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College Rankings as an Interorganizational Dependency: Establishing the Foundation for Strategic and Institutional Accounts

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Abstract Higher education administrators believe that revenues are linked to college rankings and act accordingly, particularly those at research universities. Although rankings are clearly influential for many schools and colleges, this fundamental assumption has yet to be tested empirically. Drawing on data from multiple resource providers in higher education, we find that the influence of rankings depends on constituencies' placement in the higher education field. Resource providers who are vulnerable to the status hierarchy of higher education—college administrators, faculty, alumni, and out-of-state students—are significantly influenced by rankings. Those on the periphery of the organizational field, such as foundations and industry, are largely unaffected. Although rankings are designed largely for stakeholders outside of higher education, their strongest influence is on those within the higher education field.

Keywords College · Rankings · Strategy · Resource dependence · Organizations · Institutions · Institutional theory

Introduction

Over the past decade, economists and higher education researchers have been interested in understanding the effects that rankings have on student behavior, especially college selection and choice (Bowman and Bastedo 2009; Griffith and Rask 2007; McDonough

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et al. 1998; Meredith 2004; Monks and Ehrenberg 1999; Volkwein and Sweitzer 2006). Educational sociologists, on the other hand, have been more interested in the impact of rankings on organizational reputation, identity, and adaptation (Bastedo and Bowman 2010; Bowman and Bastedo in press; Elsbach and Kramer 1996; Espeland and Sauder 2007; Sauder and Fine 2008). Based on this research, we know that rankings have demonstrably salient effects on potential students and administrators at peer institutions due to their perceived influence on resource providers. However, the actual impact of rankings on these financial resource providers, such as industry, foundations, student families, and alumni, remains undocumented.

This paper explores whether the rankings of U.S. research universities conducted by *The U.S. News and World Report* serve as an interorganizational dependency, whereby increases in rankings yield increases in important resources. To measure these effects, this paper examines the impact of early *U.S. News* rankings on future research and development giving by government, foundations, and industry. We also examine whether higher rankings allow institutions to charge higher tuitions to students, and whether alumni are more inclined to donate to their alma mater. To isolate these effects, we only examine changes in financial resources provided over time, controlling for prior peer assessments and measures of instructional quality and organizational performance.

Our current understanding of the impacts of university rankings on external actors, combined with resource dependency theories of organization, would suggest that certain third-party resource providers would be sensitive to shifts in rankings over time. Prior studies have found that rankings have a strong influence on students as they make choices to enroll at research universities (Bowman and Bastedo 2009; Meredith 2004; Monks and Ehrenberg 1999). In addition, rankings have a strong influence on the reputational assessments made by peers (Bastedo and Bowman 2010; Bowman and Bastedo in press; Elsbach and Kramer 1996; Espeland and Sauder 2007) and external actors (Volkwein and Sweitzer 2006). From a rational choice perspective, resource providers would be expected to gravitate toward high-status universities as the best chances for return on their investment (Brewer et al. 2001).

We know theoretically that universities as organizations are highly dependent and contingent upon the continuing financial support generated by external resource providers (Pfeffer and Salancik 1978; Slaughter and Rhoades 2004). This interorganizational dependency is predicted by all open systems theories, particularly resource dependence theory (Pfeffer and Salancik 1978; Pfeffer 2003, 2005; Tolbert 1985) and institutional theory (Scott 2008). Each theory also predicts a set of cognitive and strategic responses to the rankings as a threat in the environment. Thus we can see that, as expected by open systems theories of organization, universities have adapted to these shifts in evaluation both in their internal structure and culture as well as in their external presentations of organizational identity (Elsbach and Kramer 1996; Espeland and Sauder 2007; Stevens 2007). In addition, we have witnessed multiple attempts by institutions and university-based organizations to mitigate the power of the rankings.

We test these predictions using structural equation models. We find that published college rankings have a significant impact on future giving by resource providers, independent of changes in organizational quality and performance. The only exception is the proportion of alumni who donate to their university, but the amount of giving is not impacted. Shifts in peer assessment of reputation, which are themselves a by-product of college rankings (Bastedo and Bowman 2010; Bowman and Bastedo in press), also show significant effects on financial resources in many instances. This provides strong support for multiple open-systems theories of organization, as well as for the resource-based

assumptions of empirical work on the strategic responses of universities and professional schools to ranking systems.

Strategic and Institutional Perspectives on Rankings

Open-systems theories have a long history both in the study of organizations (Katz and Kahn 1966; Thompson 1967) and in the study of higher education as an organization (Peterson 1985). Nonetheless, misunderstandings of their basic premises, assumptions, and predictions are relatively common. For example, it is commonly assumed that any organizational response to resources in the environment constitutes "resource dependence theory," but this is only partially true; all open-systems approaches theorize about resource flows from environments to organizations. It is more accurate to examine interorganizational resource dependencies from a variety of theoretical standpoints, including resource dependence theory, contingency theory (Donaldson 1996), and institutional theory. Resource dependence and institutional theory will be considered in this paper.

Each standpoint provides a different predicted set of organizational mechanisms and strategic responses related to externally-driven status and evaluation systems. We argue that rankings, as a status system and a crucial form of evaluation, now serve as an essential interorganizational dependency for research universities as an organizational field. The following sections highlight the theoretical standpoints of open-systems theories and how they contribute to our understanding of rankings as an interorganizational dependency.

Resource Dependence Accounts

Resource dependence focuses explicitly on shifts in the internal power dynamics of organizational subunits that result from interorganizational dependencies (Pfeffer and Salancik 1978; Pfeffer 2003, 2005). In a classic study, Pfeffer and Salancik (1978) show how university departments with stronger resource flows, those who solve particularly essential problems for the university, are more likely to receive higher marginal increases in their budgets and to be placed on high-status committees within the university. More recently, Thornton and Ocasio (1999) demonstrate that as the higher education textbook market became increasingly market-driven, the executive succession patterns of those selected to lead these firms changed concomitantly.

Thus analyzing universities from a resource dependence perspective requires data and analysis *within* universities and cannot simply be a demonstration of field-level changes. As a result, resource dependence theories have rarely been directly tested in university settings after Pfeffer and Salancik's foundational work (see Tolbert 1985, for a notable exception). However, Pfeffer and Salancik (1978) describe and analyze data related to a number of strategic responses to be expected from firms with interorganizational dependencies. These predicted strategic responses can be seen repeatedly in the higher education field in response to ranking pressures.

Cooptation

It is expected that organizations will manage their environment by incorporating agents of external groups into the decision making or advisory structures of the organization (Pfeffer and Salancik 1978). Thus we often see universities using trustee selection processes to incorporate wealthy, connected, and powerful individuals onto their boards (Bastedo

2009a; Pusser et al. 2006), a phenomenon that has been analyzed extensively among firms (Davis and Greve 1997). Cooptation as a phenomenon thus allows universities to trade "sovereignty for support" (Scott and Davis 2007, p. 235; see also Selznick 1949).

However, cooptation can also occur by absorbing or assimilating the services provided by external actors. Thus we can witness, for example, how the Motion Picture Association of America (MPAA) was formed by film studios to prevent the government from rating motion pictures for content (Bernstein 2000). Similarly, we can see attempts by universities, in the face of an uncontrolled dependency on *U.S. News* as an external evaluator, to coopt the system by serving as an alternative source of rankings information. Stanford University, for example, decided to become more transparent by providing institutional data information on its website, ostensibly for use by potential students and parents (Hoover 2007).

Influence Tactics

Another way universities have sought to reduce the influence of the *U.S. News* survey is to manipulate the data provided to it. Stevens (2007), for example, describes in brutal detail how a national liberal arts college in New York manipulated the data in its survey report to stay within self-defined ethical bounds but also to ensure that the college was portrayed in the best possible light. Similarly, Sauder and Fine (2008) describe how business school administrators, as reputational entrepreneurs, used the tactics of synthesis, selection, and simplification to influence national surveys. Empirically, college presidents and deans increasingly refuse to submit the reputational surveys that form 25% of the overall *U.S. News* ranking. From 2000 to 2008, the participation rate has fallen from 68% to 51%, raising concerns about the statistical representativeness of the sample, and thus potentially undermining the legitimacy of the ranking itself (Hoover 2007).

In 2009, it was revealed that some colleges are engaging in more aggressive influence tactics. Catherine Watt, the former director of institutional research at Clemson University, revealed at a professional conference that senior officials sought to engineer each statistic used by *U.S. News* to rate colleges to raise the school into the top 20 public research universities (Lederman 2009a). More ominously, she claimed Clemson administrators conspired to manipulate the *U.S. News* reputational survey. It was subsequently revealed that Clemson president James F. Barker had rated Clemson in the highest category, and all other colleges (including Harvard, Yale, and Stanford) in lower categories (Lederman 2009b).

Subsequently, a Florida newspaper used the Freedom of Information Act to obtain the reputation surveys of administrators at Florida public universities. Most notably, they showed that University of Florida president Bernard Machen systematically marked his survey naming Florida equivalent to Harvard and Princeton, and all other Florida public colleges in the 2nd lowest category (Crabbe 2009). Further review of surveys revealed other cases of manipulation by public college administrators from around the country (Lee 2009).

Associations and Alliances

Organizations often respond to interorganizational dependencies through forms of collective action, such as the formation of trade associations, councils, and coalitions that seek to influence the environment through joint action (Pfeffer and Salancik 1978). These forms of collective action seek to provide for the common good through the pursuit of mutually

agreed-upon goals and objectives. Higher education has a particularly large proliferation of these groups sprinkled throughout the country, representing virtually every major subunit of the university (e.g., the Association of University Technology Managers) as well as universities as a lobbying group (e.g., One Dupont Circle).

The creation of the Education Conservancy and the use of the Annapolis Group have been recently prominent in opposition to the *U.S. News* rankings. The Education Conservancy seeks to protect the integrity of the college-choice and admissions process from undue influence from rankings and over-gaming of the system by students, parents, and institutions (Thacker 2005). Thus the Conservancy sees rankings as undermining admissions and college choice in their role as a fundamentally educational process for students. In 2007, the Conservancy decided to enlist the help of the Annapolis Group, which is an informal alliance of the elite U.S. liberal-arts colleges.

For example, the strategy of refusing to participate in the *U.S. News* reputation survey has been endorsed by Lloyd Thacker, director of the Education Conservancy. In a letter to the Annapolis Group, he uses influence tactics to encourage presidents to undermine the rankings process:

> We believe these rankings are misleading and do not serve well the interests of prospective students in finding a college or university that is well suited to their education beyond high school. Among other reasons, we believe this because such rankings imply a false precision and authority that is not warranted by the data they use; obscure important differences in educational mission in aligning institutions on a single scale; say nothing or very little about whether students are actually learning at particular colleges or universities; encourage wasteful spending and gamesmanship in institutions' pursuing improved rankings; overlook the importance of a student in making education happen and overweight the importance of a university's prestige in that process; and degrade for students the educational value of the college search process (Thacker 2005).

The letter continues to argue that universities should only provide data that are related to "clear, professional standards" independent of the needs of any particular rankings publication, and endorses both refusing to participate in the reputation survey and refusing to use rankings in any promotional materials. The EC claims 61 liberal arts college presidents have signed the letter; notably, only three of the current top 25 liberal arts colleges are among them.

Executive Contracts

Interorganizational dependencies are often reflected in executive succession processes, procedures, and expectations (Thornton and Ocasio 1999). As presidents are expected to manage the crucial strategic contingencies of the organization, both selection procedures and contract provisions often shift to recognize changing environments. Unfortunately, there has been little research on executive succession in higher education, and there is little national data on presidential contracts. However, in 2007, Michael Crow, the president of Arizona State University, announced publicly that his contract carried a $60,000 bonus provision tied to increasing the university's tier ranking in *U.S. News* (Jaschik 2007). Notably, this exact provision was endorsed by a separate opinion-editorial published by *The Arizona Republic* (Goodman 2007). To date, however, this type of incentive pay provision seems quite rare (Jaschik 2007), and it remains to be seen whether these provisions are the cutting edge or simply an outlier.

Institutional Accounts

Institutional theory addresses how organizations adapt and manage the norms, values, and beliefs in their environment to increase the probability of organizational survival (Scott 2008). Implicit in the institutional conception is the idea that conformity to norms results in increased resource flows, which are both material (through financial support and personnel) and virtual (through increased legitimacy). Increases in virtual resources, such as legitimacy, in turn improve material resource flows, creating a kind of virtuous circle of accumulative advantage.

From an institutional perspective, rankings constitute a third-party status system that form a significant part of the normative environment of universities (Rao 1994; Sauder 2006). Powerful institutional effects are created by third-party organizations in the organizational field, especially those that seek to measure and evaluate others from whom they have organizational distance. Because they are not formally part of the organizational field, and they seek to provide ostensibly objective information, these third-party organizations have high legitimacy among the public and policymakers seeking to gather information on the field. As a result, they have a unique power to shape the normative environment of the organizational field without participating or providing material resource flows. They also help facilitate a formal stratification system that sorts and selects institutions for students, parents, and policymakers who are seeking to identify and reward elite functions. Institutional theory also explains why the associations and alliances predicted by resource dependence theory are often of limited influence in the competition for legitimacy, because they lack the perceived objectivity of third parties.

Although institutional approaches are often viewed as highly deterministic, there is mounting evidence that organizations respond strategically even within highly institutionalized environments (e.g., Oliver 1991). Analyzing the strategic ability to manage institutional environments provides a space for agency within a theoretical perspective that has been seen as overemphasizing convergence (through isomorphism, for example) towards a single norm of indeterminate history, and underemphasizing the role of power, influence, entrepreneurship, and elites on the institutionalization process. Recently, however, scholars have described a wide range of cases that rectify this imbalance (Bastedo 2005, 2007, 2009b; Guler et al. 2002; Martins 2005; Rao et al. 2003).

In particular, we have seen recent scholarship identifying the strategic responses of universities in the face of rankings as a normative environment. This research identified a number of important mechanisms of strategic response, including reactivity, decoupling, and impression management. Each of these strategic and internal organizational responses assumes an interorganizational dependency on resource flows related to the *U.S. News and World Report* college rankings.

Reactivity

As Heisenberg famously observed with subatomic particles in 1920s, the process of observing a phenomenon inevitably shapes the dynamics of that phenomenon. Thus yields an uncertainty principle: You can never be sure that a phenomenon, when observed, acts the same when the phenomenon is not being observed. Social life is certainly no exception. Thus, for social scientists, reactivity has been defined as the process by which social actors are influenced by the process of being evaluated, observed or measured. Espeland and Sauder (2007) describe how reactivity has played a role in the response of law schools to the development of rankings. They examine how Merton's famous self-fulfilling

prophecies (Merton 1948), or the process by which a false belief about future events influences the likelihood of the occurrence of those events, influences law school reactivity.

They also argue law schools are influenced by the process of commensuration (Espeland and Stevens 1998), by which evaluation "is characterized by the transformation of qualities into quantities that share a metric, a process that is fundamental to measurement" (Espeland and Sauder 2007, p. 16). In other words, the process of measuring an organizational quality inevitably changes how people think about that quality. This occurs primarily through the cognitive processes by which we simplify, reduce, and assimilate quantitative information. As a result, we can see the organizational mechanisms by which institutionalized, normative forces in the environment are shaped by internal, cognitive dynamics among individuals; indeed, rankings prove to be one of the best examples of how this process may occur.

Decoupling

In subsequent work, Sauder and Espeland (2009) similarly argue that the disciplining of rankings makes it difficult for university actors to buffer themselves from institutional environments. One of the foundational principles of neo-institutional theory is the idea of decoupling, or the process by which organizations seek to disconnect themselves from attempts by environmental actors to inspect core organizational activities (Meyer and Rowan 1977; see also Coburn 2004; Westphal and Zajac 2001). At times, organizational actors can be seen to be strategically decoupling themselves from these pressures (Bastedo 2004). Sauder and Espeland (2009), however, argue that the ability of organizations to decouple is mediated by the concept of discipline (Foucault 1977), the process by which social actors are coerced and seduced to internalize the normative pressures imposed upon them. Sauder and Espeland observe that rankings anxiety, the ability of administrators to manipulate and respond to ranking demands, and the rationalization of performance imposed by rankings all contribute to the disciplining process.

Image, Identity, and Impression Management

Impression management through manipulation of organizational images and identity are powerful in organizational fields (Dutton and Dukerich 1991). Every organization has images, both those created by the organizations themselves (self-images) and those that external actors seek to impose upon them in organizational fields, either as competitors or consumers. Every modern organization thus identifies individuals who are primarily responsible for managing this aspect of the institutional environment; these individuals are responsible for promoting the organization's desired self-image to those who seek to inspect and evaluate the organization.

Elsbach and Kramer (1996) examine the identity threats presented by the powerful *Business Week* rankings of management programs. They found that the initial rankings were highly disruptive to the beliefs among management programs of their place in the status hierarchy of business schools, and forced them to question the core values and structures that had been institutionalized within the school. Instead of being disciplined to the rankings as described by Sauder and Espeland (2009), Elsbach and Kramer (1996) describe a process by which faculty and administrators found ways to emphasize aspects of the rankings that were consonant with their self-image and identity. Following this line of reasoning, Martins (2005) subsequently demonstrated that identity threats are most likely

to create organizational change when the rankings are inconsistent with the identity and self-image of the organization. Thus we might conclude that the competing results of the two studies are the result of placement in time; in the early institutionalization of the rankings, resistance to self-image, identity, and organizational structures and processes are more probable than later in history, when the rankings themselves have become more fully institutionalized.

Institutional Entrepreneurs

A recent trend in institutional theory has been the identification of entrepreneurs who successfully manage institutional environments (Bastedo 2005; Rao et al. 2003). Institutional entrepreneurs utilize their power, influence, and elite status to influence institutional change through effective deployment of traditional social skills (DiMaggio 1988, 1991; Fligstein 1997). Sauder and Fine (2008) argue that business school administrators, in the face of particularly powerful rankings environments, act as reputational entrepreneurs who manipulate the rankings to suit their purposes. These administrators, imbued with the responsibility to shape and manipulate organizational image and identity, seek strategic efforts to manage identity threats. This is done by synthesizing, selecting, and simplifying information in ways that best represents their university to "reputational arbiters": rankings managers and the public at large. Thus, despite the disciplining effect of rankings, institutional entrepreneurs still effectively have the power to maintain some degree of managerial autonomy in the face of rankings as a normative force.

Hypotheses

Having addressed core theoretical propositions and predicted strategic and institutional responses, this leaves us to demonstrate the interorganizational dependency at the heart of the assumed relationship between rankings and their effects. Overall, resource dependence theories provide significant guidance for the development of hypotheses related to college rankings. First, we would expect that universities that are better able to manage their strategic contingencies, including rankings, will be able to garner greater support for their resource and development efforts from a variety of resource providers (Pfeffer and Salancik 1978). Second, we would expect universities that are better able to manage these contingencies will be able to charge more for their services to enrolled students (Jin and Whalley 2007). Finally, we would expect alumni to respond positively to these strategic responses by increasing their likelihood to donate to the institution, and increasing the amount that they donate.

We would make the same predictions based on institutional theory. We would expect that universities that better conform to the values and norms of rankings systems to garner greater support for their research and development efforts from government, industry, and foundations (DiMaggio 1983). We would also expect that universities that receive the imprimatur of third-party status providers like *U.S. News and World Report* will be able to charge higher tuitions to students, independent of actual changes in quality (Sauder 2006). We would similarly expect alumni to respond to these sanctions by increasing the likelihood and amount of their donations.

Importantly, the effect of college rankings on financial indicators should be independent of the effects of numerous related variables, such as general perceptions of reputation, institutional control, and any objective changes in institutional quality. Institutional

reputation (as indicated in the *U.S. News* peer assessment ratings) may serve as a particularly important control variable, because this measure not only reflects institutional prestige, but it is also very highly correlated with numerous indicators of academic quality (Volkwein and Grunig 2005). Institutional control may also play an important in shaping financial outcomes; for example, *U.S. News* shows that alumni of selective public schools are less likely to send donations than their private college counterparts. Finally, institutional theory suggests that the influence of rankings should be independent of actual changes in institutional quality. By controlling for these several indicators, any observed effect of rankings implies that the rankings themselves—not other aspects of quality or reputation—are primarily responsible for bolstering financial revenues.

Based on our understanding of resource dependence and institutional theories, this leads us to the following hypotheses:

H1 After controlling for prior reputation, institutional control, and changes in quality indicators, rankings will have a significant effect on resource flows from government, industry, and foundations to research universities for research and development.

H2 After controlling for prior reputation, institutional control, and changes in quality indicators, rankings will be significantly and positively related to higher tuition charges by research universities.

H3 After controlling for prior reputation, institutional control, and changes in quality indicators, rankings will be significantly and positively related to higher percentages of research university alumni who donate, as well as total alumni donations in dollars.

Method

Data Sources

All universities that appeared in the 1998 *U.S. News and World Report* national university rankings were eligible for this study. Two institutions that merged with other schools within the subsequent years were excluded, which yielded a total sample of 225 universities. Data on college rankings, peer assessments, changes in institutional quality, and the proportion of alumni donating to institutions were taken from print editions of the *U.S. News* college rankings. The exact formula for computing college rankings has varied slightly during the past decade, but the basic components have remained the same: peer assessments of reputation (25% of the overall score before 2010); graduation and freshmen retention rates (20%); faculty resources, such as salary/benefits, class size, and student-faculty ratio (20%); student selectivity, as defined by average test scores, high school class rank, and acceptance rates (15%); educational spending per student (10%); graduation rate performance, which is the difference between the institution's actual graduation rate and the "expected" graduation rate (5%); and the proportion of alumni who donate to their alma mater (5%) (Morse and Flanigan 2008). These figures are used to compute an overall score, which is then scaled so that the top-ranked school receives a score of 100. National universities ranked in the top 50 receive ordinal rankings based on their overall score; schools with the same overall score (rounded to the nearest whole number) are tied for that rank. Before 2003, institutions ranked in the top 50 were considered to be Tier 1 schools, and those outside of the top 50 were classified into Tier 2, Tier 3, or Tier 4. With the

exception of Tier 1, the universities within each tier did not receive ordinal rankings; all institutions within a tier were listed alphabetically.

The Integrated Postsecondary Educational Data Set (IPEDS) provided data on in-state and out-of-state tuition and fees and on institutional control (public vs. private). IPEDS is a system of annual surveys conducted by the National Center for Education Statistics; all colleges and universities that participate in the federal student financial aid programs are required to participate in IPEDS. Research and development funding (R&D) data were gathered from the National Science Foundation's Survey of Research and Development Expenditures at Universities and Colleges. Since 2004, all higher education institutions that had bachelor's or higher programs in science and engineering (S&E) and received at least $150,000 per year in S&E R&D were included in the sample. Prior to 2004, all institutions that had doctoral programs in S&E (regardless of R&D funding) and all historically black colleges and universities were included in the survey population (National Science Foundation 2008). Although the sampling for this survey is focused on S&E, R&D data for the entire institution is provided.

Finally, the total funding from foundations and total donations from alumni were taken from the Council for Aid to Education's Voluntary Support of Education (VSE) survey. The annual VSE survey is the largest of its kind, capturing an estimated 85% of all voluntary support to American colleges and universities (Council for Aid to Education 2009). Although only 25% of all U.S. postsecondary institutions participate in the VSE, the response rate for the national universities in the present sample was quite high (83% in 2006).

Measures

Financial Indicators

Financial indicators from 1998, 2000, 2002, and 2006 were used. Several sources of research and development funding were included: federal government, state and local government, industry, and overall funding (the sum of R&D from federal, state/local, industry, institutional, and other sources). The total amount of donations from alumni and funding from foundations were also included. Tuition and fees were also used; separate variables were created for in-state tuition and fees and for out-of-state tuition and fees. In addition, the proportion of alumni who donated money to the university was included. Since the distributions of all of these financial figures were strongly skewed, the natural log of each variable was computed and used in the analyses.

Exogenous and other Endogenous Variables

Dummy variables were created to measure Tier 2, Tier 3, and Tier 4 college rankings in 1998, with Tier 1 serving as the referent group. Ordinal variables that indicated tier level in 2000, 2002, and 2006 were also included (i.e., Tiers 1–4). Institutional control was indicated with a dichotomous variable (1 = public, 0 = private). Peer assessments of reputation in 1998 from the *U.S. News* rankings were also included. This figure came from the *U.S. News* survey in which deans and presidents were asked to rate institutions on a 1 ("marginal") to 5 ("distinguished") scale.

To determine changes in institutional quality, the six-year graduation rate, freshman retention rate, proportion of freshman in the top 10% of their high school class, and acceptance rate were used. The acceptance rate was reverse-coded, and all variables were

then standardized with a mean of zero and a standard deviation of one. A composite institutional quality variable for each year was computed by averaging the four standardized variables (Cronbach's alphas = .92 for 1998, .92 for 2000, .93 for 2002, and .92 for 2006). The quality index from 1998 was subtracted from the quality index in 2000 to indicate change in overall institutional quality over this two-year span. This same procedure was performed to calculate change in quality from 1998 to 2002 and 1998 to 2006.

Finally, to ensure that the relative variances among all variables were approximately equal for the structural equation models described below, all continuous variables were standardized with a mean of 0 and standard deviation of 1.

Imputation of Missing Values

Missing data constitutes a substantial problem in social science research, because analyses of incomplete data can yield misleading results, particularly when a sizable proportion of cases have missing values (Allison 2002; Little and Rubin 2002). Moreover, some common corrections for this problem (e.g., pairwise deletion) may be even more problematic than simply analyzing cases for which complete data exist (Allison 2002). Allison suggests two broad techniques for dealing with missing data appropriately: maximum likelihood estimation (e.g., EM algorithm) and multiple imputation. Maximum likelihood (ML) is most effective when providing estimates for linear and log-linear models, whereas multiple imputation can produce reliable estimates for both linear and non-linear models. The benefit of both approaches is that they provide estimates that are approximately unbiased and efficient.

The presence of missing data constituted a potential concern for the current study. Thus, the EM algorithm was used to impute missing values; this technique is effective for producing maximum likelihood estimates when some data are missing (Dempster et al. 1977; McLachlan and Krishnan 1997). The EM algorithm is an iterative regression-based technique that uses existing cases and variables to impute missing values. For the current sample, the MI procedure in SAS Version 9.2 was used. All variables noted above were used in the EM algorithm, including the log-transformations (not the original dollar amounts) of the financial indicators. The only exception was that a single variable was used to measure tier level for each year in the imputation process; these variables had a value of "1" for Tier 1 universities, "2" for Tier 2 schools, etc. The use of a single tier variable, as opposed to several dummy variables for tiers, ensured that the EM algorithm would produce only one imputed value for each institution whose tier level was missing in a given year.

Analyses

To examine how college rankings and other factors affect financial indicators, structural equation modeling (SEM) was used. The use of SEM is preferable to ordinary least squares multiple regression in this study, because SEM can account for high correlations between predictor variables that are problematic within multiple regression (Maruyama 1998). Specifically, multicollinearity is a concern in SEM when the variance inflation factor (VIF) is greater than 10 (Kline 2005), whereas VIFs far less than 10 can cause substantial problems within multiple regression analyses (Cohen et al. 2003). Moreover, Kline (2005) states that appropriate correlations within SEM can be as high as .85. SEM can account for multicollinearity by including the correlations among independent variables as a part of the overall model. The correlations among the predictor variables in the current study are

Table 1 Correlations among independent variables

	Tier 2	Tier 3	Tier 4	Peer assessment	Public	Change in quality
Tier 2	–					
Tier 3	−.38***	–				
Tier 4	−.37***	−.30***	–			
Peer assessment ratings	.08	−.31***	−.54***	–		
Public	−.02	.10	.27***	−.27***	–	
Change in quality (1998–2006)	−.01	−.00	−.01	.01	−.05	–
In-state tuition/fees	.05	−.16*	−.33***	.40***	−.86***	.01
Out-of-state tuition/fees	.10	−.28***	−.37***	.57***	−.67***	.06
Proportion of alumni donating	.15*	−.14*	−.50***	.58***	−.33***	−.03
Alumni dollars (total)	.19**	−.20**	−.50***	.72***	−.20**	.01
Foundation funding	.01	−.10	−.48***	.74***	−.19**	.03
Overall R&D funding	.09	−.12	−.41***	.66***	.25***	.03
Federal R&D funding	.08	−.13	−.43***	.69***	.18**	.01
State/local R&D funding	.06	−.02	−.17*	.30***	.44***	.04
Industry R&D funding	.06	−.08	−.37***	.55***	.12	.03

Note: Except for change in quality (1998–2006), all independent variables use data from 1998. Only one financial indicator was included in each model

* $p < .05$, ** $p < .01$, *** $p < .001$

shown in Table 1; clearly, numerous variables were moderately or highly correlated with one another.

The SEM software program EQS 6.1 for Windows was used to analyze covariance matrices of the data with maximum likelihood estimation. Twenty-seven separate models were created. Each model used one financial indicator (overall R&D, federal R&D, state/local R&D, industry R&D, in-state tuition and fees, out-of-state tuition and fees, proportion of alumni donating, total alumni donations, and total foundation funding) in one year (2000, 2002, or 2006) as the endogenous (i.e., dependent) variable. The financial indicator was predicted by the corresponding financial indicator in 1998, 1998 college rankings, 1998 peer assessment ratings, institutional control, and change in institutional quality from 1998 to the respective year. Therefore, direct effects of college rankings on financial indicators represent changes in financial outcomes, independent of the effects of other reputational assessments and of objective changes in quality. As noted earlier, peer reputation scores are extremely highly correlated with objective indicators of institutional quality (Volkwein and Grunig 2005), so no other quality measures were used in the models. Because all of the relevant variables were single-item indicators that were directly observable (e.g., college rankings, institutional control), latent variables were not created; as a result, it was not necessary to perform confirmatory factor analyses or to create measurement models. To ensure that the data fit the model well and that the relationships between the predictors and financial outcome were properly estimated, correlations among several predictor variables were included. A sample diagram appears in Fig. 1.

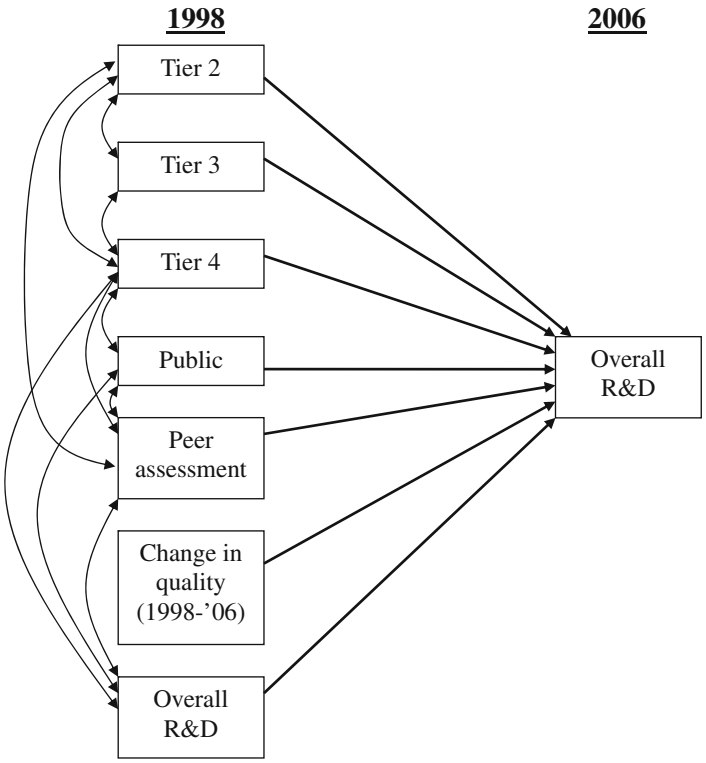

Fig. 1 Diagram of structural equation model predicting overall research and development (R&D) in 2006

Examining SEM Assumptions and Model Fit

Preliminary analyses showed that univariate skewness and kurtosis statistics for all variables were well below the recommended values of 3 and 10, respectively, for SEM (Kline 2005). For all models, variance inflation factors (VIFs) were below the recommended 10:1 ratio for all variables in all models. Several common goodness-of-fit indices were used to judge adequacy of the models: the Bentler-Bonnet normed fit index (NFI), Bentler-Bonnet non-normed fit index (NNFI), the comparative fit index (CFI), and the ratio of the Chi-square statistic to degrees of freedom (χ^2/df). In the models that predicted financial indicators, the NFI, NNFI, CFI, and χ^2/df indices ranged from reasonable to excellent (NFIs $> .96$, NNFIs $> .93$, CFIs $> .97$, $\chi^2/df < 3.0$). Reasonable fit is generally indicated by NFIs, NNFIs, and CFIs greater than .90, and χ^2/df ratios less than 3.0 (Bentler and Bonett 1980; Bollen 1989; Hu and Bentler 1999).

Limitations

Some limitations should be noted. First, although analyses of data imputed through the EM algorithm typically yield estimates that are superior to those from analyses of incomplete data (Allison 2002; Dempster et al. 1977; Little and Rubin 2002; McLachlan and Krishnan 1997), the true values for the missing data are unknown. In other words, the imputed values may or may not accurately reflect the actual values for the relevant missing data. Second, *U.S. News* peer assessment ratings serve as a proxy for widespread perceptions of institutional reputation. Although peer assessment ratings overlap substantially with other indicators of institutional quality (Bastedo and Bowman 2010; Volkwein and Grunig 2005;

Volkwein and Sweitzer 2006), the reputational perceptions of college deans and presidents (who complete the peer assessments) and other financial stakeholders (who are responsible for allocating various sources of funding) may differ. However, this disconnect may actually be minimal, as evinced by the incredibly high correlation between *U.S. News* peer assessment ratings and National Research Council academic reputation ratings ($r = .91$; Volkwein and Grunig 2005). Third, we were interested in whether and how college rankings affect financial indicators, but some effects may also occur in the opposite direction (i.e., financial indicators predicting changes in rankings). To test this possibility, the same 27 SEM analyses were conducted, except the financial outcome was replaced with an single, ordinal variable representing *U.S. News* tier level in 2000, 2002, or 2006 (for details about modeling ordinal variables in SEM, see Bentler 2006). Only a few analyses contained significant paths from the financial variable to future rankings, so it seems that the primary influence is the expected effect of rankings on financial indicators.

Results

College rankings in 1998 significantly predict financial indicators in 2006. That is, controlling for previous financial indicators, peer assessments, institutional control, and changes in objective quality, being ranked below Tier 1 adversely affects R&D funding (overall, federal, and industry), the proportion of alumni donating, and out-of-state tuition and fees ($ps < .05$; see Table 2). These effects are strongest and most consistent for institutions that are ranked in Tier 4. Effect sizes were calculated to characterize the magnitude of these relationships; the effect size (ES) is defined as the proportion of a standard deviation change in the dependent variable associated with being in a particular tier group (relative to Tier 1), *ceteris paribus*. According to Rosenthal and Rosnow (1991), effect sizes between .10 and .30 are considered small, between .30 and .50 are moderate, and greater than .50 are large. By these standards, the impact of being classified as Tier 4 (relative to Tier 1) is generally moderate for most outcomes, including overall R&D (ES = .35), industry R&D (ES = .45), federal R&D (ES = .29), out-of-state tuition and fees (ES = .33), and proportion of alumni donating (ES = .54). No significant effects of college ranking are apparent for the other financial indicators, but small or even moderate effect sizes are observed for Tier 4 universities predicting state/local R&D (ES = .42), total alumni donations (ES = .16), and foundation funding (ES = .13). All effects are in the expected direction; that is, better college rankings are associated with greater gains on financial indicators.

Other factors are also related to changes in 2006 financial indicators (see Table 2). Public institutional control has a significant positive effect on six of the nine financial outcomes (all forms of R&D, total alumni donations, and total foundation funding), whereas it is negatively related to the proportion of alumni who donate. Objective changes in institutional quality are positively associated with total alumni donations and foundation funding, but these are not significantly related to any other financial indicators. Peer assessment ratings have a positive impact on industry R&D, total alumni donations, and total foundation funding.

The effects of college rankings on financial indicators 2 or 4 years later were generally weaker than the effects over an 8-year period. As shown in Table 3, significant effects are only observed for R&D funding (overall, federal, and state/local). Similar to the patterns for 2006 financial indicators, being ranked in Tier 4 (relative to Tier 1) had the strongest negative relationship with financial outcomes in 2000 and 2002. The effect sizes for Tier 4

Table 2 Standardized coefficients for structural equation models predicting 2006 financial indicators

Independent variable	Dependent variable								
	Overall R&D funding	Federal R&D funding	State/local R&D funding	Industry R&D funding	In-state tuition/fees	Out-of-state tuition/fees	Proportion of alumni donating	Alumni dollars (total)	Foundation funding
Tier 2 (1998)	−.08*	−.07*	−.08	−.01	.00	−.06	−.04	−.01	−.02
Tier 3 (1998)	−.08*	−.06	−.07	−.05	−.02	−.06	−.12	.05	−.00
Tier 4 (1998)	−.17**	−.14*	−.20	−.21*	−.01	−.16*	−.25*	−.07	−.06
Peer assessment (1998)	−.05	−.03	.05	.15*	−.01	−.04	.13	.17**	.34***
Change in quality (1998–2006)	−.03	−.02	−.03	.00	−.00	.04	.04	.07**	.08**
Public institution	.06*	.06*	.15**	.17***	−.02	.05	−.15***	.09**	.11**
Pre-test level (1998)	.91***	.91***	.70***	.62***	.96***	.91***	.53***	.77***	.57***
Fit indices									
NFI	.977	.978	.969	.972	.985	.976	.966	.971	.969
NNFI	.965	.968	.956	.961	.980	.964	.947	.954	.951
CFI	.985	.987	.982	.984	.992	.985	.978	.981	.980
χ^2/df	2.627	2.454	2.293	2.271	2.090	2.482	2.599	2.775	2.706

NFI normed fit index, *NNFI* non-normed fit index, *CFI* confirmatory fit index, χ^2/df ratio of Chi-square to degrees of freedom

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 3 Standardized coefficients for structural equation models predicting financial indicators in 2000 and 2002

Independent variable	Dependent variable								
	Overall R&D funding	Federal R&D funding	State/local R&D funding	Industry R&D funding	In-state tuition/fees	Out-of-state tuition/fees	Proportion of alumni donating	Alumni dollars (total)	Foundation funding
Predicting 2000									
Tier 2 (1998)	−.06*	−.06*	−.02	−.04	.00	−.03	−.02	.04	−.04
Tier 3 (1998)	−.05	−.05	−.05	−.02	−.01	−.05	−.06	.09	−.01
Tier 4 (1998)	−.09**	−.10*	−.19*	−.04	.00	−.06	−.07	.01	−.12
Predicting 2002									
Tier 2 (1998)	−.05*	−.07*	−.03	−.04	.01	−.01	.02	.05	−.06
Tier 3 (1998)	−.05	−.06	−.05	−.03	−.01	−.05	−.02	.11	−.02
Tier 4 (1998)	−.12**	−.13**	−.21*	−.12	−.00	−.07	.11	.09	−.18

Note: All models include 1998 peer assessment, change in quality, institutional control, and 1998 levels of the relevant financial indicator

* $p < .05$, ** $p < .01$, *** $p < .001$

were small for overall R&D (ES = .20 and .26 in 2000 and 2002, respectively) and for federal R&D (ES = .21 and .28, respectively), whereas they were moderate for state/local R&D (ES = .39 and .45).

In summary, the findings provide some support for all three hypotheses. Regarding Hypothesis 1, college rankings have an effect on research and development funding from government and industry, but there is no significant effect on funding from foundations. College rankings also significantly affect out-of-state tuition and fees, which is consistent with Hypothesis 2. However, no such effect is observed for in-state tuition and fees. Moreover, as predicted in Hypothesis 3, rankings affect the proportion of alumni who donate to their university, but this effect is not apparent for the total amount of alumni donations.

Discussion

In general, our findings support the assumptions of open-systems theories of organizations; that is, universities will be financially impacted by the evaluations of certain legitimate third parties through their influence with external resource providers. This paper thus provides empirical support for the resource-based assumptions underlying previous qualitative and conceptual work, which has analyzed the strategic and organizational responses of universities to ranking systems (e.g., Elsbach and Kramer 1996; Espeland and Sauder 2007; Sauder and Fine 2008). Reputation is clearly an organizational resource in higher education that has been, and is increasingly defined by, the formal structure of rankings (Bastedo and Bowman 2010; Sauder 2006). The results described here allow us to go further to specify the organizational conditions under which rankings can be predicted to influence varying resource flows.

These findings also suggest, however, that assessing the *status vulnerability* of environmental actors is important to predict their behavior. Rankings are likely to influence those who are vulnerable to status hierarchy produced by rankings, and that hierarchy of perceived value generates resources for research universities. That is to say, students who attend public out-of-state institutions are more likely to believe they need to attend high-status universities to obtain good jobs and to attain their own status expectations. Thus more highly ranked research universities can charge higher tuition to out-of-state students, but not for in-state students who are less vulnerable to these effects. Policymakers would also not be expected to support tuition increases for in-state students based on ranking increases. Similarly, alumni are vulnerable to the perception of the value of their degree in the job market, and in elite circles, socially and through homophily in the marriage market (Stevens et al. 2008). Thus we also see that rankings seem more likely to affect *whether* alumni donate rather than *how much* they choose to donate.

Similarly, faculty and senior administrators seem vulnerable to rankings when they are involved in reputational assessments and resource provision. When considering the current results alongside research about the influence of college rankings on various constituent groups (Bowman and Bastedo 2009, in press; Meredith 2004; Monks and Ehrenberg 1999), the rankings have far stronger effects on those *within* the organizational field (faculty and senior administrators at peer institutions and resource providers) than on the students and parents they are primarily designed to serve. Peer assessments by senior administrators are the most highly influenced by rankings, because the rankings help to establish the hierarchy within the field, and are perceived to have strong influences on students, alumni and resource providers (Bowman and Bastedo in press). Ironically, among students and alumni,

the effects found to date have been significant, but far weaker than those found among senior administrators. Similarly, the faculty members who serve on federal R&D committees seem more likely to fund projects from highly-ranked institutions. Magazine rankings may be designed to affect students, parents, and policymakers, but their impact is far more demonstrable on universities themselves.

The same argument allows us to specify conditions for when interorganizational dependencies do not yield shifts in resource flows. From the data, we can see that resource providers who are on the margins of the organizational field—foundations, industry, and state government—seem more impervious to ranking influences. Because they are not internal to the higher education system, they will not be impacted in one way or another by the rankings, and are thus free to consider (or fail to consider) them at will. Effects related to internal power dynamics, structure reorganization, and coercive and normative isomorphism simply do not apply to these external actors. Organizationally, we can say that these resource providers are largely buffered from the pressures of rank. That is not to say that the prestige of these universities does not matter to them; certainly it does. But movement in the ranking does not matter as much as the stable evaluation of reputation over time.

We must also consider the differing organizational structures across these resource providers. The federal government doles out money through earmarks, which are related to political power in legislative districts, and through government agencies, which most often employ experts to dole out funds on a project-by-project basis. For state governments, resources flow primarily to public universities, where the hierarchy of prestige is firmly established by state action, law, regulation, and public policy (Bastedo and Gumport 2003). Thus, even if these external actors were inclined to be influenced by rankings (Institute for Higher Education Policy 2009), the organizational structure of resource allocation in these sectors mitigates against this influence.

We hope this paper inspires further work on the underlying mechanisms of resource dependence and institutional theory in higher education. Although we have good work on these theories as broad field-level influences (e.g. Tolbert 1985), our knowledge of the mechanisms within colleges and universities—those driven by environmental influences—is underdeveloped. There are often good reasons for this: quantitatively, the data needed to assess change over time within universities has been difficult, if not impossible, to obtain. Qualitatively, collecting data across the range of colleges needed to justify broader conclusions has been time-consuming, difficult, and expensive. Yet this work is absolutely necessary to elaborate our understanding of higher education as an organization.

From an institutional theory perspective, the mechanisms of commensuration, quantification, reactivity, and disciplining are powerful socio-cognitive influences on people in organizational fields, and these result in institutional effects that snowball over time. Yet they are largely unexplored in higher education, despite their widespread influence in issues of accountability, changing budgetary practices, and data-driven decision making. In addition, research about marketing, branding, and image management in higher education is only beginning to emerge in the empirical literature (Hartley and Morphew 2008; Mael and Ashforth 1992; Toma et al. 2005).

Finally, resource dependence may be even more ripe for empirical work. Influence tactics, cooptation, alliances, and executive succession practices are hardly unknown to college faculty and administrators. Yet these organizational behavior shifts are rarely demonstrated to connect to changes in the environment over time, which would lead to a more conceptually rich understanding of organizational change in higher education. This could lead to important work examining trustee selection behaviors, succession practices

for college presidents and deans, and the formation and incredible proliferation of higher education agencies, associations, and ad-hoc lobbying groups.

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