Why I Lost My Secretary:
The Effect of Endowment Shocks on University Operations

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Abstract:

Over the past two decades, endowments have become an increasingly important component of the typical university's resource base. We examine how U.S. doctoral institutions' endowment payout policies and spending decisions are affected by financial market shocks to endowments. While most endowments have formal payout policies intended to smooth payouts over time, we find that universities are more likely to deviate from these policies following negative (but not positive) shocks. These negative shocks have important economic effects on university activities. Specifically, we find that universities with larger negative endowment shocks are relatively more likely to: (1) reduce support (e.g., secretaries) and maintenance staff, but not administrators; (2) among less selective institutions, reduce expenditures on tenure-system faculty while increasing the average salary of adjuncts/lecturers; (3) make larger cuts to tenure-system faculty and secretarial support when their endowment portfolio is less liquid (i.e. higher allocations to alternative assets such as hedge funds); and (4) among more selective universities, reduce financial aid for students the following Fall and enroll fewer freshmen. We also find that universities increase hiring when their peers experience negative endowment shocks. Thus, financial shocks have real effects on university operations, but with cross-sectional variation in how universities respond.

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As most readers of this paper will understand from first-hand experience, universities have not been immune to the recent turmoil in financial markets. One reason is that over the past few decades, as the growth rate in the average university endowment has far outpaced the growth rate of university expenditures, universities have come to rely on endowment income as an increasingly important component of their resource base. Much of this growth has been driven by investment performance, which in turn has been strongly influenced by the gradual shift of endowment investments from fixed income to equities in the 1970s and 1980s, followed by a shift towards alternative assets (such as hedge funds, private equity, and venture capital) in the 1990s and 2000s (Lerner, Schoar, and Wang (2008)). While this shift provided endowments with impressive average returns, it also increased university endowments' exposure to financial market risk, including large market downturns such as those witnessed in the 2001-2002 period (the bursting of the technology bubble) and the 2008-2009 period (the global financial crisis).

The link between financing decisions and "real" activities of an institution has long been considered in the context of corporations, dating back to the work of Modigliani and Miller (1958). This paper is the first to consider how financial shocks to university endowments and the investment decisions of these endowments affect institutions of higher learning. Specifically, we explore how U.S. doctoral universities respond to endowment shocks[1] (i.e., financial shocks to endowment values) by addressing two questions. First, do university endowments' payout policies smooth over shocks to asset prices? Second, to the extent that endowments do not engage in complete payout smoothing, how do universities adjust their operations to the resultant shocks to their endowment income?

The answers to these questions are important for multiple reasons. At a broad level, universities serve as a major source of knowledge creation and dissemination and thus contribute to the global stock of human capital. Our research helps us understand whether financial markets have an effect on these educational activities and thus provides evidence on a channel through which financial markets can influence the real economy in important and long-lasting ways. We test whether fluctuations in asset prices affect real university outcomes, and at a finer level, whether, controlling for the size of the financial shock to the endowment, the *composition* of the

[1] Our measure of endowment shocks is constructed to capture shocks from financial markets, not shocks from donations. However, for expositional purposes we use the term "endowment shocks" rather than "financial market shocks to endowments."

endowment's portfolio matters (e.g., how the liquidity of endowment portfolio assets affects university-level operational decisions).

At a more personal level, many scholars are employed by U.S. doctoral institutions, and the effect of endowment shocks has the potential to influence our profession in a very direct and profound way. Thus, there is value in providing rigorous empirical evidence about how universities make important decisions following endowment shocks.

Our analysis is also potentially helpful in guiding theoretical research on universities, endowments, and other not-for-profit entities. In contrast to the theory of the profit-maximizing firm or the utility-maximizing individual, the economic theory of non-profits is less clearly developed, despite the fact that the non-profit sector is quite large in the U.S (9.4% of 2007 U.S. GDP according to figures published by the National Center for Charitable Statistics). While our paper does not attempt to fill the theoretical gaps in the literature, the empirical results on how universities respond to exogenous financial shocks nonetheless provide useful guidance when evaluating alternative models of this sector. In particular, we highlight the importance of allowing for heterogeneity in universities' responses to financing disruptions, suggesting a "one-size-fits-all" model of non-profits is likely inappropriate in many contexts. Indeed, we find that more selective universities respond to financial shocks along different margins than do less selective universities, with each type of university attempting to protect expenditure items most central to its mission statement.

In addition to helping understand universities' responses to endowment shocks, the results from this analysis can provide more general insights about how universities likely respond to other types of financial shocks, such as shocks arising from unexpected changes in the level of public funding or unexpected changes in gifts, grants, and contracts. The advantage of using endowments to identify a university's response to resource shocks is that they represent a largely exogenous phenomenon, as the variation in this component of a university's resource base arises from historical differences in activities to build and invest an endowment combined with fluctuations in global financial markets. In contrast, other types of variation in a university's resource base might be endogenously and contemporaneously determined, such as if a state legislature changes funding in response to how the money is being spent.

To examine these issues, we combine several sources of data into a panel that includes information on both endowments and their associated universities. We construct a measure of

endowment shocks that is equal to the endowment return multiplied by the beginning-of-period endowment size normalized by the total university budget. Our shock measure thus incorporates both the return of the endowment as well as the endowment's financial importance to the university. To allow for potential asymmetric responses, we then decompose endowment shocks into positive and negative shocks. Our panel data allows us to control for a rich set of covariates, including university fixed effects and state-by-year-by-public/private fixed effects. As such, we can control directly for all time-invariant characteristics that might be unique to a given university (e.g., its location, history, prestige, etc.), as well as control for any factors that might differentially affect a given state, be specific to a given year, or even be specific to a given type of institution (public vs. private) within a specific state within a specific year (e.g., economic and financial conditions or demand for certain types of universities that may vary both regionally and over time). In essence, our identification comes from studying different responses by universities of the same type (i.e., public or private), in the same state, and in the same year to differences in the size of both positive and negative endowment shocks while controlling for time-invariant differences across universities.[2]

During our sample period from the 1987-88 academic year to the 2007-08 academic year, university endowments experienced one particularly severe negative financial shock – the collapse of the technology bubble. It is primarily this episode that enables us to identify universities' responses to negative shocks. From July 1, 2000 to June 30, 2002 (i.e., the 2000-01 and 2001-02 academic years), the value-weighted stock market fell approximately 30% and the average (median) endowment lost about 9% (10%), with one quarter of university endowments losing 14% or more.[3]

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[2] It is important to stress that the inclusion of fixed effects means that we are examining *relative* responses. Thus, when we find that an endowment with a larger negative shock "reduces" payouts or that a university responds to a larger endowment shock by "reducing" a particular activity such as hiring faculty, this means that there is a reduction *relative to what this endowment or university would have done compared with other similar universities who experience smaller shocks*. This does not necessarily imply that endowments or universities reduce the activity in *absolute* terms: it may simply be that they had a smaller increase (e.g., rather than reducing endowment payouts in absolute terms, they may increase payouts but not as much as would be expected, or rather than firing faculty, they may simply hire fewer). It is also important to note that, as with any regression analysis, our results show the *average* response in our sample and do not imply that each individual institution responds in this same way. Indeed, as we will show below, there is heterogeneity in the response of different universities.

[3] Data for the academic year 2008-2009, which covers the recent global credit crisis, will not be available for all of the university-employment-related variables that we use until the summer/fall of 2010 and for all the incoming-freshman-class variables we use until the summer/fall of 2011. Further, to relate university decisions to lagged endowment shocks would require data from the 2009-2010 academic year, which will not completely be available until the summer/fall of 2012.

We begin our analysis by investigating how endowment payouts – the amount of money the endowment transfers to the university each year – respond to financial shocks to the endowment. As noted by Hansmann (1990), Winston (1999), and others, the theory of the non-profit sector in general, and higher education in particular, is not well developed. Because we do not have an obvious objective function for universities or endowments to make crisp empirical predictions, our approach is to use a university's own endowment spending policy as a benchmark. In general, most universities have endowment spending guidelines that specify a rate at which the university will spend from its endowment, such as 5% (although endowment managers are generally free to deviate from these mechanical payout guidelines).

As an indication that universities place some value on smoothing payouts over time, the vast majority of policies use a multi-year, moving average of *past* endowment values as the basis to which the payout percentage applies. Basing the level of payouts on an average of several years of past endowment balances has three implications. First, if endowment managers are mechanically following these payout guidelines, a change in the endowment asset value during the *current* year would not affect the endowment's *payout rate in that same year*.[4] Rather, the return on the endowment during the year will affect the level of *future* endowment payouts through the moving-average formula. We examine whether endowment payout rates are related to contemporaneous financial shocks – this provides a test of whether endowment managers to some extent "actively manage" payouts.

Second, the use of the moving-average formula for endowment payouts implies that payout rates should move countercyclically. Suppose endowment guidelines specify paying out 5% of the average market value of the endowment over the past three years. Mechanically, in up markets, the endowment's payout rate will be typically be less than 5% (reflecting that the past endowment values, that determine the level of payouts, are smaller than the current endowment value). In a period when asset prices are falling, the reverse will be true: the endowment's payout rate will typically be more than 5%. This simply reflects the smoothing inherent in a mechanical application of the moving-average formula. Following a negative shock, an endowment may deviate from its own guidelines by reducing payouts relative to the amount

[4] Throughout the paper, unless stated otherwise, we define an endowment's "payout rate" as the amount of payouts made to the university during the academic year divided by the *beginning-of-year* endowment market value. This is consistent with the definition used by endowments themselves. An endowment's payout rate is also commonly referred to as a "spending rate" or a "draw rate."

implied by its policy. This reduction in payouts could, at the same time, represent an increase in the payout rate relative to a prior period of upward-moving markets (e.g., the endowment may pay out 5.2% of assets instead of the 5.4% implied by its payout guidelines) – but, in this example, an increase less than one would have expected. This distinction is important to keep in mind when interpreting our results.

Third, these payout policies call for a symmetric response to positive and negative shocks, and are consistent with a "payout-smoothing" model in which universities seek to avoid dramatic changes in payout levels over time. In this sense, the typical payout guidelines instituted by most university endowments have some similarities to a standard consumption-smoothing model of utility-maximizing consumers, or to Lintner's (1956) model of profit-maximizing firms seeking to smooth dividends across the business cycle.

Empirically, we reject the hypothesis that university endowments consistently abide by their own mechanical payout guidelines. Specifically, we document an asymmetric response to *contemporaneous* positive and negative financial shocks. Endowments tend to follow their own payout guidelines during good times, with a contemporaneous positive endowment return having little effect on payouts to the university that year. However, many endowments deviate from their stated payout policy during bad times, *reducing* payout rates in response to contemporaneous negative shocks to a level lower than that implied by the simple mechanical policy.

Our finding that university endowments reduce payout rates below expected levels following a negative shock, suggests that endowments do not fully smooth payouts over time. Rather than using endowments as insurance against bad states of the economy (e.g., states in which a marginal dollar of additional resources is especially valuable for retaining faculty or avoiding staff layoffs), some endowment managers may instead behave in a manner consistent with an objective of maintaining the value of the endowment.

If universities do not fully smooth over endowment shocks (and even more so if they do the opposite), then the simple existence of a budget constraint implies that universities must adjust on some other margin. Thus, in the second part of our paper, we examine how financial shocks to endowments affect their associated universities' real operations. We focus primarily on university employment (i.e., tenure-system faculty, adjuncts/lecturers, support staff, maintenance staff, and administrators), because university employees are a key input to the

education process.[5] In addition to examining employment responses to endowment shocks, we also consider the effect of endowment financial shocks on university financial aid for students and the resultant effect on the number of incoming freshman.

We have five key findings from this analysis. First, we find that universities with larger negative endowment shocks respond, on average, by reducing the number of tenure-system faculty relative to universities with smaller shocks. Specifically, we find that a negative endowment shock that is equivalent to 10% of a university's budget leads to a 5.1% reduction in the number of tenure-system faculty during the year of the negative shock (either through less new hiring, greater attrition, or more dismissals), with an additional 6.6% reduction in the year following the shock. In contrast, we do not observe any changes in the number of faculty following positive shocks. When we differentiate institutions based on undergraduate admissions selectivity, we find that in the year following the shock, less selective universities reduce tenure-system faculty by a much greater extent than more highly selective universities.

While we do not find an effect on the number of non-tenure track faculty (e.g., adjuncts and lecturers), we do find that the average salaries of non-tenure track faculty rise in the year following a negative shock among less selective universities. This suggests that less selective universities respond to negative shocks by foregoing the hiring or accelerating the dismissal of (more expensive) tenure-system faculty and instead paying their non-tenure track faculty more in order to cover the teaching responsibilities. More highly selective institutions do not appear to engage in this behavior.

Second, in addition to reducing tenure-system faculty, universities react to negative shocks by cutting support employees (e.g., secretaries) and maintenance employees to a similar extent. We find no effect, however, on the number of administrators.[6] Selective universities, which presumably place greater weight on research, pass some of a positive endowment shock to their research-active faculty through salary increases or through changes in the composition of the faculty (i.e., replacing retirees with more expensive professors), while less selective

[5] Further reasons for studying the effect of endowment shocks on university employment decisions are that: 1) salaries and benefits to university employees are sizeable, representing roughly 60% of the university budget for the typical doctoral university during the 2007-08 academic year; and 2) accounting measures for university employees, such as the simple head counts and average salaries, are measured consistently across universities and within a given university over time, enabling valid cross-sectional and time-series comparisons.

[6] For reporting purposes personnel are assigned to only one job category (e.g., tenure-system faculty or administration) based on the role in which they spend more than half of their time.

universities instead pass the gains from their endowment to their teaching faculty (adjuncts) and hire more administrators and maintenance employees.

Third, we examine whether universities respond to the endowment shocks of peer institutions. We find that when a particular institution's peers – defined as the 20 universities with the most similar admissions rates – suffer a negative endowment shock, it responds, on average, by increasing faculty hiring in the following year. This effect operates independently of the university's own endowment shock, and is consistent with a view of universities competing for academic talent.

Fourth, we explore how endowment portfolio liquidity affects universities' reactions to endowment shocks. In recent years, there has been a dramatic shift away from publicly-traded equity and fixed-income securities into more illiquid, alternative investments such as hedge funds, private equity, venture capital, and commodities. These alternative investments are potentially more difficult and costly to liquidate during an economic downturn and may, in the case of private equity and venture capital, have explicit lock-up periods that impose substantial penalties for "cashing out" (see Lerner and Schoar (2004)). Consistent with this view, we find that universities with higher allocations to alternative assets reduce spending (or increase by less) on key expenditure items such as tenure-system faulty and support employees when they experience a negative endowment shock. Thus, even after controlling for the magnitude of the endowment shock, the composition of holdings has real effects on university operations.

Finally, we find that more selective universities cut back on student financial aid to incoming freshman following a negative financial shock and as a result, enroll a lower number of incoming freshmen the year after the negative shock. We do not find such a reduction in student financial aid or the number of incoming students at less selective universities. These results, combined with the effects on employment, provide some insight into university objective functions and suggest that a "one-size-fits-all" approach to modeling university behavior is not appropriate. These findings are also consistent with universities trying to preserve (bolster) expenditure items more central to its mission following negative (positive) financial shocks.

Taken as a whole, these results provide strong evidence that endowment shocks and endowment investment decisions have an important and significant impact on the real operations of the universities that these endowments are meant to support. Lerner, Schoar, and Wang (2008) highlight the strong performance of university endowments, especially of Ivy League

universities' endowments, over the pre-credit-crisis period, with this strong performance mainly driven by increased allocations to alternative assets during their sample period.[7] Our results highlight a potential downside of such endowment investment policies during a financial downturn. In particular, our results show that reduced payouts and a lack of liquidity arising from alternative-asset holdings become particularly painful for university employees when interacted with a collapsing stock market.

The paper proceeds as follow. In Section 1, we present an overview of U.S. university endowments and discuss various hypotheses related to university responses to endowment shocks. In Section 2, we describe our data sources, present summary statistics, and discuss the methodology. In Section 3, we investigate the effect of financial shocks on endowment payouts. In Section 4, we provide evidence on the effects of endowment shocks on various university decisions. Section 5 provides a discussion of how our results generalize to university responses to the 2008-09 financial crisis. In Section 6, we conclude.

1. An Overview of University Endowments

1.1 The Long-Term Growth of, and Recent Negative Shocks to, University Endowments

Endowments consist of both financial and real assets held to generate income for current and future operations of their associated universities (Ehrenberg (2009)). Typically, the size of the endowment reported by a university consists of both "true endowments," i.e., assets specified by a donor to be held in perpetuity, as well as "quasi-endowments," i.e., funds the university treats as an endowment but which could be spent should the university decide to do so.[8]

In this paper, we focus attention on universities with the Carnegie Classification of "doctoral" (i.e., universities that offer PhD degrees).[9] In 2008, there were just over 200 U.S. doctoral universities with endowment data available through a survey conducted on behalf of the National Association of College and University Business Officers (NACUBO). The NACUBO survey sample accounts for 80% of institutions, 94% of spending, 90% of students, and 99.9% of

[7] See Swensen (2000, Chapter 8) for a discussion of alternative-asset investing.
[8] Hansmann (1990) and Dimmock (2010) both use the term "quasi-endowment," whereas Ehrenberg (2009) uses the term "funds functioning as endowments."
[9] For more information on Carnegie Classifications see http://classifications.carnegiefoundation.org/.

federal research spending of the entire universe of U.S. doctoral institutions. Throughout the paper, for expositional purposes, we use the term "universities" to refer to doctoral universities.

We report the distribution of endowment market values as of June 2008 across all of the doctoral universities in the first row of Table 1, Panel B.[10] This data is provided by the 2008 NACUBO report and also summarized in Ehrenberg (2009). There is enormous variation in the size of endowments, with Harvard University in possession of the largest endowment at nearly $36.6 billion dollars, whereas the average and median endowments were $1.8 billion and just under $400 million, respectively.

In the second row of Table 1 Panel B, we report the distribution of the endowment-to-cost ratio (endowment market value normalized by annual university budget) for all doctoral institutions, again as of 2008. This ratio measures the importance of the endowment to the university. At the end of 2008, Princeton, Harvard, Rice, Yale, and Notre Dame all had endowments that were roughly 10 times (or more) their annual university budget. Across all universities, this ratio averaged 1.36, with a third of universities having endowments whose value exceeded their total annual budget. This implies that a -10% return to the endowment would be equivalent to a financial "shock" that represents on average 13.6% of one year's budget for the university.

The large size of university endowments is a fairly recent phenomenon. As illustrated in Figure 1, the total value of endowments among doctoral institutions in the U.S. has experienced tremendous growth over the past two decades, growing to $370 billion in 2008. In Figure 2, we benchmark the growth in endowment values over this period with that of university budgets. In the top chart, we simply plot the growth rate in the average endowment value and average annual university budget over the period 1986-2008. In the bottom chart, we plot the growth rate in the median values of these two variables over the same period. The annual growth rate for the average (median) endowment is 10.3% (9.8%) over 1986-2008, far outpacing the growth rate for the average (median) university budget of 6.4% (5.5%).

Although our sample period was dominated by rising equity markets, it was not immune from negative shocks. While the recent drop in endowment values is quite substantial in both dollar amounts and percentage terms, it appears somewhat less drastic when placed in historical

[10] Our endowment and university data is measured in academic years. Thus, since the 2007-08 academic year, for example, started July 1, 2007 and ended June 30, 2008, we will often refer to it as simply 2008 (and analogously for other academic years).

perspective. For example, as a result of the recent market declines, endowments, on average, returned to their level of only three to four years earlier (e.g., 2005 or 2006). Thus, the extent to which universities felt the pain of the recent declines will depend, in part, on how quickly they incorporate the prior endowment gains into their spending decisions.

1.2 How Should University Endowments Respond to Shocks?

Although university endowments play an instrumental role in supporting higher education, the economic theory of endowments is not particularly well-developed, a point made most forcefully by Hansmann (1990). It is not clear if endowments should be regarded as having distinct objectives from their associated universities.[11] Even if this point were clear, as Winston (1999) discusses, it is not at all obvious how to specify a university's objective function. He discusses several possibilities in the literature, including Clotfelter's (1999) suggestion that university managers are motivated by "the pursuit of excellence," which, as noted by Bowen and Breneman (1993), means improving the quality and equity of educational services, or James' (1990) notion of "prestige maximization." Of course, even if one were to adopt one of these objective functions, it would not necessarily provide crisp predictions about optimal spending policies unless one goes further, such as, for example, specifying a "prestige production function" that maps spending into prestige.

Lacking an explicit objective function, it is difficult to specify the characteristics of optimal spending behavior or the expected response of a university to a financial shock, be it a shock arising from endowment returns or from unexpected changes to other components of its revenue stream. Of course, the literature has not been silent on this issue; a number of distinguished economists, including at least two Nobel Laureates, have suggested that we should think of endowments as seeking to smooth payouts to the institutions that they support or to help smooth aggregate revenues to the university. For example, Tobin (1974) argues that the trustees of an endowed institution should act as if the institution is immortal and seek to treat all generations equally, thus behaving as if they have a zero subjective rate of time preference. He further argues that current consumption should not benefit from the prospects of future gifts to

[11] University endowments are legally distinct entities from their associated universities. However, the endowment board, which makes the investment decisions for the endowment, is appointed by the university. As we discuss in our conclusion, the interplay between the endowment board and the university administration concerning investment and payout policy decisions is a natural topic for future research.

the endowment. Merton (1992) summarizes the approach of the academic literature in this area (including Eisner (1974), Litvack, Malkiel, and Quandt (1974), and Nichols (1974)) by noting that it takes "as given that the objective for an endowment is to provide a perpetual level flow of expected real income."

Hansmann (1990) analyzes a wide range of potential motives for universities holding endowments, and argues that the most compelling reasons to accumulate endowments "are that they serve as a financial buffer against periods of financial adversity, that they help to insure the long-run survival of the institution's reputational capital, that they protect the institution's intellectual freedom, and that they assist in passing on values prized by the present generation" (p. 39). He goes on to question whether endowments are really managed in a manner that is consistent with these goals, suggesting that "prevailing endowment spending rules seem inconsistent with most of these objectives" (p. 39). However, Hansmann does not provide any rigorous empirical tests to support these arguments and his conclusions have been subject to criticism by, among others, Swensen (2000, p. 43-50).

Recognizing the lack of a well-specified objective function, we take a somewhat agnostic approach in analyzing how universities respond to endowment shocks. We do so by specifying our null hypothesis as "endowments adhere to their own payout smoothing guidelines in the face of shocks." The typical endowment spending policy specifies a payout rate that is applied to a multi-year moving average of endowment values. According to the *2008 NACUBO Endowment Study*, 73% of universities have such a rule. For example, an endowment might specify that it spends 5% of the average endowment balance over the prior three years. This rule has the effect of helping to smooth the payout level, even though it implies that the payout level as a fraction of the *contemporaneous* market value of the endowment varies over time.

A simple example helps to illustrate this distinction: Suppose an endowment has a value of $70 million at the start of year *t*, experiences net growth of $10 million per year for the next three years (net growth includes new donations and returns on existing balances less payouts to the university), followed by a substantial loss of $20 million during year *t*+3, and no net growth in year *t*+4.

	t	*t*+1	*t*+2	*t*+3	*t*+4	*t*+5
Endowment Value (beginning of year)	$70	$80	$90	$100	$80	$80
Net Growth in Endowment (during year)	$10	$10	$10	-$20	$0	-
Payout Amount (during year)	-	-	$4.0	$4.5	$4.5	$4.3
Payout Rate from 3-Year Moving Average Endowment Value			5.0%	5.0%	5.0%	5.0%
Payout Rate from Current Endowment Value	-	-	4.4%	4.5%	5.6%	5.4%

This example illustrates the inherent smoothing effect of multi-year averaging payout rules. In rising markets, the endowment payout rate relative to contemporaneous market value is below 5%, whereas in falling markets, the contemporaneous payout rate is above 5%. Since the endowment payouts are mechanically based on market values of the endowment measured at the beginning of the year or earlier, financial shocks during the year should not affect payouts to the endowment that year (they will affect future payouts, however, through the moving-average formula). In our data, we can relate payout decisions of all university endowments over the period 1993-2008 to contemporaneous endowment shocks, controlling for both university-specific fixed effects and time trends. We also have access to the exact smoothing rule for a large subset of the university endowments in our sample, which allows more precise tests of whether endowments mechanically follow their payout policy or whether the endowment managers engage in "active management" of payout rates.

We stress that in our empirical analysis, a finding that universities "reduce" their payout rate in response to a negative shock means that their payout rate is lower than what one would expect based on payout policies. This does not necessarily imply that the payout rate declines in absolute terms: the payout rate could indeed be rising relative to prior years, but simply by an amount less than one would expect from the application of the payout guidelines. In the above example, if an endowment's payout rate was 5.2% in year *t*+4, instead of the expected 5.6%, this would still be technically be an increase from the 4.5% payout rate of the prior year. However, the 5.2% payout rate would represent a cut in the payout rate relative to *that implied by the endowment's payout guidelines*. In our discussion, we will refer to this deviation as a "reduction" in the payout rate.

Smoothing hypotheses – whether they be Tobin's formal hypothesis or the mechanical application of the reported payout guidelines of most university endowments – have two important implications. First, virtually by definition, the short-term payout response to shocks is small, owing to the fact that endowments "spread the gain/pain" out over a multi-year period. In the extreme, if a university's endowment engaged in complete smoothing over an infinite life, we would expect the endowment to adjust to permanent shocks by adjusting payout levels by the perpetuity value of the shock. Second, the responses to positive and negative shocks are symmetric.

There are, of course, a number of alternative hypotheses that would predict either larger short-run responses to shocks, or asymmetric responses to positive and negative shocks. If universities behave myopically, for example, they might choose to forego smoothing in order to immediately respond to shocks. In this case, we would expect much larger payout responses, although we would expect symmetric large reactions to both positive and negative shocks. However, if there is an agency problem with the current administrators of the university in that they wish to share endowment "gains" immediately with current faculty and students and postpone the "pains" for future administrators, then a large response in endowment payouts is only expected following positive shocks (the reaction to negative shocks occurs later).

Another alternative hypothesis is that universities treat endowments like an insurance policy against "rainy days." Such an approach is implicit in the work by both Black (1976) and Merton (1992) in their discussion of endowment portfolio choice. In this case, assuming a positive correlation between financial markets and a university's revenue stream, we might expect endowment managers to be very conservative in their payouts during rising markets, thus engaging in precautionary saving, but then spend more aggressively out of the endowment during bad times. This would imply an asymmetry in response to shocks, with endowments being slow to adjust spending on the upside, but quick to increase spending in the face of negative shocks.

A third alternative might arise if managers are explicitly or implicitly rewarded for having a large endowment, possibly leading to a situation in which they respond slowly to positive shocks in order to grow the endowment, but cut endowment payouts in the face of a downturn in order to maintain endowment size (see Hansmann (1990) for a discussion).

There are, of course, other alternative hypotheses as well. The goal of the first part of our empirical work is to test broadly whether universities adjust payouts in the face of shocks, in which direction, and whether they do so symmetrically. This approach can help to narrow the list of possible hypotheses to a subset that have predictions consistent with the empirical evidence. After investigating whether university endowments' payout policies smooth over shocks to asset prices, in the second part of our paper, we examine how financial shocks to the endowments affect their associated universities' important operations.

2. Sample and Methodology

2.1 Data Sources for Endowments and University Characteristics

We use two data sets for most of our analysis and combine them with a third for a subset of specifications. The first is the NACUBO annual endowment survey, a data set used in several prior studies of endowment investment behavior (e.g., Lerner, Schoar, and Wang (2008), Brown, Garlappi, and Tiu (2010), and Dimmock (2010)). This data covers the period from 1986 through 2008 (where 1986 refers to the 1985-86 academic year and 2008 refers to the 2007-08 academic year) and provides us with information on the market value of the endowment, investment performance, portfolio shares across broad asset classes, payout rates, as well as other information about endowment management. Because we use both contemporaneous and lagged control variables, and some of these control variables incorporate lagged endowment market values, the 1988 academic year is the first year in our regressions. For a more detailed description of the NACUBO data, we refer the reader to Brown, Garlappi, and Tiu (2010).

The second data source is the Integrated Postsecondary Education Data System (IPEDS), collected by the National Center for Educational Statistics, a division of the U.S. Department of Education. This data includes extremely rich information on nearly every aspect of universities, including financial statements, numbers of employees by job category, average faculty salaries, numbers of students, and more. By merging the NACUBO and IPEDS data sets, we are able to combine data on endowments with data on the institutions that they support.[12] The number of

[12] Coverage in the dataset differs by variable. Number of employees and average salaries are available throughout the sample except for the years 1988, 1990, and 2000, when this information was not collected by IPEDS. The number of freshman entering next year is available for all years except 1989. Unrestricted student financial aid from the university to be given in the upcoming year is available for all years except 2008. Payouts from the endowment

employees and average salaries per employee are measured at the *end* of the academic year (e.g., the 2008 number of employees reflects the head count as of June 30, 2008). The number of freshmen enrolled and the amount of unrestricted student financial aid represents the number/amount at the start of the *next* academic year (e.g., in our regressions, the "2007" observations for the number of freshmen reflect the number of freshman enrolled at the start of the 2008 academic year). Thus, an endowment shock during the year could affect all of these variables both contemporaneously and with a lag.

When analyzing university endowment payout decisions, we conduct some analyses using only institutions that also appear in a third data set – the Commonfund surveys. The Commonfund is a non-profit organization whose stated mission is to "enhance the financial resources of nonprofit institutions and to help them improve investment management practices."[13] The Commonfund surveys allow us to construct the spending rates that would be observed if the endowment mechanically followed its specified payout policy guideline over the period 2000-2008. Specifically, we are able to identify 69 doctoral institutions in the Commonfund data for which we can precisely measure the lagged endowment values used in their moving-average formulas and the exact percentage applied to these lagged values.[14] We will discuss in more detail below the evidence suggesting that the findings from this subsample echo those from the broader NACUBO sample.

2.2 Summary Statistics for Endowments and University Characteristics

In Table 1, we present summary statistics for various university endowment characteristics over our full sample 1986-2008 (Panel A) and for 2008 only (Panel B). As discussed earlier, there is substantial variation in the size of endowments and their importance to their associated universities. On average over the full time period of our study, the average endowment is comparable in size to the annual budget of its associated university, and by 2008, the average endowment is 36% larger than its university's annual budget. Payout rates (the

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are available starting in 1993 in the NACUBO dataset. The size of the endowment, the return of the endowment, and total university costs are available for the full sample.

[13] http://www.commonfund.org/Commonfund/About+Us/commonfund_mission_2004

[14] We limit our sample to university endowments whose payout guidelines are based on a moving average of prior end-of-year endowment asset values, as we calculate the precise amount of expected payouts for these endowments. We do not consider universities that base payouts on a moving average of past quarterly asset balances because NACUBO only reports end-of-year endowment values.

amount of money transferred from the endowment to the university in a given year normalized by the market value of the endowment at the start of the year) are generally between 4-5%. Across the full sample, endowment payouts account for about 5% of a university's revenue base, with endowments accounting for at least 12% of the annual budget at one-tenth of universities. The average annual return earned by university endowments was 10% over the full sample, with a two-year average cumulative return over the 2001 and 2002 academic years of -9% in the aftermath of the technology-bubble collapse. Figure 3 illustrates both the time-series and cross-sectional variation in the performance of endowments over the sample.

There is substantial heterogeneity in the allocation decisions of endowment fund managers. Over the period 1986-2008, the average share of the endowment invested in alternative assets (i.e., hedge funds, private equity, venture capital, and commodities) is 10%, with one-fourth of managers investing at least 17% of their endowment in alternative assets and one-tenth investing at least 31%. These figures, calculated over the full sample, are very similar to the alternative asset shares calculated for the 2000 cross-section. In 2008, the average portfolio share invested in alternative assets skyrockets to 28%, with one-fourth of endowments having alternative asset allocations of at least 40%. From 2000 to 2008, about 2/3 of the rise in the alternative asset share is accommodated by a reduction in the share of publicly-traded equity, a much more liquid asset class.

In Table 2, we present summary statistics for various university characteristics – with Panel A providing statistics over the full sample 1986-2008 and Panel B providing statistics for 2008 only. Panel A shows that, not surprisingly, the main component of university expenditures is payment to its employees – their salaries and benefits account for 58% of the average university budget over the full sample, with a tight distribution across universities in the importance of labor costs (the 10^{th} percentile budget share is 42% and the 90^{th} percentile budget share is 65%). The average salary per person is provided by IPEDS for both tenure-system faculty and adjuncts, with tenure-system faculty salaries almost twice as high as adjuncts.[15] The average (median) number of full-time employees at a university is 4,810 (3,794). Tenure-system

[15] The number of faculty is taken from the Human Resource data files in IPEDS. In the Human Resource data files, we observe tenure status, whereas in the Salary file, we observe only faculty titles (e.g., Assistant Professor, Associate Professor). Average salaries (and the number of faculty used in computing total salaries) come from the Salary files in IPEDS. We classify Assistant, Associate, and Full Professors as tenure track to obtain the average salary for tenure-system faculty. Instructors and Lecturers are classified as non-tenure track to obtain the average salary for adjunct faculty.

faculty account for approximately one-quarter of the workforce of a typical university, with support employees (i.e., secretaries) accounting for just under half of all full-time employees. Thus, tenure-system faculty (through their average salary) and support employees (through their aggregate numbers) account for a large share of the annual university budget at most universities.

Unrestricted student financial aid given to incoming freshman accounts for about 7% of the average university budget, and over 15% of the budget at one-tenth of the universities. There is substantial heterogeneity in the size of the entering freshman classes across the doctoral institutions in our sample.

2.3 Methodology

Our empirical strategy is to use financial shocks to university endowments as a key explanatory variable in order to answer two broad questions: (1) Do university endowments engage in payout smoothing; and (2) How do financial shocks affect real university operations?

As noted above, our working null hypothesis with regard to the first question is that university endowments will mechanically follow their own payout guidelines, which automatically implies a reasonable degree of payout smoothing across years. Also, as we reported earlier, given the vast majority of university endowments have a policy that calculates the amount of payouts as a fraction of *past* endowment market values, we predict there should be no relation between *contemporaneous* financial shocks and endowment payouts. Thus, we first simply relate the actual payout rate from the university endowment to contemporaneous and one-year lagged financial shocks to the endowment. We include university-fixed effects to account for differences in payout policies across endowments and year-fixed effects to account for differences over time in asset returns.[16] The inclusion of these fixed effects is meant to help control for the "expected payout rate" of the university endowment. We also extend our fixed effects strategy to include state-by-year-by-public/private university fixed effects in order to allow the expected payout rate to vary across states, years, and type of institution.

Further, we also look at a subset of university endowments covered in the Commonfund data that enables us calculate the endowment's actual payout rate in a given year less the payout

[16] Including university fixed effects also addresses any concerns that the variation in the shock variable arising from endowment size may be simply picking up other characteristics of a university that might be correlated with the endowment size, such as the age of the university.

rate that would occur if the manager mechanically followed the endowment's own payout guidelines For this subset of institutions, we analyze the extent to which the endowment deviates from its own payout guidelines and "actively manages" payouts to the university.

For the second part of our analysis, we examine how universities respond to endowment shocks. We consider a variety of university responses as our dependent variables, including the numbers of employees by job category, the average salary for tenure-system and adjunct faculty, the number of incoming freshman students, and the amount of student financial aid, all obtained from the IPEDS dataset.

Our key explanatory variable is the financial shock to the university endowment, defined as:

$$\text{Shock}_{i,t} = \text{Return}_{i,t} \times \frac{\text{Endowment Fund Size}_{i,t-1}}{\text{Total Univ. Costs}_{i,t-1}} \qquad (1)$$

where subscript *i* denotes the university and subscript *t* denotes the academic year.

Note that this variable normalizes the endowment shock by the university's prior year total budget to capture the importance of the endowment shock relative to the university's finances. This is meant to capture the intuitive notion that a university with a large endowment-to-cost ratio may be more responsive to endowment returns than a university with a small endowment-to-cost ratio. For intuition, consider the extremes: a university that relies on endowment income to cover the majority of its expenses would likely respond to a given percentage return differently from a university whose endowment is a trivial share of its expenses. In essence, this means that there is variation in the "shock" variable arising from both the rate of return realized by the endowment and the size of the endowment relative to university costs. Put differently, one can also think of the "shock" variable as the ratio of two flows: the change in the value of the endowment attributable to changes in asset prices during the year and the total flow of annual university costs.

Figure 4 illustrates both the time-series and cross-sectional variation in the endowment shock variable from 1986-2008. Over the full sample, the average endowment shock to a university was a positive 0.106 (i.e., the average financial shock to the endowment represented 10.6% of the university's total costs). However, most universities suffered through two years of negative endowment shocks over the period 2001-2002. For example, in 2002, the average endowment shock was -0.054 (i.e., a shock equivalent to a 5.4% cut in the budget), with one-

quarter of universities having a shock worse than -0.076 and one-tenth having a shock worse than -0.127.

As noted above, there is a range of alternative hypotheses that have different implications for the symmetry of responses to positive and negative shocks. In order to test for possible asymmetric responses, we decompose the shock variable into two components:

$$\text{Shock}^{+}_{i,t} = \text{Max}\left[0, \quad \text{Return}_{i,t} \times \frac{\text{Endowment Fund Size}_{i,t-1}}{\text{Total Univ. Costs}_{i,t-1}}\right] \tag{2}$$

$$\text{Shock}^{-}_{i,t} = \text{Min}\left[0, \quad \text{Return}_{i,t} \times \frac{\text{Endowment Fund Size}_{i,t-1}}{\text{Total Univ. Costs}_{i,t-1}}\right] \tag{3}$$

We include both contemporaneous and one-year-lagged values of both of these variables in our regressions. Thus, our baseline specification is:

$$\begin{aligned}\text{Dependent Variable}_{i,t} = {} & \beta_1 \cdot \text{Shock}^{+}_{i,t} + \beta_2 \cdot \text{Shock}^{-}_{i,t} + \beta_3 \cdot \text{Shock}^{+}_{\text{i,t-1}} + \\ & \beta_4 \cdot \text{Shock}^{-}_{i,t-1} + \sum_{j=1}^{3} \gamma_j \cdot \text{Revenue Controls}_{\text{i,t}} + \\ & \sum_{k=1}^{3} \gamma_k \cdot \text{Revenue Controls}_{\text{i,t-1}} + \upsilon_i + \lambda_{state \times year \times private} + \varepsilon_{i,t}\end{aligned} \tag{4}$$

In those instances where we take the logarithm of a dependent variable that can take the value of zero, we use ln(Dependent Variable + 1). υ signifies the inclusion of a complete set of university fixed effects, and λ represents a complete set of state-by-year-by-private fixed effects (where "private" distinguishes private from public universities). The inclusion of university fixed effects means that we are comparing *differences* in the dependent variable to differences in the shocks. Thus, any differences in the dependent variable driven by time-invariant characteristic of a university (e.g., its history, the composition of its alumni base, geography, etc.) are differenced out of the specification. Furthermore, we control for differences between public and private universities (such as different sources of funding, administrative models, or political pressures), differences across states, differences over time, and for all interactions between these three factors (which control for, among many things, time-varying regional differences in economic and financial conditions).

Given this rich set of controls, the primary source of variation that is used to identify the effect of the shock on university operations arises from differences in two public (or two private)

institutions within the same state in the same year. For example, we are implicitly comparing how changes over time in the shocks faced by UCLA differ from shocks faced by UC-Berkeley, or how shocks faced by Northwestern University differ from shocks faced by the University of Chicago. We test how these differences influence payout rates and university behavior. Later in the paper, we further allow universities' responses to financial shocks to vary by the selectivity of the university, as measured by admission rates, as well as the illiquidity of that university's endowment, as measured by its allocation to alternative assets.

Finally, we present results with and without additional revenue controls. In particular, "Revenue Controls" include both the contemporaneous and lagged amount of government appropriations (from federal, state, and local governments), net tuition revenue (tuition revenue less university financial aid), and current gifts, grants and contracts (e.g., current-revenue gifts to the university as well as research funding through agencies such as NSF and NIH) received by the university. All of these revenue controls are normalized by the prior year university budget, just like our endowment shock measure. In Table 2, we provide summary statistics for the fraction of university costs financed by these three sources of revenue.

We present results with and without these additional revenue controls to be sure that endowment-dependent universities do not have revenues from other sources that "kick-in" to offset endowment shocks, or alternatively, sources that suffer similar shocks due to common correlations with broader economic activity that would magnify the measured effect of the endowment shock. In all of our regressions, we find the inclusion of these additional revenue controls has no effect on the relation between university operations and endowment shocks. However, we make no claims about the causality behind the correlations we find between university activities and these additional revenue controls. As we highlighted in the introduction, the advantage of using endowment shocks to identify a university's response to financial shocks is that they represent a largely exogenous phenomenon, while, in contrast, these other three types of variation in a university's resource base might be endogenously and contemporaneously determined, such as if a state legislature changes funding in response to university spending.

3. How Do Endowment Payouts Respond to Endowment Shocks?

In the first three columns of Table 3, we report the coefficients from regressions of the actual endowment payout rate over the period 1993-2008 for the full NACUBO sample on our measures of contemporaneous positive and negative shocks as well as one-year lagged positive and negative shocks. The payout rate is defined as payouts made by the endowment to the university during the year divided by the endowment market value at the start of the year and is expressed in percentage points. In column (1), we include university and year fixed effects, while in column (2) we further include state-by-year-by-private university fixed effects. In column (3), we further control for contemporaneous and lagged changes in other sources of revenue. Detailed definitions of the variables used in Table 3 and subsequent tables are presented in the Appendix. In all of our regressions, the standard errors of the coefficients, shown in parentheses, allow for correlations among observations of a given university over time as well as cross-sectional correlations.

Across all the specifications, we find an asymmetric response to *contemporaneous* endowment shocks. Specifically, when an endowment experiences a negative shock during the year equal to 10% of the university's budget (i.e., SHOCK_NEG = -0.10), the payout rate for the average endowment falls by a highly significant 0.26 to 0.34 percentage points across the specifications (the sample average payout rate is 4.5 percentage points). In contrast, when an endowment experiences a positive shock during the year of an equivalent size, payouts from the average endowment are little changed. If anything, they fall very slightly, but this result is one-tenth the magnitude of the response to a negative shock and is not statistically significant. As we discussed earlier, these results do not necessarily imply that payout rates decline in absolute terms in response to negative shocks. Rather, they indicate that after conditioning out the average level of changes in payout rates for comparable universities, universities with larger negative shocks have relatively lower payout rates. Put differently, universities that experience larger negative shocks have lower payout rates than one would expect. It is this negative shock to a university's revenue stream that causes universities to have to make adjustments to their operations (which we study in Section 4).

An initial reaction to our results concerning payout rates and endowment shocks is that endowments might react not only to financial shocks when setting their payouts, but also to

concurrent information about current and future revenues to their university (e.g., asset returns, government funding, tuition revenue, donations, etc). With regard to non-endowment revenue sources (e.g., government appropriations, tuition revenue, and gifts, grants, and contracts), we find that the inclusion of these measures have no impact on the endowment shock variable – see column (3) of Table 3. We also find that there is no relation between payouts from the endowment and other contemporaneous and lagged revenue sources such as government appropriations, tuition revenue, gifts, grants, and contracts (either individually or collectively). Further, the inclusion of these other important revenue sources does not affect the relation between endowment payout rates and financial shocks to the endowment. Thus, it appears that the level of endowment payouts is set independently of what is happening to other sources of university revenues.

It is also important to note that our rich set of institutional and state-by-year-by public/private fixed effects will control for many changes in expectations. Specifically, any change in expectations during any year occurring among the group of universities that are from the same state and of the same type (i.e., public or private) will be accounted for in our regression analysis with our fixed effects. For example, changing expectations about state funding (whether it be state appropriations for public universities or federal funding for research grants) or changing expectations about asset returns are largely captured by state-by-year-by-private university fixed effects.

Indeed, for changing expectations to have any material effect on our results, it would have to be the case that they are correlated with the size of endowment shocks. In other words, it is not enough for a university to change its future expectations as a result of an endowment shock, but rather it must be the case that institutions that experience larger shocks make larger changes in their expectations (controlling for the change in expectations during the year common to all universities from the same state and of the same type). As a partial test of this possibility, we also (in unreported results) test whether endowment payouts are related to the amount of life-income gifts held by the endowment. In exchange for making a life-income gift, the donor receives an annuity. The endowment "owns" and invests these gifts, but the gifts are not considered part of the endowment and payouts to the university cannot be made from them until the donor dies. Nonetheless, a university with a larger amount of life-income gifts can expect to

have a larger endowment in the future.[17] Thus, we test whether the anticipation of the larger *future* endowment resulting from these life-income gifts affects the payout rate from the endowment *today*. We find that this is not the case – the ratio of life-income gifts to the total costs of the university has no relation with current payouts from the endowment, and its inclusion in the regression leaves the coefficient on the contemporaneous negative shock essentially unchanged.

It is also important to ensure that our results are not simply reflecting a mechanical application of an endowment's payout guidelines to changing endowment returns. In columns 4 through 6 of Table 3, we are able to address this concern directly by examining the subset of university endowments with sufficient information provided by the Commonfund data. We use the deviation from the implied payout rate (i.e., the actual payout rate less the payout rate that would occur if the manager mechanically followed the endowment's own payout guidelines) as the dependent variable. This deviation from payout guidelines is expressed in percentage points.

Given the similarity of endowment spending rules across institutions, and our inclusion of university and year fixed effects in all of the regressions, we obtain qualitatively similar results across the Commonfund subsample using the "deviation from payout guidelines" and the full NACUBO sample using the actual payout rate. Estimated effects are somewhat larger when the dependent variable is "deviation from payout guidelines", and the payout response to contemporaneous positive shocks is now also statistically significant (but still much smaller in magnitude than the response to contemporaneous negative shocks). For example, in column (6), a negative shock to the endowment representing 10% of the university budget is predicted to reduce the payout rate by 0.6 percentage points below what the mechanical rule would imply, while a positive shock of the same magnitude is predicted to result in a decrease of the payout rate by 0.1 percentage points relative to what the mechanical rule implies.

Keep in mind, as noted above, that the mechanical application of standard university payout rules implies a degree of payout smoothing over time. The small, negative response to positive shocks suggests that university endowments tend to smooth positive shocks a bit more than the mechanical rule would suggest. One interpretation is that they are engaging in a small amount of precautionary saving following large, positive surprises. In contrast, endowments

[17] Across all doctoral universities in 2008, the ratio of life-income gifts to the university budget averaged 0.10 (with this ratio exceeding 0.19 at one-tenth of universities).

react to large, negative shocks by immediately cutting payouts below the level specified by the universities' own payout rules. Thus, whatever extra saving that the endowments are doing during good times does not appear to be used to help cushion the downside blows.[18]

These results do not support the prediction of the "endowments as insurance" hypothesis. Hansmann (1990) conjectured that "spending rules may be simply fair-weather expedients, to be adhered to only so long as times are flush" and argued that in bad times "universities may be prepared to abandon their spending rules altogether and actually reduce their endowments" (p. 24). At the time, he also noted that it was difficult to tell from the historical data whether universities would actually behave this way. With our data and empirical approach, we find that endowments behave contrary to the "endowments as insurance" hypothesis. While we do find that university endowments adhere to spending rules during good times, the deviations that occur in bad times are in the direction of preserving the endowments' size rather than providing additional resources to their institutions. As we will later discuss in Section 5, a survey conducted by NACUBO and the Commonfund in December of 2008 suggests that endowment payout policy during the 2008-09 financial crisis also followed this behavior, providing out-of-sample confirmation of our results.

Core, Guay, and Verdi (2006) consider alternative explanations of why excess endowment holdings exist at some not-for-profit institutions. They find that excess endowments are generally associated with higher pay for CEOs and directors, as well as greater agency problems. We do not have the data to draw such conclusions for the university endowments we study. We do note, however, that the asymmetric payout behavior we observe by the university endowment managers in our sample is consistent with attempts to maximize or protect assets under management.[19]

Before turning to an analysis of how universities adjust their spending in response to endowment shocks, it is important to rule out one alternative hypothesis for the finding that university endowments *choose* to scale back their spending following negative shocks – namely that they may have been *required* to do so. Specifically, the Uniform Management of

[18] We also note that endowment payouts are unrelated to government appropriations, tuition revenue, and current gifts, grants, and contracts received by the university, as shown in columns (3) and (6) of Table 3. Thus, counter to the payout policy suggested by Black (1976) and Merton (1992), university endowments do not seem to cushion the university to changes in these revenue streams either.

[19] University endowments are exempt from the rule that requires most foundations/endowments to pay out at least 5% of the endowment value each year (Section 501(c)(3) of the Internal Revenue Service Code creates this exemption).

Institutional Funds Act (UMIFA) historically placed restrictions on the payouts of endowments.[20] UMIFA was promulgated by the National Conference of Commissioners on Uniform State Laws (NCCUSL) in 1972 and, according to Gary (2004) "although variations exist, the general principles of UMIFA have been adopted almost universally … UMIFA created the concept of 'historic dollar value' and then permitted the expenditure of appreciation in excess of historic dollar value if the institution determined that expenditure of the funds was prudent. Historic dollar value was determined based on contributions to the endowment fund. Income, appreciation and depreciation of assets did not affect historic dollar value."

Given the restriction against spending the endowment below its historic dollar value, it is possible that universities found themselves constrained by UMIFA following negative endowment shocks. For example, if a shock reduced the endowment value below the historical dollar value, then the university would be constrained to reduce expenditures in order to abide by the limits. Such restrictions are typically applied on a gift-by-gift basis.

We believe it is unlikely that the UMIFA constraints can explain our results, even during the 2001-2002 negative endowment shocks.[21] If we look, for example, at the ten-year cumulative return through June 30, 2002 – *after* netting out a hypothetical 5% annual payout – we find that the median university experienced capital gains in excess of 100%. Even if we look at the lower tail of the distribution, we find that the 10th percentile cumulative 10-year return, less the hypothetical 5% payout rate per year, was still 66%.

Nonetheless, a university endowment that received a donation in early 2000, just before the technology bubble burst, would be constrained in 2001 and 2002 from making payouts from this gift. If this 2000 donation was large enough relative to the entire endowment, payouts in 2001 and 2002 could be reduced simply due to the UMIFA constraints binding.

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[20] "At its annual meeting in July 2006, the National Conference of Commissioners on Uniform State Laws (NCCUSL) approved the Uniform Prudent Management of Institutional Funds Act (UPMIFA) and recommended it for enactment by the legislatures of the various states. UPMIFA is designed to replace the existing Uniform Management of Institutional Funds Act (UMIFA)." Source: upmifa.org homepage, last accessed 3/18/2010: http://www.upmifa.org/DesktopDefault.aspx?tabindex=2&tabid=69

[21] The vast majority of states relaxed the UMIFA rules over 2006-08. Specifically, under the new approach adopted by 43 states to date, the historical-dollar-value method was replaced with a standard of prudence that applies to the decision-making process of the governing board (Gary (2004), TIAA-CREF (2009), and the 2009 *NACUBO-Commonfund Study of Endowments*). As such, the historical-value constraint would not apply during the later years of our sample and during the 2008-09 financial crisis, allowing spending from an endowment to still occur when its market value falls below its historic value.

To account for this possibility, we re-run the "Deviation from Payout Guidelines" regression, presented in column (6) of Table 3, to account for the possibility that in a particular year, a certain cohort of gifts may be underwater, and thus payouts could not be made from these gifts. Using historical data on annual donations to the endowment and annual endowment returns, we recreate the implied level of payouts that an endowment would make if it was following its payout guidelines and accounting for UMIFA restrictions under the following three assumptions: 1) the eligibility of each year's gifts for inclusion in the imputed payouts is determined at the start of the academic year; 2) partial inclusion of a cohort of gifts is possible, i.e. if a given year's gifts were valued at 103% of the original donation value, then up to 3% could be paid out from these gifts; 3) all endowment donations given prior to 1998 were sufficiently above water that UMIFA was not binding (this assumption, which is made because of data limitations on historical gift giving, is unlikely to be problematic because returns prior to 1998 were sufficiently high that these gifts were highly unlikely to be underwater even after the technology bubble burst).

Accounting for the possible effect of UMIFA restrictions on endowment payouts has little effect on the regression results; the coefficient on contemporaneous negative shocks is 6.55 (SE = 2.35, statistically significant at the 1-percent level), the coefficient on contemporaneous positive shocks is -1.06 (SE = 0.47, statistically significant at the 5-percent level), and the coefficients on the lagged endowment shocks and all of the contemporaneous and lagged non-endowment revenue sources are all insignificant. The similarity in regression results is not surprising given that even after the tech bubble collapse, the average U.S. doctoral institution had only 3.7% of its endowment fund assets underwater at the end of 2002 (authors' calculations).

4. How Do Endowment Shocks Affect University Operations?

Results from the previous section indicate that universities with larger negative endowment shocks respond by reducing their payout rates more relative to their payout guidelines than do universities with smaller shocks. As a result, universities experience a negative shock to one component of their revenue stream, and must respond along some other margin. In this section, we investigate how these shocks affect universities' spending on faculty, staff, and student financial aid. Because we find that, consistent with our payout regressions, the

primary coefficients of interest are unaffected by including or excluding contemporaneous and lagged values of other revenue controls, we will generally report only the results that include these controls (unless stated otherwise).

4.1 The Effect of Endowment Shocks on Numbers of Personnel

In Table 4, we begin by examining the effect of endowment shocks on university employment decisions. The dependent variable in the regressions is the logarithm of the number of employees in a specific job category (i.e., tenure-system faculty, adjuncts/lecturers, support staff, maintenance, and administrators). As with the payout regressions, we report the coefficient on the contemporaneous and lagged values of the positive and negative endowment shock variables. For each job category, we report regression results without and with the additional revenue controls (in the odd and even numbered columns, respectively).

The results in columns (1) and (2) suggest that when universities experience a negative shock, they respond in part by reducing the number of tenure-system faculty. As in the payout regressions, by "reduce" we mean a reduction relative to otherwise similar universities, which could imply either a reduction in absolute terms or a smaller increase. In column (2), for every 10% of a university's budget that is lost in an endowment shock, we observe a 5.1% reduction in tenure-system faculty. This can reflect reduced hiring for new faculty slots, an increased attrition rate (i.e., failing to replace faculty who retire or depart), or increased firings (at least for non-tenured faculty). Further, we observe an additional 6.6% reduction in the number of tenure-system faculty the year following the negative shock. While the corresponding coefficients associated with negative shocks are of similar magnitude for adjuncts (reported in columns (3) and (4)), they are very imprecisely measured.

The next four columns indicate that following a negative endowment shock, universities also make very significant and immediate cuts in the number of support employees (e.g., secretaries) as well as maintenance workers. In both cases, a negative endowment shock equivalent to a 10% reduction in a university's budget results in nearly a 7% decline in the number of secretaries and maintenance employees the year of the shock. According to columns

(9) and (10) in Table 4, university administrators[22] are unaffected by endowment shocks – there is no significant response to contemporaneous or lagged shocks for this group.[23]

These results reflect an average response across all universities, yet it is natural to suspect that different universities place different values on various educational inputs. For example, a prestigious research university might go to greater lengths to protect research faculty relative to a less research-intensive university. In order to address this possibility, in Table 5, we interact the shock variables with the university's undergraduate admissions selectivity rank, which we use as a proxy for the university's prestige and research focus (note when interpreting this variable that a lower admissions rate indicates higher selectivity). Specifically, the university with the lowest admissions rate (most selective) receives a score of 0, and the university with the highest admissions rate (least selective) receives a score of 1.[24] All other universities are placed on a continuum between 0 and 1 based on the rank of their admissions rate, with the median admissions rate university receiving a value of 0.5.

In the specification that includes interaction terms, the coefficients on the shock variables represent the effects for the most selective university in our sample, while the coefficients on the interaction terms represent the differences between the least and most selective universities. The sum of the shock variables and the interaction terms represent the effects for the least selective university in our sample – we report the effects for the least selective university in italics for ease of interpreting the results. By extension, the median university would be half-way between these two endpoints.

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[22] While we recognize that the classification of personnel into faculty versus administrators may vary across universities, the inclusion of university fixed effects will control for this so long as these definitions are reasonably consistent within a university over time. There is no reason to believe that this finding is driven by a labeling issue, unless a university is more likely to re-classify faculty as administrators following negative shocks, and then revert back to labeling them as faculty in years without negative shocks. As stated in the introduction, for reporting purposes, personnel are to be assigned to only one job category (e.g., tenure-system faculty or administration) based on the role in which they spend more than half of their time.

[23] Adding up the coefficients on the contemporaneous and lagged negative shocks results in the cumulative two-year university response. For tenure-system faculty, the sum of coefficients is 1.2, which is significant at the 1 percent level. This point estimate suggests that tenure-system faculty face a relative reduction in numbers on the order of 12% during the two years following a negative endowment shock that represents a 10% loss to the university budget (relative to a university with no endowment shock). The sum of these two coefficients for administrators is -0.3, suggesting that their ranks actually increase by 3% following the negative shock (though this estimate is not statistically different from zero). However, the two-year cumulative effect on hiring following a negative endowment shock for administrators is *significantly different* than that for tenure-system faculty at the 5 percent level. Thus, the number of administrators employed is significantly *less likely to decrease* (or more likely to increase) in the event of a negative endowment shock, when compared with tenure-system faculty.

[24] Among doctoral universities in 2008, Harvard University had the lowest admissions rate (most selective), and the University of Texas – El Paso had the highest admissions rate (least selective).

The results displayed in Table 5 highlight the importance of allowing for heterogeneity in universities' responses to endowment shocks, reflecting differences in what they view as most expendable when times get tough or what should be increased when times are unexpectedly good. We continue to find that universities reduce, or hire fewer, tenure-system faculty following negative shocks – the results do not differ significantly by admissions selectivity in the year of the shock. One year later, however, we find a significant and striking difference. Specifically, in the year following a negative shock, less selective universities significantly reduce tenure-system faculty lines, while more selective universities do not. As a result, the cumulative two-year effect of a negative shock on tenure-system faculty at the least selective university is about double that of the most selective university.

Another difference across universities arises in their response to *positive* endowment shocks. Following a positive shock to the endowment that is equivalent to a 10% increase in the university budget, less selective universities respond one year later by increasing the number of maintenance workers by 5% and the number of administrators by 7% – for the most selective universities there is no such reaction.

4.2 The Effect of Endowment Shocks on Salaries

In Table 6, we examine the effect of endowment shocks on average university salaries for tenure-system faculty and adjuncts (the only two job categories for which IPEDS provides such data). Panel B includes admissions-selectivity interaction terms while Panel A does not. For reference, in both panels, we first report results using the number of employees as the dependent variable, followed by the average salary per employee, and, in the final column, the total salary expense for all employees within each job category (i.e., the product of number of employees and average salary per employee). All of these dependent variables are in logarithms.

As seen in Panel A, the average tenure-system salary tends to rise after positive shocks, both contemporaneously and with a lag. When we interact with admissions selectivity, as seen in Panel B, we find that the salary increase for tenure-system faculty is concentrated among more selective universities, while less selective universities instead increase the salaries of their adjuncts a year after a positive endowment shock. Thus, more selective universities, which presumably place greater weight on research, appear to gradually pass some of a positive

endowment shock to their research-active faculty, while less selective universities instead seem to pass the gains to their teaching faculty (adjuncts).

At less selective universities, the year following a negative shock is marked not only by a reduction in the number of tenure-system faculty, but also a significant reduction in the average salary of this group.[25] At the same time, while the *number* of adjuncts at these institutions is unchanged, their average salary *increases* substantially one year after a negative endowment shock. One natural interpretation for this finding is that the salary increase for adjuncts reflects payments for increased workloads (e.g., payments for teaching another section of a course or a more advanced course formerly taught by more expensive, research-active faculty).

Finally, we find that, at the most selective universities, the average salary of tenure-system faculty actually rises slightly a year after a negative endowment shock. At first blush, this result may seem somewhat surprising, but, as we discuss in the next subsection, this could reflect competitive pressures from peer universities that were able to better weather the financial storm.

4.3 Shocks to Peers

It is well known that universities compete with one another for talent. In Table 7, we explore whether universities respond not only to shocks to their own endowments, but also to the endowment shocks of their peer institutions. While there is no single definition of a university's peers, we define it based on admissions selectivity. Specifically, we define a university's peer group as the 20 institutions whose admissions rates are closest in absolute value to one's own.

Having defined peers for each university, we then compute the average endowment shock for each university's peer group.[26] We separate the average competitor shocks, both contemporaneous and lagged, into positive and negative values, just as we did with a university's own shock. We then relate a university's employment decisions regarding tenure-system faculty to both its own endowment shocks as well as that of its likely competitors for academic talent. We report regression results first including only the own-shock variables, then the peer shocks, and then with both types of shocks.

[25] We stress that since we are looking at *average* salaries, it is possible that, rather than current faculty members experiencing salary increases or decreases, we could instead simply be observing a change in the *composition* of the faculty (i.e., hiring/firing decisions at the university change the pool of employees over which the average is taken).
[26] We find that the simple correlation of a university's own endowment shock with that of its peer group is 0.62.

As reported in Table 7, we find that universities respond to their peers' endowment shocks, and that these "peer shocks" operate independently from a university's "own-shock" effect. Specifically, we find that when one's peers experienced a negative shock last year, a university responds in the current year by hiring more tenure-system faculty, and total spending on tenure-system faculty rises as a result. Focusing on the point estimates in column (9), suppose a university experiences a negative shock to its endowment of -0.10 (i.e., the magnitude of the shock is equivalent to a 10% decline in the university budget), while its competitors had zero shocks to their endowments. Spending on tenure-system faculty would be predicted to fall by 7.3 percentage points at that university over the next two years (obtained by summing up the coefficients on the "own" contemporaneous and lagged negative endowment shock coefficients). Now suppose, instead, that the university had zero shock to its own endowment, but its 20 peers averaged an endowment shock of -0.10. In this case, the university is predicted to *increase* spending on tenure-system faculty by 12.9% over the next two years, taking advantage of its rivals' financial travails. We also find that positive shocks to a university's rivals eventually bode well for the average salary of that university's own faculty.

4.4 Does Endowment Portfolio Liquidity Matter?

In recent years, endowments have dramatically increased their allocations to alternative assets, with average alternative asset allocations rising from 10% in 2000 to 28% in 2008. While these alternative asset classes have the potential for larger average returns, they are relatively illiquid, meaning that that they are difficult to unload quickly, particularly in a down market. When faced with an endowment shock, the ability of the endowment to adjust its payouts this year or in future years may depend, in part, on the liquidity of its portfolio and the various contractual constraints on holding periods of certain assets.

We consider, after controlling for the *size* of the endowment shock, whether the *composition* of the endowment's asset holdings (i.e., the fraction of the portfolio held in illiquid alternative assets) matters for endowment payout policy and for the university's operational decisions. One of the defining features of alternative assets is their illiquidity. Many alternative asset vehicles have lengthy lock-up periods and restrict investors' ability to sell their positions to other investors. Further, private equity and venture capital partnerships often require investors to make capital commitments, i.e., to supply money upon the demand of the partnership. These

capital commitments require the endowment to maintain sufficient liquidity to meet possible future capital calls. See Lerner and Schoar (2004) for further discussion.

To explore the effect of portfolio illiquidity on university employment decisions, we interact our shock variables with the share of an endowment's portfolio held in alternative assets. In these liquidity-interaction regressions, the coefficients on the shock variables represent the effect for a university whose endowment holds no alternative assets, while the interaction terms represent the differences between an endowment holding no alternative assets and one whose endowment is 100% invested in alternative assets. For ease of interpretation, we also report in italics the sum of the shock variables and the interaction terms, which represent the effects for a university whose endowment is 100% invested in alternative assets. A university whose endowment was invested 50% in alternative assets would be half-way between these two endpoints.

We first relate deviations from the university endowment's payout policy to the liquidity of the endowment portfolio (i.e., add alternative-asset-share interaction terms to the specifications used in column (6) of Table 3). In unreported results, the interaction terms of the negative contemporaneous shock variable with the illiquidity of the portfolio is of the expected sign and large in magnitude, but very imprecisely measured. Specifically, the point estimates imply that the year of a negative endowment shock that represents 10% of the university budget, the endowment's payout rate is reduced by 0.6 percentage points (standard error of estimate is 0.3, statistically significant at the 5-percent level) for an endowment with no alternative assets and 1.4 percentage points (standard error of estimate is 2.1) for an endowment that is entirely invested in alternative assets.[27] Thus, while suggestive, these results are so imprecisely measured as to preclude any conclusions regarding the immediate effect of portfolio liquidity on endowment payout policy.

Nonetheless, the liquidity of the endowment portfolio may still affect employment decisions of the university even in the absence of a direct and immediate effect on endowment payouts. Even after a negative shock, endowments with enough highly liquid assets such as cash and publicly-traded equity may have no difficulty satisfying current payout needs. However,

[27] A year following a negative endowment shock of this magnitude, the payout rate is unchanged at an endowment with no alternative assets (predicted increase in payout rate of only 0.02 percentage points) and the payout rate is reduced by 0.6 percentage points (standard error of estimate is 1.3) for an endowment that is all invested in alternative assets.

when the negative shock is combined with large illiquid holdings, universities may be more cautious in their operations (e.g., hiring less or firing more as a precaution) in anticipation of a future liquidity crunch. Indeed, according to the *2009 NACUBO-Commonfund Study of Endowments* (Figure 5.10), while only 24% of universities reported that "they had experienced a liquidity squeeze" during the 2009 academic year, 70% said that "they had taken action in response to the liquidity situation or anticipate taking action to avert a liquidity problem in the future."[28]

In Table 8, we consider how university employment decisions are affected by the liquidity of the endowment portfolio, and find significant effects. Following a negative shock, those universities whose endowments have high levels of alternative assets make immediate, larger cuts (or hiring freezes relative to other universities) to tenure-system faculty and secretaries relative to universities associated with more liquid endowments. Specifically, for a negative shock to the endowment representing 10% of the university budget, increasing the share of the endowment held in alternative assets by 10 percentage points (i.e., from 10% to 20% of the portfolio) leads to an *additional* 3.5% reduction in tenure-system faculty, an *additional* 9.6% increase in the use of adjuncts/lecturers, and an *additional* 3.5% reduction in support employees. Thus, even after controlling for the size of the endowment shock, the composition of holdings has real effects on university operations during a financial downturn.[29]

Given the inherent difficulty in assessing the true market value of illiquid assets, an alternative interpretation of our alternative-asset interaction results is that, during a financial downturn, the returns *reported* by managers of alternative assets (e.g., hedge fund managers) may be over-stated (i.e., not negative enough). To the extent that endowment funds rely on these valuations in reporting the value of their endowments, this would result in endowment funds with large alternative asset allocations being over-stated relative to the perceived but unobservable true market value in down markets.

[28] The NACUBO-Commonfund study surveyed all universities, not just doctoral universities. However, they did break their results down by size of the endowment. Among universities with endowment assets in excess of $1 billion, 50% reported taking actions or anticipate taking actions related to the liquidity squeeze (while only 31% reported that they themselves had already experienced a liquidity squeeze). For universities with endowment assets between $100 and $500 million, the numbers are 63% and 28%, respectively.

[29] We also find that, for a university whose endowment is heavily invested in alternative assets, the number of administrators actually *increases* a year after experiencing a negative endowment shock (statistically significant at the 10-percent level), that is, a year after the employment cuts to faculty and staff discussed above.

We bring no evidence to bear on this issue in our paper; however, academic research and the financial press raise this as a possibility.[30] For example, Bollen and Pool (2008, 2009) find that hedge funds appear to smooth over losses but not gains, and Cumming and Walz (2010) find a similar result for private equity and venture capital funds. To the extent that university and endowment officials have reason to be concerned that the alternative asset valuations may be over-stated in down markets, a rational and prudent response could be to adjust payouts accordingly. Such a story could explain what appears to be an over-reaction to *reported* returns. In short, the larger cuts to faculty and staff at universities whose endowments have large alternative asset holdings could reflect a concern that the true *market* value of the negative endowment shock is larger in magnitude than the *reported* endowment shock.

4.5 The Effect of Endowment Shocks on Financial Aid and Student Enrollment

The results presented thus far have examined how financial shocks to the endowment affect the employment decisions of the university. In this section, we briefly examine the direct effect of endowment shocks on students. In Table 9, we consider how endowment shocks are related to the number of students enrolled at the university at the start of the upcoming academic year (the first and second columns) and the university's expenditures on unrestricted student financial aid during the upcoming academic year[31] (the third and fourth columns). Both the number of freshman and the dollar amount of student financial aid are expressed in logarithms. We report results from our baseline specification, as well as results from regressions that include interactions with the selectivity of the university (based on admission standards).

In columns (1) and (2) of Table 9, we examine the effect of endowment shocks on the size of the entering freshmen class. Allowing for heterogeneity in the response across universities is important – at the most selective universities, a negative endowment shock is immediately followed by a reduction in the size of the incoming freshman class (a negative 10% shock to a university's budget is associated with a 3.5% reduction in the number of incoming

[30] Several media outlets have suggested that in the recent credit crisis endowment losses may have been understated, as the return to alternative assets is likely worse than reported (e.g., "Endowment Results May be Worse than Reported," *Investment News*, October 11, 2009 and "Losing Harvard's Billions," *Slate Magazine*, January 27, 2009).
[31] This represents financial aid to all students, not just freshmen. Unrestricted student financial aid is defined as financial aid to students that is funded by the university and is not tied to a specific scholarship. Thus, the university has discretion as to the amount of this financial aid that it will give from year to year. Unrestricted student financial aid does not include student loans and makes up the vast majority of university-funded student financial aid.

freshmen immediately following the shock), while there is no such drop-off in students at less selective universities. This pattern persists one year later as well. The channel through which this effect operates seems to be student financial aid – consistent with the number of enrolling freshmen results – student financial aid is cut following negative endowment shocks at the most selective universities, but not at the less selective universities. Following a positive shock to the endowment, financial aid to students is increased at the less selective universities but remains unchanged as the most selective universities.

Thus, in sum, less selective universities appear to cushion their students from financial shocks to the endowment – they pass along financial windfalls to their student population by increasing financial aid but do not cut that financial aid in response to negative shocks. More selective universities, on the other hand, do the opposite; they cut student financial aid immediately following financial turmoil to the endowment but do not share positive shocks to the endowment with their students (at least directly by increasing their financial aid). These results, combined with the effects on employment presented earlier, provide some insight into university objective functions and highlight the importance of allowing for heterogeneity when modeling university behavior.

5. Discussion of University Responses to the 2008-09 Financial Crisis

Our results are based on data over academic years 1988 through 2008, which includes a large negative financial shock in 2001-2002. As mentioned earlier, to fully measure university responses to the most recent financial crisis of 2008-09 requires waiting until the summer of 2011 for the data to become available (2012 for student-based outcome variables). Nonetheless, both survey and anecdotal evidence over the past year suggest that the estimated relations in this paper likely generalize and, indeed, seem to be currently playing out in many universities across the country.

The *2009 NACUBO-Commonfund Study of Endowments* reports that, relative to academic year 2008 (that ended June 30, 2008), 43% of endowments increased their spending rate[32] in

[32] Just as we do, the NACUBO-Commonfund study defines an endowment's payout rate (spending rate) as the ratio of endowment dollars spent during the academic year to the beginning-of-year endowment market value.

fiscal year 2009, 25% lowered it, and 28% made no change (Figure 5.3).[33] The study further reports that, "While 43 percent of participating institutions increased their spending rate, an average of 54 percent increased spending in dollars."

At first blush, this finding seems inconsistent with our endowment payout regression results. However, given that endowment asset values steadily increased from 2003 to 2007, with a slightly negative average return of -3.0% during the 2008 academic year, payout rates and dollars spent from the endowment *should have increased* for virtually every endowment in academic year 2009 simply through mechanical application of a moving-average payout formula.

The link between endowment performance and the resultant payouts over 2005 to 2009 is best illustrated in the example summarized in the table below. We assume that the endowment had a market value of $100 at the start of academic year 2005, that it earned the average return across all university endowments as reported in the *2009 NACUBO-Commonfund Study of Endowments* (Figure 2.1), that each year new donations to the endowment just offset payouts from the endowment (this is assumed for simplicity), and that the endowment's payout policy is to spend 5% of the average endowment balance over the past three years. For ease of comparison, in the bottom row of the table, we list the *actual* average payout rate across all university endowments as reported in the *2009 NACUBO-Commonfund Study of Endowments* (Figure 5.1).

	2005	*2006*	*2007*	*2008*	*2009*	*2010*
Endowment Value (beginning of year)	$100	$109.3	$121.1	$141.9	$137.7	$111.9
Endowment Return (during year)	9.3%	10.8%	17.2%	-3.0%	-18.7%	N/A
Net Growth in Endowment (assume donations = payouts)	$9.3	$11.8	$20.8	-$4.3	-$25.7	N/A
Payout Amount (during year)	-	-	$5.5	$6.2	$6.7	$6.5
Mechanical Payout Rate from Current Endowment Value	-	-	**4.5%**	**4.4%**	**4.9%**	**5.8%**
ACTUAL Average Payout Rate Across All Universities	-	-	***4.6%***	***4.3%***	***4.4%***	***N/A***

[33] Changes to payout rates varied by the size of the endowment. Specifically, 15% of endowments with assets in excess of $1 billion decreased their payout rate in the 2009 academic year relative to 2008, compared to 21% for endowments with assets between $100 and $500 million, and 29% for endowments with assets between $25 and $50 million (Figure 5.3).

As this simple example illustrates, we would expect both the payout amount and the payout rate to increase in academic year 2009 relative to 2008 through a mechanical application of a moving-average payout formula. Thus, the fact that 25% of surveyed endowments report that they *lowered* their spending rate in absolute terms despite nearly all of them suffering negative returns in 2008 is the "real news" and is consistent with the hypothesis that many endowments *actively-managed* their payout rate below what their guidelines would have implied. Indeed, consistent with this interpretation, the *2008 NACUBO-Commonfund Endowment Study Follow-Up Survey* reports that when interviewed in December of 2008 (halfway through the 2009 academic year), 27% of university endowments indicated that they planned to reduce their payout rate over the remainder of the 2009 academic year (only 1% of respondents planned to increase it) in response to the autumn 2008 stock-market collapse.[34] The simple example above also suggests that we should expect 2010 endowment payout rates to increase substantially relative to 2009 payout rates (by almost a full percentage point). However, only 4% of endowments surveyed in the *2008 NACUBO-Commonfund Endowment Study Follow-Up Survey* reported that they anticipated increasing their payout rates in the 2010 academic year.

We recognize, of course, that more endowments are underwater as a result of the more recent crisis than were underwater after the collapse of the tech bubble. As the *2009 NACUBO-Commonfund Study of Endowments* (p. 62) highlights, university survey participants reported that just over 20% of their endowment, on average, was underwater in the wake of the most recent financial crisis. In 2001 and 2002, when the UMIFA regulations were in place (i.e., an endowment could not make payouts from underwater gifts), this statistic was 0.5% and 3.7% of the endowment being underwater, respectively (authors' calculations). However, relative to the 2001-2002 environment:

> "The problem of underwater funds is ameliorated by the passage of the proposed Uniform Prudent Management of Institutional Funds Act (UPMIFA), which, to date, has replaced UMIFA in 43 states and the District of Columbia. UPMIFA replaces the use of historic dollar value with a more flexible spending standard for nonprofits to use in making decisions about whether to make expenditures from their endowments. In the absence of a prohibition in the gift instrument, trustees

[34] For endowments with assets in excess of $1 billion, 15% planned to decrease payout rates (3% planned to increase), and for endowments with assets between $100 and $500 million, 30% planned to decrease payout rates (less than 1% planned to increase).

> will be able to spend or accumulate as much of an endowment fund—including principal or income, realized or unrealized appreciation—as they deem prudent, taking into account the intended duration of the fund, the fund's purposes, economic conditions, expected inflation, investment returns, other resources of the institution and the investment policy." (p. 62-63).

This survey also contains anecdotal evidence that is consistent with our results. In their description of how universities have been effected by the financial downturn, one university administrator made the following comment, which purportedly illustrates the general sentiments across universities, "We have frozen the creation of any new positions, …will review any vacant positions before deciding to refill, and will not be increasing any departmental budgets for the next fiscal year." The study also mentions that two areas also likely to be affected by the recent negative endowment shock are enrollment and financial aid – as one respondent to the survey put it, "Student scholarship dollar availability will be less, at a time they are most in need" – an assessment that again mirrors our results.

Articles in the financial press throughout the fall of 2009 highlight the interaction between a stock-market collapse and the underlying liquidity of the university endowments' portfolio – and the difficulties this was causing for universities. As Frances Denmark and Julie Segal put it in the November 4, 2009 *Institutional Investor*, "Liquidity is now front and center … the financial crisis has led schools to rethink how they implement the [investment] model, as well as to reassess the role that endowment funds play in their institutions' operating budgets and capital projects." Christopher Brown, CIO of Bucknell University, admits later in the article, "Liquidity is something we and others had not paid as close attention to as we should have."

6. Conclusions

Over the past two decades, the growth rate of university endowments has far outpaced that of university expenditures, and endowment payouts have become an increasingly important component of most universities' revenues. We use financial shocks to endowments, particularly responses to the technology-bubble collapse in 2001-2002, to study both the payout decisions of endowment funds and the resultant effects on universities' operational decisions.

We find that the payout policy of university endowments is generally inconsistent with the endowment-management advice given by Tobin (1974), Black (1976), and Merton (1992) to seek to smooth payouts to the institutions that they support or to help smooth aggregate university revenues. While most universities do have formal payout policies intended to smooth payouts over time, endowments significantly deviate from these policies following negative financial shocks by reducing payouts by more than their formal smoothing policies would suggest.

Financial shocks to an endowment ultimately have real consequences for the operational decisions of the university. As a result of a negative endowment shock, universities cut back on the hiring (or accelerate the firing) of employees across all job categories, with the exception of university administrators. However, the response of universities to endowment shocks varies by university selectivity. In response to a negative shock, universities with more selective undergraduate admission rates are more likely to reduce student financial aid than the number of tenure-system faculty, while less selective universities instead reduce expenditures on tenure-system faculty. We also find evidence of peer effects, as universities increase their hiring of tenure-system faculty in the year after their peers have suffered negative endowment shocks.

Another important channel through which financial shocks affect university operations is through the portfolio allocations of the endowment fund. We find that, after controlling for the size of the financial shock, the *composition* of the endowment's assets also matters for the resultant effect on university operations – cutbacks in the number of tenure-system faculty and support staff are more severe if the endowment fund experiences a negative shock *and* is holding a substantial share of illiquid assets.

Thus, in the context of endowments and universities, it is not sufficient to examine only the mean-variance properties of asset returns. The liquidity of an endowment's assets and the fluctuations in their liquidity across good and bad states are also important considerations (see Ang and Bollen (2010) for explicit estimates of the utility cost of illiquidity and Nagel (2010) for a discussion of how liquidity dries up in bad states of the world). Thus, just as a corporation must incorporate the costs of financial distress and the state of the world in which these costs are incurred into their capital structure decision (Almeida and Philippon (2007)), so must a university endowment incorporate the costs of illiquidity into its financial decisions. Although high alternative-asset allocations have led to greater average returns in the past, and may

continue to do so in the future, this should be weighed against the fact that the cost of the resulting illiquidity is likely to be borne in periods when universities experience their greatest financial need.

Taken as a whole, our results provide strong evidence that endowment shocks and endowment investment decisions have an important and significant effect on the real operations of the universities that these endowments are meant to support. Thus, our results show one previously unexplored channel through which financial markets affect real investments. In light of these results, understanding the decision-making process within the endowment board that sets these investment policies is a natural topic for future research.

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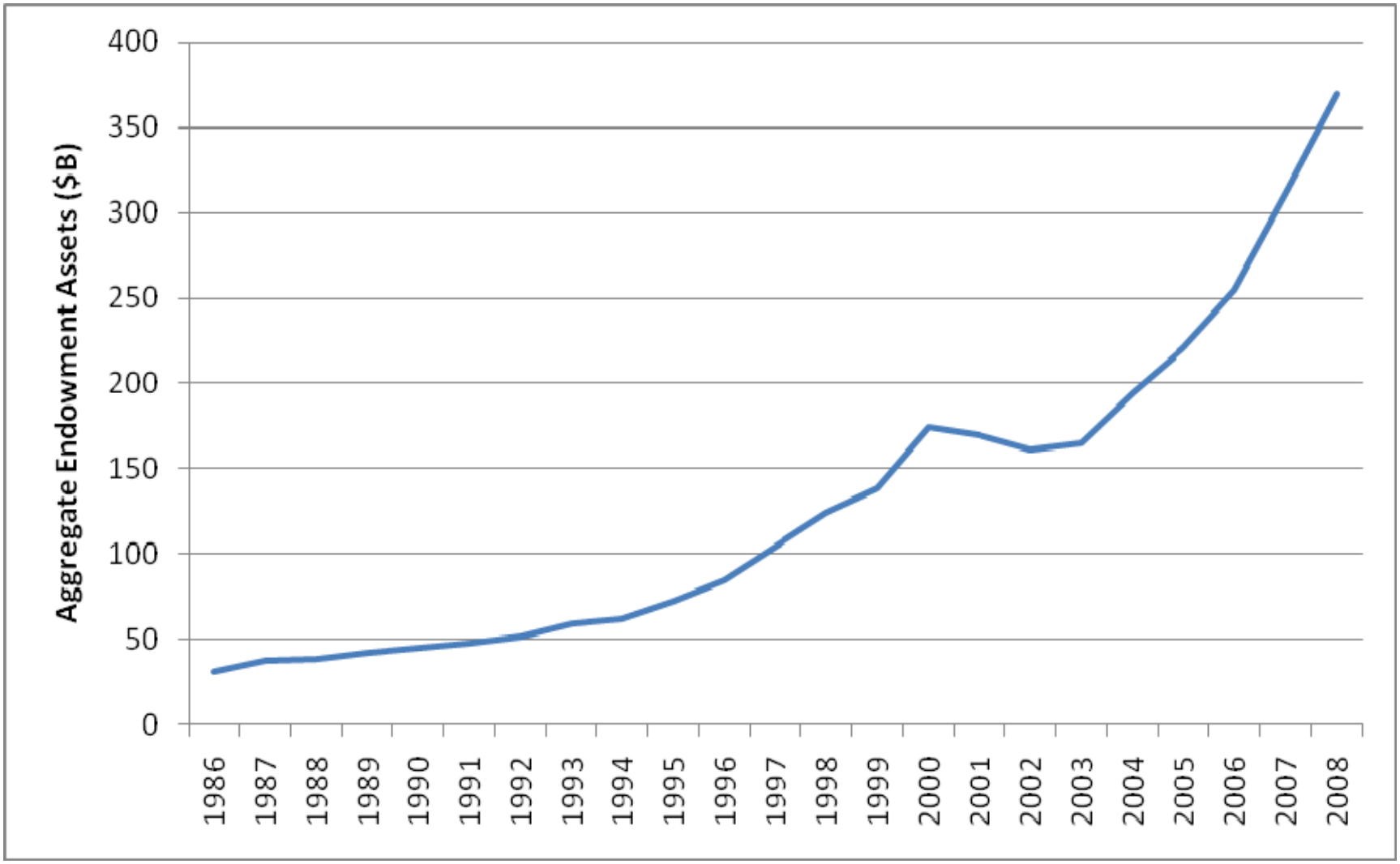
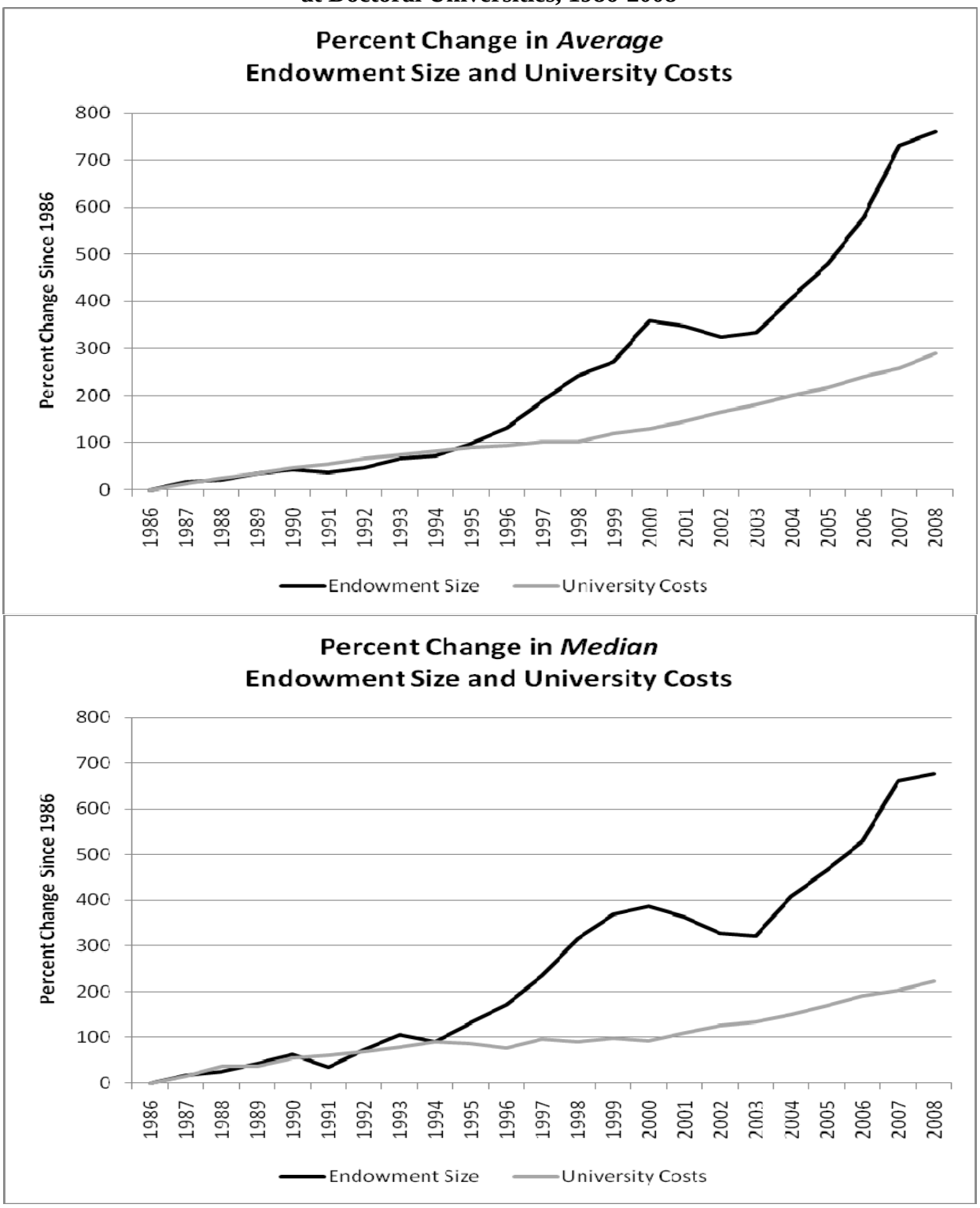
Figure 1: Aggregate Market Value of Endowment Fund Assets at Doctoral Universities, 1986-2008



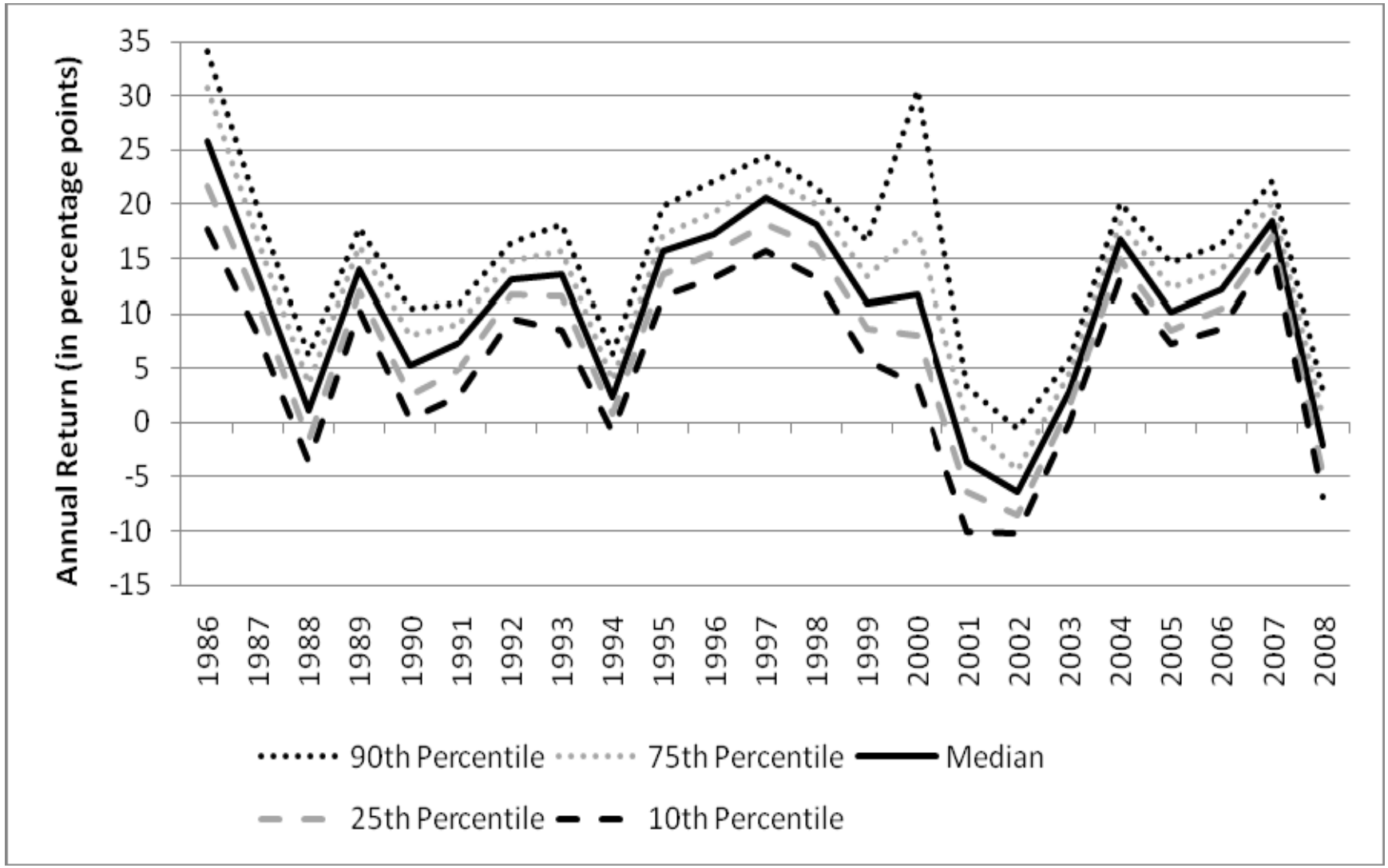
Source: NACUBO database. Year refers to academic year (e.g., 2008 is the 2007-08 academic year). Endowment values measured at the end of the academic year.

Figure 2: Growth Rate of Endowment Size (Market Value) and University Costs at Doctoral Universities, 1986-2008



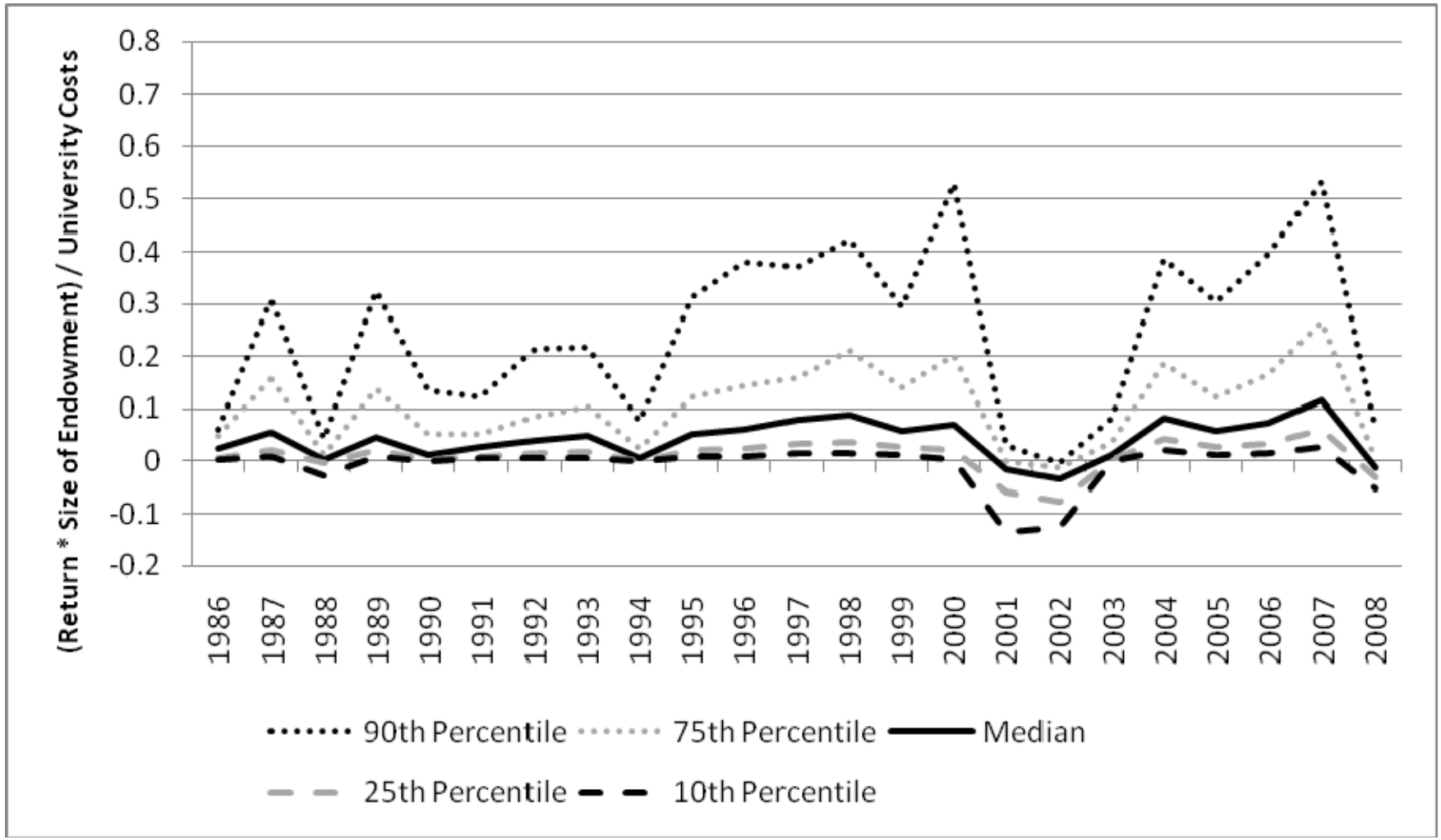
Source: NACUBO for endowment market values and IPEDS for total university costs. Year refers to academic year (e.g., 2008 is the 2007-08 academic year). Endowment values are measured at the end of the academic year and university costs are measured during the year.

Figure 3: Distribution of Endowment Returns at Doctoral Universities, 1986-2008



Source: NACUBO. Year refers to academic year (e.g., 2008 is the 2007-08 academic year).

Figure 4: Distribution of Endowment Shocks at Doctoral Universities, 1986-2008



Source: NACUBO for endowment returns and market value and IPEDS for university costs. Year refers to academic year (e.g., 2008 is the 2007-08 academic year). The endowment shock for a university for a given year is defined as the endowment return during the year multiplied by the endowment market value at the end of the prior year normalized by total university costs during the prior year.

Table 1: Distributions of Various Characteristics of Endowments of Doctoral Universities

Panel A: Full Sample, 1986-2008	**Mean**	**Std. Dev.**	**10th**	**25th**	**Median**	**75th**	**90th**
Endowment Size, Payouts, and Performance							
Assets (market value, $M)	731.4	2,207.5	29.9	65.4	188.0	556.6	1,499.5
Endowment-to-University-Cost Ratio	1.03	1.66	0.10	0.22	0.51	1.14	2.29
Dollar Payout ($M)	37.8	107.0	1.4	3.6	9.8	31.0	83.0
Payout Rate in percent (payouts / asset value start of year)	4.5	1.4	3.4	4.0	4.7	5.1	5.8
Payout-to-University-Cost Ratio	0.049	0.079	0.004	0.010	0.024	0.054	0.117
Endowment Portfolio Shares							
Public Equities	0.56	0.15	0.37	0.48	0.58	0.66	0.72
Fixed Income	0.26	0.13	0.12	0.18	0.25	0.32	0.41
Cash	0.06	0.08	0.00	0.01	0.03	0.08	0.13
Real Estate	0.03	0.04	0.00	0.00	0.01	0.04	0.07
Alternative Assets	0.10	0.14	0.00	0.00	0.03	0.17	0.31

Panel B: 2008 only	**Mean**	**Std. Dev.**	**10th**	**25th**	**Median**	**75th**	**90th**
Endowment Size, Payouts, and Performance							
Assets (market value, $M)	1,824.5	5,458.9	77.0	165.3	398.4	1,222.0	3,652.4
Endowment-to-University-Cost Ratio	1.36	2.16	0.17	0.34	0.67	1.30	2.75
Dollar Payout ($M)	78.3	240.0	3.2	6.5	16.5	50.1	155.0
Payout Rate in percent (payouts / asset value start of year)	4.3	0.9	3.4	3.9	4.3	4.7	5.2
Payout-to-University-Cost Ratio	0.059	0.096	0.007	0.013	0.028	0.060	0.131
Endowment Portfolio Shares							
Public Equities	0.48	0.13	0.30	0.41	0.48	0.56	0.65
Fixed Income	0.17	0.10	0.07	0.10	0.16	0.22	0.28
Cash	0.03	0.05	0.00	0.00	0.01	0.05	0.10
Real Estate	0.05	0.04	0.00	0.01	0.04	0.07	0.09
Alternative Assets	0.28	0.17	0.05	0.15	0.27	0.40	0.50

Source: NACUBO. Year represents academic year (e.g., 2008 represents the 2007-08 academic year).

Table 2: Distributions of Various Characteristics of Doctoral Universities

Panel A: Full Sample, 1986-2008	**Mean**	**Std. Dev.**	**10th**	**25th**	**Median**	**75th**	**90th**
Budget, Employment, and Salary Data							
Total University Costs ($M)	599	628	111	197	374	756	1,400
Total Salary and Benefits for All Employees ($M)	361	434	65	118	221	419	825
Budget Share of Salary and Benefits for All Employees	0.58	0.21	0.42	0.51	0.57	0.61	0.65
Average Salary of Tenure-System Faculty ($)	68,425	18,432	47,604	55,272	65,447	78,548	93,219
Average Salary of Adjuncts ($)	35,962	13,267	21,423	27,006	35,440	43,958	52,676
Total Number of Employees	4,810	3,794	1,195	2,007	3,781	6,679	9,993
Employee Share of Total University Employment							
Share of Tenure-System Faculty	0.26	0.11	0.14	0.18	0.24	0.31	0.41
Share of Adjuncts	0.07	0.05	0.01	0.03	0.05	0.09	0.13
Share of Support Employees	0.47	0.11	0.33	0.40	0.47	0.54	0.61
Share of Maintenance Employees	0.13	0.05	0.06	0.10	0.13	0.16	0.19
Share of Administrators	0.08	0.05	0.03	0.04	0.06	0.10	0.15
Financial Aid and Student Characteristics							
Unrestricted Student Financial Aid ($M)	27.7	32.7	0.8	5.5	16.8	37.4	69.1
Unrestricted Student Financial Aid (share of total costs)	0.07	0.07	0.00	0.02	0.04	0.09	0.17
Total Number of Freshman Students	2,642	2,300	640	1,195	2,102	3,478	5,038
Non-Endowment Revenue Sources							
Government Appropriations (share of all revenue)	0.21	0.20	0	0	0.23	0.38	0.61
Net Tuition Revenue (share of all revenue)	0.31	0.20	0.11	0.16	0.25	0.40	0.63
Current Gifts, Grants, and Contracts (share of all revenue)	0.29	0.21	0.12	0.16	0.23	0.33	0.54

Source: IPEDS. Year represents academic year (e.g., 2008 represents the 2007-08 academic year).

Table 2: Distributions of Various Characteristics of Doctoral Universities (continued)

Panel B: 2008 only	**Mean**	**Std. Dev.**	**10th**	**25th**	**Median**	**75th**	**90th**
Budget, Employment, and Salary Data							
Total University Costs ($M)	1,001	1,007	191	322	615	1,387	2,452
Total Salary and Benefits for All Employees ($M)	587	576	116	190	368	764	1,430
Budget Share of Salary and Benefits for All Employees	0.59	0.06	0.53	0.57	0.60	0.63	0.65
Average Salary of Tenure-System Faculty ($)	92,026	18,993	70,314	79,197	88,900	102,426	117,072
Average Salary of Adjuncts ($)	50,580	10,288	39,525	43,818	49,616	57,064	64,037
Total Number of Employees	5,534	4,916	1,240	2,241	4,064	7,255	11,851
Employee Share of Total University Employment							
Share of Tenure-System Faculty	0.18	0.06	0.10	0.14	0.18	0.22	0.26
Share of Adjuncts	0.08	0.05	0.03	0.04	0.07	0.10	0.14
Share of Support Employees	0.47	0.09	0.36	0.40	0.46	0.52	0.57
Share of Maintenance Employees	0.19	0.07	0.11	0.14	0.18	0.23	0.29
Share of Administrators	0.09	0.07	0.03	0.04	0.06	0.12	0.17
Financial Aid and Student Characteristics							
Unrestricted Student Financial Aid ($M)	47.8	47.7	3.3	13.9	35.3	64.3	107.0
Unrestricted Student Financial Aid (share of total costs)	0.08	0.08	0.00	0.02	0.05	0.10	0.20
Total Number of Freshman Students	3,178	2,731	901	1,445	2,551	4,149	5,759
Non-Endowment Revenue Sources							
Government Appropriations (share of all revenue)	0.18	0.17	0	0	0.18	0.32	0.40
Net Tuition Revenue (share of all revenue)	0.34	0.22	0.11	0.18	0.28	0.44	0.69
Current Gifts, Grants, and Contracts (share of all revenue)	0.29	0.20	0.10	0.16	0.23	0.36	0.59

Source: IPEDS. Year represents academic year (e.g., 2008 represents the 2007-08 academic year.

Table 3: Payout Rates and Deviations from Payout Guidelines (in percentage points) of University Endowments

	Payout Rate, 1993-2008			*Deviation from Payout Guidelines, 2000-2008*		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
SHOCK_POS = Max(SHOCK, 0)	-0.23	-0.31	-0.32	-0.42	-0.92**	-1.03**
	(0.15)	(0.20)	(0.21)	(0.27)	(0.44)	(0.46)
SHOCK_NEG = Min(SHOCK, 0)	2.58***	3.37***	3.27***	2.25*	6.06***	6.02***
	(0.74)	(1.08)	(1.09)	(1.22)	(2.23)	(2.28)
SHOCK_POS_LAG	-0.55***	-0.43**	-0.40*	-0.34	-0.01	-0.23
	(0.15)	(0.21)	(0.21)	(0.31)	(0.51)	(0.56)
SHOCK_NEG_LAG	-0.43	-1.23	-1.39	-0.18	-1.37	-0.89
	(0.77)	(1.12)	(1.13)	(1.27)	(2.17)	(2.24)
Approp_Cost			1.03			-0.66
			(1.24)			(2.96)
Approp_Cost_Lag			-1.64			-0.33
			(1.22)			(2.82)
Tuition_Cost			-0.66			-0.92
			(0.78)			(1.84)
Tuition_Cost_Lag			-0.71			2.20
			(0.75)			(1.69)
GGC_Cost			-0.42			1.44
			(0.39)			(0.91)
GGC_Cost_Lag			-0.20			0.25
			(0.38)			(0.71)
p-value of Revenue Controls	N/A	N/A	0.21	N/A	N/A	0.48
University Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State-by-Year-by-Private Fixed Effects	No	Yes	Yes	No	Yes	Yes
R-squared (within)	0.07	0.41	0.41	0.04	0.61	0.62
Number of Observations	2,882	2,882	2,861	563	563	562

See the Appendix for variable definitions. Standard errors, shown in parentheses, allow for correlations among observations of a given university over time as well as cross-sectional correlations.

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 4: Relation Between University Employment and Endowment Shocks

	Tenure System		*Adjuncts*		*Support*		*Maintenance*		*Administration*	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**
SHOCK_POS = Max(SHOCK, 0)	-0.01	-0.01	-0.07	-0.05	-0.10	-0.10	0.02	0.01	-0.05	-0.06
	(0.03)	(0.03)	(0.17)	(0.17)	(0.07)	(0.07)	(0.07)	(0.07)	(0.09)	(0.09)
SHOCK_NEG = Min(SHOCK, 0)	0.51***	0.51***	0.30	0.43	0.71**	0.66**	0.65**	0.65**	0.04	0.05
	(0.18)	(0.18)	(0.93)	(0.92)	(0.32)	(0.32)	(0.32)	(0.32)	(0.42)	(0.42)
SHOCK_POS_LAG	0.03	0.02	-0.30*	-0.33**	0.07	0.08	0.03	0.05	-0.04	-0.04
	(0.03)	(0.03)	(0.16)	(0.16)	(0.06)	(0.06)	(0.06)	(0.06)	(0.07)	(0.07)
SHOCK_NEG_LAG	0.53***	0.66***	-0.18	0.34	0.21	0.08	0.24	0.13	-0.33	-0.33
	(0.20)	(0.20)	(1.01)	(1.01)	(0.35)	(0.35)	(0.35)	(0.35)	(0.46)	(0.46)
Approp_Cost		0.12		0.14		-0.49		-0.52		0.28
		(0.18)		(0.89)		(0.35)		(0.35)		(0.46)
Approp_Cost_Lag		0.39**		0.15		-0.84**		-0.07		0.47
		(0.17)		(0.88)		(0.36)		(0.36)		(0.48)
Tuition_Cost		-0.03		1.09*		-0.46**		-0.09		0.11
		(0.11)		(0.57)		(0.23)		(0.23)		(0.30)
Tuition_Cost_Lag		-0.03		1.15**		-0.12		-0.46**		0.02
		(0.11)		(0.54)		(0.22)		(0.23)		(0.30)
GGC_Cost		0.19***		0.56*		-0.02		0.05		-0.04
		(0.07)		(0.34)		(0.13)		(0.13)		(0.17)
GGC_Cost_Lag		0.05		0.14		-0.16		-0.3**		-0.07
		(0.07)		(0.36)		(0.13)		(0.13)		(0.18)
p-value of Revenue Controls	N/A	0.00***	N/A	0.00***	N/A	0.00***	N/A	0.00***	N/A	0.75
University Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-by-Year-by-Private Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (within)	0.85	0.85	0.65	0.65	0.87	0.87	0.67	0.67	0.59	0.59
Number of Observations	2,810	2,790	2,808	2,788	2,202	2,199	2,201	2,198	2,202	2,199

See the Appendix for variable definitions. Standard errors, shown in parentheses, allow for correlations among observations of a given university over time as well as cross-sectional correlations.

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 5: Interaction of Employment Decisions with University Selectivity

	Tenure System	*Adjuncts*	*Support*	*Maintenance*	*Administration*
	(1)	(2)	(3)	(4)	(5)
SHOCK_POS = Max(SHOCK, 0)	**0.05**	**-0.01**	**-0.10**	**-0.05**	**-0.14**
(effect for most selective university)	(0.04)	(0.20)	(0.08)	(0.08)	(0.10)
SHOCK_POS*Admission Rate	**-0.02**	**-0.58**	**0.41**	**0.61***	**0.26**
	(0.16)	(0.88)	(0.38)	(0.37)	(0.49)
Effect of SHOCK_POS for least selective university	*0.03*	*-0.59*	*0.32*	*0.56*	*0.12*
SHOCK_NEG = Min(SHOCK, 0)	**0.46****	**-0.09**	**0.91****	**0.80***	**0.88**
(effect for most selective university)	(0.23)	(1.26)	(0.45)	(0.44)	(0.59)
SHOCK_NEG*Admission Rate	**-0.39**	**0.66**	**-0.47**	**-0.26**	**-2.43**
	(0.58)	(3.20)	(1.16)	(1.14)	(1.50)
Effect of SHOCK_NEG for least selective university	*0.07*	*0.58*	*0.43*	*0.54*	*-1.55*
SHOCK_POS_LAG	**0.04**	**-0.45****	**0.06**	**0.01**	**-0.10**
(effect for most selective university)	(0.03)	(0.18)	(0.07)	(0.06)	(0.09)
SHOCK_POS_LAG*Admission Rate	**-0.09**	**0.79**	**0.36**	**0.47***	**0.82****
	(0.14)	(0.75)	(0.28)	(0.27)	(0.36)
Effect of SHOCK_POS_LAG for least selective university	*-0.06*	*0.34*	*0.41*	0.48*	*0.72***
SHOCK_NEG_LAG	**0.17**	**0.21**	**0.27**	**0.38**	**-0.05**
(effect for most selective university)	(0.21)	(1.18)	(0.43)	(0.42)	(0.55)
SHOCK_NEG_LAG*Admission Rate	**1.05****	**-0.20**	**-0.98**	**-1.34**	**-1.59**
	(0.53)	(2.89)	(1.05)	(1.03)	(1.36)
Effect of SHOCK_NEG_LAG for least selective university	*1.21****	*0.01*	*-0.72*	*-0.96*	*-1.64*
Revenue Controls	Yes	Yes	Yes	Yes	Yes
University Fixed Effects	Yes	Yes	Yes	Yes	Yes
State-by-Year-by-Private Fixed Effects	Yes	Yes	Yes	Yes	Yes
R-squared (within)	0.88	0.67	0.87	0.69	0.62
Number of Observations	2,699	2,693	2,122	2,121	2,122

See the Appendix for variable definitions. The "*Effect of SHOCK_POS for least selective university*" is the sum of the coefficient on SHOCK_POS and the coefficient on the interaction of SHOCK_POS with the Admission Rate (likewise for the other SHOCK variables). We omit the standard errors for the "least selective university" effects and only indicate their statistical significance. Admission Rate refers to the ranking of the university's undergraduate admissions rate, with 0 assigned to the university with the lowest admissions rate (most selective) and 1 assigned to the university with the highest admissions rate (least selective). Standard errors, shown in parentheses, allow for correlations among observations of a given university over time as well as cross-sectional correlations.

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 6: Number of Employees, Average Salary, and Total Salary Expense for Tenure-System Faculty and Adjuncts

Panel A: Basic Specification

	Tenure-System Faculty			Adjuncts		
	Number of Employees	***Average Salary***	***Total Salary Expense***	***Number of Employees***	***Average Salary***	***Total Salary Expense***
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
SHOCK_POS = Max(SHOCK, 0)	-0.01	0.05****	0.01	-0.05	-0.07	-0.09
	(0.03)	(0.01)	(0.03)	(0.17)	(0.30)	(0.60)
SHOCK_NEG = Min(SHOCK, 0)	0.51***	-0.03	0.69***	0.43	-0.85	-1.90
	(0.18)	(0.06)	(0.18)	(0.92)	(1.50)	(3.48)
SHOCK_POS_LAG	0.02	0.03***	0.07**	-0.33**	-0.09	0.11
	(0.03)	(0.01)	(0.03)	(0.16)	(0.28)	(0.58)
SHOCK_NEG_LAG	0.66***	-0.19***	0.46**	0.34	0.12	0.78
	(0.20)	(0.06)	(0.19)	(1.01)	(1.49)	(3.50)
Revenue Controls	Yes	Yes	Yes	Yes	Yes	Yes
University Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State-by-Year-by-Private Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (within)	0.85	0.97	0.79	0.65	0.48	0.55
Number of Observations	2,790	2,789	2,738	2,788	2,909	2,588

See the Appendix for variable definitions. Standard errors, shown in parentheses, allow for correlations among observations of a given university over time as well as cross-sectional correlations..

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 6 (Continued)

Panel B: Interactions with University Selectivity

	Tenure-System Faculty			Adjuncts		
	Number of Employees	***Average Salary***	***Total Salary Expense***	***Number of Employees***	***Average Salary***	***Total Salary Expense***
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
SHOCK_POS = Max(SHOCK, 0)	**0.05**	**0.02**	**0.05**	**-0.01**	**-0.28**	**-0.19**
(effect for most selective university)	(0.04)	(0.01)	(0.04)	(0.20)	(0.33)	(0.66)
SHOCK_POS*Admission Rate	**-0.02**	**-0.04**	**-0.17**	**-0.58**	**0.26**	**0.02**
	(0.16)	(0.05)	(0.16)	(0.88)	(1.51)	(3.08)
Effect of SHOCK_POS for least selective university	*0.03*	*-0.02*	*-0.12*	*-0.59*	*-0.02*	*-0.17*
SHOCK_NEG = Min(SHOCK, 0)	**0.46****	**-0.02**	**0.54****	**-0.09**	**0.11**	**-1.06**
(effect for most selective university)	(0.23)	(0.07)	(0.23)	(1.26)	(1.85)	(4.42)
SHOCK_NEG*Admission Rate	**-0.39**	**0.18**	**0.23**	**0.66**	**-1.22**	**-0.49**
	(0.58)	(0.18)	(0.59)	(3.20)	(4.69)	(11.69)
Effect of SHOCK_NEG for least selective university	*0.07*	*0.17*	*0.77*	*0.58*	*-1.11*	*-1.55*
SHOCK_POS_LAG	**0.04**	**0.02****	**0.07****	**-0.45****	**-0.26**	**-0.17**
(effect for most selective university)	(0.03)	(0.01)	(0.03)	(0.18)	(0.30)	(0.61)
SHOCK_POS_LAG*Admission Rate	**-0.09**	**-0.06**	**-0.08**	**0.79**	**3.18****	**4.88***
	(0.14)	(0.04)	(0.14)	(0.75)	(1.28)	(2.69)
Effect of SHOCK_POS_LAG for least selective university	*-0.06*	*-0.04*	*-0.01*	*0.34*	*2.92***	*4.71**
SHOCK_NEG_LAG	**0.17**	**-0.13***	**0.05**	**0.21**	**1.08**	**0.23**
(effect for most selective university)	(0.21)	(0.07)	(0.21)	(1.18)	(1.78)	(3.86)
SHOCK_NEG_LAG*Admission Rate	**1.05****	**0.36****	**1.35*****	**-0.20**	**-8.98***	**-12.91**
	(0.53)	(0.16)	(0.51)	(2.89)	(4.75)	(9.82)
Effect of SHOCK_NEG_LAG for least selective university	1.21***	0.23	1.40***	0.01	-7.90*	-12.68
Revenue Controls	Yes	Yes	Yes	Yes	Yes	Yes
University Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
State-by-Year-by-Private Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (within)	0.88	0.98	0.83	0.67	0.52	0.58
Number of Observations	2,699	2,698	2,649	2,693	2,815	2,512

See the Appendix for variable definitions. The "*Effect of SHOCK_POS for least selective university*" is the sum of the coefficient on SHOCK_POS and the coefficient on the interaction of SHOCK_POS with the Admission Rate (likewise for the other SHOCK variables). We omit the standard errors for the "least selective university" effects and only indicate their statistical significance. Admission Rate refers to the ranking of the university's undergraduate admissions rate, with 0 assigned to the university with the lowest admissions rate (most selective) and 1 assigned to the university with the highest admissions rate (least selective). Standard errors, shown in parentheses, allow for correlations among observations of a given university over time as well as cross-sectional correlations. ***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 7: Peer Effects in Staffing of Tenure-System Faculty

	Number of Faculty			*Average Salary*			*Total Salary Expense*		
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**
SHOCK_POS_OWN_UNIVERSITY	-0.01		0.04	0.05***		0.02	0.01		0.03
	(0.03)		(0.04)	(0.01)		(0.01)	(0.03)		(0.04)
SHOCK_NEG_OWN_UNIVERSITY	0.51***		0.26	-0.03		-0.02	0.69***		0.41**
	(0.18)		(0.18)	(0.06)		(0.06)	(0.18)		(0.18)
SHOCK_POS_LAG_OWN_UNIVERSITY	0.02		-0.02	0.03***		-0.00	0.07**		0.00
	(0.03)		(0.03)	(0.01)		(0.01)	(0.03)		(0.03)
SHOCK_NEG_LAG_OWN_UNIVERSITY	0.66***		0.39**	-0.19***		-0.07	0.46**		0.32*
	(0.20)		(0.19)	(0.06)		(0.06)	(0.19)		(0.18)
SHOCK_POS_PEER_GROUP		0.16***	0.14**		0.04**	0.03*		0.20***	0.18***
		(0.05)	(0.06)		(0.02)	(0.02)		(0.05)	(0.06)
SHOCK_NEG_PEER_GROUP		-0.01	-0.06		0.19***	0.20***		0.34*	0.28
		(0.20)	(0.20)		(0.06)	(0.06)		(0.20)	(0.20)
SHOCK_POS_LAG_PEER_GROUP		0.18***	0.17***		0.07***	0.07***		0.25***	0.22***
		(0.05)	(0.06)		(0.02)	(0.02)		(0.05)	(0.06)
SHOCK_NEG_LAG_PEER_GROUP		-1.22***	-1.27***		-0.28**	-0.27*		-1.54***	-1.57***
		(0.46)	(0.47)		(0.14)	(0.15)		(0.45)	(0.45)
Revenue Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
University Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State-by-Year-by-Private Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared (within)	0.85	0.88	0.88	0.97	0.98	0.98	0.79	0.83	0.83
Number of Observations	2,790	2,788	2,691	2,789	2,787	2,690	2,738	2,738	2,641

See the Appendix for variable definitions. Standard errors, shown in parentheses, allow for correlations among observations of a given university over time as well as cross-sectional correlations.

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 8: Interaction of University Employment with Liquidity of Endowment Portfolio

	Tenure System	*Adjuncts*	*Support*	*Maintenance*	*Administration*
	(1)	**(2)**	**(3)**	**(4)**	**(5)**
SHOCK_POS = Max(SHOCK, 0)	**0.02**	**0.01**	**-0.09**	**0.05**	**0.12**
(effect for university with 0% Alternative Assets)	(0.06)	(0.33)	(0.12)	(0.11)	(0.16)
SHOCK_POS*Alternative Asset Share	**-0.24**	**0.28**	**-0.06**	**-0.02**	**-0.41**
	(0.16)	(0.83)	(0.27)	(0.26)	(0.38)
Effect of SHOCK_POS for university with 100% Alternative Assets	*-0.22**	*0.29*	*-0.14*	*0.03*	*-0.29*
SHOCK_NEG = Min (SHOCK, 0)	**-0.06**	**2.30**	**-0.11**	**0.59**	**0.85**
(effect for university with 0% Alternative Assets)	(0.26)	(1.41)	(0.42)	(0.41)	(0.60)
SHOCK_NEG*Alternative Asset Share	**3.51*****	**-9.58***	**3.53****	**0.33**	**-3.77**
	(1.06)	(5.65)	(1.71)	(1.65)	(2.41)
Effect of SHOCK_NEG for university with 100% Alternative Assets	*3.46****	*-7.28*	*3.43***	*0.92*	*-2.92*
SHOCK_POS_LAG	**0.06**	**-0.49***	**0.05**	**0.07**	**0.18**
(effect for university with 0% Alternative Assets)	(0.05)	(0.28)	(0.09)	(0.09)	(0.12)
SHOCK_POS_LAG*Alternative Asset Share	**-0.09**	**-0.33**	**0.19**	**-0.14**	**-0.66***
	(0.15)	(0.80)	(0.25)	(0.24)	(0.35)
Effect of SHOCK_POS_LAG for university with 100% Alternative Assets	*-0.04*	*-0.82*	*0.24*	*-0.07*	*-0.48**
SHOCK_NEG_LAG	**0.24**	**0.21**	**0.03**	**0.04**	**0.07**
(effect for university with 0% Alternative Assets)	(0.32)	(1.71)	(0.51)	(0.50)	(0.73)
SHOCK_NEG_LAG*Alternative Asset Share	**1.56**	**1.24**	**-0.53**	**-1.31**	**-3.21**
	(0.99)	(5.27)	(1.59)	(1.54)	(2.24)
Effect of SHOCK_NEG_LAG for university with 100% Alternative Assets	*1.79***	*1.45*	*-0.50*	*-1.28*	*-3.14**
Revenue Controls	Yes	Yes	Yes	Yes	Yes
University Fixed Effects	Yes	Yes	Yes	Yes	Yes
State-by-Year-by-Private Fixed Effects	Yes	Yes	Yes	Yes	Yes
R-squared (within)	0.87	0.68	0.90	0.77	0.63
Number of Observations	2,356	2,359	1,849	1,849	1,849

See the Appendix for variable definitions. The "*Effect of SHOCK_POS for university with 100% Alternative Assets*" is the sum of the coefficient on SHOCK_POS and the coefficient on the interaction of SHOCK_POS with the Alternative Asset Share (likewise for the other SHOCK variables). We omit the standard errors for the "university with 100% Alternative Assets" effects and only indicate their statistical significance. Alternative Asset Share refers to the fraction of the endowment's portfolio that is invested in alternative assets and it takes on values between 0 (no alternative assets in the endowment) and 1 (endowment is 100% invested in alternative assets). Standard errors, shown in parentheses, allow for correlations among observations of a given university over time as well as cross-sectional correlations.

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Table 9: Number of Incoming Freshmen and Student Financial Aid, by University Selectivity

	Number of Freshmen		*Student Financial Aid*	
	(1)	**(2)**	**(3)**	**(4)**
SHOCK_POS = Max(SHOCK, 0)	**-0.05****	**-0.06****	**0.03**	**-0.34**
(effect for most selective university in interaction specification)	(0.02)	(0.03)	(0.44)	(0.54)
SHOCK_POS*Admission Rate		**0.10**		**4.21****
		(0.10)		(2.06)
Effect of SHOCK_POS for least selective university		*0.04*		*3.86***
SHOCK_NEG = Min(SHOCK, 0)	**0.11**	**0.35****	**3.13**	**5.87***
(effect for most selective university in interaction specification)	(0.12)	(0.16)	(2.41)	(3.10)
SHOCK_NEG*Admission Rate		**-0.88****		**-9.02**
		(0.40)		(7.97)
Effect of SHOCK_NEG for least selective university		*-0.53*		*-3.14*
SHOCK_POS_LAG	**-0.03**	**-0.04***	**-0.77***	**-1.16****
(effect for most selective university in interaction specification)	(0.02)	(0.03)	(0.45)	(0.55)
SHOCK_POS_LAG*Admission Rate		**0.12**		**2.91**
		(0.11)		(2.18)
Effect of SHOCK_POS_LAG for least selective university		*0.08*		*1.75*
SHOCK_NEG_LAG	**0.30****	**0.47*****	**3.06**	**5.66***
(effect for most selective university in interaction specification)	(0.13)	(0.16)	(2.35)	(2.99)
SHOCK_NEG_LAG*Admission Rate		**-0.64**		**-13.46***
		(0.41)		(7.74)
Effect of SHOCK_NEG_LAG for least selective university		*-0.17*		*-7.80*
Revenue Controls	Yes	Yes	Yes	Yes
University Fixed Effects	Yes	Yes	Yes	Yes
State-by-Year-by-Private Fixed Effects	Yes	Yes	Yes	Yes
R-squared (within)	0.70	0.71	0.55	0.56
Number of Observations	3,359	3,244	3,253	3,141

See the Appendix for variable definitions. The "*Effect of SHOCK_POS for least selective university*" is the sum of the coefficient on SHOCK_POS and the coefficient on the interaction of SHOCK_POS with the Admission Rate (likewise for the other SHOCK variables). We omit the standard errors for the "least selective university" effects and only indicate their statistical significance. Admission Rate refers to the ranking of the university's undergraduate admissions rate, with 0 assigned to the university with the lowest admissions rate (most selective) and 1 assigned to the university with the highest admissions rate (least selective). Standard errors, shown in parentheses, allow for correlations among observations of a given university over time as well as cross-sectional correlations.

***, **, * denote significance at the 1 percent, 5 percent, and 10 percent levels, respectively.

Appendix: Description of Variables

Panel A: Dependent Variables

Variable Name	Definition
Payout Rate	Payouts made by the endowment to the university during the year divided by the endowment market value at the start of the year (expressed in percentage points).
Deviation from Payout Guidelines	Payouts made by the endowment to the university during the year less the amount of payouts that would be implied by the endowment's payout policy guidelines, divided by the endowment market value at the start of the year (expressed in percentage points).
Tenure System	Logarithm of the number of tenure-system faculty.
Adjuncts	Logarithm of the number of adjuncts/lecturers.
Support	Logarithm of the number of support staff (e.g., secretaries).
Maintenance	Logarithm of the number of maintenance employees.
Administration	Logarithm of the number of administrators.
Number of Employees	Logarithm of the number of employees in a specific job category.
Average Salary	Logarithm of average salary per employee for each job category.
Total Salary Expense	Logarithm of total salary expense for all employees (i.e., the product of number of employees and average salary per employee) for each job category.
Number of Freshmen	Logarithm of the number of freshman enrolled at the university at the start of the upcoming academic year.
Student Financial Aid	Logarithm of unrestricted student financial aid given by the university in the upcoming academic year.

Appendix: Description of Variables (continued)

Panel B: Explanatory Variables

Variable Name	Definition
$SHOCK_{i,t}$	$\text{Return}_{i,t} \times \frac{\text{Endowment Fund Size}_{i,t-1}}{\text{Total Univ. Costs}_{i,t-1}}$
SHOCK_POS	Max (SHOCK, 0).
SHOCK_NEG	Min (SHOCK, 0).
SHOCK_POS_LAG	One-year-lagged value of SHOCK_POS.
SHOCK_NEG_LAG	One-year-lagged value of SHOCK_NEG.
Approp_Cost	Contemporaneous amount of government appropriations (from federal, state, and local governments) divided by prior year total university costs.
Approp_Cost_Lag	One-year-lagged value of Approp_Cost.
Tuition_Cost	Contemporaneous net tuition revenue (tuition revenue less university financial aid) divided by prior year total university costs.
Tuition_Cost_Lag	One-year-lagged value of Tuition_Cost.
GGC_Cost	Contemporaneous amount of gifts, grants and contracts (e.g., current-revenue gifts to the university as well as research funding through agencies such as NSF and NIH) received by the university divided by prior year total university costs.
GGC_Cost_Lag	One-year-lagged value of GGC_Cost.
SHOCK_POS_OWN_UNIVERSITY	University's own SHOCK_POS.
SHOCK_NEG_OWN_UNIVERSITY	University's own SHOCK_NEG.
SHOCK_POS_LAG_OWN_UNIVERSITY	One-year-lagged value of SHOCK_POS_OWN_UNIVERSITY.
SHOCK_NEG_LAG_OWN_UNIVERSITY	One-year-lagged value of SHOCK_NEG_OWN_UNIVERSITY.

Appendix: Description of Variables (continued)

Panel B: Explanatory Variables (continued)

Variable Name	Definition
SHOCK_POS_PEER_GROUP	Max (average SHOCK of peers, 0), where a university's peers are defined as the 20 universities with the most similar undergraduate admissions rates.
SHOCK_NEG_PEER_GROUP	Min (average SHOCK of peers, 0), where a university's peers are defined as the 20 universities with the most similar undergraduate admissions rates.
SHOCK_POS_LAG_PEER_GROUP	One-year-lagged value of SHOCK_POS_PEER_GROUP.
SHOCK_NEG_LAG_PEER_GROUP	One-year-lagged value of SHOCK_NEG_PEER_GROUP.
Admission Rate	Rank of university's admission rates for undergraduates, with 0 representing the most selective university and 1 representing the least selective university.
Alternative Asset Share	Fraction of the portfolio held in alternative assets (such as hedge funds, private equity, venture capital, and commodities).