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SURVEYS AND CROSSOVERS

This section provides surveys of the literature in investment management or short papers exemplifying advances in finance that arise from the confluence with other fields. This section acknowledges current trends in technology, and the cross-disciplinary nature of the investment management business, while directing the reader to interesting and important recent work.

A SURVEY OF UNIVERSITY ENDOWMENT MANAGEMENT RESEARCH

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There is significant interest in how university endowments manage money and perform, and an emerging strand of finance research specializes in this growing area. The purpose of this paper is to survey and review the state-of-the-art in this field. We classify papers into four areas. (1) *asset allocation, where we discuss the main theoretical framework and the relevant observations both across time and types of endowment;* (2) *performance, where (risk-adjusted) performance is discussed and distinguished by type and size of endowment;* (3) *spending, where the relation to the classical views and theoretical literature is reviewed as well as what university endowments do in practice; and* (4) *organization, where governance structure and the investment policy statement are discussed. We find that the modern framework for theoretical and empirical analyses can provide a very useful perspective for understanding the role of endowments. Nonetheless we highlight areas where more work remains to be done.*

1 Introduction

Endowments have provided critical support to many not-for-profit institutions for a long time. An early example is that of University College, Oxford, to which William of Durham bequeathed 310 marks in 1249. This money was used to

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purchase real property providing income for the university operations. Another early example is Stift Klosterneuburg, a monastery near Vienna founded by Markgraf Leopold III in 1114. He endowed the monastery with valuable assets including real estate and vineyards which have helped to support the institution through to the present. When it comes to university endowments, undoubtedly it is US institutions that have been the pioneers and role models for others throughout the world. In the USA, the majority of universities are members of the National Association of College and University Business Officers (NACUBO), an organization that was established in 1962. Today, endowments from member institutions are worth over $400 billion as of June 2012. Along with other institutional investors, such as mutual funds, sovereign wealth funds, and pension funds, there is significant interest in how university endowments manage money and perform. Given the rapid growth in university endowments both in terms of numbers and valuation, there is an emerging strand of finance research that specializes in looking specifically at endowments. The purpose of this paper is to survey and review the state-of-the-art in this field. Thus, we present the relevant academic contributions as well as point out fruitful areas for future research.

The well-known book of Swensen (2009) provides three reasons that justify the use of endowments for universities: funding through endowment income allows greater independence, provides operational stability, and facilitates educational excellence. The modern approach to endowment funds management is relatively recent, stretching back little more than a quarter century. In the early days endowments were usually comprised of gifts of property bestowed upon an institution to provide it with a source of secure income, as for instance University College, Oxford. An important evolution in endowment management has been the growing importance of fund performance in addition to fundraising as the main vehicle for endowment growth. Today's endowment funds are typically highly diversified portfolios, consisting of conventional as well as alternative assets. In many cases US institutions have set up their own management companies to handle fund management in a semi-autonomous operation.

The outline of this survey is such that we cover scientific contributions to the whole endowment management process including the final outcomes—endowment returns and spending. Most endowment practitioners hold the view that asset allocation is of vital relevance for endowments. Therefore, we begin by discussing the theoretical and empirical literature on asset allocation in Section 2. We then turn to the question of the risk and return performance of endowment funds in Section 3. A scientific analysis of endowment performance is very relevant as university operating budgets rely increasingly on income streams from endowments, creating a need to reconcile long-term performance goals with short-term spending requirements. Section 4 therefore presents the results from the literature on spending policy, the channel through which positive endowment returns translate into benefits for all university constituencies. The last area of research is related to organizational aspects of endowment management, presented in Section 5. Finally, Section 6 provides a perspective on the literature and summarizes our conclusions.

2 Asset allocation

The subject of asset allocation in funds management refers to the selection of asset categories to which funds are committed. Most pools of assets—whether they are pension funds, mutual funds, or endowments—delineate their investment in these sorts of categories because it helps to decompose returns and to see how these investment categories perform on an individual basis. Moreover, manager selection is an important element of successful investing. Normally managers are appointed as specialists whereby they are retained for the expressed purpose of investing in certain asset categories and also compensated implicitly and explicitly with reference to benchmarks that track passive returns in these respective categories.

Endowments differ from other institutional investors by employing two forms of asset allocation decisions. First, *strategic asset allocation* denotes some form of long-run asset allocation, i.e., portfolio weights allocated to asset classes which are intended to be relatively stable over time. A benchmark portfolio made up solely of these weights is often referred to as the "policy portfolio". Second *tactical asset allocation* refers to the choice of asset class weights that vary from the strategic weights for some "temporary" time period. One justification for varying asset class weights, often also referred to as *dynamic asset allocation* is that investment opportunities (typically expected returns) are time-varying and it makes sense not to keep the weights perfectly constant. Another justification is due to portfolio rebalancing constraints. Since actual returns for the various asset classes differ, keeping weights constant would involve continuous trading in and out of assets. This is typically infeasible due to excessive transaction costs, illiquidity, or required commitment periods (e.g., for hedge funds and private equity). Finally, another justification for the use of tactical weights that differ from strategic weights is due to active management. When managers select investments within an asset class that differ from passive indexes then it can make sense to over- and under-weight asset class investments depending on the relative success of the active management.

As an example, as of mid-2012 the Princeton University fund held assets in seven major categories (Princeton University, 2012). The asset categories are defined as domestic equity (6.5%), international equity-developed (5.5%), international equity-emerging (11%), fixed income (6%), real assets (23%), private equity (23%), and independent return (25%). Although policy weights are intended to be long-term, they are adjusted over time. For instance in 1991 Princeton's policy portfolio comprised 45% domestic equities and 20% fixed income. It held nothing in emerging markets and only 10% in real assets and private equity. The remainder of Princeton's portfolio consisted of 10% in international developed equities, and 5% in cash.

Figure 1 illustrates Yale University's policy portfolio weights and their changing patterns over the period 1985–2012 (Yale University, 2012). In this case the allocation to domestic equity has

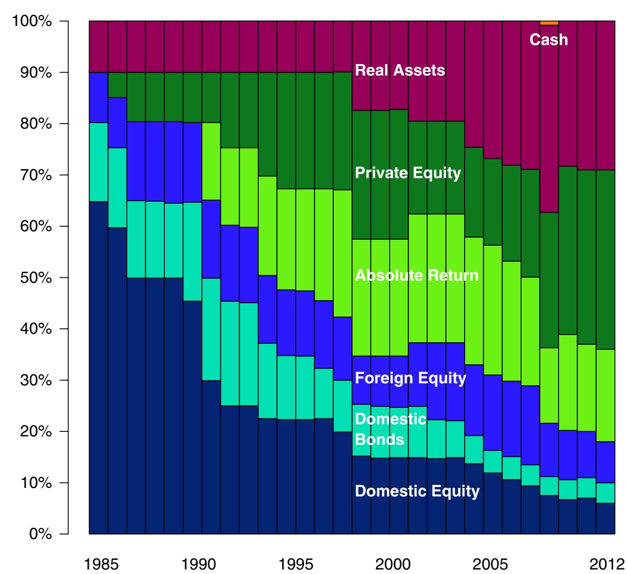

Figure 1 Yale university's target asset allocation 1985–2012.

This figure shows the target asset allocation as specified by the Yale University Investments Office for the fiscal years 1985–2012, and is updated from Yale University (2010). Data for 2011 and 2012 are from Yale University (2011, 2012) respectively. Due to a change in classification, we calculate the allocation to real assets for 2011 and 2012 as the sum of the allocations to real estate and natural resources.

decreased dramatically and the allocation to absolute return, private equity, and especially real assets has increased markedly.

These trends toward alternative investments (absolute return, private equity, and real assets) are indicative of all large endowment funds. Lerner *et al.* (2008) document that average endowment funds holdings in alternative assets have doubled from roughly 11% in 1993 to 21% by 2005. In a recent study, Goetzmann and Oster (2012) hypothesize that trend following amongst university endowments can result from competitive pressure. Among the leading endowments, it is often the case that the chief investment officer was educated at one of the other universities or was appointed after an earlier engagement with a competitor. For instance, Figure 2 from Goetzmann and Oster (2012) illustrates that the decrease in US equities started with Yale in the early 1990s, then subsequently spread to Princeton in the mid-1990s and on to Harvard in the early 2000s. The authors use a measure of "nearest competitor" based on the likelihood of potential student browsing on university websites. They find that when a nearest competitor outperforms, the endowment fund is more likely to mimic their asset allocation in subsequent years. This is an interesting extension of the well-known "tournament effect" for mutual funds to endowments (Chen *et al.*, 2012).

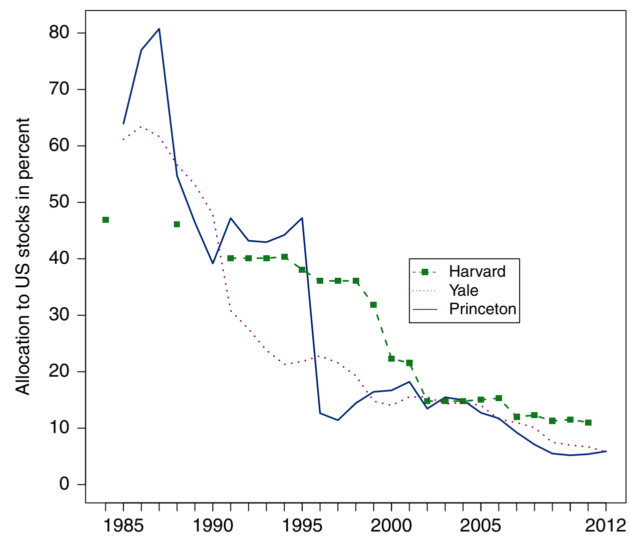

Figure 2 Pattern of allocation to US equity.

The figure shows the percentage allocation to US publicly listed equities by Harvard, Yale, and Princeton endowments from fiscal years 1984 to 2011.

Source: Figure 1 from Goetzmann and Oster (2012), updated using Yale University (2012) and Princeton University (2012) for fiscal years 2011 and 2012.

2.1 *Target returns*

At the simplest possible level, one relatively coarse theoretical method of devising the weights for asset allocation decisions is to establish a target endowment return level and then "back out" the weights necessary to achieve such a return. In general this method is not sufficient to identify uniquely what the weights ought to be given a target return unless there are but two asset categories. For instance, suppose that an endowment desires to have an average geometric portfolio real return equal to 5%. Using data from Siegel (2008) that show that average geometric stock real returns are equal to 6.8% over the period 1802–2006 and short-term governments (bills) equal to 2.8%, if the weights on stocks and bills, are x_s and x_f, respectively, we must have $x_s(6.8) + (1 - x_s)(2.8) = 5.0$, which then implies that $x_s = 0.55$ and $x_f = 0.45$. Of course this is an overly simplistic approach to asset allocation, since nothing but average returns is considered and there are only two asset classes. But it is a reminder that when funds use targets, one needs to consider the relation between these targets, asset allocations, and historical return patterns to establish feasibility.

2.2 *Asset allocation according to Merton*

The seminal paper on asset allocation is Merton (1971). Consider the following consumption portfolio problem:

$$\max_{\{x_t, c_t\}} U(W_0) = \int_0^\infty e^{-\delta t} u(c_t) dt,$$

where x_t indicates the allocation of portfolio wealth to a risky asset (stocks), c_t is consumption at time t, W_0 is the initial portfolio value, δ is the rate of time discount, and u is the utility function of the endowment. The classical Merton problem involves solving this maximization subject to the following constraints. Suppose there is a single risky asset whose price is S_t which follows a geometric Brownian motion. In continuous time, the endowment can trade continuously and without frictions in and out of the risky asset (stock) and a risk-free asset with constant return r. The problem is therefore solved subject to the constraints:

$$\frac{dS_t}{S_t} = \mu dt + \sigma dZ_t$$

$$dW_t = W_t r dt + x_t W_t(\mu dt + \sigma dZ_t - r dt) - c_t dt$$

$$W_t \geq 0 \quad \forall t$$

Then it is well known that when utility exhibits constant relative risk aversion so that

$$u(c) = \frac{c^{1-\rho}}{1-\rho},$$

where ρ is the risk aversion parameter, the optimal asset allocation to the risky asset (stock) is constant over time and is exactly equal to

$$x_t = \frac{\mu - r}{\rho \sigma^2}.$$

Incidentally this same formula applies (with $\rho = 1$) when there are changing investment opportunities (μ is time-varying) when the utility function is logarithmic. In this case the asset allocations are not constant any longer. This result extends easily to the case where there are N asset classes; once again with geometric Brownian motions and constant relative risk aversion asset allocation weights are constant. Since the consumption rate is essentially the spending plan of an endowment, it is of interest to consider the optimal consumption rate which is given by

$$c_t = \gamma W_t \tag{1}$$

That is, consumption is perfectly correlated with the current value of the endowment. This provides a theoretical link between the endowment performance and the optimal spending policy. The performance of this optimal policy has been investigated using a historical "backtest" by Dybvig (1999). In this case he assumes that stock expected returns, the risk-free rate, risk aversion, and volatility yield an optimal asset allocation of 50% to stocks and 50% to the risk-free asset. He also assumes that the optimal spending rate is given by 4.5% of current endowment value.

Figure 3 shows the results of applying the standard Merton model to historical data from 1946 to 1996. As is obvious, this results in a spending pattern that is just as volatile as the value

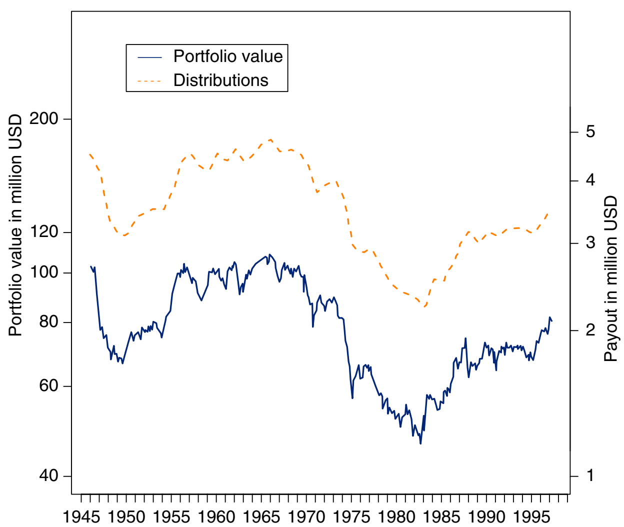

Figure 3 Backtest 1946–1996 of Merton myopic asset allocation.

The figure shows inflation-adjusted portfolio value (left-hand scale) and spending (right-hand scale) resulting from a policy representing a 50% allocation to US stocks and 50% to T-bills, and a spending rate of 4.5% of the portfolio value.
Source: Figure 1, A from Dybvig (1999).

of the endowment. During periods of significant drawdowns, the university would have to reduce spending drastically. Dybvig hypothesizes that a better representation of a reasonable consumption policy is one that never decreases over time. This is based on a type of "path dependence" criterion in which quality considerations dictate that it is never possible to reduce expenditure levels. He therefore adds the constraint, $c_s \geq c_t$ for all $s \geq t$. It turns out that this additional constraint changes the endowments behavior drastically.

Now Figure 4 illustrates the impact of this form of constrained spending. By contrast with Figure 3 the initial spending is significantly reduced. In fact it is less than one-half of the unconstrained spending policy. However, by the end of the period, the spending level is higher than that of the unconstrained policy. The portfolio value is much higher as well.

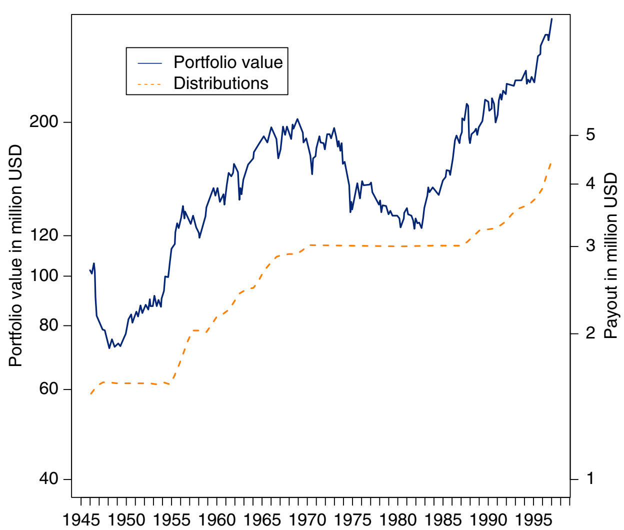

Figure 4 Backtest 1946–1996 of a non-decreasing spending policy.

The figure shows inflation-adjusted portfolio value (left-hand scale) and spending (right-hand scale) resulting from a policy where the portfolio is split into a protected part (spending level divided by 3.5%) invested in T-bills and the remainder invested in US stocks. Spending is increased as necessary to keep it from falling below 1.5% of the portfolio value and is never decreased. *Source*: Figure 3, A from Dybvig (1999).

To achieve this constrained optimal spending level, the endowment is required to utilize a form of portfolio insurance. As the risky asset decreases in price, the endowment is required to reduce its holdings thereof. These holdings can only be restored once the risky asset price raises sufficiently. In the extreme case where the portfolio value is less than the current spending level discounted using the risk-free rate, $W_t \leq c_t/r$, maintaining the spending level becomes impossible (without being able to utilize the funds from short sales of the risky asset). The difficulty of this approach is therefore that endowments would have to reduce their spending rates while significantly deviating from current practices. Moreover, it requires them to take portfolio insurance strategies and finally they may have to allocate massive amounts of capital to riskless investments just at the time when interest rates are lowest. These are formidable challenges for the theory.

2.3 *Time-varying investment opportunities*

The framework of Merton (1971) can be used to take account of varying investment opportunities. In this vein, it is known that if investment opportunities can be described by a finite set of factors, F, where these factors are affecting both means and volatilities of risky assets, the optimal portfolio is obtained by adding a set of F "hedge portfolios" to the myopic portfolio derived earlier. These hedge portfolios are ones that are chosen to have the highest possible correlation with the factors driving returns.

Merton (1993) adapts this approach to the case of university endowment funds. In addition to tangible wealth representing the endowment portfolio, the university is assumed to possess a stream of future cash flows (referred to as nonendowment income). This could comprise donations or student tuition fees for instance. A simple intuitive example of the type of impact that nonendowment income has is given when the income is highly (perhaps perfectly) correlated with the returns on a risky asset. Then even without holding any risky assets in the endowment portfolio the university effectively has a "shadow" holding of risky assets overall. Therefore, when one focuses on the investment portfolio alone, it is not surprising that the level of risky assets is reduced compared to the case of a university where there are no future cash flows, or where those cash flows are uncorrelated with asset performance.

At the same time universities face liabilities as well. Merton provides an example where universities must compensate faculty for the costs of housing. As a result this implies that it may be rational to invest a larger proportion of the endowment funds in real estate, since this essentially hedges the risk that faculty may need increased housing allowances. The general solution takes the following form. Assume that the nonendowment stochastic income sources are "spanned" by the set of risky assets. Then the value of these income sources can be computed (using martingale-equivalent measures). This value is added to the actual cash value of the endowment fund. The overall funds are then invested in a mean–variance efficient set of asset classes to begin with. The university then may hedge by modifying this original asset allocation by tilting the portfolio away from assets that are most correlated with positive income sources. One major difficulty of this approach is the imposing set of parameter estimations that would be required to implement it. In a practical sense, donations and other forms of income may not be easily related to economic forces, so figuring out what sort of hedge portfolios to utilize is complex. Further the university cannot "borrow" from future income sources typically and therefore monetizing these amounts in order to invest the required cash amounts in risky assets may also have serious practical limitations. Nevertheless the Merton paper does provide an interesting set of potentially testable implications to see how asset allocations may be affected by the operating and income cash flow streams anticipated over future time periods.

Dimmock (2012) empirically relates the volatility of nonendowment income (as a measure of income risk separate from endowment performance) to endowment funds' asset allocation. This paper shows that higher nonendowment income risk leads to a significantly higher proportion allocated to fixed income and a lower proportion invested in alternative assets.

One important feature of the Merton analysis concerns the time period over which the endowment horizon extends. If investment opportunities are constant over time then the time horizon does not matter because the same mean–variance efficient set of weights is selected and held constant. However, this is no longer true when there are predictable patterns in returns. Barberis (2000) uses a simple model in which expected returns are autocorrelated and positively related to the dividend/price ratio. Based on parameter simulations the optimal asset allocation can vary significantly by time horizon.

Figure 5 illustrates the results of the model for a situation where there is no portfolio rebalancing. It contains four cases. The unpredictable case is the benchmark case where there is a fixed allocation to stocks no matter what horizon is chosen. The predictable case shows that when the horizon is extended to 10 years the allocation to stocks becomes much greater. Intuitively when there is mean reversion, the risk of long-term holdings decreases relative to short-term holdings and therefore the optimal portfolio holds many more stocks than bonds. These results, however, are crucially dependent on whether the predictability can be estimated and the magnitude of such predictability. As can also be seen in Figure 5

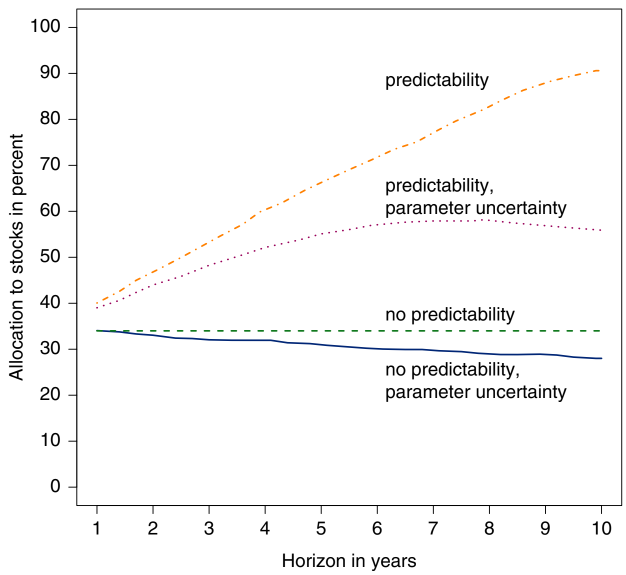

Figure 5 Horizon effects on asset allocation.

The figure shows the optimal allocation to stocks depending on the investment horizons in years, where the investor follows a buy-and-hold strategy, has power utility over terminal wealth with risk aversion of 10, and uses a VAR model which allows for predictability in returns.
Source: Figure 2 from Barberis (2000).

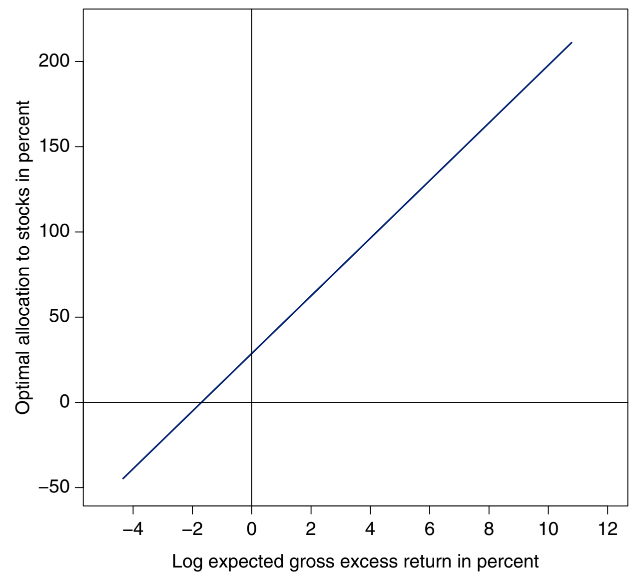

Figure 6 Effects on dynamic asset allocation from return predictability.

The figure shows optimal allocation to stocks for risk aversion of 4, if investment opportunities are time-varying.
Source: Figure 1.d from Campbell and Viceira (1999).

with parameter uncertainty the allocation to risky assets is decreased.

Campbell and Viceira (1999) also consider the dividend/price ratio as having predictive power for expected returns. However, focusing only on the consumption stream, they consider the impact of changes in the forecast of expected returns for a risky asset for an investor with a relative risk aversion coefficient of 4. Figure 6 shows that when the logarithm of gross excess returns varies from -4% to $+10\%$, the allocation to stocks varies from more than 20% short to almost 220% long. Of course this is a very extreme variation and depends on the believability of parameter estimates, but this indicates the value of deviating from a long-run target when investment opportunities vary over time.

Using related methods Campbell and Viceira (2001) consider the possibility of holding long-term bonds for an infinitely lived investor. As they demonstrate, in a model in which the state variable is related to short-term interest rates, the Merton hedging portfolio creates an incentive to hold real bonds in large magnitude only for a very risk averse investor. Such a motive is not present from the mean–variance optimized myopic portfolio. However, when the investor is more risk tolerant, and bonds offer only nominal returns, the allocation to long-term bonds is sharply reduced and replaced with equities and cash depending on the risk aversion coefficient. When one considers this as applied to endowments, the implications are that in the current (as of this article) environment of very low short-term rates, the hedging motive of protecting against short rate reductions is not present anymore. Therefore, one would expect that endowment holdings of long-term bonds should be less than in the previous historical period.

Cejnek *et al.* (2013) extend the frameworks of Merton and Campbell and Viceira to include endogenous donation inflows, which are positively correlated with either risky asset returns or endowment returns. They show that the allocation to stocks decreases due to a substitution effect if donations depend on risky asset returns, whereas this effect is less pronounced if donations are positively correlated with endowment returns. Moreover, they find support for a wealth effect, indicating that small endowments allocate substantially more to the risky asset if investment opportunities are exceptionally good.

2.4 Data on endowment returns

Before discussing the empirical evidence on asset allocation for endowment funds, we describe a common data source. The most comprehensive data source providing annual returns of university endowment funds is a set of studies compiled by NACUBO. This set of NACUBO studies is widely used in recent academic papers on university endowments. Some studies use quarterly data on endowment performance from a proprietary database of Cambridge Associates in addition, e.g., Brown *et al.* (2010). UK endowment returns for Oxford and Cambridge during 1998–2002 are provided by Acharya and Dimson (2007).

As data from NACUBO surveys is the basis for most academic papers in the field of university endowment management, survivorship bias or selection issues are potential concerns. Lerner *et al.* (2008) indicate that university endowments covered by NACUBO surveys tend to be larger, more selective and more likely to be private than average schools. However, they report that their results are qualitatively similar when the sample is adjusted to contain similar numbers of public and private schools. Similarly, Brown *et al.* (2010) mention that even though NACUBO data are the largest sample of its kind, misrepresentations of the overall universe of universities cannot be excluded. After creating subsamples according to criteria such as size (assets under management), payout ratios, and public versus private the conclusions of their study do not change. Importantly, they also claim in their paper that NACUBO does not change data from earlier years when a specific endowment fund drops out of the sample, thus making the dataset entirely free from survivorship bias. In their earlier paper (Brown *et al.*, 2007) they also highlight that NACUBO does not backfill performance data when new endowments are added to the sample and that self-selection bias seems less of an issue since the number of participating schools is sufficiently large. Barber and Wang (2013) concur that survivorship bias should not be a big issue with endowment funds as most educational institutions (including their endowment funds) endure over long periods (there are no mergers between schools, and very few bankruptcies). Furthermore, they quantitatively test for self-selection bias. First, they compare returns of endowments that report consistently every year with endowments with reporting gaps; second, they compare returns of first time reporters with other endowments and finally returns of endowments that reported consistently in all 20 years of their sample (1991 to 2010) to all endowments. Since on the one hand differences in returns for all three methods are economically small and on the other hand consistently and diligently reporting institutions have slightly higher (not lower!) returns than either first time reporters or endowments exhibiting reporting gaps, self-selection bias does not seem to be problematic.

2.5 Empirical analysis

In order to see the relevance of asset allocation to fund returns, it is helpful to utilize the decomposition into three parts (Brinson, 1986). Following Brown *et al.* (2010), suppose that we define the rate of return of the endowment fund to be R_t, at the end of period t. Let the number of asset classes be N and define x_{jt} to be the amount of wealth in asset class $j \in N$ over the period from time $t-1$ to t. Denote r_{jt} as the actual rate of return of the sub-portfolio invested in asset class j (the active return). Correspondingly, suppose that we can represent each asset class by a benchmark return, r^B_{jt}. Let x^B_{jt} be the strategic or policy weights for asset class j. Then without loss of generality, we can write the actual portfolio rate of return in the following form:

$$\begin{aligned} R_t &= \sum_{j=1}^{N} x_{jt} r_{jt} \\ &= \sum_{j=1}^{N} x^B_{jt} r^B_{jt} + \sum_{j=1}^{N} (x_{jt} - x^B_{jt}) r^B_{jt} \\ &\quad + \sum_{j=1}^{N} x_{jt}(r_{jt} - r^B_{jt}). \end{aligned}$$

This shows that the actual rate of return can be thought of as being composed of three sub-portfolios. The first portfolio is just the return to strategic asset allocation. The second term represents the incremental return to dynamic asset allocation, since the difference in portfolio weights represents deviations from the strategic weights. The third term can be interpreted as the gains to active management. As long as the portfolio weights are observable and two out of three of the terms on the right can be identified, it is possible to disentangle the three effects. Suppose that we denote the three return components as R^B_t, R^T_t, and R^S_t, the return to strategic asset allocation, to tactical asset allocation, and to active management, respectively. Brown *et al.* (2010) then regress the total endowment returns on each of these sub-portfolio return components in a separate regression and compute the adjusted R^2 from the regression, as in for instance:

$$R_t = a + bR^B_t + \epsilon_t.$$

Table 1 indicates the results of these regressions when run across all funds in the NACUBO study for which policy weights were able to be determined. The table shows that on average, strategic asset allocation can account for as much as 75% of return variation. Furthermore, even the lowest quartile of strategic asset allocation was 68%.

Table 1 Strategic and tactical asset allocation components.

	Mean	Median	Lower quartile	Upper quartile
Strategic asset allocation	74.42	81.94	67.82	91.25
Tactical asset allocation	14.59	10.54	−7.04	34.87
Active management	8.39	−0.41	−7.69	17.69

The table reports summary statistics from the cross-sectional distribution of adjusted R^2 coefficients from performing 704 time series regressions explaining endowment returns.
Source: Table 4 Panel A from Brown *et al.* (2010).

This table is generated by running time series regressions for each fund. On the other hand the authors then regress (for each time period) the returns to the cross-section of funds on the cross-section of return components. Now one finds that the same percentage of explanatory power, 75%, is due to active management rather than to either form of asset allocation.

Table 2 provides the results for the cross-sectional regressions. It is evident that while strategic asset allocation explains the vast majority of returns for a given fund over time, it is active management that explains the relative performance of fund returns within a given year.

An interesting question is how to reconcile these two disparate results. The results from Table 1 pertain to a form of "replication" strategy, that is basically how close one can get to tracking the average returns from an endowment using only benchmarks. The cross-sectional results in Table 2 are completely different in that the

Table 2 Cross-sectional attribution results.

	Mean	Median	Lower quartile	Upper quartile
Strategic asset allocation	11.10	4.69	2.79	11.06
Tactical asset allocation	3.30	2.43	0.80	4.34
Active management	74.69	77.17	61.23	87.13

The table reports summary statistics from the time series distribution of adjusted R^2 coefficients from performing 16 cross-sectional regressions explaining endowment returns.
Source: Table 4 Panel B from Brown *et al.* (2010).

actively managed component is not replicable at all. The fact that actively managed fund choices can provide a strong indication of relative performance is perhaps the reason for the well-established focus on manager selection and on the competitive market that drives manager compensation.

In a closely linked paper, Brown and Tiu (2010) emphasize the importance of active management. They found that the average endowment could have significantly increased its risk-adjusted performance by shifting its portfolio away from its passive benchmarks. The size of such an over-allocation was as much as 30% relative to its alpha-optimal portfolio. This effect is most pronounced for large endowments. This over-allocation to the passive component for large endowments is, however, consistent with decreasing returns to scale, since it is likely the abnormal alphas would be substantially depreciated were these funds to engage in this active strategy to the calculated extent.

Barber and Wang (2013) consider a standard Sharpe (1992) style attribution analysis amongst the NACUBO endowments. This study uses annual data as does the previous paper and runs a time series regression of the following form for each endowment:

$$R_t = \alpha + \sum_{f=1}^{F} \beta_f R_{ft} + \epsilon_t,$$

where $F = 5$ denotes the number of asset allocation "factors" and R_{ft} asset allocation benchmark returns. As with the previous analysis the R^2 from the regression can be interpreted to mean the amount of the return that is due to asset allocation across the five classes. In order to achieve the interpretation of β_f as portfolio weights, the regression is estimated with the constraint $\sum_{f=1}^{F} \beta_f = 1$. The five factors are chosen as the S&P 500, US bonds, international stock, private equity, and hedge funds, and benchmarks are chosen from publicly available

Table 3 Style attribution analysis of US endowments.

	Average empirical weights					
Alpha	US stocks	US bonds	Non-US stocks	Hedge funds	Private equity	R^2
0.04%***	0.59***	0.41***				0.94
0.40%***	0.41***	0.38***	0.21***			0.99
−1.82%***	0.36***	0.28***		0.17***	0.19***	0.98
−0.68%***	0.36***	0.31***	0.13***	0.11***	0.08***	0.99

This table reports the intercepts (alpha) and estimated loadings for attribution models that use various combinations of benchmark returns. The dependent variable is the equal-weighted average annual return on all endowments reporting to NACUBO. The dataset runs from 1991 to 2011. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.
Source: Table 3 from Barber and Wang (2013).

sources. Therefore, the regression coefficients can be interpreted as the average asset allocations to the five factors. Table 3 shows the average regression coefficients. Two things are evident: the average fund had about 60% invested in equities and 40% in bonds over the reporting period. Even this two-factor model could explain 94% of the time series return. Second average performance relative to the style-adjusted benchmark is negative or insignificant from zero.

The authors repeat these regressions for different filters amongst endowments. For instance the top performing university endowment funds have weights as indicated in Table 4. Even though the percentage allocations to stock and bonds are roughly the same as the average fund, what shows up noticeably is that there is a much greater allocation to non-US stocks, hedge funds, and private equity. Nevertheless, when these factors are included it appears that even the top performers may have difficulty in outperforming the benchmark.

These asset allocation studies appear to show that the ability to access the breadth of asset allocation categories is crucial. But that once these categories are accessed most of the active management benefits go away. However, there are two caveats to keep in mind. First, some of the indexes chosen do not necessarily represent what could be achieved by passive investing. There are well-known issues with back filling and selection bias for hedge fund indexes for instance. And second, the regression estimates are conducted "in sample" which means that the coefficient estimates (and hence the asset allocation average weights) use return information that was *not* available at the time the assets were allocated.

From observations on asset allocations one can attempt to infer endowments' a priori beliefs about these asset class returns. To this end, Ang *et al.* (2013) use a Bayesian framework to estimate implied beliefs of endowments on alternative asset returns relative to traditional asset classes. They find that anticipated alphas of these alternative asset returns have increased over time and often exceed historically realized alphas. The authors question whether the high expectations with respect to alternative assets' alphas will be met in the future, especially in the light of declining illiquidity premia.

In conclusion, the asset allocation decision of an endowment fund can be given a rigorous theoretical perspective based on the classic Merton (1971) model. This, however, does not reflect actual constraints that are often employed by university endowments and also requires taking

Table 4 Performance attribution for top performing endowments.

	Average empirical weights					
Alpha	US stocks	US bonds	Non-US stocks	Hedge funds	Private equity	R^2
2.19%***	0.61***	0.39***				0.90
2.41%***	0.40***	0.34***	0.25***			0.95
−0.70%***	0.27***	0.21***		0.22***	0.30***	0.97
−0.18%***	0.27***	0.23***	0.07***	0.19***	0.25***	0.97

This table reports the intercepts (alpha) and estimated loadings for attribution models that use various combinations of benchmark returns for the top decile of institutions reporting to NACUBO. The dependent variable is the equal-weighted average annual return. The dataset runs from 1992 to 2011. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.
Source: Table 4 Panel B from Barber and Wang (2013).

a stand on the functional form of endowment "utility". Empirical evidence suggests that it is possible to identify implicit benchmarks for endowment funds, but these benchmarks are heterogeneous across the sample and there remains a strong motive for active management.

3 University endowment performance

Considerable attention is focused on the actual performance of university endowments. This section highlights research related to endowment returns and focuses on variables influencing endowment returns. Moreover, research on risk-adjusted endowment performance and performance persistence is presented.

Since traditionally, a common benchmark is to compare university endowments with a portfolio consisting of 60% equity and 40% fixed income (Barber and Wang, 2013), we provide Figure 7 which compares the average NACUBO endowment returns with this portfolio using S&P 500 stocks and US treasuries with maturities of 1–3 years.

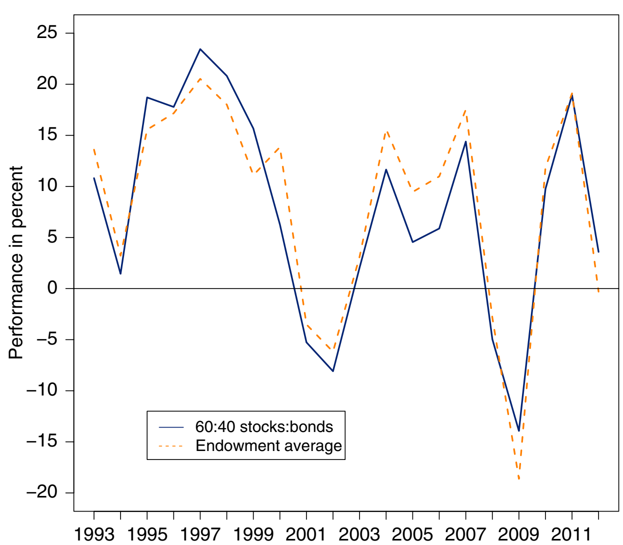

Figure 7 Endowment returns vs. 60:40 portfolio.

This figure compares equal-weighted endowment returns of institutions reporting to NACUBO with an annually rebalanced portfolio consisting of 60% S&P Total Return Index and 40% Barclays US Government 1–3 Year Total Return Index, for fiscal years 1993–2012.
Data: NACUBO, Bloomberg.

3.1 *Endowment performance: A success?*

The average endowment performs reasonably well: Lerner *et al.* (2008) conclude that endowment returns in general were healthy over the period analyzed. They state that over the 20-year period ending in 2005 many endowment funds were in the top percentile of performance among institutional investors. Five percent of endowment funds even exceeded the top percentile return for corporate pension funds for the 10 years ending 2005. Private equity investments by endowment funds are another case in point: according to Lerner *et al.* (2007) returns in this asset class are approximately 21% better for endowments than for other institutional investors. With respect to hedge funds alone, Agarwal *et al.* (2013) derive a similar result for 63 large endowments (which include 19 of the 100 largest NACUBO endowments). They observe that superior performance relative to other institutions such as pension funds is obtained by investing directly, rather than through funds of funds and by not relying on the advice of investment consultants.

3.2 *Size and other characteristics affecting endowment returns*

We have already discussed the evidence for considerable cross-sectional variation in endowment returns. Lerner *et al.* (2008) analyze returns for average endowment funds, endowments of private schools (excluding Ivy League), Ivy League endowments, large endowments, and endowments of universities with high SAT scores separately. The authors find that Ivy League endowments outperformed the overall median endowment by more than 3 percentage points per annum (between 1992 and 2005), whereas private schools had returns similar to the median. Large endowments and schools with high average SAT scores managed to generate similar and above overall average returns. Corroborating evidence is in Barber and Wang (2013) who provide a mean performance (from 1991 to 2010) of 11.49% for Ivy League schools, 10.23% for the top-30 schools by SAT scores and 8.17% for other institutions.

As mentioned above, endowment size seems to be one of the important variables influencing variation in endowment returns. Lerner *et al.* (2008) claim that in a sample of endowment funds sorted by size in 1992 a 10-percentile increase in size results in consistently higher returns in the following years through 2005 (the same is true for a sample sorted by SAT scores). Reasons provided by the authors for economies of scale in endowment management are better trained and more sophisticated endowment managers (e.g., small endowments may be managed by financial officers with other duties) and a mix of specialized inside and outside managers at larger endowments. As to the influence of SAT score on performance the authors posit that the SAT score may be a proxy for the skill of the university administration as well as the connections of the alumni network. Moreover, the prestige of the university brand may contribute indirectly to endowment performance. Some studies relate the superior performance of larger endowments to the higher allocation of alternative assets (see above concerning asset allocation and below on risk-adjusted returns).

Finally, there seems to be scope for further research investigating the causal links between endowment size and performance. Further research could shed light on the reasons behind endowment returns that seem to increase monotonically in size. One possibility is that this is nothing more than a pure mechanical result of the methodology of allocating endowments into given size buckets. For instance one and ten-year returns (NACUBO-Commonfund, 2013) are given in Table 5.

3.3 *Risk-adjusted endowment performance*

A thorough analysis of endowment performance needs to take risk into account. This is usually investigated using the well-known risk factor approach. To this end, Brown *et al.* (2010) conduct risk-adjusted return tests using Fama and French (1993) as well as Carhart (1997) factors. The authors estimate several versions of the model, however the full model is as follows:

$$R_t - R_{ft} = \alpha_i + \beta_{mkt} MKT_t + \beta_{smb} SMB_t + \beta_{hml} HML_t + \beta_{umd} UMD_t + \beta_{term} TERM_t + \beta_{def} DEF_t + \epsilon_t,$$

Table 5 One- and ten-year annualized endowment returns according to size.

	Endowment size					
\$	>1bn	501 m–1bn	101 m–500 m	51 m–100 m	25 m–50 m	<25 m
FY 2012						
Total net return %	0.8	0.4	−0.7	−1.0	−0.5	0.3
Ten-year (ending 2012)						
Net return %	7.6	6.6	6.0	5.7	5.8	5.7

This table reports the average one- and ten-year net returns according to the size of the endowments.
Data source: Figure 2.2 from NACUBO-Commonfund (2013).

Table 6 Coefficients for a multifactor model.

α	MKT	SMB	HML	UMD	DEF	TERM	PTFSBD	PTFSFX	PTFSCOM	R^2
A. Cross-sectional average: NACUBO										
0.007	0.586***	0.016	0.057	0.045	−0.032	−0.009				0.951
B. Cross-sectional average: quarterly subsample										
0.003	0.562***	0.094**	0.047	0.013	−0.613***	−0.052	−0.728	0.759	−0.499	0.911

The table reports cross-sectional average results for alpha and estimated coefficients of risk factor models explaining endowment returns. Panel A reports coefficients explaining annual returns from the NACUBO database. Panel B reports coefficients from a quarterly return subsample. MKT is the value-weighted return of US stocks, SMB is the difference in average returns to small-cap and large-cap portfolios, HLM is the difference in average returns to high book-to-market and low book-to-market portfolios, UMD is the difference in the average returns to high prior-return and low prior-return portfolios, DEF is the return difference between a portfolio of long-term corporate bonds and the long-term government bond, TERM is the return difference between the long-term government bond and the one-month Treasury bill. PTFS fators are portfolios of look back straddle positions from the bond markets (PFTSBD), currencies (PFTSFX), and commodities (PFTSCOM). *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively.
Source: Table 7 Panels A and B from Brown *et al.* (2010).

where $R_t - R_{ft}$ is the equally weighted excess return of all endowments in the sample at time t; and the factors are returns on market-, size-, value-, momentum-, term structure- and default factors. As the authors supplement their NACUBO-based return estimation by quarterly return data containing large endowments with heavy allocations to alternative investments, a second augmented model is estimated. In addition to the model stated above three trend following strategy factors are included. The factors are look-back straddle positions from bonds (PTFSBD), currencies (PTFSFX), and commodities (PTFSCOM), see Fung and Hsieh (2004). Table 6 taken from Brown *et al.* (2010) reproduces results for the full model (using NACUBO return data) and the augmented model (using quarterly return data).

In the light of the insignificance of most alphas the authors claim that endowment funds overall do not produce significant risk-adjusted returns. After regressing only the security selection component of returns (see Section 2) they further conclude that the security selection component actually has negative risk-adjusted returns. Some patterns emerge once endowment returns are sorted by the return fraction generated by policy returns (strategic rather than tactical asset allocations): the difference in risk-adjusted returns between very passive and very active endowment funds is large and statistically significant. Additionally, the study finds that passive endowments have significantly negative risk-adjusted returns, whereas active endowments have significantly positive risk-adjusted returns.

An earlier study (Brown, 1999) calculated Jensen's alpha of endowment returns (for the ten years ending 1995) on a broad market index. Alphas are in the range of 1.02% (using the S&P 500) to 0.98% (using the Wilshire 5000) net of fees leading to the conclusion that the average endowment outperformed a broad market index on a risk-adjusted basis. However, the paper indicates that this could be due to underreported expenses, the specific time period chosen or lack of a detailed multifactor benchmark. Brown (1999) also shows that large endowments have the largest abnormal returns and suggests that this may be due to allocations to non-traditional asset classes. Note, however, that this analysis does not try to treat returns of non-traditional assets by multifactor models as in more recent studies.

3.4 *Performance persistence*

Several studies find significant persistence in endowment returns. Lerner *et al.* (2008) state that top endowments (Ivy League, Large Endowments, and High-SAT Score) post consistently above average returns over the sample period considered (1992–2005) whereas endowments that perform below average tend to continue doing poorly year after year. This finding is illustrated in Figure 8, showing returns compared with the S&P 500 from 1992 to 2005.

Similarly, Barber and Wang (2013) rank endowments by performance deciles in year t and observe returns in year $t + 1$. Regardless of the model specification (number of asset classes), the bottom decile endowments generate negative alphas in the style attribution analyses (discussed above). When looking at the spread between top and bottom deciles, alphas are positive but not reliably different from zero when benchmarks for alternative assets are included. Furthermore, Brown *et al.* (2007) explain performance persistence by the degree of active versus passive returns: the fraction of endowment returns that can be explained by asset allocation policy versus market timing or security selection components. To this end, the authors rank on performance in one year, observe subsequent performance and check to what degree the return of persistent winners or persistent losers is attributable to active returns. The evidence they find is mixed: there is no obvious relation between performance persistence and degree of active versus passive returns, however, empirical evidence indicates that persistent winners tend to have low passive return components as do losers that revert to becoming winners.

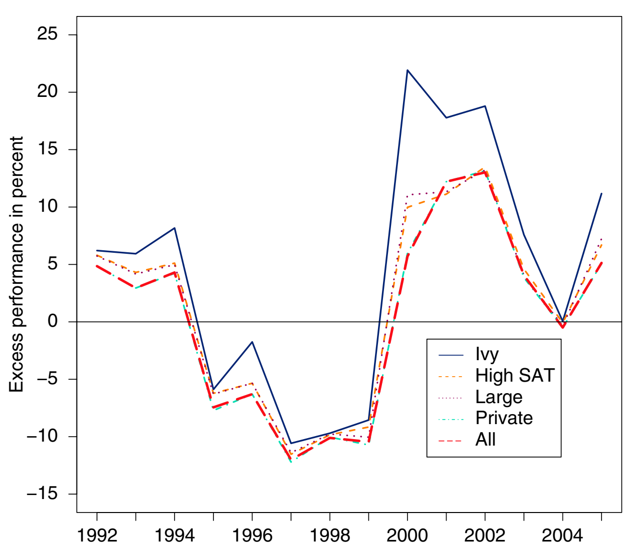

Figure 8 Excess returns by school type.

This figure shows the median endowment return minus the S&P 500 return for schools in each category which reported at least 10 years of return data between 1992 and 2005 to NACUBO. Large denotes schools in the top quartile of endowment size in 1992, High SAT denotes schools in the top quartile of SAT score in the sample in 1992. The Private, Large, and High SAT categories exclude schools in the Ivy League.
Source: Figure 1 from Lerner *et al.* (2008).

4 Spending policy

In the US, spending from endowment funds is an important source of university income. NACUBO institutions on average reported a contribution of 8.7% to their university's fiscal year 2012 operating budget. This number has considerable cross-sectional variation, nevertheless. Most institutions do not rely heavily on endowment income, as shown by the 3.0% median. The average, however, is driven higher by institutions with large endowments over $500 million and very large endowments over $1 billion. For these groups, contributions from the endowment to the operating budget constitute an average of 14.9 and 16.2% respectively.

This budget contribution was achieved by spending an average 4.2% of the value of the endowment. Spending rates are related to the size of the endowment, with richer endowed institutions exhibiting an average of 4.7%, and a rate for the smallest endowments (under $25 million) of just

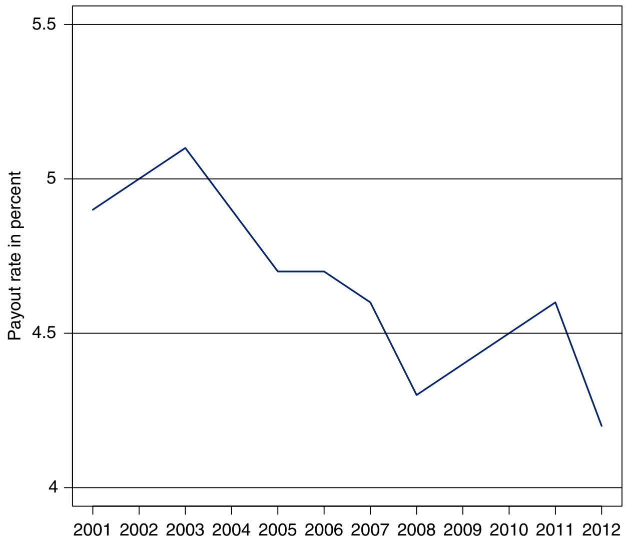

Figure 9 Spending rates.

This figure shows the average annual reported effective spending rate for fiscal years 2001–2012 for all institutions reporting to NACUBO. The number of institutions present in the average varies from year to year with a minimum of 693 institutions in 2001 and a maximum of 850 institutions in 2010.
Source: Figure 5.1 from NACUBO-Commonfund (2013).

3.7%. Figure 9 shows the time path of average spending rates from 2001 to 2012 as reported in the most recent NACUBO-Commonfund study. While realized portfolio performance and the size of the endowments varied substantially during this period, spending rates appear to have trended downward recently.

Changes in the value of an endowment can have substantial effects on the operations of a university through changes in annual payouts. In an empirical study covering the years 1986 to 2009, Brown *et al.* (2014) find that universities tend to adapt spending rates in an asymmetric way to changes in the value of the endowment. Interestingly, the study finds only a small effect from positive endowment returns on spending, but significantly reduced payouts following a negative shock on the value of an endowment, leading to the reduction of faculty and support and maintenance employees.

4.1 Definition of endowment income

From the empirical facts, it is yet unclear to what extent decisions on endowment spending are grounded in economic theory. Historically, the traditional approach was to spend the current income of endowment funds such as dividends and interest, leaving capital gains out of consideration. However, this can lead to an erosion of the real value of the endowment if in an inflationary environment the entire nominal cash distribution is spent. Sustainable endowment spending thus requires a proper definition of endowment income, which was the focus of a 1974 special issue of the *American Economic Review*, featuring early papers on the determinants of endowment spending rates.

Litvack and Malkiel (1974) set out criteria to develop a framework for the definition of endowment income. First, they assumed independence of spending from investment management. Second, they focused on the total rate of return rather than on the composition of returns as dividends and capital gains. Third, the real value of the endowment should be protected. The traditional approach ignores the effect of inflation: spending exactly dividends and interest does not assure preservation of the purchasing power of the endowment. Fourth, university income from the endowment should be reasonably stable. The paper proposes a definition of income by setting the spending rate equal to the long-run real return, where the nominal return considers both cash income (dividends and interest) and capital gains, and the university is assumed to grow the nominal value of the endowment at the inflation rate to keep the real value constant. Achieving a higher degree of income stability can be reached by applying the spending rule to a moving average of past endowment values. Accordingly, the paper specifies the fraction of endowment value that can be spent as $y = R - i$ of the endowment's market value, where R is the expected nominal rate of return and i is the inflation rate, assumed to be equal to the rate at which the endowment grows on average over time. As an example, under the assumption of a 9% expected total return and a 5% anticipated inflation, a 4% spending rule can be applied.

In a more formal way, Tobin (1974) sets forth a formula for sustainable endowment income with the objective of intergenerational equity preservation among generations. He assumes that the trustees of an endowed institution have a zero subjective rate of time preference. This implies that endowment income should be consumed in such a way that the existing endowment can support the same set of activities in the future as in the present. The endowment—after consideration of spending but ignoring future contributions from donations—should therefore grow at the rate of inflation relevant to the university. The basic difference in the Litvack and Malkiel (1974) paper is that the dividends and interest are assumed to be stable, in contrast to the capital gains which can exhibit transitory fluctuations over time. The Tobin spending formula can be written as follows:

$$y_t = \frac{d_t}{W_t} + \frac{R_t - d_t/W_t - i_t}{1 + R_t - d_t/W_t},$$

where d_t is the cash dividends and interest paid by the endowment at the beginning of the period, R_t is the expected rate of return of the entire endowment from the standpoint at time t, i_t is the expected inflation rate, and W_t is the current value of the endowment. Thus, the spending rule states that the endowment fund should spend at the rate of current dividend and interest yields plus an implied amount of endowment liquidation given by the difference between the expected rate of capital gains and the inflation rate. In this spending rule, Tobin takes into account that the capital gains may be abnormally high or low during a period, represented as a large deviation from the expected rate of return, R_t. If cash dividends and interest are stable, this implies that the spending rate out of dividends and interest will actually decrease when W_t grows faster than the expected rate of return and the spending rate out of dividends and interest will increase when W_t grows at a rate below the expected rate of return. If expected rates of return and inflation stay constant, then the spending rate generated from sales of securities will also remain constant. Of course the actual cash spending rate will be given by multiplying the spending rate by the value of the endowment.

Closely related to Tobin, Nichols (1974) discusses the role of income and capital gains. The market value of an endowment portfolio can increase either due to an increase in the cash receipts from the portfolio or because of a reduction in the discount rate. These different kinds of market value changes have to be treated differently. Capital gains due to an increase in the expected cash receipts (or the growth rate of cash receipts) can be fully counted into income. In contrast, capital gains resulting from a lower discount rate mean that the same stream of future cash flows is now valued higher. This should be considered as income only to the extent the institution is a net seller of securities, also leading to the Tobin result of spending at the current income yield plus the fraction of the endowment by which the growth rates of cash flows exceed the desired growth rate of the endowment.

4.2 *Intergenerational equity*

Applying the Merton model as specified in Section 2 with the assumptions of constant relative risk aversion, ρ, and time-additive utility with intertemporal discount factor, δ, gives the following expression for γ in Equation (1):

$$\gamma = R - i - \frac{R - (i + \delta)}{\rho} + (1 - \rho)\frac{\sigma_*^2}{2}$$

where σ_*^2 represents the variance of the optimal portfolio. This shows that the optimal spending rate in the Merton model is equal to the original Litvack and Malkiel (1974) formula plus two additional terms. The first additional term is related to the difference between the real expected return on the endowment and time preference, scaled by risk aversion. The second additional term is a precautionary adjustment that takes into account the risk of the optimal portfolio. There are therefore two possibilities under which the basic rule of spending the real return can be justified: either the rate of time preference $\delta = R - i$ and utility is logarithmic (which implies that $\rho = 1$), or else risk aversion must be infinite. If the time preference rate is low, i.e., the university puts a lot of relative weight on future generations, then intuitively spending rates are reduced. On the other hand, if risk aversion is infinite, then all assets must be invested in the riskless asset, which is likely to give a very low spending rate.[1]

Gilbert and Hrdlicka (2013a) question whether high payouts from endowments (enabled by an asset allocation geared toward assets with high expected return) constitute unfair risk shifting to future generations. They model an endowed university's objective function as a concave fairness function across overlapping generations. Each generation derives utility from consumption by spending from the endowment. The curvature of the university's objective function measures the fairness preference across generations and is distinct from the curvature in each generation's utility that captures its risk aversion. They numerically provide values for optimal spending rates and the allocation to the risky asset depending on the degree of fairness, risk aversion, expected risk premium, and horizon of each generation. For realistic choices of parameter values, the model yields results on spending and asset allocation that are at variance with common practices. Increasing fairness leads to more stable albeit lower optimal endowment payout ratios (of less than 2% for the reported parameter values), achieved through a smaller proportion of the endowment invested in the risky asset which accompanies lower expected returns.

4.3 Positive models of endowments

In order to better understand how universities decide on their investments, both financial and internal spending on research and teaching capacity, Gilbert and Hrdlicka (2013b) model universities as producers of social dividends. Donors prefer investments in (risky) internal investments. However, stakeholders such as faculty and staff dislike such internal growth because it dilutes their own claims, while investment in the capital market does not. In this setup, observing large endowments shifted to risky assets is a bad signal, as this is consistent with giving donors little weight in decision making as well as with a low productivity of marginal internal projects.

An opposite conclusion is obtained by Hoxby (2012) in another paper addressing the objective function of a university. She proposes a positive model of the university that maximizes its contribution to the intellectual capital of society, valued at social returns. As investments of a university in its intellectual capital are unlikely to be funded by private means, since private providers of capital need to earn a private return, this is where endowments come in. Endowment funds provide a form of commitment to a long-run policy of investing into intellectual property that creates social value. Spending rules then arise naturally from viewing this problem within the Merton framework, taking into account the intellectual capital portfolio of the university.

4.4 Types of spending rules

Since the prescriptions from the papers characterizing spending are not uniform, it is instructive to investigate actual spending rules and evaluate their performance under various return scenarios. Sedlacek and Jarvis (2010) describe the variety of spending rules that universities employ to determine the annual contribution from the endowment to their operating budget. We report the frequency of use in parentheses (NACUBO-Commonfund, 2013).

A minority of institutions use simple spending rules. Some universities restrict their spending to all current income (4%). This method does not relate spending to the market value of the endowment, but restricts spending to eligible cash flows as dividends and interest. Surprisingly, many institutions decide each year on an appropriate rate (11%). Another simple rule is to spend a pre-specified percentage of the beginning market value (4%). Due to the resulting of high volatility of spending, this rule is preferred by institutions less dependent on their endowments. Finally, there exists the simple rule to set the spending rate at the IRS minimum of 5% for philanthropic foundations (negligible percent).[2]

A second category is a set of inflation-based rules. Inflation-protected spending means that the dollar amount distributed grows at a predetermined inflation rate (negligible percent). More sophisticated is the banded inflation method (4%). With this rule, spending is increased at the inflation rate, but subject to both a lower bound and an upper bound expressed as a percentage of the endowment's value. During rising markets, this method tends to keep endowment spending relatively low compared with rising market values, whereas in down markets it allows the institution to keep spending relatively high. In severe or prolonged market downturns the cap protects the endowment.

Third, smoothing rules are applied. Most widely used is the *moving average rule* (75%), which states that a pre-specified percentage of a moving average of the endowment's market value will be spent, where the moving average is often based on three annual or 12 quarterly observations. Usage of this rule has varied substantially. The proportion of institutions adhering to this rule was considerably lower after the bursting of the tech bubble in 2000.

Among the more prominent *hybrid methods* (7%) are the so-called *Yale Rule* and the *Stanford Rule*. The use of these hybrid rules is more prevalent among larger institutions (12–15%). Here, the spending rate is typically calculated from a weighted average of an inflation method and a moving average method. The Yale Rule is the sum of two components. First, 80% of last year's spending is adjusted by the inflation rate. Second, 20% of the result from applying the target spending rate to the endowment's market value is added. This calculation reduces volatility of spending but ensures that spending is tied to the endowment value over the long-term. For the Stanford Rule, similarly the weights are 60% of prior year's portfolio payout and 40% on the policy spending rate multiplied with the endowment's market value.

Interestingly, university endowments change their spending policies more frequently than one would expect (Brown and Tiu, 2013). In their sample, which was also drawn from NACUBO, the percent of endowments changing their spending rule is on average 18% (for example from a moving average rule to a hybrid rule). Roughly 25% of endowments alter their spending policy (i.e., a change in either the spending rule or spending rate) from year to year on average. They find this to be inconsistent with the relatively constant view of investment opportunities. However, the distribution of spending rate changes is skewed. Exactly half of the funds did not make any formal adjustment within the sample. Of all rules considered the moving average and hybrid rules seem to be the most consistent rule categories with a retention rate of 88% and 80%, respectively. Three endowment characteristics are mainly responsible for a policy change: fund size, the level of the endowment's actual payout, and the return to its investment portfolio. Finally, changes in asset allocation policy tend to lead changes in spending rules, rather than the other way around.

Reconciling some of these empirical observations with a formal theoretical model, Cejnek *et al.* (2013) show that a spending rule that adjusts a target spending rate by a factor representing investment opportunities is closer to the theoretically derived optimal spending pattern than either moving average rules or hybrid spending rules.

Several papers utilize simulation studies to investigate spending rules. Kaufman and Woglom (2005) show a clear advantage of the Yale/Stanford mixed rule. Blume (2010) argues for a flexible rule under which a fixed percentage of the market value of the endowment is spent each year. Bajeux-Besnainou and Ogunc (2006) analyze a complex spending rule subject to minimum payout requirements. Coiner (1990) highlights that if a university wants to set a target endowment growth rate at a median value, the spending rate has to be set lower than if it targets the same expected growth return under lognormally distributed endowment values. Moreover, Ho *et al.* (2010) argue that spending decisions should not only be linked to expected returns but also maximum acceptable levels of volatility.

5 Governance

As in any financial organization, good governance is critical. Generally research in this area of endowment management is limited and there are many questions that deserve further study. We focus here on the following aspects of the governance structure: the investment policy statement, board structure, management costs and compensation, outsourcing principles, and links to fundraising.

5.1 Investment policy statement

The asset management process should begin with a formulation of guidelines pointing out a strategy, objectives of the endowment, and spending (Tuckman, 1998). Such guidelines can help all parties involved to understand the investment strategies and endowment objectives, especially if certain tasks of the endowment management process are outsourced. Fraser and Jennings (2010) indicate the desirable content of the Investment Policy Statement (IPS). The authors analyzed best practice with a number of university endowments in the state of Florida. According to their study, an IPS should include a clear statement of investment belief (e.g., relevant asset classes, investment costs), specific investment objectives (return targets, spending rules), performance benchmarks, rebalancing policy, guidance for proxy votes, and any ethical or social responsibility criterion. However, more rigorous research using broad data on what an IPS should contain would be beneficial.

If constraints are employed in the IPS they should not be too tight (Tseng *et al.*, 2010). The authors describe how endowments shifted successfully into equities during the financial crisis of 1929, encouraged by flexible guiding principles. Minimum liquidity requirements can also be important to mitigate the impact of severe financial crises on the endowment's ability to meet spending targets when markets are tight.

5.2 Boards

Boards play a crucial role in the endowment management process through their involvement in the definition of investment objectives, asset allocation, and manager selection decisions. Overall the academic literature has not yet considered this matter specifically for endowments. Links to the literature on corporate boards are not clear, either. What is currently available are basically case studies, surveys on narrow databases, and recommendations of practitioners and consultants.

In terms of board composition, the literature is more complete and suggests a well-balanced mixture, including finance professionals. Board members should also appreciate the university's mission and objectives; see Malkiel and Firstenberg (1976), Swensen (2009), and Core and Donaldson (2010). Acharya and Dimson (2007) argue that including finance professionals helps to cope with complex financial decisions like asset allocation. Drawing on a 2009 survey among NACUBO member institutions, Brown *et al.* (2011) examine the composition and decision making of boards. On average, two-thirds of board members serve as voting members on the investment committee. Nearly 90% of investment committee members are donors, most members have substantial experience in business, and about half are alumni of the institution that the endowment serves. The actual composition of the committee is correlated with operational and investment decisions. For instance, the presence of university employees on the board tends to reduce allocations to risky assets. A higher fraction of donors tend to be associated with lower exposure to alternative investments and a higher propensity to outsource.

5.3 Costs and compensation

An important component of overall performance is related to costs. Exactly how to benchmark costs in the context of university endowments is an open question. A potential benchmark for university endowments could be the cost structure of similar sized endowments. Table 7 shows data on management costs for endowments grouped according to their size, as reported by NACUBO-Commonfund (2013). The average cost as a percentage of assets exhibits a U-shaped pattern.

This table shows that while total costs obviously increase with endowment size, interestingly, also average and median costs as a fraction of assets are generally higher for funds with larger size. Hence if there are economies of scale, these are not evident solely by looking at cost percentages.

Performance evaluation clearly ought to be related to the compensation level of endowment managers. Swensen (2009) points out that while skilled investment staff tend to earn more than

Table 7 Average endowment cost.

	Endowment size						
$	All	>1bn	501 m–1bn	101 m–500 m	51 m–100 m	25 m–50 m	<25 m
Responding institutions	704	41	51	224	151	115	112
Average cost ($ in thousands)	1,845	19,033	4,432	1,462	345	196	85
Average cost (basis points)	66	100	68	69	54	57	69
Median cost (basis points)	52	80	49	58	43	46	57

This table reports the average cost of managing investment programs for fiscal year 2012.
Source: Figure 5.8 from NACUBO-Commonfund (2013).

their colleagues in other not-for-profit jobs within a university, the compensation levels would still be lower than in similar positions in the private sector. This could lead to tensions between investment staff and other university employees. To mitigate these problems, some universities have established their endowment management groups as separate legal entities.

Ellis (1970) also emphasizes that the higher cost of top talent managers should be reflected in better results. Other issues are highlighted by Core and Donaldson (2010) who stress that self-interested managers could press for a lower endowment payout ratio. Larger endowments tend to increase job security, have higher salaries, and potentially lighter workload, per capita. Very high compensation schemes have also been criticized (Humphreys *et al.*, 2010). In general cost efficiency can be a reason to outsource management, the next area we turn to.

5.4 Outsourcing

Most endowments outsource at least some parts of the management tasks. Hence, it is necessary to outsource efficiently. Crucial aspects are the implementation of a good monitoring process, achievement of high levels of transparency and cost efficiency, and ensuring a mutual understanding of investment objectives; see Malkiel and Firstenberg (1976), Acharya and Dimson (2007), and Swensen (2009). Malkiel and Firstenberg (1976) discuss the relative merits of outsourcing. While delegation of tasks offers potentially access to outside experience, it often results in loss of control. Nevertheless outsourcing can provide cost efficiencies, and valuable expertise that is not present in-house. Furthermore, it can be quicker than for the endowment to build up a group from scratch. In their case study on six New England schools, Humphreys *et al.* (2010), however, criticize external management for complicating the measurement of risk exposures.

Overall 80% of endowments employ outside consultants (NACUBO-Commonfund, 2013). Table 8 shows some details from the survey that exhibits a non-monotonic function of the fraction of institutions using outsourcing of various tasks. The smallest and the largest endowments rely less heavily on consultants compared with medium-sized endowments. A potential reason is that small-sized endowments hold less complex portfolios which are managed directly by the investment committee or the board of trustees. Large endowments can afford more in-house staff. With respect to investment management outsourcing, a monotonically decreasing pattern is found as this is practically nonexistent for endowments over $1 billion.

Overall more understanding about the potential role and applicability for outsourcing would be a fruitful avenue for further research.

5.5 Fundraising

Gifts to universities are the main building block of endowment funds, emphasizing the importance of fundraising. There are three main elements of successful fundraising, namely a good and long-term relationship with donors, transparency, and communication, as well as implementation and preservation of a good fundraising infrastructure, see for example Heinzl (2004) and Rogers (2005). Heinzl (2004) also highlights the potential boost to giving by tax incentives, which are much stronger in the US as compared to European universities.

The importance of gifts is emphasized by the recent NACUBO Commonfund Study of Endowments (NACUBO-Commonfund, 2013). On average 4% of a university's operating budget was funded by giving in fiscal year 2012. This compares to a 8.7% overall support from endowment funds with the operating budget. Since a full survey of fundraising is outside the scope of this

Table 8 Outsourcing.

$	Endowment size						
	All	>1bn	501 m–1bn	101 m–500 m	51 m–100 m	25 m–50 m	<25 m
Responding institutions	831	68	71	250	164	128	150
Used consultants (%)	82	72	90	93	87	77	61
Outsourcing services used (%) (multiple answers possible)							
Asset allocation/ rebalancing (%)	86	43	83	91	94	87	89
Manager selection (%)	85	45	83	93	93	88	75
Policy review (%)	79	41	83	83	85	80	77
Performance attribution and measurement (%)	87	51	84	94	92	85	85
Investment management (%)	39	6	19	31	49	59	57

This table summarizes the percentage of responding institutions using specified outsourcing services in fiscal year 2012.
Source: Figure 6.4 from NACUBO-Commonfund (2013).

paper, we refer the reader to other surveys on this topic (Lindahl and Conley, 2002).

While good governance is essential for good endowment management, there are still a lot of open research questions. In general it is necessary to fully understand the university's objectives and to integrate this with appropriate performance measures and evaluation structures. Moreover, hardly any research sheds light on how boards of university endowments should be structured optimally, and, how much outsourcing is efficient.

6 Conclusion

This review has surveyed the literature on endowment management research, classifying the extant literature into four areas: asset allocation, performance, spending policy, and governance. Of these four areas, the earliest rigorous work dates from the period 1974 when eminent economists such as Burton Malkiel and James Tobin examined endowment spending rules. This was followed up in 1993 by a paper by Robert Merton who adapted his seminal work on the consumption portfolio problem in continuous time to an endowment setting. Nevertheless it is only within the last decade that most progress has been made in breaking new ground. A possible reason for this is that due to outside funding constraints and changes in investment opportunities academic researchers have recognized that their own welfare may be tightly connected with better endowment performance.

Practitioners often maintain that asset allocation is the key to endowment success. Endowment funds, unlike other institutional investors such as mutual funds, can afford to have a long-term perspective and are subject to fewer restrictions on asset-class choices. An important aspect unique to endowment funds is their practice of adopting strategic asset allocation weights and then adjusting them tactically in a dynamic fashion. Given sufficient data on strategic weights, tactical weights and asset-class benchmarks it is possible to decompose portfolio returns into strategic, tactical, and active components. Interestingly in time series for a given endowment, most of the returns are directly related to the choice of strategic weights. Essentially this means that (at least in sample) one can replicate a lot of the returns using only benchmarks. However, when one compares funds cross-sectionally the major difference is due to active management. This implies that competitive advantages gained by having superior endowment performance require specialist expertise within asset classes.

In a theoretical sense, applying the standard consumption portfolio problem has serious challenges in the endowment context. First of all, the objective function is not clear. Second, the consumption rate may be subject to serious constraints as most spending is used to employ faculty which is a scarce resource. Third, income from other revenue sources and outside donations can interact with investment opportunities in complex ways. All of this implies that the standard model has been unable to be applied meaningfully to the actual practice of deriving tactical asset allocation weights. Our latest research has been devoted to developing a new theory on the linkage between dynamic asset allocation and spending rules.

Empirical studies are somewhat limited by data considerations. The only large-scale data source is NACUBO and then most of the data involve annual reports rather than regulatory filings and market prices. This has put strong constraints on researchers. Nevertheless we have learned some facts about endowment performance to this point. First, endowments have outperformed other institutional investors on average. Second, there is considerable cross-sectional variation illustrating that the elite (e.g., Ivy League) US university endowments outperform smaller university endowments. Since these institutions are larger there is the appearance of increasing returns to scale in endowment returns. However, this inference is questionable because of the mechanical bias that obviously better endowment success implies bigger size. Third, elite institutions' endowments exhibit substantial performance persistence over time. It is notable that these observations are broadly similar to those of private equity funds, which is unsurprising, given that the elite US institutions have substantial private equity in their asset allocations.

When it comes to spending out of the endowments, the major question deals with how sensitive spending should be to the current value of the endowment, i.e., with significant drawdowns, how much does the university need to cut back. Unfortunately there is no exact prescription for the resolution here, as one school of thought holds that the university should not cut at all and thereby preserve the interests of the present generation, while the opposite side believes that such situations are correlated with better investment opportunities, meaning that instead institutions should never spend out of the corpus. Actual practice among the major funds is usually some combination of past endowment returns as well as the current (inflation adjusted) spending rate. Unfortunately there is no adequate theoretical foundation for this kind of spending policy. Evidence also exists that spending policies are asymmetric in the sense that there is an incomplete adjustment to unexpectedly high returns as compared to the "austerity" in spending observed with respect to fund drawdowns.

The counterpart of the corporate charter and board of directors in the case of an endowment fund is the investment policy statement and the board of trustees. Compared to the voluminous body of research on these important corporate governance forms, very little has been done in the endowment context, except to survey actual practices. One key aspect that differs in particular from the corporate context is that donors play an important role in advisory committees. In terms of endowment costs, there is not necessarily a monotonic relationship as it appears that larger funds require higher percentage costs due to the complexity of operations and the higher levels of expertise required. Of course one major component of costs is that of the managerial compensation itself. This can be quite high in order to attract top talent from the outside investment management industry and can create challenges within the political environment of a university. In order to take advantage of economies of scale, the use of outsourcing has become more prevalent in recent years, although whether this has translated into actual net benefits remains to be established.

Our perspective on what has been accomplished so far has two key observations. On one hand, endowment management is a fertile area for application of the advanced state of development of modern financial theory and empirical analysis. On the other hand, there are major differences in the context in which these tools can be utilized. Balancing both these considerations represents the challenge for future researchers in endowment management.

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Notes

[1] Note that with infinite risk aversion the optimal portfolio risk, $\sigma_*^2 = 0$. Woglom (2003) points out that there should be a link between the expected endowment return and the degree of risk aversion. He attempted to derive optimal spending from the Merton model, however his formula is erroneous, since the risk term was neglected.

[2] University endowments, unlike philanthropic foundations in the US, are not subject to required minimum distributions due to tax regulations.

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