807 observations reported as lagged historical data in the first electronic filings by each organization. At this point we have a sample size of 223,495.

We next check all observations for internal consistency against the equation for an identity that is implicit in the IRS's filing format: end-of-year endowment assets must equal starting assets, plus contributions, less grants and other distributions, plus investment gains, less administrative expenses and other expenses. For 96% of the observations this identity holds exactly (in a minority of cases we must adjust for sign conventions by taking the absolute value of outflows in order to make the identity hold). We resolve some discrepancies in the 9,523 (or 4%) of observations that lack internal consistency by looking ahead to future years' filings, which sometimes correct prior years' errors. This allows us to hold onto 1,907 corrected observations. We also retain 4,382 observations for which the identity is satisfied to a tolerance of 1%, and we end up excluding 3,294 observations that lack acceptable internal consistency and cannot be repaired.

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We elect to restrict the sample to observations beginning no earlier than 2009 and ending no later than 2017, since data are quite incomplete either before or after this data range. This results in the deletion of 3,733 older observations and 18,884 early filings for 2018 or 2019.

Finally, we trim from the sample the top and bottom 0.1% of observations for annual investment return, as calculated by our method described below, reducing our sample size by a total of 394. These outlier observations appear to represent reporting errors, such as the mis-classification of endowment withdrawals as "expenses" that lead to the calculation of a very negative investment return. We conclude the sample construction with a sample size of 197,177. Please see Appendix 1 for additional detail.

Table 1 shows that the sample sizes gradually increase up to 2013 and then level off at 23,000 to 24,000 endowments per year. The growth in annual observations likely occurs due to the gradual adoption of electronic filing by organizations during the sample period. In all, we have data for 29,892 unique filing organizations, and the annual sample size peaks at 24,426 in 2015. We expect that a number of late filings will eventually occur for 2017 so that its sample size, currently 23,597, would be very close to those observed in 2015 and 2016.

Our analysis focuses on the rates of return earned by endowment funds. As reported to the IRS, investment returns are based on dividends, interest, and capital appreciation of the market values of funds' assets rather than only their realized gains. An organization can either include its expenses as part of a report of net investment earnings on Line 1c of this schedule, or it can report gross investment earnings on Line 1c while listing administrative expenses separately on Line 1f. For the minority of organizations that follow the latter practice, we calculate net investment earnings by subtracting any value reported on Line 1f from Line 1c. We then calculate the annual investment return by taking the ratio of net investment earnings over

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the sum of start-of-year assets plus one-half of contributions minus one-half of distributions. Contributions generally include bequests, gifts, and other funds deposited into endowments, while distributions consist of grants, scholarships, and transfers to the organization's operating accounts. Thus, our calculation implicitly assumes that the typical contribution is received halfway through the fiscal year and that any distributions from the fund also occur halfway through the year. We test the importance of these timing assumptions in sensitivity analysis reported below, and we find that they have no material effect on our results.

Due to these limitations of the available data, our calculations of investment performance lack the precision of measures such as the time-weighted returns commonly used to evaluate professional asset managers. A further limitation to our analysis arises from the absence of information about asset allocation, which is not a mandatory disclosure on the IRS Form 990, although for some organizations it can be obtained through a careful reading of certain schedules and appendices (these tend to present the data in narrative form, so that downloading a large sample is impractical).

Table 1 presents further detail about the distribution of endowment assets by year and by industry sector. We follow the 12 major industry classification (ntmaj12) scheme of National Taxonomy of Exempt Entities (NTEE). Aggregate U.S. endowment assets surpassed $700 billion as of 2015, and slightly more than half of this total is held by colleges and universities in the higher education sector, with the next largest holdings in the "Education (other)" sector that includes private secondary schools. Organizations with their main operations in the arts, hospitals, other healthcare sectors, social services, and other "public and social benefit" areas account for most of the rest of the endowment funds. As shown in the table, several hundred

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religious organizations also file disclosures even though many could avail themselves of reporting exemptions.

Table 2 presents descriptive statistics for the sample. The table shows endowment data for the sample of 197,177 observations alongside basic financial data for 117,251 fiscal years of their parent organizations and certain governance data for up to 154,832 observations. We have significantly more observations for annual endowment performance due to the availability of up to four years of historical performance data for endowment funds on Schedule D, Part V, as noted above. The typical endowment size is quite small, with a mean of $26.8 million and median of $1.2 million, but the largest funds run into the tens of billions, with a maximum value of $36.4 billion (Harvard University, 2016). Outside the education sector, the largest funds are the MasterCard Foundation ($9.4 billion as of 2017) and the Shriners Hospitals for Children ($7.3 billion as of 2014). The median annual net investment return, calculated according to our method, is 4.84%, and the median distribution ratio is lower, 2.41%.

III. Investment returns

This section presents our analysis of investment returns. Subsection III.A includes basic overview statistics and comparisons with equity and debt market benchmarks. Subsection III.B uses the Fama-French-Carhart four-factor model to estimate the risk-adjusted abnormal returns for endowment funds, and we analyze these results in size cohorts. Subsection III.C investigates the relation between endowments' abnormal returns and several governance variables in an effort to understand better the forces that influence the funds' investment performance. Subsection III.D investigates the returns of endowments in the higher education sector, including

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comparisons of our results to those for colleges and universities in the widely used NACUBO sample.

A. Overview of endowment returns

Table 3 presents summary statistics for annual endowment returns for the entire sample and four subsamples partitioned by size. We use average start-of-year assets for each fund to determine membership in the size cohorts. For comparison we show returns on the Center for Research in Securities Prices (CRSP) value-weighted equity index, the CRSP 10-Year U.S. Treasury Bond Index, and a "balanced portfolio" comprised of 60% of the equity index and 40% of the Treasury bond index.[7] All index returns are aligned with the fiscal year reporting periods for each endowment, which accounts for slight differences in the benchmark returns for the four size cohorts. Data in the table represent means, medians and inter-quartile ranges for 12-month reporting periods and should not be interpreted as compound annual returns for 2009-2017, because observations are not uniformly distributed through time. Many endowments' 12-month reporting periods end in June or December, and the number of observations generally rises over time to reflect increasing compliance with IRS electronic filing requirements especially by smaller organizations

Data in Table 3 show a fairly dismal pattern of endowment returns. The mean and median returns for the entire sample are 5.68% and 4.84%, respectively, The median falls not only 446 basis points below the 60-40 balanced portfolio return, but also just 81 basis points above the 10-Year Treasury bond return. Looking at the size-weighted mean return instead of the equal-weighted mean makes very little difference. Within the four size cohorts of Table 3,

[7] The 60% - 40% combination of the equity and bond indexes is a heuristic commonly used to evaluate the performance of asset managers. For example, Barber and Wang (2013) refer to "the 60/40 stock/bond portfolio used as a performance benchmark by many endowments."

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we find that the largest endowment funds, those with assets greater than $100 million, exhibit the highest median returns, an outcome that runs counter to our analysis of endowments' risk-adjusted abnormal returns below.

Our 2009-2017 sample period represents an atypical market environment which includes a financial market collapse that began in 2008 and continues into our first year, followed by an extremely strong recovery of the equity markets beginning in late 2009 and continuing up to the end of the sample. For most of the sample period bonds also earn strong returns, due to a Federal Reserve policy of driving interest rates to sustained record lows. In addition, the alternative investments held by many larger endowments increase sharply in value toward the end of our sample period, when an IPO wave begins, and some endowments may have been slow to re-value their illiquid positions in venture capital, private equity, and related categories. Readers may therefore interpret our results with caution if these market conditions seem so unusual that they are unlikely to hold in the steady state.

Older NACUBO studies about the performance of higher education endowments prior to the global financial crisis have led to very different conclusions about overall endowment performance. We cannot validate the older research, which uses a much smaller sample and is concentrated on one industry sector, because the government disclosures that enable us to look more broadly at endowment performance do not begin until 2009. As discussed in Section III.D below, the more recent NACUBO studies show under-performance by higher education endowments in a pattern very similar to our findings for the universe of all non-profit endowments, and whether poor endowment results will persist remains a question for the future.

For the interested reader, Appendix 2 presents a more detailed version of Table 3, with the performance statistics reported for all observations with 12-month fiscal reporting periods

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ending in each of the 108 months during the 2009-2017 sample. The median endowment return is lower than the 60/40 benchmark in 97 out of 108 months.

B. Risk-adjusted abnormal returns

To estimate risk-adjusted excess returns, we use the standard four-factor model of Fama and French (1993) and Carhart (1997):

$$ExcessReturn_{i,t} = \alpha_i + \beta_{i,RMRF} \ln(1 + RMRF_t) + \beta_{i,SMB} \ln(1 + SMB_t) + \beta_{i,HML} \ln(1 + HML_t) + \beta_{i,UMD} \ln(1 + UMD_t) + \varepsilon_{i,t} \quad (1)$$

The Excess Return is estimated as $[\ln(1 + R_{i,t}) - \ln(1+R_{f,t})]$, where $R_{i,t}$ is the annual return for endowment i for year t, defined as the 12-month fiscal reporting period for that non-profit organization. $RMRF_t$ is the excess return on a value-weighted market portfolio annualized over the same 12-months. SMB_t, HML_t, and UMD_t are the zero-investment factor returns for size, book-to-market and one-year momentum stock return, respectively. These are also annualized over the same 12-month period as the endowment's fiscal year.

We face a challenge implementing this model, because it requires estimating five parameters, including the alpha intercept term, separately for each endowment fund, but our 2009-2017 sample period yields at most nine annual observations of performance data per fund. Our overall sample includes 197,177 annual observations for 29,892 endowments, and we subsample the 18,245 endowment funds that have at least seven annual observations. This subsample includes 152,079 endowment-years, or about 77% of the overall sample, and it

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probably imparts a slight positive bias to our estimates of alpha, since those charities with uninterrupted patterns of filing annual reports are probably the most financially successful.[8]

We start by estimating the OLS model described in equation (1) using the time-series annual returns for each of the 18,245 endowments. Thus, for each non-profit organization *i* we estimate

$$ExcessReturn_{i,t} = \hat{\alpha}_i + \hat{\beta}_{i,RMRF} \ln(1 + RMRF_t) + \hat{\beta}_{i,SMB} \ln(1 + SMB_t) + \hat{\beta}_{i,HML} \ln(1 + HML_t) + \hat{\beta}_{i,UMD} \ln(1 + UMD_t) + \hat{e}_{i,t} \qquad (2)$$

For each endowment *i* , we save the coefficient estimates ($\hat{\alpha}$, $\hat{\beta}_{RMRF}$, $\hat{\beta}_{SMB}$, $\hat{\beta}_{HML}$, $\hat{\beta}_{UMD}$) as well as the time series of residuals ($\hat{e}_{i,t}$). The cross-sectional average of alpha across the 18,245 endowments funds is reported in the first row of the first column of Table 4.

To test the statistical significance of these alpha estimates, we employ the bootstrap methodology described by Kosowski *et al.* (2006), and the description in the following passages closely adheres to that source. For each non-profit endowment *i*, we draw a sample (with replacement) of the residuals of that fund estimated from equation (2) above. This yields pseudo-time series of resampled residuals $\{\hat{e}(b)_{i,t}\}$, where *b* indexes the bootstrap iteration number. Thus, we scramble the time order of residuals for each endowment.

For the next step we create a time series of pseudo endowment returns imposing the condition of zero alpha:

[8] Many of the endowments that have fewer than seven observations simply have not filed their Form 990 returns for the entire sample period, or the documents have not yet been uploaded by the IRS to Amazon Web Services, and we expect these observations to become available for research purposes at some point in the future.

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$$\left[ExcessReturn(b)_{i,t} \right] = \hat{\beta}_{i,RMRF} \ln(1+RMRF_t) + \hat{\beta}_{i,SMB} \ln(1+SMB_t) + \hat{\beta}_{i,HML} \ln(1+HML_t) + \hat{\beta}_{i,UMD} \ln(1+UMD_t) + \hat{e}(b)_{i,t} \qquad (3)$$

Note that the construction method for the pseudo return for endowment *i* for year *t* consists of a predicted return with a zero alpha plus a randomly bootstrapped error term. Thus by construction the pseudo-time series of returns has a true alpha of zero. There is, however, the additional error term that adds randomization, since the residuals may be sampled more than once and the residuals have been scrambled across time.

Once the pseudo time series of zero alpha returns (with a randomly sampled residual added) has been constructed for every endowment-year, we re-estimate the four-factor model using these bootstrapped pseudo endowment returns similar to equation (1). Even though the true alpha is zero, the estimate for alpha from this regressions may be positive (or negative) if that bootstrap has drawn an abnormally high number of positive (or negative) residuals. Thus we are now able to generate a cross-section of bootstrapped alphas for all 18,245 funds. We save the cross-section average of the alphas. This process is repeated for 5,000 bootstrap iterations, (*b* = 1, …. , 5,000). This repetition yields a distribution of 5,000 average (cross-sectional) alphas. Comparing the observed average alpha of -0.0112 in the top left cell of Table 4 to this distribution allows us to conduct non-parametric statistical inference. We find that the probability of average alpha being -0.0112 is less than 1% if the true alpha was zero. In other words, in our 5,000 bootstraps we obtained an average alpha of that magnitude in less than 1% of the cases. Thus, we can reject the null hypothesis that average alpha is zero below the 1% significance level.

In addition to illustrating our main result, that endowment funds have mean risk-adjusted returns 1.12% below their benchmarks, Table 4 also shows the fraction of alpha estimates that

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are negative (61%) in our subsample of 18,245 endowments, and it shows the cross-sectional average estimates for the four risk factors without testing their statistical significance. The estimate of 0.5021 for the market risk factor implies that endowments invest conservatively, with just over half of their endowment excess return exposed to the equity markets.

We continue the analysis by examining separately each of the four size cohorts introduced in Table 3 above. The table shows that even though all cohorts earn average alphas that are negative, performance is better for smaller endowments compared to larger ones. Second, systematic risk decreases with endowment size, as shown by the estimates for the market return factor which decline from 0.63 to 0.44 across the size cohorts. This is consistent with a wealth effect that leads to decreasing absolute risk aversion as the value of an endowment grows (Merton, 1993). Note that the larger endowments, which have the worst performance, account for a minor number of observations by number, but an overwhelming fraction of the invested capital in the non-profit sector. For instance, the "large" cohort of endowments, those worth more than $100 million, account for 3.9% of the observations and 77.8% of the assets. In contrast, the very smallest endowments, those with asset values below $1 million which we label as "tiny," comprise 41.0% of the observations in the sample but account for only 0.5% of the assets invested.

The inverse relation we find between endowment size and performance echoes the pattern found for mutual funds in several studies. This pattern is regarded as something of a puzzle, since larger funds should enjoy advantages in trading costs and access to research and other information. Chen et al (2004) proposes a range of explanations, including the costs of investing in illiquid securities, which are more commonly held by larger funds, and the administrative costs of team management that is often used by larger funds. Pollet and Wilson

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(2008) discuss the costs of diversification and fund family membership as possible explanations, but neither of these issues would seem relevant for endowments, which are typically the only funds overseen by their parent organizations. The liquidity explanation is possibly the most sensible, as some non-profit endowments are known to be over-weighted in alternative investments as well as small-cap securities donated by university alumni or other benefactors who found their own companies and contribute a slice of the equity to their favorite charities.[9] The costs of hedging and eventually unwinding these block ownership positions may create a drag on the overall returns for certain funds.

As noted in Section II above, our calculation of annual percentage investment returns for each fund is based on an assumption that inflows of gifts and bequests occur halfway through the fiscal year, and outflows of distributions also occur halfway through the year, so we calculate the return by dividing net investment gains by the sum of beginning-of-year assets plus half of new contributions minus half of distributions. A more aggressive estimate would assume that all distributions occur at the beginning of the year while gifts are received at year-end, in which case the denominator would equal start-of-year assets minus distributions. The most conservative estimate would make the opposite assumptions, that gifts occur at the beginning of the year and that distributions are made at year-end, which would change the denominator to start-of-year assets plus 100% of contributions. We test whether our results change materially under either of these extreme assumptions. In the first case, the median portfolio return of 4.84% in the bottom row of Table 3 would increase to 5.22%, while in the second case it would drop to 4.57%, implying a range of about +/- 40 basis points depending upon the assumption chosen, a magnitude far below the levels of underperformance documented in the right column of Table 3.

[9] There are numerous examples, but perhaps the best known is the connection between Emory University and the founders of The Coca Cola Co.

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The impact on the alpha estimates in Table 4 is only minor. The alpha of -112 basis points shown in the first column of Table 4 changes to -109 basis points under the former, aggressive measure and -116 basis points under the latter, conservative measure. Other results shown in Tables 3 and 4 exhibit only similarly tiny differences under either alternative assumption.

C. Governance and endowment performance

In this section we study aspects of non-profit governance and its association with endowment performance. Most endowments are overseen by a board of trustees. In larger organizations, a legally separate "captive" foundation or trust may hold the endowment assets and have its own board. In the absence of such a structure, the trustees of the parent organization, perhaps acting through an investment committee, will make decisions about managing the endowment's investments and making periodic distributions from the endowment to the organization.

An emergent literature has begun to study the success of asset management as a function of the characteristics of the individual trustees. In line with research into public companies, the recent papers studying investment fund governance show that the professional backgrounds, incentives, and conflicts of interest of individual board members exhibit significant ex post associations with performance. One of the first papers, Smith and Smith (2016), uses survey data collected by NACUBO as part of its 2009 and 2010 annual studies of university endowments. The authors find connections between the size and composition of investment committees and their propensities to engage in socially responsible investment practices.

Andonov, Hochberg and Rauh (2018) examine the backgrounds of trustees of public pension funds, and the authors identify the proportion of board positions occupied by political

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appointees as opposed to investment industry experts. In a sample of 212 pension funds between 1990-2011, the performance of the funds' private equity investments is negatively related to the presence of state officials on the board. The negative performance is more pronounced when these officials receive political contributions from the finance industry, suggesting that they may direct business to suboptimal investment management firms.

In a related paper Binfarè et al (2019) analyze the backgrounds and professional networks of more than 11,000 university trustees who collectively have oversight responsibility for 579 university endowments tracked by the NACUBO sample between 2004-15. The study finds that when trustees have expertise in alternative investments and larger professional networks, then their universities engage in greater asset allocation to this category of investments and earn higher returns.

Binfarè and Harris (2020) analyze the compensation of chief investment officers of 191 endowment funds between 2009-17 using data from IRS Form 990, the same source used in this study. The authors find that CIO pay increases when endowments perform well, implying that a pay-for-performance relation motivates CIOs to identify investment opportunities for their endowments. One interesting aspect of this study is the very low frequency of organizations that have a CIO listed among the officers of the endowment or its parent organization. In attempting to replicate its results, we filtered the Form 990 filings for our sample of more than 170,000 endowment-years and were able to identify only about 1,075 observations with CIOs (or similar titles) present among the officer group, essentially the same sample of CIOs identified in the recent paper by Binfarè and Harris.[10] This indicates that non-profits have CIOs only about 0.6%

[10] We have nearly four million person-years in our sample of 170,000 endowment-years, about 24 individuals per organization. The sample is mainly comprised of 991,098 individuals who identify themselves as Directors, 695,495 Trustees, and 486,811 Board Members. There are about 22,000 CFOs or Chief Financial Officers and 112,000 Treasurers, but only 1,075 CIOs or Chief Investment Officers (some of the CIOs may, in fact, be Chief

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of the time and are outsourcing the endowment management function to professional firms in the vast majority of cases.

These studies all rely on data about the personal characteristics of individual trustees or officers, and their limited sample sizes of up to a few hundred organizations keeps this data collection manageable. In our comprehensive sample of all non-profit endowments, this type of granular data collection is infeasible since we track almost 30,000 endowments with almost four million individual person-years of information included in their filings. Moreover, we are unable to identify with clarity many governance variables that might be relevant to endowment performance, such as conflicts of interest related to donor or alumni status for individual trustees.

Rather than study the attributes of individual trustees, we instead investigate governance data measured at the board level. With coverage of tens of thousands of individual endowments, our large sample size provides sufficient degrees of freedom to analyze the significance of board-level covariates in a way that would not be easy in the studies above, which are drawn from much smaller samples of a few hundred endowment funds. We are able to use Form 990 to construct four governance variables that should play a role in the effectiveness of endowment oversight: board size, complete board independence, the accountability of the board to the organization's membership or other constituents with voting power, and the fraction of the endowment fund that is designated by the board as restricted. For each organization, we average these variables together and regress the estimated alpha for each endowment against the time series average of the governance variables as well as an intercept.

Board size equals the number of members of governing body as reported on Line 1a of Part VI. Yermack (1996) shows a relation between smaller board size and higher value in public

Information Officers). In contrast, the filings include 838 Basketball Coaches and more than 11,000 Professors listed among the top officers or most highly paid employees of various non-profits.

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companies, a result confirmed in numerous successor studies. Tufano and Sevick (1997) extend the board size variable into the investment management industry, finding that smaller mutual fund boards succeed in negotiating lower management fees for their beneficiaries. We delete observations that report having boards of more than 100 members in the belief that these are mostly coding errors (the maximum board size has more than 36,000 people). This removes 936 observations or 0.6% of the sample, and our regression estimates reported below change very little if these implausibly large board size values are left in the analysis. In particular, the estimates for the board size variable move slightly closer to zero, implying that the overall negative and significant estimates for the full sample are not dependent on the small number of pathologically large-valued observations.

We identify boards that are fully independent by comparing the number of board members reported on Line 1a with the number of independent board members reported on Line 1b. If Line 1b is less than Line 1a, we set an indicator variable equal to one for "board not fully independent." Fama and Jensen (1983), in their study of corporate governance, observe that most non-profit boards exclude all insiders and are fully independent to compensate for the weakness or absence of other governance mechanisms.

A third governance variable is an indicator set equal to one for boards that are not fully self-perpetuating but are instead at least partly accountable to a group of members, stockholders, or other constituents either for re-nomination or for ratification of certain policy decisions. These organizations are identified by questions on Lines 7a and 7b of Form 990, and if either of these questions is coded Yes, we set the "accountable" indicator equal to one.

Finally, we include a fourth governance variable, the fraction of endowment assets that are restricted, as reported in Section 2, Part V, of Schedule D. Yermack (2017) studies restricted

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endowment funds, which are established by donors as an indirect governance mechanism to reduce the discretion of the board. In line with earlier studies, we expect smaller boards, fully independent boards, and accountable boards to be associated with better investment performance. Fewer restrictions on the use of endowment funds may also lead to higher alphas, assuming that trustees may adopt conservative investment policies to safeguard capital that has restrictions on its use.

Results of the alpha regressions appear in Table 5, which shows estimates for models using the entire sample and each of the four size cohorts. Recall that the alphas are estimated only for those endowments with at least seven years of valid data, so the analysis in Table 5 has the same sample restriction. The board size variable is expressed in log form (the log of each endowment's time-series average board size), as done in most earlier studies.

The first line of Table 5 shows a negative estimated association between investment returns and the log of board size, consistent with numerous other studies that find superior performance by smaller boards. Some of the benefits of small board size include a propensity to take greater risk and less temptation for individual members to engage in free-rider behavior. The relation between alphas and board size is estimated as negative in all four size cohorts, significant in three out of the four, and it appears to operate with increasing strength as endowments grow larger.

We also find a positive association between board accountability and investment performance, as shown in the third row of Table 5. The relation is positive and significant for the overall sample and in two of the four size cohorts, but it is virtually zero for the largest endowments, as shown in the second column. Accountable boards are either elected by the organization's members or must submit certain decisions to the organization's membership for

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ratification (in some universities, for example, alumni elect the governing boards). A non-accountable board has the power to choose its own successors and is not vulnerable to removal or reversal by its constituents. Our finding that accountable boards are associated with better investment performance is an important one for non-profits and to our knowledge has not been studied before in a large-sample setting.

We do not find significant associations in the overall sample between investment performance and either board independence or the fraction of endowment capital that is restricted, although restrictions do appear to impact performance negatively in smaller endowments.

D. Comparison of results with studies based on NACUBO sample

As noted in the introduction, most earlier research into endowments' investment returns has used NACUBO's annual reports on higher education endowments. NACUBO relies on voluntary participation by colleges, universities, and research institutions. As recounted in the Foreword to the executive summary of NACUBO's 1988 study, its annual endowment survey began in 1971 when NACUBO took over a project previously housed within the administration of Dartmouth College. In 1988 NACUBO's annual reports began disclosing identities of participating endowments, which numbered 315 at that time. In 2009 NACUBO merged its study with similar research by Commonfund, resulting in a larger sample size and a change in the format of its annual reports. In 2018 TIAA replaced Commonfund as sponsor and the study

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was renamed and the annual reports again reformatted.[11] In 2019 the sample size dropped to 774, continuing a pattern of attrition experienced since 2010, when it peaked at 850.

Along with the gradual reduction in sample size, we find considerable entry and exit from the NACUBO sample on a year-to-year basis; during our sample period of 2009-17, a total of 425 institutions drop out of the NACUBO sample after appearing in the previous year (some later rejoin), while 385 new institutions opt into the sample after not appearing the prior year (603 appear continuously in all nine years). This leads to a net decline in sample size of 40, as the survey drops from 842 institutions in 2009 to 802 in 2018. In contrast, our sample size increases from 13,797 in 2009 to 23,597 in 2017, with the higher participation driven by the phase-in of IRS disclosure regulations. Once endowments begin reporting data to the IRS on Form 990, they should not drop out of our sample unless the endowment or its parent organization is dissolved and ceases to exist.[12]

Some researchers examining the NACUBO data during earlier sample periods have concluded that these endowment funds earn returns above market benchmarks, and these studies have contributed to a widely held belief that non-profit endowments have been successful investors. For instance, Lerner, Schoar and Wang (2008, Figure 1) show that on average, endowments in the NACUBO sample out-perform the S&P500 index during the 1993-2005 sample period of their study. Similarly Binfarè *et al.* (2020, Table 8) find that NACUBO

[11] See the press release describing the reorganization at https://www.tiaa.org/public/about-tiaa/news-press/press-releases/pressrelease705.html. Past NACUBO reports are available at the organization's data archive, https://www.nacubo.org.

[12] An exception could occur if an organization reverts to paper filing, but we are likely to capture most such observations through the use of lagged data in subsequent electronic filings. IRS regulations require electronic filing if the organization has total assets of at least $10 million and files at least 250 returns annually, including income tax, excise tax, employment tax and information returns (such as Forms W-2 and 1099 reporting employee compensation).

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endowments on average outperform a 50/30/20 benchmark of indexes for public equity, fixed income, and international equity during their 2004-2015 sample period.

However, other studies that calculate excess endowment returns on a risk-adjusted basis have come to less favorable conclusions. Brown, Garlappi and Tiu (2007) find that estimated alphas in the four-factor model (similar to the model we estimate) are not statistically significant for the NACUBO endowments during their 1989-2005 estimation period. A similar 1992-2011 study by Barber and Wang (2013) using NACUBO data finds "no evidence that the average endowment is able to deliver alpha relative to public stock/bond benchmarks."

Our study, which finds significantly negative alphas for endowment returns between 2009-17, is sharply at odds with the results of earlier research that finds either positive or statistically insignificant excess returns in the NACUBO sample. Potential explanations for our different conclusions would include the slightly later sample period of our study, our vastly larger sample size and inclusion of industry sectors other than just higher education, and methodological differences including the choices of benchmarks, measurement of fiscal years, and selection of endowments into the sample. While we investigate a number of these possible explanations, as described more fully below, we believe our results closely agree with data reported in recent years by NACUBO itself, which indicate a marked downturn in the success of college and university endowments' investments over the past decade.

In NACUBO's 2017 report, Figure 2.2 reports average annual returns of 4.6% over the prior 10 years for the 809 endowments in that year's sample; the comparable five-year and three-year average annual returns were 7.9% and 4.2%, respectively. These are far below the annual returns on the S&P500 Index of 7.2%, 14.6%, and 9.6% for the prior ten-year, five-year, and three-year periods, respectively, as shown in a table on page 8 of the same report. For fixed

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income (Bloomberg Barclays Aggregate Bond Index) and private equity / venture capital (Burgiss Private IQ), the ten-year average annual returns were 4.5% and 8.9%, respectively. In other words, over the 2008-17 decade NACUBO's endowment funds barely earned the same as an investment in the fixed income index and were far behind the indexes for public and private equity. We believe these findings are completely consistent with our study's results, which show significant underperformance by a much larger sample of endowments between 2009-17 with overall returns not much higher than the index of U.S. Treasuries. These findings are reinforced by NACUBO's 2018 report, one year after the end of our study, in which a graph on page 12 shows the NACUBO endowments underperforming their own internal targets (generally in the 7% range) in every one of the years between 2009-18.

We attempt to apply our study's methodology to the endowments in the NACUBO sample but run into a number of problems. The parent organizations for certain endowments covered by NACUBO, especially state universities and religious institutions, are not required to file Form 990 with the IRS, so they cannot appear in our sample. NACUBO also uses benchmarks that assume all endowments have a June 30 fiscal year and encourages them to report data on this basis,[13] but in reality only 42% of endowments' years end on June 30, and the majority report to the IRS on the basis of other time periods. Although NACUBO provides a list of participating institutions, not all of them are included in its calculations of overall investment returns, with some endowments only providing data about other categories such as asset

[13] We cannot tell how many institutions with different fiscal years actually comply with NACUBO's request to adjust their annual reporting periods to June 30. In its 2007 Executive Summary, NACUBO writes, "NACUBO again encouraged participants to report their investment pool data on the basis of a June 30 fiscal year-end date. NACUBO hopes that in the future all participant institutions will provide data based on June 30 to allow for the highest level of comparability. . ." The language, which suggests incomplete compliance by reporting members, does not appear in subsequent reports.

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allocation.[14] This incomplete participation would tend to exacerbate the year-to-year changes in NACUBO's sample discussed above.

While we are unable to replicate our overall results within the NACUBO sample, we undertake additional analysis to assess whether differences exist between the entire non-profit universe covered by our study and the smaller, more focused higher education segment from which NACUBO draws its observations. Table 6 presents the average alphas that we estimate for colleges and universities compared to non-profits in other sectors. The differences appear large: higher education institutions, whose endowments account for more than half of all assets in the sample despite representing just 6% of the observations, significantly underperform market benchmarks, with abnormal investment returns of minus 149 basis points per year. All other (non-higher education) endowment funds also earn negative alphas, with a statistically significant estimate of minus 110 basis points per year. The difference in these two estimates is itself significant below the 1% level. However, this result appears to be size-driven, as NACUBO participants are overly concentrated in the larger endowment size cohorts, which underperform smaller endowments during our sample period as shown in Table 4.

Following studies such as Lerner, Schoar and Wang (2008), we look at the abnormal returns earned by endowments of the top 20 national universities (the Ivy League schools and others such as MIT, Stanford, and Georgetown) as ranked in 2017 by *U.S. News and World Report*. Due to inconsistent data in the filings of Cornell University, we drop it from the analysis and instead use Emory University in its place. These highly ranked schools earn close to zero

[14] For instance, in its 2009 Executive Summary, NACUBO writes, "Of the 842 institutions participating in the year's Study, 94 percent - or 794 institutions - provided return data for the most recent fiscal year." In 2010, a similar disclosure indicates that only 817 of the 850 "participating" institutions had actually provided return data. NACUBO does not identify which endowments withhold data, and it discontinued providing information about the numbers of such endowments beginning with its 2013 report. In one report NACUBO listed the names of a smaller number of institutions than the number it identified as participating.

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abnormal return (minus 20 basis points per year, not statistically significant), a result that gives no indication of superior performance but is nevertheless much better than other colleges and universities. While these results are not in line with earlier studies and copious media coverage about the out-performance of elite schools, they suggest that the most selective schools do better than others within their sector and basically earn returns that are no worse than average. However, they also support the conclusion that the investment wisdom of top universities today amounts to little more than a myth, as one could expect to earn these types of returns simply by chance. Frequent mentions in the media of the out-performance of top schools may be due to the publicity about the success of just one university, Yale (see Phalippou, 2013).

Finally, we compare NACUBO and non-NACUBO institutions' alphas in the right two columns of Table 6. We count a college or university as a NACUBO participant if its endowment appears in the NACUBO study at any time between 2009-18, which captures 884 institutions, while there are a further 528 higher education institutions that do not participate in NACUBO during this time.[15] The NACUBO participants have very negative alphas, estimated at minus 193 basis points per year, compared to the non-NACUBO institutions, which have estimated alphas of minus 106 basis points. These estimates belie any possibility of sample selection into the NACUBO study by strongly performing endowments, an issue we investigate further below. We conjecture that the poor results for NACUBO schools are probably in line with the overall negative size-performance effect shown in Table 4 above, since larger colleges and universities are over-represented in NACUBO relative to smaller ones.

[15] The total number of observations in the right two columns of Table 6 exceeds the number of observations for colleges and universities in the second column. This occurs because the sample in the second column is identified by the NTEE higher education sector classification, while the NACUBO sample includes a number of additional non-profits that are not classified as higher education institutions by NTEE.

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The possibility that sample selection bias influences NACUBO's results has been the object of speculation in numerous academic studies.[16] Brown, Garlappi, and Tiu (2007) and Barber and Wang (2013) both contain thoughtful discussions of the issue as well as some indirect evidence that tends to suggest that selection bias has little or no importance. Until now, directly studying the presence of selection bias in NACUBO has not been possible, since researchers have not been able to observe the endowment returns of institutions that don't opt in to NACUBO's sample, and are able to address this issue directly.

We conduct regression analysis within the sample of NACUBO endowments to assess whether their first years in the sample exhibit abnormally strong performance, which would be consistent with above-average funds opting into the sample, and we also test whether performance is abnormally poor in those years in which endowments drop out of NACUBO. We exclude sample entrants during the year 2009, since NACUBO's merger of its study with Commonfund's that year greatly increased its sample size. The results, which we do not tabulate in order to save space, show no significant performance differences for these subsets of entering and exiting endowment observations. This failure to reject the null hypotheses is consistent with an absence of selection bias in the overall NACUBO sample.

[16] NACUBO's annual studies say little about the issue of selection bias. The cooperation rate of potential survey participants appears to have been last mentioned in the 2008 Executive Summary, when NACUBO wrote 1,028 institutions were "invited to participate" in the study and 796 agreed, a cooperation rate of 77%. We are unable to locate similar information in later reports. The reports generally contain oblique language about sample recruitment that makes no mention of cooperation issues or the declining sample size experienced since 2010. For instance, the 2017 report states only that "The design of the 2017 [study] took place in the spring and early summer of 2017. Web-enabled questionnaires and field interviews followed in the third and fourth quarters of calendar 2017." Identical language appears in many previous reports.

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IV. Distribution policy

Endowments exist to distribute funds to their parent organizations. In principle, these distributions could fund part of an organization's operating budget on a recurring basis, or be used for non-recurring capital expenditures, or could occur as needed to close unexpected deficits. Little is known about the distribution policies for non-profit endowments other than two recent small-sample studies by Brown *et. al* (2014) and Yermack (2017) which appear to reach opposite conclusions. Brown *et. al* study approximately 200 large research universities and find a surprisingly pro-cyclical distribution pattern, in which universities experiencing negative financial shocks reduce their endowment payouts. Yermack (2017) studies 120 large art museums and finds that endowment withdrawals increase when the museums' operating surpluses decline.

Numerous papers beginning with Tobin (1974) have proposed spending rules for endowments, and Brown *et. al* (2014) provide an excellent review of this literature. Many of these rules resemble the consumption-smoothing prediction of Tobin's permanent income hypothesis or the dividend-smoothing payout rules followed by corporations as first documented by Lintner (1956). The tenor of these policies implies that non-profits aim for a stable distribution rate from their endowments, with the rate equal to the long-run expected return of the fund. However, other papers have taken issue with this type of distribution policy, such as Hansmann (1990) and Merton (1993). Hansmann focuses on issues of intergenerational equity and concludes that an overly conservative distribution policy may give undue benefit to more affluent future generations. Merton notes that an endowment fund can be invested, and can

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follow distribution policies, that hedge an organization's cash flows from other assets, such as a university's streams of tuition revenue and donations. He would therefore expect a counter-cyclical distribution policy.

Table 7 shows descriptive statistics about the distribution policies for the endowment funds in our sample. We calculate the distribution rate based on information in Part V, Schedule D of Form 990. The distribution rate equals the ratio of distributions for grants and scholarships (Line 1d) plus distributions for facilities and programs (Line 1e) over the sum of beginning-of-year assets (Line 1a) plus 50% of new contributions and transfers during the year (Line 1b). It should be thought of as similar to the dividend policy for a company deciding what fraction of its equity to pay out to shareholders each year. We present data for the sample overall in the left column of Table 7 and for each of the four size cohorts in the next four columns. The data indicate that endowments have a mean distribution rate of 4.91% and a median rate of 2.41%, with more than one-third of funds not making any distribution at all. Analysis of the size cohorts reveals a clear connection between endowment size and payout policies. In the second column of Table 7, data indicate that most large endowment funds have very stable distribution policies, with mean and median distribution ratios of 4.89% and 4.38%, respectively, and more than 95% of all funds making a distribution in a given year.[17] In the right column of Table 7, the data indicate that the majority of tiny endowment funds make no distribution at all. The other two size cohorts see the data trend monotonically between these two extremes.

The data suggest that smaller endowments follow an accumulation strategy, with a predisposition to make no distributions to their parent organizations, and they instead attempt to

[17] For comparison, Brown *et. al*'s (2014) survey of about 200 large universities drawn from the NACUBO sample between 1986-2009 shows mean and median payout rates of 5.2%, calculated with slightly different methodology than ours. Yermack's (2017) study of 120 art museums between 2008-2013 shows mean and median spending rates of 5.8% and 4.7%, respectively.

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grow to a critical mass. Once endowments have grown large, they follow very different distribution strategies. The mean and median distribution rates for large endowments are very close, in the neighborhood of 4.5%. Extraordinary distributions from larger endowments seem to be rare, since the mean and median withdrawal rates are almost equal, and virtually all large funds make at least some distribution. In contrast, the mean distribution for tiny endowments is 4.47%, even though more than half make no distribution at all. This implies that smaller funds are accessed from time to time for large extraordinary withdrawals.

The 4.5% distribution rate appears to be a focal point that is commonly used by many large, established funds. This figure may approximate the real return that one might expect from a fund invested 60% in equities and 40% in risk-free debt, but if inflation is greater than zero, the 4.5% nominal distribution rate is likely to be less than the return of a typical fund, meaning that endowments will tend to grow over time.[18] This conservative distribution policy has been the focus of much of the external criticism that has focused especially on the growth of elite universities' endowments and contributed to Congress's decision to enact a 1.4% tax on large university endowment profits beginning in 2018. By comparison, private foundations are generally required to distribute at least 5.0% of their assets in order to maintain their non-profit status, and that number also has drawn criticism for being below the likely investment returns for funds held in these entities.

Table 8 presents a regression analysis of annual endowment distributions as a function of six potential sources of cash for the organization: operating income, cash on the balance sheet at the start of the year, new donations, new government grants, an increase in debt, and investment earnings on the endowment itself. Standard errors are clustered at the organization level, and we

[18] Hansmann (1990, pp 9-10) writes, "nearly all discussions of spending rules simply take it for granted that the rate of spending out of endowment should not, over time, exceed the real rate of return on the investments constituting the endowment."

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show estimates for the overall sample and for each of the four size cohorts. We exclude from this analysis observations for lagged investment performance that are reported on Schedule D, Part V of Form 990, since we lack annual operating data for these observations. We also exclude organizations that identify themselves as "Supporting Public Charities" (coded as S for the NTEE classification variable "Level 2"). These are typically organizations affiliated with other non-profits, and they usually hold or manage the other organization's endowment funds but have few if any operating expenses of their own.

In the left column of Table 8, estimates indicate that the dollar value of endowment distributions exhibits positive associations with three variables: cash available at the start of the year, operating deficits, and endowment earnings. Results for the four size-based subsamples shows that the operating surplus and cash effects can be attributed to the payout behavior of very large endowments. However, a positive association of similar magnitude exists in all four subsamples between endowment earnings and distributions to the parent organizations.

The point estimates in the second column of Table 8 show that when large endowments run operating deficits, about 22 percent of the deficit is covered by increased distributions from the endowment, a result similar to Yermack's (2017) estimate of 13 percent for a much smaller sample of prominent art museums. This result seems to contradict Brown *et. al*'s finding that endowment payouts are reduced when an organization experiences negative financial shocks. However, that paper takes a different empirical approach, defining a "shock" not in terms of operating losses, but instead as a deterioration in the ratio of endowment assets over total expenses.

The other strong result in the first column of Table 8 shows that when an endowment's earnings rise or fall, annual payouts from the endowment to its parent can be expected to rise or

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fall by about 25% of the change in endowment earnings. This surprisingly high partial correlation may occur because some institutions follow a primitive distribution policy of simply paying to the parent most or all of the annual realized income of the fund (Hansmann, 1990).

V. Endowment performance and its impact on fundraising

Given the high public interest in the investment performance of endowment funds, a natural hypothesis to examine is whether donors respond to successful years in which funds earn strong investment returns. We test this hypothesis in regressions analysis shown in Table 9. The dependent variable in this table is based on total donations during the fiscal year. We calculate this from Part VIII of Form 990 as the sum of federated campaigns (Line 1a) plus fundraising events (Line 1c) plus all other contributions, gifts, and grants (Line 1f). We do not include membership dues (Line 1b), income from related organizations (Line 1d) or government grants (Line 1e). Our dependent variable in Table 9 is then $\ln(\text{donations}_t / \text{donations}_{t-1})$, and we regress this against the endowment investment return for the prior year with results shown in the left column. In the center column, we repeat this regression after subtracting the equity market index from the endowment return, so that the explanatory variable becomes the net-of-market return. In the right column, we subtract the 60% - 40% balanced portfolio of the equity and Treasury bond indexes introduced as a benchmark in Table 3 above. We lack a sufficient number of annual observations for each fund to fit a more elaborate model of expected returns.

Results in Table 9 indicate a positive and significant intercept around 0.02, implying a secular growth rate in donations of close to 2% per year, and estimates of 0.2101, 0.1718, and 0.1163 for the lagged raw returns, net-of-market returns, and net of 60-40 benchmark returns respectively, all significant at the 1% level based on standard errors clustered by endowment.

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These coefficient estimates indicate a modest but significant elasticity between investment performance and the willingness of donors to contribute in future periods. If a fund out-performs the equity market benchmark by 10%, for instance, donations would grow by about 1.7% in the following year, all else equal. These results parallel those found in other "flow-to-performance" studies in the asset management industry that document increased inflows of new capital after years in which a money manager outperforms market benchmarks. Lewellen and Lewellen (2018) provide a recent contribution in this area and a review of the lengthy literature.

VI. Discussion and conclusions

We study the investment returns and distribution policies of non-profit endowment funds, which have grown into a $0.7 trillion institutional investor class in the U.S. economy. Up to now, nearly all research on endowments has focused on the NACUBO sample of major colleges and universities, using self-reported survey data from about 800 organizations. Although higher education endowments represent somewhat more than half of the total asset class, our results suggest that the research focus on them may be somewhat misleading, as they have inferior investment performance on an absolute basis and also when compared to endowments with parent organizations in other sectors.

In a sample of more than 29,000 endowment funds drawn from U.S. Internal Revenue Service filings, our regression analysis indicates that on average, endowment funds underperform their market benchmarks significantly. This pattern is influenced by an endowment's size, as larger endowments tend to underperform the most on a risk-adjusted basis, even though the larger funds earn higher raw returns. Our performance results must be viewed in the context of the unusual market behavior during our 2009-2017 sample period, which began

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with a sharp decline in equity values during the global financial crises and was followed by a very strong market recovery that many endowments appear not to have fully participated in. These market movements are widely viewed as exceptional, and it is certainly possible that endowments have achieved better investment performance in the past and may do so again in the future in more ordinary market environments.

Endowments' returns appear to be influenced by their internal governance, as those funds with smaller boards of trustees deliver better investment results, as do endowments whose trustees are not completely self-perpetuating and instead are accountable to an organization's membership or other constituents.

Most endowments appear to follow distribution policies that are quite conservative, with a median payout ratio below 2.5% of their assets. Again, size plays a big role, as most tiny endowments make no distributions at all, and larger endowments tend to cluster around a distribution rate of about 4.5% of fair market value. This number would appear to resemble the expected long-run real return on a fund that is invested 60% in equities and 40% in debt.

We find an interesting connection between an endowment's investment performance and the willingness of donors to change their contributions in future years. We estimate an elasticity between investment returns and the growth of donations of approximately 0.18. This implies that the constituent donors of a non-profit, such as the alumni of a university, are aware of how well the organization performs as an investor and adjust their donations in a pattern that rewards stock market profits with a supply of new capital, much as one sees the inflows to a mutual fund increase when the fund outperforms the market.

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Table 1
Sample of Form 990 filings

The table shows the sample of Internal Revenue Service Form 990 filings that we retrieve from Amazon Web Services. We retain all observations that have non-missing, positive values for endowment assets at the start and end of the year as well non-missing values for investment income and exhibit no contradictions or inconsistencies in Table V, Schedule D, where the endowment data is reported. Certain duplicate filings for the same organization are dropped according to a procedure described in the text. Observations are classified according to each organization's National Taxonomy of Exempt Entities (NTEE) code.

Panel A: Number of unique Form 990 filers by year and NTEE code

Year	Arts, culture, and humanities	Higher education	Education (other)	Hospitals	Environment	Health (other)	Human services	International	Mutual benefit	Public and societal benefit	Religion	Unknown or missing	Total
2009	1,578	1,066	2,293	709	620	1,646	3,386	178	215	1,528	283	295	13,797
2010	2,322	1,149	3,279	837	868	2,238	4,638	244	303	2,101	421	365	18,765
2011	2,736	1,176	3,998	863	1,008	2,491	5,249	289	343	2,474	476	317	21,420
2012	2,966	1,187	4,281	866	1,096	2,632	5,619	307	363	2,674	513	217	22,721
2013	3,120	1,206	4,478	888	1,187	2,724	5,908	327	386	2,781	540	131	23,676
2014	3,210	1,208	4,631	879	1,218	2,805	6,105	338	398	2,906	569	98	24,365
2015	3,216	1,205	4,639	856	1,255	2,804	6,149	338	422	2,908	576	58	24,426
2016	3,227	1,184	4,615	823	1,279	2,756	6,188	336	446	2,936	563	57	24,410
2017	3,165	1,166	4,534	746	1,248	2,613	5,990	328	407	2,791	537	72	23,597
Total	25,540	10,547	36,748	7,467	9,779	22,709	49,232	2,685	3,283	23,099	4,478	1,610	197,177

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Panel B: Beginning-of-year endowment assets ($million) by year and NTEE code

Year	Arts, culture, and humanities	Higher education	Education (other)	Hospitals	Environment	Health (other)	Human services	International	Mutual benefit	Public and societal benefit	Religion	Unknown or missing	Total
2009	$27,851	$297,461	$63,955	$28,092	$5,473	$13,579	$14,952	$2,835	$2,074	$22,235	$1,222	$1,897	$481,627
2010	$26,451	$230,679	$67,234	$30,153	$5,771	$14,523	$16,869	$4,048	$2,340	$27,195	$1,922	$1,839	$429,024
2011	$32,154	$250,372	$76,063	$34,863	$6,542	$17,477	$19,138	$4,669	$2,604	$30,469	$2,317	$1,858	$478,526
2012	$36,234	$297,764	$90,391	$35,983	$7,210	$20,560	$20,678	$5,220	$2,717	$38,972	$2,632	$1,562	$559,921
2013	$37,127	$295,297	$92,610	$39,092	$7,726	$22,522	$22,120	$5,719	$2,884	$44,727	$3,138	$1,101	$574,061
2014	$42,576	$323,262	$105,865	$42,609	$8,577	$25,548	$24,770	$7,500	$2,759	$53,493	$3,653	$1,651	$642,263
2015	$46,274	$368,381	$109,663	$45,219	$9,348	$27,457	$26,717	$8,381	$3,078	$57,601	$4,024	$1,443	$707,586
2016	$42,100	$380,981	$114,223	$44,696	$9,367	$27,349	$26,241	$5,383	$2,860	$60,706	$2,487	$1,533	$717,924
2017	$39,643	$367,341	$113,912	$44,513	$9,181	$26,351	$25,350	$5,088	$2,854	$57,427	$2,463	$1,829	$695,952
Total	$330,412	$2,811,537	$833,917	$345,219	$69,195	$195,365	$196,835	$48,843	$24,169	$392,825	$23,856	$14,713	$5,286,884

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Table 2
Descriptive statistics
The table shows descriptive statistics for a sample of 29,892 U.S. non-profit organizations between 2009-2017. Data are obtained from Internal Revenue Service Form 990 filings, and all dollar values are in $millions. Panel A shows annual observations for endowment funds, and the number of observations is greater than for other panels because of the inclusion of up to four years of historical lagged endowment data available on Schedule D of Form 990. Endowment assets at the start of year are reported in Part V of Schedule D (Line 1a). Endowment additions appear on Line 1b, and the endowment distribution rate equals the sum of grants and scholarships (Line 1d) and other expenditures for facilities and programs (Line 1e) divided by start-of-year endowment assets plus 0.5 times endowment contributions. Net investment return equals net endowment investment gains/losses (Line 1c) minus any administrative expenses (Line 1f), divided by start of year endowment assets plus 0.5 times endowment contributions (Line 1b) minus 0.5 times endowment distributions (Lines 1d and 1e). Panel B shows annual financial data for the endowments' parent organizations, and we exclude endowments that are classified as "supporting public charities" and are held in a separate legal entity than the operating affiliate. Total revenue is reported in Part I, Line 12. Total assets and liabilities are reported as of the start of the fiscal year in (Part X, lines 16 and 26). Endowment distribution equals the sum of grants or scholarships (Line 1d) and other expenditures for facilities and programs (Line 1e) as reported in part V of Schedule D. Cash donations equal the sum of federated campaigns (Part VIII, Line 1a), fundraising events (Part VIII, Line 1c) and other gifts (Part VIII, Line 1f). Operating surplus equals program service revenue (Part VII, Line 2g) minus program service expenses (Part IX, Line 25). Endowment earnings is from part V of Schedule D (Line 1b). Net change in long-term debt equals the difference in bonds, loans, and notes outstanding at the end of year from the beginning of the year (sum of Line 20, Line 23, and Line 24 in part X). Government grants received equal cash from newly awarded grants (Part VIII, Line 1e) minus changes in grants and pledges receivable (Part X, Line 3). Cash on the balance sheet is the sum of reported cash (Part X, Line 1) and savings (Part X, Line 2). Panel C shows certain governance data for the organizations holding each endowment. Board size is the number of voting members of governing body as reported on Part VI, Line 1a. We show data for both the overall sample and for a subset of observations omitting those reporting board sizes of more than 100 people. The indicator for a board not fully independent equals one if the number of independent trustees reported on Line 1b is less than the total number of trustees reported on Line 1a. The accountable board indicator equals one if some members of the board are elected by the organization's members or other constituents, or certain governance decisions are reserved to or ratified by those groups, as reflected by the organization's responses on Lines 7a and 7b. The ratio of board-designated restricted funds in the endowment is reported on Schedule D, Section 2, Part V.

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Panel A: Endowment data

	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Endowment assets	197,177	$26.8	$1.2	$374.6	$0.0	$36,428.5
Endowment additions	197,177	$1.1	$0.005	$12.8	($25.8)	$1,415.7
Endowment distribution rate	197,177	0.0491	0.0241	0.1103	0	1.9992
Net investment return	197,177	0.0568	0.0484	0.0887	-0.4801	0.9353

Panel B: Financial data

	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Total revenue	117,251	$51.1	$3.6	$298.1	($33.0)	$12,712.2
Total assets	117,251	$102.3	$7.4	$848.8	($11.7)	$75,287.5
Total liabilities	117,251	$36.8	$0.7	$317.7	($1.6)	$35,024.4
Endowment distribution	117,251	$1.7	$0.01	$23. 3	$0	$1,989.6
Cash donations	117,251	$5.0	$0.6	$36.2	($1.2)	$2,654.3
Operating surplus	117,251	($1.9)	($0.3)	$63.7	($2,671.9)	$1,315.3
Endowment earnings	117,251	$2.7	$0.03	$49.3	($602.9)	$5,394.7
Net change in long-term debt	117,251	$0.6	$0	$18.1	($926.6)	$2,052.6
Government grants received	117,251	$2. 9	$0.02	$29.6	($305.4)	$1,299.8
Cash on balance sheet	117,251	$6.9	$0.7	$47.0	($78.9)	$2,972.8

Panel C: Governance data

	Obs.	Mean	Median	Std. Dev.	Min.	Max.
Board size (as reported)	154,832	21.6	16	132.6	0	36,516
Board size (omitting obs.>100)	153,896	18.9	16	11.5	0	100
Board not fully independent	154,832	0.297	0	0.457	0	1
Accountable board	154,832	0.265	0	0.441	0	1
Ratio of restricted funds	154,832	0.271	0	0.382	0	1.000

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Table 3
Endowment returns

The table shows summary statistics of net investment returns on endowment funds for a sample of 29,892 U.S. non-profit organizations between 2009-2017. Endowment data are obtained from Part V of Schedule D of Internal Revenue Service (IRS) Form 990 filings. The annual net investment return for each endowment fund is estimated as endowment investment gains/losses (Line 1c) net of any administrative expenses (Line 1f), divided by start of year endowment assets plus 0.5 times endowment contributions (Line 1b) minus 0.5 times endowment distributions (Lines 1d and 1e). For comparison purposes, the table also shows mean benchmark returns based on the trailing 12-month returns on the Center for Research in Securities Prices (CRSP) value-weighted index, the CRSP 10-Year U.S. Treasury Bond Index, and a "balanced portfolio" comprised of 60% of the CRSP equity index and 40% of the Treasury bond index. The right three columns show descriptive statistics for the difference between each endowment's return and the balanced portfolio for the same time period. Data in the table represent means and medians for 12-month reporting periods and should not be interpreted as compound annual returns for the 2009-2017 period. Observations are not uniformly distributed through time. Many endowments' 12-month reporting periods end in June or December, and the number of observations generally increases over time to reflect increasing compliance with IRS electronic filing requirements especially by smaller organizations. Each endowment is assigned to one of four size cohorts based on its average start-of-year assets across all observations. The weighted mean is calculated using start-of-year endowment assets (Line 1a) as the weighting factor within each size cohort as well as the full sample.

		Endowment returns					Benchmark returns			Endowment returns less balanced portfolio		
	Obs.	Mean	Weighted mean	25th %ile	Median	75th %ile	Equity	10-year Treasuries	Balanced portfolio	Mean	Weighted mean	Median
Large: assets > $100 mm	6,594	0.0599	0.0601	-0.0034	0.0819	0.1328	0.1109	0.0447	0.0845	-0.0245	-0.0185	-0.0220
Medium: $100 mm > assets > $10 mm	29,343	0.0604	0.0562	0.0008	0.0670	0.1237	0.1199	0.0424	0.0889	-0.0285	-0.0286	-0.0275
Small: $10 mm > assets > $1 mm	70,129	0.0600	0.0573	0.0048	0.0551	0.1136	0.1283	0.0405	0.0932	-0.0332	-0.0322	-0.0319
Tiny: Assets < $1 mm	91,111	0.0530	0.0525	0.0014	0.0374	0.1035	0.1318	0.0391	0.0947	-0.0417	-0.0395	-0.0403
Full Sample	197,177	0.0568	0.0592	0.0020	0.0484	0.1122	0.1281	0.0403	0.0930	-0.0361	-0.0210	-0.0345

Table 4
Abnormal net investment returns (four-factor model)
The table shows regression estimates of investment alphas for a sample of U.S. non-profit organizations between 2009-2017 for which we have at least seven years of annual data, using the standard four-factor model:

$$\ln(1+R_{i,t}) - \ln(1+R_{f,t}) = \alpha_i + \beta_{i,RMRF} \ln(1+RMRF_t) + \beta_{i,SMB} \ln(1+SMB_t) + \beta_{i,HML} + \ln(1+HML_t) + \beta_{i,UMD} \ln(1+UMD_t) + \varepsilon_{i,t}$$

The analysis is limited to 18,245 endowment funds that report at least seven years of performance data in U.S. Internal Revenue Service Form 990 filings. We fit a separate time series regression for each endowment fund, and the first row of the table reports the cross-sectional average of these alpha estimates. The second row reports the bootstrapped *p*-values of the four-factor alphas, calculated according to a method described more fully in the text. For the last four columns each endowment is assigned to one of the four size cohorts based on its average start-of-year assets.

	Entire Sample	Large: assets > $100 mm	Medium: $10 mm < assets < $100 mm	Small: $1 mm < assets < $10 mm	Tiny: assets < $1 mm
Four-factor alpha (cross-sectional average)	-0.0112 ***	-0.0167 ***	-0.0152 ***	-0.0110 ***	-0.0092 ***
Cross-sectionally bootstrapped *p*-value	<0.01	<0.01	<0.01	<0.01	<0.01
Fraction of endowments with estimated alpha < 0	0.61	0.74	0.69	0.61	0.56
Observations	18,245	712	3,126	6,928	7,479
Fraction of observations	1.000	0.039	0.171	0.380	0.410
Fraction of endowment assets	1.000	0.778	0.173	0.045	0.005
β_{RMRF} (cross-sectional average)	0.5021	0.6324	0.5841	0.5165	0.4421
β_{SMB} (cross-sectional average)	0.0029	0.1478	0.0667	-0.0138	-0.0222
β_{HML} (cross-sectional average)	-0.0542	-0.0172	-0.0316	-0.0584	-0.0632
β_{UMD} (cross-sectional average)	-0.0668	-0.0142	-0.0465	-0.0675	-0.0797
R^2 (cross-sectional average)	0.8370	0.9362	0.8996	0.8479	0.7914

Significant at 1% (***), 5% (**) and 10% (*) levels.

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Table 5
Endowment alphas and governance

The table shows regression estimates of investment alphas for a sample of 18,245 U.S. non-profit organizations between 2009-2017 for which we have at least seven years of data. We save the alphas estimated for each endowment fund from the regressions in Table 4. We then regress these alphas against the time series averages of four governance variables within each organization along with an intercept. Board size is reported on Form 990, Part 6, Line 1a, and we drop all observations for organizations that report board sizes greater than 100 members. The indicator for a board not fully independent equals 1 if the number of independent trustees reported on Line 1b is less than the total number of trustees reported on Line 1a. The Accountable board indicator equals one if the board is elected by or otherwise accountable to the organization's members or other constituents, as reflected by the organization's responses on Lines 7a and 7b. The ratio of restricted funds in the endowment is reported on Schedule D, Section 2, Part V. Standard errors appear in parentheses. For the last four columns each endowment is assigned to one of the four size cohorts based on its average start-of-year assets.

	Entire Sample	Large: assets > $100 mm	Medium: $10 mm < assets < $100 mm	Small: $1 mm < assets < $10 mm	Tiny: assets < $1 mm
Ln(Board size)	-0.0038***	-0.0086**	-0.0036*	-0.0026***	-0.0020
	(0.0007)	(0.0036)	(0.0017)	(0.0010)	(0.0014)
Board not fully independent indicator	0.0006	0.0092**	-0.0000	0.0000	0.0050**
	(0.0010)	(0.0037)	(0.0018)	(0.0016)	(0.0021)
Accountable board indicator	0.0020**	-0.0016	0.0030*	0.0009	0.0028*
	(0.0009)	(0.0032)	(0.0018)	(0.0015)	(0.0016)
Ratio of restricted funds	-0.0012	-0.0033	0.0010	0.0017	-0.0034*
	(0.0011)	(0.0046)	(0.0023)	(0.0017)	(0.0018)
Intercept	-0.0010	0.0069	-0.0054	-0.0044	-0.0048
	(0.0021)	(0.0122)	(0.0056)	(0.0031)	(0.0039)
Observations	18,173	699	3,109	6,904	7,461
R^2	0.0021	0.0223	0.0037	0.0011	0.0023

Significant at 1% (***), 5% (**) and 10% (*) levels.

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Table 6
Abnormal net investment returns for higher education endowments
The table shows alpha estimates for annual net investment returns for a sample of U.S. non-profit endowment funds between 2009-2017. Alphas are estimated using the standard four-factor model:

$$\ln(1+R_{i,t}) - \ln(1+R_{f,t}) = \alpha_i + \beta_{i,RMRF} \ln(1+RMRF_t) + \beta_{i,SMB} \ln(1+SMB_t) + \beta_{i,HML} + \ln(1+HML_t) + \beta_{i,UMD} \ln(1+UMD_t) + \varepsilon_{i,t}$$

The analysis is limited to 18,245 endowment funds that report at least seven years of performance data in U.S. Internal Revenue Service Form 990 filings. We fit a separate time series regression for each endowment fund, and the first row of the table reports the cross-sectional average of these alpha estimates. The second row reports the bootstrapped *p*-values of the four-factor alphas, calculated according to a method described more fully in the text. The subsample of the Top 20 Universities is based on 2017 rankings from *U.S. News and World Report,* except that Cornell University, which has data inconsistencies in its endowment performance data, was replaced in the sample by Emory University.

	Entire sample	Colleges and universities	All other organizations	Top 20 universities	NACUBO reporting funds	Higher education, non-NACUBO
Four-factor alpha (cross-sectional average)	-0.0112	-0.0149	-0.0110	-0.0020	-0.0193	-0.0106
Cross-sectionally bootstrapped *p*-value	<0.01	<0.01	<0.01	<0.50	<0.01	<0.01
Fraction of endowments with estimated alpha < 0	0.61	0.69	0.61	0.50	0.76	0.60
Observations	18,245	1,130	17,115	20	884	528
R^2 (cross-sectional average)	0.84	0.92	0.83	0.97	0.95	0.87

Significant at 1% (***), 5% (**) and 10% (*) levels.

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Table 7
Distribution rates for endowments of different sizes
The table shows descriptive statistics about the annual distribution rates for endowment funds, for a sample of 29,892 U.S. non-profit organizations between 2009-2017. Data are obtained from Internal Revenue Service Form 990 filings on Schedule D, Part V. The distribution rate is calculated as the ratio of distributions for grants and scholarships (Line 1d) plus distributions for facilities and programs (Line 1e) over the sum of beginning-of-year assets (Line 1a) plus 50% of new contributions and transfers during the year (Line 1b).

	Entire Sample	Large: assets > $100 mm	Medium: $10 mm < assets < $100 mm	Small: $1 mm < assets < $10 mm	Tiny: assets < $1 mm
Observations	197,177	6,594	29,343	70,129	91,111
Fraction of with zero distribution	0.345	0.041	0.104	0.249	0.518
Median distribution rate	2.41%	4.38%	3.99%	3.20%	0.00%
Mean distribution rate	4.91%	4.89%	5.20%	5.32%	4.50%

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Table 8
Distributions by endowments as a function of other sources of cash
The table shows least squares regression estimates of the amounts of cash distributed from non-profit endowment funds, as a function of six potential sources of cash for the parent organization. The cash distribution equals the sum of grants or scholarships (Line 1d) and other expenditures for facilities and programs (Line 1e) as reported in part V of Schedule D of Form 990. Cash donations equal the sum of federated campaigns (Part VIII, Line 1a), fundraising events (Part VIII, Line 1c) and other gifts (Part VIII, Line 1f). Operating surplus equals program service revenue (Part VII, Line 2g) minus program service expenses (Part IX, Line 25). Endowment earnings is from part V of Schedule D (Line 1b). Net change in long-term debt equals the difference in bonds, loans, and notes outstanding at the end of year from the beginning of the year (sum of Line 20, Line 23, and Line 24 in part X). Government grants received equal cash from newly awarded grants (Part VIII, Line 1e) minus changes in grants and pledges receivable (Part X, Line 3). Cash on the balance sheet is the sum of reported cash (Part X, Line 1) and savings (Part X, Line 2). All filings by "supporting public charities" are excluded. Standard errors clustered at the organization level appear in parentheses.

	Entire Sample	Large: assets > $100 mm	Medium: $10 mm < assets < $100 mm	Small: $1 mm < assets < $10 mm	Tiny: assets < $1 mm
Cash donations	-0.0052	0.0302	0.0012	0.0014***	-0.00004
	(0.0340)	(0.0788)	(0.0019)	(0.0006)	(0.00009)
Operating surplus	-0.1042**	-0.2180***	0.0006	0.0011**	0.00002
	(0.0462)	(0.0831)	(0.0013)	(0.0006)	(0.00009)
Endowment earnings	0.2547***	0.1961***	0.1383***	0.1878***	0.2291*
	(0.0222)	(0.0363)	(0.0218)	(0.0138)	(0.0549)
Net change in long term debt	0.0284	0.0568*	0.0013	-0.0006**	0.00001
	(0.0191)	(0.0335)	(0.0026)	(0.0002)	(0.00011)
Government grants received	0.0045	-0.1548*	0.0052**	0.0009	0.000053
	(0.0395)	(0.0827)	(0.0026)	(0.0008)	(0.000133)
Cash on balance sheet	0.0767***	0.1075***	0.0032*	0.0004	-0.00002
	(0.0170)	(0.0267)	(0.0019)	(0.0006)	(0.00004)
Intercept	2.6290**	88.7577***	14.0493***	1.7148***	0.01644***
	(1.2396)	(29.1472)	(1.5874)	(0.0573)	(0.00157)
Observations	117,251	4,190	16,802	39,832	56,427
R^2	0.6052	0.6351	0.0083	0.0139	0.0034

Significant at 1% (***), 5% (**) and 10% (*) levels.

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Table 9
Investment returns and subsequent donations to parent organization
The table shows regression estimates for a model of the growth in donations to the parent organizations of endowment funds, for a sample of 29,892 U.S. non-profit organizations between 2009-2017. The dependent variable is the log of the ratio of current year donations over prior year donations. Donations are estimated based on data reported in Part VIII of the Form 990 filing. Total donations equal the sum of Line 1a (federated campaigns), Line 1c (fund raising events), and Line 1f (all other contributions) of Part VIII. The main explanatory variables are the lagged endowment return, defined as ln(1+Annual Endowment Return), the net endowment return adjusted for return on the Center for Research in Securities Prices (CRSP) value weighted index, defined as [ln(1+Annual Endowment Return) – ln(1+Annual VWRETD)], and the net endowment return adjusted for a 60% - 40% combination of the CRSP value weighted index and the CRSP 10-Year U.S. Treasury Bond Index. Standard errors, clustered for each endowment, appear in parentheses.

	Estimate	Estimate	Estimate
Intercept	0.0179***	0.0205***	0.0328***
	(0.0024)	(0.0023)	(0.0024)
Lagged endowment return, unadjusted	0.2101***		
	(0.0341)		
Lagged endowment return, net of equity market index		0.1718***	
		(0.0332)	
Lagged endowment return, net of 60%-40% equity-debt balanced portfolio			0.1163***
			(0.0459)
Observations	107,896	107,896	107,896
R^2	0.0003	0.0003	0.0001

Significant at 1% (***), 5% (**) and 10% (*) levels.

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Appendix 1
Sample design

We extract the data for our study from a publicly available sample of Form 990 filings used by non-profit organizations to report annual financial data to the U.S. Internal Revenue Service (IRS). Non-profits, those organizations claiming income tax exemptions under one of the 27 sub-sections of Section 501(c) of the federal tax code, must file either Form 990, Form 990-EZ, Form 990-PF (private foundations) or Form 990-N (e-Postcard) each year. A transition from paper to electronic filing began in 2010, leading to the compilation of large amounts of non-profit data in standardized, machine readable formats. However, the IRS did not make this data publicly available in an accessible way until a January 30, 2015 ruling issued by a federal judge in a lawsuit filed by open-records activist Carl Malamud.

Starting from June 15, 2016 the IRS has published Form 990 filings in a machine-readable, cloud-based format on Amazon Web Services (AWS), where it may be accessed by researchers at https://registry.opendata.aws/irs990/. Data for each Form 990 filing is provided in an XML file that contains structured information representing the main form, any filed forms and schedules, and other control information. The available data includes Forms 990, 990-EZ and 990-PF but not Form 990-N (e-Postcard), and it is updated periodically with information from new filings.

AWS provides different "index files" on a calendar year basis in JSON and CSV formats. For example, the CSV index for 2013 is available at https://s3.amazonaws.com/irs-form-990/index_2013.csv, and the JSON index file for 2015 is available at https://s3.amazonaws.com/irs-form-990/index_2015.json. Since these index files are based on filing dates rather than the fiscal year-end dates of each

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organization, it is common for filings to appear in a particular calendar year index file that cover earlier fiscal years. Each index file allows us to separate Form 990 filings from others and includes an URL address for each individual filing's corresponding XML file. We use these URL addresses to locate and harvest the Form 990 XML data.[19]

Our main source of endowment data is Part V of Schedule D of Form 990. Figure A1 provides an illustrative example of the 2012 filing for New York University, covering the fiscal year from September 1, 2011 through August 31, 2012. This table consists of seven line items which are self-explanatory. More detailed description is provided in an IRS publication titled "Instructions for Schedule D (Form 990)" available at https://www.irs.gov/pub/irs-pdf/i990sd.pdf.

For our study covering the period 2009-2017, we have downloaded Form 990 data from AWS several times when preparing successive drafts of this paper. Most recently we obtain data in February 2020, which when added to our previous retrievals provides a sample universe of 1,712,621 annual Form 990 filings representing fiscal years since 2010. As we describe more fully later, the filings allow us to backfill endowment related data for 2009. Data in Table A1 imply that about 240,000 organizations currently file Form 990 electronically each fiscal year, and lags in filing delays and IRS processing may lead to several years of elapsed time before a virtually complete cohort of returns is available on AWS for a given fiscal year. Our most recent download allowed us to increase our sample size by several thousand observations relative to the most recent prior draft. The new observations mainly represented reports

[19] One filing by Dream Builders Mission, EIN 81-1338606, has an electronic filing available at https://s3.amazonaws.com/irs-form-990/201940149349301304_public.xml with an improper XML schema. This filer does not have an endowment, and we exclude it from our sample like other such organizations.

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for fiscal years ending in 2017, which now appears to be nearly complete in our dataset given the sample sizes reported in Table A1. The table also implies that as of February 2020, the AWS data currently contains a majority of observations that will eventually be filed for 2018 fiscal years, and a few early filings for 2019 as well.

We go through a number of screens to reduce the 1.7 million Form 990 filings to the sample used in our study. Table A2 describes the process step-by-step.

1. Drop duplicate filings

We begin by eliminating duplicate filings. There are 1,291 filings that are complete duplicates, and we drop these. This reduces the sample size to 1,711,330. An additional 12,245 filings are duplicates in terms of employer identification number (EIN) and year but have different timestamps. We retain the latest timestamped filings. Dropping these 12,245 duplicate filings results in a sample of 1,699,085 unique EIN-year observations for 323.618 organizations.

2. Add imputed interior observations

Next we take advantage of the structure of endowment data reported in Part V of Schedule D of Form 990. The table asks organizations to provide endowment data for the reporting year as well as up to four years of lagged historical values. We identify organizations whose sequences of filings are interrupted by at least one missing "interior" year that falls between a start year and an end year in which electronic filings occur (an organization may have reverted to paper filings in the missing years). There are 82,414 such cases, and we are able to use lagged historical data from later filings to fill in the data for 80,497 of them, or almost 98%. Note that we retain even blank or zero data at this point, as zero-valued endowments will be dropped from the sample in the next step

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described below. We add back these 80,497 "imputed" missing interior years, increasing our sample size to 1,779,582 observations.

3. Drop observations without endowments

We drop observations for EIN-years during which organizations give no indication of having endowment funds. Endowment data are reported in a table in Part V of Schedule D of Form 990, and we identify 1,559,935 filings (nearly 88% of the potential sample) where each of the seven line items are left blank or where this schedule is omitted. Basic financial data indicate that these non-endowment observations are overwhelmingly associated with smaller non-profits.[20] After excluding all filings for which endowment data is not reported, our sample size becomes 219,647.

4. Drop observations with problematic or missing data

We next identify endowment observations with problematic data. Our calculation of annual endowment returns requires that we have useable data for endowment balance at the beginning of the year (Line 1a), end of the year (Line 1g), and investment earnings or losses during the year (Line 1c). We flag all observations where beginning or ending balances are either missing or reported as less than or equal to zero, as well as those for which the earnings/losses line item is missing. Of the 219,647 observations, 39,373 filings (or about 18%) have this issue. For these observations we check filings up to four years in the future to see if the data is later corrected. We are able to repair the data for

[20] We obtain financial data from other parts of Form 990 to compare those non-profits with endowments against the much larger group of those without endowments. There are 212,138 observations with valid financial data in the former group, and 1,486,859 observations in the latter group. The total revenue of the endowment group has a mean of $36.9 million, compared to a mean of $6.6 million for the non-endowment group. Total assets for the endowment group are $82.2 million on average (including the endowments themselves), compared to $13.4 million for the non-endowment group. Total reported compensation for the two groups is $16.2 million vs. $2.0 million. All of these differences in means are statistically significant even at very low levels.

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3,206 observations, and we substitute these corrected values for the original ones. We drop the 36,167 observations that we cannot correct, reducing the sample to 183,480. These 36,167 observations include 2,550 observations for which beginning of year endowment assets is missing, 1,334 observations for which it is reported as zero, 1,764 observations for which end of year assets is missing, 125 observations for which it is reported as zero (likely cases of endowment liquidations), and 30,394 observations for which the annual investment gains or losses are missing.

5. Drop observations with irregular fiscal years

A small number of observations have irregular reporting periods, often due to transition periods associated with changes in fiscal year-end dates. If the number of days in the reported fiscal year is less than 360 or greater than 370, we drop those filings, a total of 99 observations, reducing the sample to 183,381.

6. Drop observations for organizations sharing the same endowment

In certain cases two or more organizations report exactly the same endowment data in at least one year while reporting different balance sheet or operating data on Form 990. These organizations fall into two broad groups. In some cases two different operating entities are allied with the same endowment fund.[21] The alternative variation occurs when a separate legal entity holds the endowment in the form of a foundation that supports an operating entity, but both report the endowment on their Form 990 filings.[22]

[21] For example, Dana-Farber Inc. (EIN 04-3102433) and Dana-Farber Cancer Institute Inc. (EIN 04-2263040) are obviously related and report exactly same data for Part V of Schedule D, but no other part of their Forms 990 is the same.

[22] For example, Concordia University Wisconsin (EIN 39-0833608) and Concordia University Wisconsin Foundation Inc. (EIN 39-6077337). In some cases the names of the two entities does not suggest an obvious connection. For example, Indiana State University Foundation Inc. (EIN 35-6045550) and Sycamore Foundation Holdings Inc. (EIN 26-3673809) report exactly same Part V data but differ on everything else. After further research one finds that the stated mission of Sycamore Foundation Holdings

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In these situations, we wish to avoid having more than one observation for each endowment-year so that identical observations are not repeated in our sample. We attempt to identify the senior or "parent" organization by looking at the total revenue reported each year on Form 990. This method resolves the large number of cases, and we eliminate 1,043 organizations that are always the more junior relative to a larger affiliate in every year of the sample. In another 39 cases the relative ranking of two organizations by revenue is indeterminate, so we choose one randomly to identify as the more junior. For these 1,082 junior organizations we drop all annual filings, eliminating a total of 6,693 observations. This adjustment reduces the sample size to 176,688.

7. Add lagged historical observations when available

The Schedule D, Part V endowment table reports data for up to four prior years. We locate the first annual filing for each organization in the sample, and based upon the completeness of the disclosure in this filing, we add observations of endowment data (but no other data) for up to four prior years. We apply the same missing/unusual data screens described above to this backfilled data. This yields an additional 46,807 observations, increasing the sample size to 223,495.

8. Drop observations with inconsistent data

The Schedule D, Part V endowment table has seven line items which must be related to each other through the following identity:

Inc. is to provide support to Indiana State University Foundation, Inc., including soliciting and receiving charitable contributions and managing real property and other investments (the university's sports teams are nicknamed the Sycamores). Unlike private universities, public universities do not file Form 990. However, many public universities house their endowments in legally separate foundations such as Indiana State University Foundation, Inc., which do file Form 990 and are therefore included in our sample.

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$$
\begin{aligned}
\text{End-of-year balance (Line 1g)} = \;& \text{Start-of-year balance (Line 1a)} \\
&+ \text{Contributions (Line 1b)} \\
&\pm \text{Investment Gain/loss (Line 1c)} \\
&- \text{Grants (Line 1d)} \\
&- \text{Other Expenses (Line 1e)} \\
&- \text{Administrative Expenses (Line 1f)}
\end{aligned} \tag{A1}
$$

We check the internal consistency of each observation according to this identity. Some observations require adjustments for sign conventions, as they report the outflow lines 1d, 1e, and 1f as negative numbers while a vast majority report these line items as positive numbers. We take the absolute value of the reported entry for each of these three line items. After this adjustment, for 213,912 out of 223,495 observations (about 96% of the sample) the endowment identity holds exactly.

For the remaining 9,523 observations that exhibit some discrepancy in the identity, we check future filings by the same organization to see if corrected data is reported that resolves the issue. This method proves successful by using data from the next year's filing in 1,089 cases. For a further 400 observations we resolve the issue by looking at filings two years ahead, and we find corrections for 222 observations in filings three years ahead, and for 196 observations in filings four years ahead. We use this corrected, consistent data in place of the original inconsistent data, leaving 7,676 observations still with discrepancies.

For this last group, we check whether the size of discrepancy in the endowment identity is *de minimus*, which we define as less than 1% of the sum of start-of-year assets plus one half of contributions. This tolerance is satisfied by 4,382 observations, and we

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retain these, leaving 3,294 observations with larger discrepancies which we drop. This reduces the sample size to 220,201 observations.

9. Drop observations out of sample range

We drop 3,733 observations for fiscal years ending in 2008 and a further 18,884 observations for fiscal years ending in 2018 or 2019. These exclusions reduce our sample size to 197,584 observations.

10. Drop observations with extreme distribution data

We estimate the annual endowment return as:

$$\text{Endowment Return} = \frac{[(\text{Investment Gain/Loss}) - (\text{Admin Expenses})]}{[(\text{BoY Assets}) + 0.5 \times (\text{Contributions}) - 0.5 \times (\text{Grants} + \text{Other Expenses})]} \quad \text{(A2)}$$

For 13 observations, the outflow variables of Grants and Other Expenses are large enough to make the denominator negative, which will mechanically make the endowment return negative even if the endowment has a positive net investment gain. We drop these 13 observations as we are not able to estimate reliably the annual investment return. This reduces our sample to 197,571.

11. Trim top and bottom 0.1% of observations

Since the endowment return calculation is a ratio, a small denominator can create large outliers. We address this issue by dropping those observations which have an endowment return in the lowest 0.1% (197 observations) and in the largest 0.1% (197 observations). This results in final sample of 197,177 observations.

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Figure A1
Form 990, Section D, Part V filing for New York University for fiscal year ended August 31, 2012
This example shows the seven line items disclosed by non-profit organizations about their endowments in annual IRS filings since 2010. The calendar year in which the final month of the fiscal year reporting period occurs determines the placement of each observation in our sample, so in this example, the "current year" in column (a) would be classified as a 2012 observation since the fiscal year ends in August 2012. The prior years in column (b), (c), and (d) would represent data for the years 2011, 2010, and 2009 in our sample. Even though disclosure of this information did not begin until 2010, we obtain data for 2009 for this organization and many others by using the lagged historical data reported in this table. Note that the organization has left blank column (e), as the IRS did not require historical disclosure for 2008 and earlier years.

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Form **990**

Department of the Treasury
Internal Revenue Service

Return of Organization Exempt From Income Tax

Under section 501(c), 527, or 4947(a)(1) of the Internal Revenue Code (except black lung benefit trust or private foundation)

▶ The organization may have to use a copy of this return to satisfy state reporting requirements

OMB No 1545-0047

2011

Open to Public Inspection

A For the 2011 calendar year, or tax year beginning 09-01-2011 and ending 08-31-2012

Part V Endowment Funds. Complete if the organization answered "Yes" to Form 990, Part IV, line 10.

		(a)Current Year	(b)Prior Year	(c)Two Years Back	(d)Three Years Back	(e)Four Years Back
1a	Beginning of year balance	2,690,369,662	2,375,939,165	2,134,635,606	2,394,484,490	
b	Contributions	177,795,800	142,888,000	160,162,000	102,440,000	
c	Investment earnings or losses	72,055,356	301,857,827	172,386,687	-258,404,408	
d	Grants or scholarships	22,281,071	18,645,572	14,219,178	21,727,000	
e	Other expenditures for facilities and programs	149,033,859	105,415,479	81,135,377	78,727,904	
f	Administrative expenses	3,151,990	6,254,279	3,040,411	3,429,572	
g	End of year balance	2,765,753,898	2,690,369,662	2,368,789,327	2,134,635,606	

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Table A1
Distribution of AWS filings by fiscal year, as of February 2020

Fiscal year end	Observations	Annual percentage	Cumulative percentage
2010	98,206	5.73%	5.73%
2011	139,341	8.14%	13.87%
2012	170,760	9.97%	23.84%
2013	190,513	11.12%	34.97%
2014	210,515	12.29%	47.26%
2015	227,989	13.31%	60.57%
2016	240,137	14.02%	74.59%
2017	239,854	14.01%	88.60%
2018	183,438	10.71%	99.31%
2019	11,868	0.69%	100.00%
Total	1,712,621	100.00%	

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Table A2
Sample selection process

Universe of all form 990 "Electronic" filings as of February 2020	**1,712,621**
Remove complete duplicates	**(1,291)**
Remove duplicates in terms of EIN and year, retaining latest time stamp	**(12,245)**
	1,699,085
Unique EIN-year observations	**80,497**
Add missing interior-year data that is reported in subsequent years' filings	**1,779,582**
	(1,559,935)
Remove observations reporting no endowment data	**219,647**
	(36,167)
Remove observations with problematic data for assets or returns	**183,480**
	(99)
Remove observations for fiscal years with irregular length	**(6,693)**
Remove organizations reporting at least one year of identical endowment data as an affiliate organization that we retain	**176,688**
	46,807
Add backfilled annual data from first disclosure for each organization	**223,495**
	(3,294)
	(3,733)
	(18,884)
Remove observations not satisfying endowment identity within 1%	**(13)**
Remove observations for 2008 fiscal years	**(394)**
Remove observations for 2018 and 2019 fiscal years	**197,177**
Remove observations with extreme distribution data	
Trim observations for top and bottom 0.1% of investment returns	
Final Sample	

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Appendix 2
Endowment return data for each monthly fiscal year reporting period

Table A3 provides month-by-month performance data for the endowment funds in our sample alongside the relevant equity and debt market benchmarks, in a format identical to Table 3. Each row of the table shows the sample size and summary statistics for endowment returns for those funds whose 12-month fiscal year reporting periods end in that month. Specifically, for each calendar month we identify all endowments with their fiscal years ending in that month. We calculate the median and inter-quartile returns for these subsets of endowments and report these statistics in columns two through four. We next calculate the returns for the CRSP value weighted index and the CRSP 10-Year U.S. Treasury Bond index over the same 12-month periods that match the fiscal years of the endowments. As shown in the table, a significant number of endowments have fiscal years ending in either June or December, with a smaller number ending in September and the rest scattered among the remaining nine months of each year. In addition, our sample size gradually increases over time, as more non-profit firms comply with electronic filing requirements phased in during our sample period by the IRS.

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Table A3
Endowment returns

The table shows summary statistics of net investment returns on endowment funds for a sample of 29,892 U.S. non-profit organizations between 2009-2017. Each line of the table shows the distribution of annual endowment returns and the comparable trailing 12-month benchmark returns for observations whose 12-month fiscal year reporting periods end in that month. Endowment data are obtained from Part V of Schedule D of Internal Revenue Service Form 990 filings. The annual net investment return for each endowment fund is estimated as endowment investment gains/losses (Line 1c) net of any administrative expenses (Line 1f), divided by start-of-year endowment assets (Line 1a) plus 0.5 times endowment contributions (Line 1b). Benchmark returns are based on the Center for Research in Securities Prices (CRSP) value-weighted index, the CRSP 10-Year U.S. Treasury Bond Index, and a "balanced portfolio" comprised of 60% of the CRSP equity index and 40% of the Treasury bond index. The weighted mean is calculated using start-of-year endowment assets (Line 1a) as the weighting factor within each size cohort as well as the full sample.

		Endowment returns					Benchmark returns			Endowment returns less balanced portfolio		
Fiscal year-end month	Obs.	Mean	Weighted mean	25th %le	Median	75th %ile	Equity	10-year Treasuries	Balanced portfolio	Mean	Weighted mean	Median
2009m1	20	-0.1031	-0.2031	-0.2157	-0.1523	0.0238	-0.3922	0.0828	-0.2022	0.0991	-0.0009	0.0499
2009m2	30	-0.1548	-0.2558	-0.3004	-0.1981	0.0183	-0.4410	0.0708	-0.2363	0.0815	-0.0195	0.0381
2009m3	215	-0.1791	-0.2137	-0.2739	-0.2208	-0.0835	-0.3861	0.0938	-0.1942	0.0151	-0.0195	-0.0266
2009m4	104	-0.1724	-0.2672	-0.2571	-0.2080	-0.1076	-0.3521	0.0722	-0.1823	0.0099	-0.0849	-0.0256
2009m5	394	-0.1590	-0.2113	-0.2346	-0.1890	-0.1050	-0.3242	0.0748	-0.1646	0.0056	-0.0466	-0.0244
2009m6	5,362	-0.1252	-0.2021	-0.1927	-0.1476	-0.0583	-0.2690	0.0664	-0.1349	0.0096	-0.0673	-0.0127
2009m7	164	-0.0794	-0.0820	-0.1427	-0.0858	0.0020	-0.1986	0.0697	-0.0913	0.0119	0.0093	0.0055
2009m8	499	-0.0685	-0.1616	-0.1200	-0.0754	-0.0077	-0.1820	0.0642	-0.0835	0.0150	-0.0781	0.0081
2009m9	1,021	0.0084	-0.0029	-0.0160	0.0081	0.0317	-0.0521	0.0743	-0.0016	0.0100	-0.0013	0.0097
2009m10	91	0.0799	0.1138	0.0223	0.0891	0.1365	0.1300	0.1019	0.1188	-0.0389	-0.0050	-0.0297
2009m11	14	0.0735	-0.0141	-0.0068	0.0378	0.1525	0.3050	0.0345	0.1968	-0.1233	-0.2109	-0.1590
2009m12	5,883	0.1373	0.1497	0.0417	0.1493	0.2117	0.3130	-0.0583	0.1645	-0.0271	-0.0148	-0.0152
2010m1	30	0.1281	0.1486	0.0110	0.1591	0.2083	0.3702	0.0060	0.2245	-0.0964	-0.0759	-0.0654
2010m2	45	0.1987	0.2284	0.0472	0.1977	0.3237	0.5759	0.0100	0.3495	-0.1509	-0.1211	-0.1519
2010m3	346	0.2178	0.2764	0.0717	0.2439	0.3331	0.5424	-0.0359	0.3111	-0.0933	-0.0347	-0.0671
2010m4	160	0.1747	0.2327	0.0611	0.1802	0.2628	0.4182	0.0164	0.2575	-0.0828	-0.0248	-0.0773

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2010m5	524	0.1092	0.1220	0.0608	0.1182	0.1484	0.2231	0.0595	0.1576	-0.0484	-0.0356	-0.0394
2010m6	7,488	0.0852	0.0949	0.0411	0.0923	0.1228	0.1646	0.0923	0.1357	-0.0505	-0.0408	-0.0434
2010m7	247	0.0793	0.1170	0.0333	0.0845	0.1133	0.1523	0.0919	0.1281	-0.0489	-0.0112	-0.0436
2010m8	692	0.0488	0.0968	0.0190	0.0482	0.0723	0.0693	0.1194	0.0893	-0.0405	0.0075	-0.0411
2010m9	1,381	0.0653	0.0897	0.0289	0.0704	0.0953	0.1167	0.1057	0.1123	-0.0470	-0.0226	-0.0419
2010m10	127	0.0861	0.1112	0.0384	0.0898	0.1259	0.1930	0.1039	0.1574	-0.0713	-0.0462	-0.0676
2010m11	29	0.0688	0.0943	0.0197	0.0626	0.0945	0.1344	0.0755	0.1108	-0.0421	-0.0165	-0.0482
2010m12	7,696	0.0802	0.0994	0.0344	0.0872	0.1163	0.1771	0.0745	0.1361	-0.0558	-0.0367	-0.0488
2011m1	35	0.0816	0.0957	0.0272	0.0952	0.1216	0.2459	0.0523	0.1685	-0.0869	-0.0728	-0.0733
2011m2	61	0.1164	0.1417	0.0221	0.1283	0.1590	0.2500	0.0500	0.1700	-0.0536	-0.0282	-0.0417
2011m3	431	0.0834	0.1037	0.0477	0.0915	0.1196	0.1791	0.0644	0.1332	-0.0498	-0.0296	-0.0418
2011m4	204	0.0898	0.1213	0.0347	0.1023	0.1385	0.1891	0.0624	0.1384	-0.0486	-0.0171	-0.0361
2011m5	635	0.1352	0.1766	0.0748	0.1531	0.1902	0.2721	0.0620	0.1880	-0.0529	-0.0114	-0.0349
2011m6	8,962	0.1397	0.1851	0.0727	0.1594	0.1999	0.3154	0.0211	0.1977	-0.0580	-0.0126	-0.0383
2011m7	303	0.0880	0.1231	0.0330	0.1017	0.1374	0.2013	0.0446	0.1386	-0.0507	-0.0156	-0.0369
2011m8	805	0.0824	0.1601	0.0365	0.0864	0.1163	0.1829	0.0567	0.1324	-0.0500	0.0277	-0.0460
2011m9	1,582	-0.0012	-0.0026	-0.0213	-0.0017	0.0131	-0.0082	0.0899	0.0310	-0.0322	-0.0337	-0.0327
2011m10	147	0.0184	0.0268	0.0032	0.0199	0.0378	0.0639	0.0824	0.0713	-0.0529	-0.0445	-0.0514
2011m11	34	0.0234	0.0334	0.0005	0.0240	0.0392	0.0519	0.0997	0.0710	-0.0476	-0.0376	-0.0470
2011m12	8,221	-0.0024	-0.0010	-0.0259	-0.0021	0.0142	-0.0107	0.1660	0.0600	-0.0624	-0.0610	-0.0621
2012m1	36	0.0136	0.0118	-0.0017	0.0072	0.0352	0.0232	0.1766	0.0846	-0.0710	-0.0728	-0.0773
2012m2	65	0.0258	0.0247	0.0017	0.0167	0.0406	0.0262	0.1643	0.0815	-0.0557	-0.0568	-0.0647
2012m3	463	0.0274	0.0206	0.0027	0.0208	0.0405	0.0474	0.1422	0.0853	-0.0579	-0.0647	-0.0645
2012m4	220	0.0144	0.0865	-0.0083	0.0038	0.0275	0.0112	0.1578	0.0699	-0.0555	0.0166	-0.0661
2012m5	659	-0.0205	-0.0328	-0.0488	-0.0247	0.0041	-0.0408	0.1652	0.0416	-0.0621	-0.0744	-0.0663
2012m6	9,476	0.0020	0.0082	-0.0179	0.0005	0.0174	0.0145	0.1644	0.0745	-0.0724	-0.0663	-0.0740
2012m7	332	0.0173	0.0695	-0.0026	0.0146	0.0357	0.0486	0.1471	0.0880	-0.0707	-0.0185	-0.0734
2012m8	849	0.0530	0.0539	0.0173	0.0537	0.0802	0.1418	0.0924	0.1220	-0.0691	-0.0681	-0.0683
2012m9	1,652	0.1133	0.1265	0.0504	0.1256	0.1645	0.2808	0.0544	0.1902	-0.0769	-0.0637	-0.0646
2012m10	163	0.0698	0.0795	0.0330	0.0687	0.0953	0.1335	0.0642	0.1058	-0.0359	-0.0262	-0.0371
2012m11	41	0.0622	0.0960	0.0410	0.0665	0.1025	0.1476	0.0649	0.1145	-0.0523	-0.0185	-0.0480
2012m12	8,765	0.0790	0.1128	0.0388	0.0875	0.1147	0.1577	0.0359	0.1090	-0.0300	0.0038	-0.0214
2013m1	41	0.0607	0.0830	0.0185	0.0687	0.0940	0.1578	0.0115	0.0992	-0.0385	-0.0162	-0.0305
2013m2	64	0.0661	0.0897	0.0175	0.0579	0.0777	0.1212	0.0342	0.0864	-0.0202	0.0033	-0.0285

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2013m3	485	0.0717	0.0797	0.0359	0.0713	0.0920	0.1335	0.0587	0.1036	-0.0319	-0.0239	-0.0323
2013m4	243	0.0840	0.1237	0.0310	0.0861	0.1124	0.1584	0.0475	0.1140	-0.0300	0.0097	-0.0279
2013m5	670	0.1211	0.1494	0.0784	0.1371	0.1634	0.2633	-0.0161	0.1515	-0.0304	-0.0021	-0.0145
2013m6	9,862	0.0852	0.1083	0.0486	0.0912	0.1173	0.1985	-0.0392	0.1035	-0.0183	0.0048	-0.0122
2013m7	350	0.0955	0.1596	0.0355	0.0981	0.1410	0.2489	-0.0584	0.1260	-0.0305	0.0336	-0.0279
2013m8	885	0.0705	0.0990	0.0320	0.0719	0.1015	0.1856	-0.0682	0.0841	-0.0135	0.0149	-0.0122
2013m9	1,715	0.0806	0.0976	0.0386	0.0815	0.1171	0.1982	-0.0455	0.1007	-0.0201	-0.0032	-0.0193
2013m10	170	0.0944	0.1338	0.0444	0.0997	0.1426	0.2638	-0.0360	0.1439	-0.0495	-0.0101	-0.0441
2013m11	42	0.0983	0.1538	0.0519	0.0843	0.1488	0.2874	-0.0567	0.1498	-0.0515	0.0041	-0.0655
2013m12	9,149	0.1090	0.1582	0.0491	0.1163	0.1572	0.3047	-0.0690	0.1552	-0.0463	0.0030	-0.0389
2014m1	42	0.0551	0.0639	0.0023	0.0501	0.0935	0.2006	-0.0212	0.1119	-0.0568	-0.0480	-0.0617
2014m2	61	0.0927	0.1197	0.0147	0.0986	0.1353	0.2456	-0.0282	0.1361	-0.0434	-0.0164	-0.0375
2014m3	493	0.0885	0.1067	0.0443	0.0890	0.1189	0.2086	-0.0357	0.1109	-0.0224	-0.0042	-0.0218
2014m4	239	0.0794	0.1583	0.0384	0.0785	0.1087	0.1928	-0.0443	0.0979	-0.0185	0.0604	-0.0194
2014m5	680	0.0929	0.1215	0.0667	0.1007	0.1232	0.1941	0.0053	0.1186	-0.0257	0.0029	-0.0179
2014m6	10,271	0.1187	0.1562	0.0825	0.1324	0.1577	0.2463	0.0338	0.1613	-0.0426	-0.0050	-0.0288
2014m7	364	0.0780	0.0212	0.0417	0.0848	0.1083	0.1595	0.0383	0.1110	-0.0330	-0.0899	-0.0262
2014m8	894	0.1130	0.1525	0.0655	0.1270	0.1532	0.2380	0.0716	0.1714	-0.0584	-0.0190	-0.0445
2014m9	1,763	0.0680	0.0814	0.0352	0.0690	0.0933	0.1633	0.0416	0.1146	-0.0466	-0.0332	-0.0456
2014m10	182	0.0612	0.0716	0.0395	0.0628	0.0826	0.1424	0.0480	0.1046	-0.0435	-0.0331	-0.0418
2014m11	44	0.0723	0.0780	0.0400	0.0651	0.0829	0.1381	0.0760	0.1133	-0.0410	-0.0353	-0.0482
2014m12	9,332	0.0402	0.0430	0.0162	0.0374	0.0570	0.1051	0.1015	0.1037	-0.0635	-0.0607	-0.0663
2015m1	44	0.0452	0.0465	0.0140	0.0297	0.0618	0.1083	0.1087	0.1085	-0.0633	-0.0619	-0.0788
2015m2	66	0.0582	0.0631	0.0185	0.0533	0.0728	0.1187	0.0762	0.1017	-0.0435	-0.0386	-0.0484
2015m3	503	0.0482	0.0505	0.0215	0.0439	0.0641	0.1021	0.0892	0.0969	-0.0488	-0.0464	-0.0530
2015m4	237	0.0484	0.0995	0.0206	0.0477	0.0695	0.1098	0.0716	0.0945	-0.0461	0.0050	-0.0468
2015m5	680	0.0417	0.0546	0.0212	0.0379	0.0576	0.0991	0.0475	0.0784	-0.0367	-0.0238	-0.0405
2015m6	10,310	0.0154	0.0418	-0.0003	0.0118	0.0283	0.0486	0.0307	0.0414	-0.0261	0.0004	-0.0297
2015m7	369	0.0262	0.0334	0.0042	0.0249	0.0471	0.0835	0.0465	0.0687	-0.0425	-0.0353	-0.0438
2015m8	878	-0.0170	0.0270	-0.0414	-0.0180	0.0015	-0.0209	0.0260	-0.0021	-0.0149	0.0292	-0.0159
2015m9	1,775	-0.0217	-0.0273	-0.0444	-0.0215	0.0000	-0.0296	0.0555	0.0044	-0.0262	-0.0317	-0.0259
2015m10	171	0.0050	0.0343	-0.0106	0.0044	0.0194	0.0206	0.0340	0.0260	-0.0210	0.0083	-0.0216
2015m11	39	0.0146	0.0150	-0.0098	0.0026	0.0163	0.0019	0.0159	0.0075	0.0071	0.0075	-0.0049
2015m12	9,354	-0.0124	-0.0007	-0.0299	-0.0126	0.0015	-0.0168	0.0107	-0.0058	-0.0066	0.0051	-0.0067

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2016m1	43	-0.0357	-0.0356	-0.0513	-0.0260	0.0005	-0.0471	-0.0016	-0.0289	-0.0068	-0.0067	0.0029
2016m2	62	-0.0323	-0.0747	-0.0833	-0.0359	0.0015	-0.0970	0.0412	-0.0417	0.0094	-0.0330	0.0058
2016m3	482	-0.0162	-0.0196	-0.0389	-0.0221	0.0013	-0.0231	0.0312	-0.0014	-0.0148	-0.0182	-0.0207
2016m4	225	-0.0142	-0.0621	-0.0393	-0.0150	0.0057	-0.0201	0.0349	0.0019	-0.0161	-0.0639	-0.0169
2016m5	669	-0.0160	-0.0338	-0.0378	-0.0208	0.0011	-0.0162	0.0401	0.0063	-0.0223	-0.0401	-0.0271
2016m6	10,318	-0.0069	-0.0174	-0.0273	-0.0069	0.0090	0.0062	0.0949	0.0417	-0.0486	-0.0591	-0.0486
2016m7	370	0.0190	0.1019	-0.0018	0.0114	0.0292	0.0327	0.0821	0.0525	-0.0335	0.0494	-0.0410
2016m8	882	0.0444	0.0359	0.0196	0.0473	0.0680	0.1017	0.0748	0.0910	-0.0465	-0.0550	-0.0437
2016m9	1,755	0.0661	0.0707	0.0387	0.0709	0.0919	0.1437	0.0546	0.1080	-0.0419	-0.0374	-0.0372
2016m10	172	0.0316	0.0583	0.0090	0.0299	0.0401	0.0419	0.0460	0.0435	-0.0120	0.0148	-0.0136
2016m11	36	0.0378	0.0329	0.0208	0.0432	0.0595	0.0814	0.0068	0.0516	-0.0138	-0.0186	-0.0084
2016m12	9,396	0.0533	0.0548	0.0287	0.0547	0.0739	0.1268	0.0070	0.0789	-0.0256	-0.0241	-0.0242
2017m1	42	0.0800	0.0969	0.0297	0.0759	0.1136	0.2216	-0.0199	0.1250	-0.0450	-0.0281	-0.0491
2017m2	59	0.0882	0.1110	0.0310	0.0968	0.1385	0.2606	-0.0289	0.1448	-0.0566	-0.0338	-0.0480
2017m3	466	0.0808	0.0888	0.0475	0.0904	0.1126	0.1801	-0.0251	0.0980	-0.0172	-0.0092	-0.0076
2017m4	225	0.0777	0.1248	0.0419	0.0816	0.1074	0.1775	-0.0099	0.1025	-0.0248	0.0223	-0.0209
2017m5	657	0.0923	0.1165	0.0707	0.1017	0.1186	0.1717	-0.0034	0.1017	-0.0094	0.0149	0.0000
2017m6	10,276	0.0924	0.1166	0.0661	0.1009	0.1230	0.1791	-0.0368	0.0928	-0.0004	0.0239	0.0081
2017m7	358	0.0777	0.0372	0.0440	0.0855	0.1086	0.1582	-0.0399	0.0789	-0.0013	-0.0417	0.0065
2017m8	870	0.0814	0.1115	0.0526	0.0864	0.1092	0.1568	-0.0157	0.0878	-0.0064	0.0237	-0.0014
2017m9	1,739	0.0893	0.1118	0.0591	0.0970	0.1201	0.1807	-0.0313	0.0959	-0.0066	0.0159	0.0011
2017m10	172	0.1074	0.1559	0.0616	0.1185	0.1486	0.2300	-0.0171	0.1312	-0.0238	0.0247	-0.0127
2017m11	36	0.1099	0.1315	0.0816	0.1322	0.1550	0.2145	0.0221	0.1375	-0.0276	-0.0060	-0.0053
2017m12	8,697	0.1123	0.1639	0.0774	0.1245	0.1494	0.2066	0.0280	0.1352	-0.0229	0.0287	-0.0106
Full Sample	197,177	0.0568	0.0592	0.0020	0.0484	0.1122	0.1281	0.0403	0.0930	-0.0361	-0.0210	-0.0345

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