Highly Cited Leaders and the Performance of Research Universities

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Abstract

There is a large literature on the productivity of universities. Little is known, however, about how different types of leader affect a university's later performance. To address this, I blend quantitative and qualitative evidence. By constructing a new longitudinal dataset, I find that on average the research quality of a university improves some years after it appoints a president (vice chancellor) who is an accomplished scholar. To try to explain why scholar-leaders might improve the research performance of their institutions, I draw from interview data with twenty-six heads in universities in the United States and United Kingdom. The findings have policy implications for governments, universities, and a range of research and knowledge-intensive organizations.

Key words: Research performance, expert knowledge, leadership, universities, innovation.

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1. Introduction

Although there is a large literature on the research productivity of universities[1], little is known about how different types of leader affect a university's performance. The success of a leader may be due to many factors. Nevertheless, it is important that researchers try to establish the effectiveness of heads despite the cloudy conditions, because leaders usually have the most power in organizations, and substantial resources are invested in their recruitment and pay.

In this paper I attempt to fill the gap. Using new longitudinal data and interview evidence, I concentrate on a particular leader-characteristic -- the level of scholarly expertise a university president or vice chancellor[2] possess. The core business of a university is research and teaching, but research quality is what separates top universities from their competitors. Institutions that produce the best research receive the largest share of public funding and private philanthropy. There is also a significant relationship between the quality of research and the extent of industry funding (Gulbrandsen and Smeby, 2005). The focus in this paper is on scholarship. It seems important to know whether individuals who have obtained a high standard as a researcher bring something different to the leadership role. An alternative possibility is that the head of a research university primarily needs high managerial ability and that the level of scholarly ability is unimportant. Using

[1] The literature on the determinants of university research performance and innovation includes, Adams and Clemmons, 2006; Charlton and Andras, 2007; Crespi and Geuna, 2006; Gonzalez-Brambila and Veloso, 2007; Johnes and Johnes, 1993, 1995; Katz, 2006; Oppenheim and Stuart, 2004; Rigby and Edler, 2005; Von Tunzelmann et. al., 2003; and, Zhang and Ehrenberg, 2006. The influence of managers on the performance of bio-medical research groups is examined by van der Weijden et al., 2008, but the authors do not look at whether the level of scholarship attained by a group leader has an effect on group performance. For the economic effects of universities and public research, see Adams, 1990; Adams & Clemmons, 2008; Aghion et al., 2005; Aghion, 2006; Anselin, Varga & Acs, 1997, 2000; Basu, Fernald & Shapiro, 2001; Basu, Fernald, Oulton & Srinivasan, 2003; Bramwell & Wolfe, 2008; Cohen, Nelson & Walsh 2002; and Stuen, 2007; and for the influence of human capital externalities on economic growth see Lucas, 1988. Zucker et al., 1998 show that there is a link between the location of top scientists and increases in the number of biotech firms. On how the location of university graduates increases salaries for those less educated, see Moretti, 2004. Finally, for a link with top scholars and size-of-research-team effect on scientific outputs and influence, see Adams, et al., 2005.

[2] The term 'president' will more commonly be used in this paper to denote the executive leader of a university -- to include vice chancellor, principal, rector, director, among others.

quantitative and qualitative data this paper attempts to address the question: does it matter to the performance of a university if the leader has been a top scholar?

First, in Part One, I test the hypothesis by means of regression analysis incorporating time lags. With a panel of 55 research universities I show that a university's research performance improves if, a number a number of years earlier, a president who is an accomplished scholar has been hired. This goes beyond a simple contemporaneous cross-sectional correlation. Next, in Part Two, I draw upon qualitative data and present possible explanations about why university performance might be enhanced under scholar-leaders. I interview twenty-six heads from universities in the United States (US) and United Kingdon (UK) -- the list is in Figure 1.

Four themes emerge from the interviews: First, scholars are seen as more *credible* leaders. A president who is a researcher will gain greater respect from academic colleagues and appear more legitimate. Legitimacy extends a leader's power and influence. Second, it is argued that being a top scholar provides a leader with a deep understanding or *expert knowledge* about the core business of universities. This informs a head's decision-making and strategic priorities. Third, interviewees suggested that it is the president who sets the quality threshold in a university, and, therefore, that the bar is raised when an accomplished scholar is hired. Thus, a *standard bearer* has first set the standard that is to be enforced. Finally, a president who is a researcher sends a *signal* to the faculty that the leader shares their scholarly values, and that research success in the institution is important. It also transmits an external signal to potential academic hires, donors, alumni and students.

Research universities are part of the knowledge-intensive sector (Mintzberg, 1979). More broadly, this paper suggests that in knowledge-based organizations, where the majority of employees are expert workers, having a leader who is also an expert may be beneficial to the institution's long-term performance. Put another way, my central argument is that in settings where expert knowledge is the key factor that characterizes an organization's core business, it is likely to be expert knowledge that should be key in the selection of its leader.

Universities are an interesting case because they are a significant source of innovation in society, and also their leaders' technical expertise can be measured reasonably objectively. There exist a number of influential empirical studies of

leaders in higher education[3]. Yet there has been little statistical thinking about how university presidents and vice chancellors can influence performance. The paper's results seem of potentially wide interest to universities, policy-makers and our understanding of R&D processes.

2. Part One -- Longitudinal Evidence

It has recently been shown that there is a positive correlation between the scholarly achievement of a university's president and the position of that university in a global league table. The higher a university is ranked in the 'Academic Ranking of World Universities'[4], the higher the life-time citations of its leader (Goodall, 2006). This cross-section pattern has also been replicated for deans of business schools (Goodall, 2009). Although correlations do not prove that more highly cited leaders are more effective, they do signal assortative matching. The most successful universities in the world arguably have the widest choice of leaders to select from, because they have deeper pockets and higher status. That they hire top researchers is notable. Knowing this is a necessary prerequisite if trying to explore whether scholar-leaders actually make a positive difference to the research performance of universities. If no correlation were found -- i.e. top universities did not select top scholars -- then the main idea in this paper is certainly wrong. But can we go beyond a simple cross-sectional correlation?

It is hard to isolate the contributions of individual leaders on organizational performance. Institutional heads are not randomly assigned, and the quality of a university is established over many years incorporating factors such as an institution's history, reputation, age and wealth. One approach adopted by authors is to assess how an organization performs after the death of a leader, which creates an exogenous shock. Jones & Olken (2005) examine the case of national leaders by using, as a natural experiment, 57 parliamentarians' deaths, and economic growth data on many countries between the years 1945 and 2000. The authors trace linkages between nations' leaders and nations' growth rates and they reject 'the deterministic view … where leaders are incidental'. Work by Bennedsen, Perez-Gonzalez & Wolfenzon (2007) establishes, in Danish data, that the death of a CEO, or a close family member,

[3] For example, Bargh et al., 2000; Birnbaum, 1988; Cohen and March, 1974; Ehrenberg 2004; Middlehurst, 1993; and Rosovsky, 1991.

is strongly correlated with a later decline in firm profitability. This, again, seems to confirm that leaders matter to the performance of organizations. Bertrand & Schoar (2003) demonstrate that CEO fixed effects are correlated with firms' profitability. Their study is important because it suggests that individuals themselves can shape outcomes[5].

Focusing on the death of a leader was not feasible in this university setting because so few presidents and vice chancellors actually die in post. It may be possible instead to get an indication of a leader's effect through a longitudinal method that uses lags, an acceptable performance measure (i.e. not league tables) and control variables. In this paper it is suggested that:

Hypothesis: There is a positive relationship between the prior scholarly ability of a university president and the future success of that institution.

3. Methodology

The hypothesis is tested by using multiple regression analysis with the change in university performance as the dependent variable and the scholarly success of presidents as the key independent variable. The focus is on longitudinal improvements in university performance. Control variables for university income, presidential age and discipline are also used. These are incorporated to check the robustness of the correlations between university performance and a leader's research history.

Information from the UK is used because of the unique method of assessing research performance that has been available in that country for a number of years – the Research Assessment Exercise (RAE)[6]. My data comprise of 157 university presidents and a panel of 55 UK research universities that competed three times in the Research Assessment Exercise (RAE) from 1992 to 2001. Performance is observed in the RAE in 1992, 1996 and 2001. To identify a president's scholarly success, each

[4] The ranking is produced by the Institute of Higher Education at Shanghai Jiao Tong University, 2004.
[5] Theoretical explorations of leadership are offered by Hermalin (1998, 2007) who focuses on the incentives used by leaders to induce followers to follow; by Majumdar & Mukand (2007), who construct a model in which a key role is played by followers' willing to put their faith in the their leader; and by Dewan & Myatt (2008), who concentrate on the role played by a leader's ability, and willingness, to communicate clearly to followers.
[6] The Research Assessment Exercise (RAE) was designed to help inform UK funding bodies' decisions about how to distribute public money for research.

individual's lifetime citations have been hand-counted and normalized for discipline[7]. An alternative would have been to use the simpler measure of a scholar's H-index -- see for example Oppenheim, 2007 -- but the decision was taken to use instead the more exact lifetime citations count.

3.1 The Sample of Institutions

The 55 institutions selected make up the oldest and most established research universities in the UK (for a list of sample institutions, see Appendix A). They are often referred to as the 'old' universities, those that existed before 1992, a period that marked a major expansion in the number of UK higher education institutions. This group has consistently generated the majority of academic research and they continue to receive the bulk of UK research income[8].

As suggested above, age, size, wealth and reputation are all contributing factors to the long-term success of any university. But it is important to mention that success over the last 40 years among UK research universities has not been confined to one particular group. There has been movement up and down in RAE performance and also in various league tables (see, for example, league tables in The Guardian newspaper, The Times and Times Higher Education).

3.2 The Leaders

The sample includes 157 British university presidents. They have led the 55 universities over, approximately, a twenty-year period. It is the presidents in place in 1992 and 1996 that appear most in the statistical analysis. Biographical information has come from 'Who's Who', the Association of Commonwealth Universities, and from individuals' biographies.

Attention in this paper is on presidents' lifetime citations. These are normalized for discipline into a P-score, or scholarly score, and used as a proxy measure of each individual leader's past research productivity. (Descriptive data on the sample of presidents are available in Appendix B).

[7] Hence I do not count patent citations in the sense of Oppenheim, 1997b.
[8] Figures available from the UK Higher Education Statistics Agency, 2006.

3.3 Dependent Variable: University Performance

There are several ways to measure the long-term performance of a university. One of the most common, although possibly the least scientific, is to use the league tables which have become ubiquitous. The main problem with rankings is their lack of consistency in assessment methodologies. Most league tables are media-generated, produced by commercial organizations designed to make money by selling their publications. To create a story, the methodology is changed, often annually, which ensures that institutions at the top rotate (Lombardi et al., 2002).

The UK has had a system for appraising research universities since 1986, one that takes place every few years. Selectivity is on the basis of quality in that institutions that conduct the best research receive a larger proportion of the available grant. Based on peer review, the Research Assessment Exercise provides quality ratings for research across all disciplines. Panels use a standard scale to award a rating for each submission. Scores are assigned to units of assessment (equivalent to academic departments broadly speaking) depending on how much of the work is judged to reach national or international levels of excellence[9].

The Research Assessment Exercise (RAE) is the measure of university performance used in this study. It was felt to be appropriate because of the emphasis it places on the output of academic research, which is a core function of research universities, the other being teaching. Although teaching is a central activity of universities, it could be argued that it is research quality that top universities prioritize. This seems clear from the fact that promotion within the faculty is typically through a peer-review process that focuses almost entirely on candidates' research productivity. There is some evidence in the UK that an academic department's teaching quality is linked to its research quality[10].

[9] Information about RAE available from www.hero.ac.uk.

[10] In the UK a separate measure for teaching quality was established by government – Teaching Quality Assessment (TQA). TQA scores have been shown to correlate highly with RAE scores (Shattock, 2003). In other words, those institutions that performed best in the RAE tended to obtain the highest TQA scores also. The question of whether good researchers make better or worse teachers to my knowledge remains open; though some scholars (e.g. Rosovsky, 1991) suggest that faculty who are motivated by research, remain interested in their subject and may, therefore, teach with more passion.

3.4 Measure of Performance

University performance is measured here across three Research Assessment Exercises and is used to assess how much each university has improved or declined in the number of top scoring departments across these periods. The ratings have changed over the different assessment exercises, but generally they range from 1 to 5-star (signified here as 5*) which is the highest grade. The paper's focus is on improvement in the number of departments that achieved the highest scores in the RAE[11]. These grades are synonymous with research considered, by peer-review, to be of international excellence. Achieving the very top rating is a challenging task because excellence must be reached across almost all faculty in a given unit of assessment. A further reason I chose to focus on the highest marks (i.e. 5A*, 5B* and 5A) was because of possible grade inflation. For example, among the sample of 55 universities in this study, a third of all RAE submissions received a rating somewhere in the fives in 1996. By RAE 2001 the number of fives awarded to the same group of institutions rose even higher to 55% of the total. Therefore, with so many submissions scoring a five grade in 1996 and 2001, it was felt necessary to lift the threshold of performance to the top three RAE grades awarded. However, even if I switch to a performance measure where improvement in all submissions that received a grade in the 5s (i.e. not just the top three scores), the results still hold[12].

University performance is, then, measured here by comparing the growth, or decline, in the number of departments graded excellent in the Research Assessment Exercise. These figures are generated both for the *level* of the number of units and also as growth in the *changes over time* for each of the sample institutions. Could the mover universities have moved in part because their leaders were better scholars? To understand whether university performance in the Research Assessment Exercise can be explained partially by the leader-characteristic of scholarship, the study examines whether there is a correlation between a president's lifetime citations and the later movement, up or down, in the number of excellent departments in his or her institution. It also controls for institutional revenue, age and the scholarly discipline of presidents.

[11] These are 5A*, 5B* and 5A. In RAE 1992 the three top scores were 5A, 5B and 5C. The 2008 RAE has once again adopted a different method of assessment.

3.5 Independent Variable: Presidents' Lifetime Citations

Citations are references to authors in other academic papers as acknowledgement of their contribution to a specific research area. They are used in this paper to measure the research success of each president. Bibliometric information is generally viewed as a reliable indicator of research performance over time (van Raan, 2003) and it compares fairly with peer review (Nederhof and van Raan, 1993); also, RAE results have been shown to correlate highly with bibliometric data (Bence and Oppenheim, 2004; Oppenheim, 1995, 1997a;)[13].

Most academics who go into administrative jobs reduce their research output. This depends, somewhat, on their discipline. The data generated for the purposes of this study make it clear that university presidents accumulate the overwhelming majority (approximately 95%) of their citations before they become institutional leaders.

For this paper the lifetime citations of British university presidents are normalized for discipline[14]. Most important when using citations as any kind of measure is recognition of the huge differences between disciplines. For example, a highly cited social scientist might have a lifetime citation total of around 1200 whereas a molecular biologist could have a score over 12,000. Bibliometric indicators have been used more consistently across the sciences than in the humanities and social sciences (van Raan, 1998). These disciplines publish more journal articles and have a higher prevalence of co-authorship.

3.6 Why Use Citations Instead of Journal Articles?

There is a growing body of work that uses citations to assess intellectual output and productivity (see, Bayers, 2005; King, 2004). Moreover, citation counts are a good predictor of professorial salaries (Hamermesh et. al., 1982) and Nobel Prizes (Garfield and Welljams-Dorof, 1992). An alternative approach is to count an author's published articles and weight by journal impact-factors. However, this presents three problems. First, monographs would be completely excluded from the

[12] Regression equations have been done for improvement in RAE awards right across the grade-5 spectrum, and a similar pattern is found. The tables showing these results -- in all submissions awarded a grade 5 A-E -- are not included in this paper, but can be found in Goodall, 2009.
[13] For an overview of the strengths and weaknesses of using bibliometric data, see Goodall, 2006 and van Raan, 1998.

data[15]. Second, the quality of a journal is a noisy measure of the future impact of individual articles (Oswald, 2007). For example, many highly cited articles are not published in 'Grade A' journals and similarly vice versa. Finally, assigning weight to journal quality through, for example, ISI Impact Factors might not be reliable -- even if they were available -- for papers published 10-20 years ago. Furthermore, impact factors still rely on citations as a way to rank journals.

3.7 Normalizing Citations to P-scores

In this paper, each university president is assigned a normalized citation score, which reflects both the differences across disciplines and their personal citation levels. This score is referred to as the *'P-score' = president's individual lifetime citation score normalized for discipline.* The P-score has been generated by developing a scale that is then used as an exchange rate, normalizing the different citation conventions across disciplines. A description of the normalization process is presented in Appendix C.

The presidents in this study span a number of years, and therefore those who are older have, in principle, had longer to accrue citations. Hence, for example, if the presidents with low numbers of citations can be shown to be significantly younger than those with high life-time scores, age could be influential. However, inspection of the age profile of all leaders in my dataset finds that there are no age differences between those with the highest and lowest citation scores[16].

3.8 Control Variables: Organizational Revenue, Age and Discipline of President

Three control variables have been included in the regression analyses: organizational income, the president's age, and the academic discipline of each president. Allowing for lags, university revenue has been included for years 1992/3 and 1996/7[17] (figures supplied by the Higher Education Statistics Agency in the UK). The income figures include government funded grants, tuition fees and education

[14] Citations data collected October 2005 from ISI Web of Knowledge.
[15] Citations to books in journal articles are recorded in this study.
[16] Age is also not a significant factor in the cross-sectional studies -- see Goodall, 2006, 2009.
[17] The income variable is included for 47 of the 55 universities. This is because no data were available to the author for the 8 University of London colleges in 1992 when the revenue figures for individual colleges were aggregated into one 'University of London' sum.

grants and contracts, research grants and contracts, endowment and investment income, miscellaneous income and income from services rendered.

The age variable has been included by calculating the age of an incumbent president in 1992 and 1996. The academic discipline of a president is defined by creating two fields, the 'sciences' that are coded 0, and the 'social sciences and humanities' coded 1.

4. Results

4.1 What the Leaders Say about Performance in the Research Assessment Exercise

Before looking at the statistical evidence, it is interesting to hear from UK vice chancellors who, in my interview, answered the question: *'How much can a university leader influence their institution's performance in the Research Assessment Exercise and generally raise the research quality of a university?'* The responses are numerous, but a sample are presented below (names are not attributed to statements for reasons of confidentiality -- information on the qualitative data collection process is in Appendix D).

British vice chancellors (VCs) expressed little doubt about the necessity for leaders to be centrally involved in the RAE.

- *"The vice chancellor is the only one in the university who can influence the RAE. A VC must set the quality standards and keep reinforcing them – pushing the quality line up."*

Vice chancellors explained the processes through which a university leader can influence RAE performance.

- *"The VC can have an impact on RAE by creating the right conditions, setting up the right schemes to motivate and attract the best people, offering good facilities and creating the right environment."*

The importance of vice chancellors being actively involved in the recruitment of faculty was a common theme. The following statements were made by three different UK university heads.

- *"You can affect the RAE by appointing and retaining staff. I am involved with all, or most, appointments and promotions. I believe this is very important."*

- *"I spend a large amount of time hiring people and trying to attract them. I became directly involved and managed the process of making appointments, and also internal promotions."*

- *"The RAE is very important in appointment committees and also severance and early retirement committees. Who is entered into the RAE is decided centrally."*

One leader suggested that a VC should be sacked if their university performs badly:

"A university must be prepared for it [the RAE] even though its research strategy cannot be solely designed around it. If a VC messes up in the RAE he or she should be sacked! It is the VCs responsibility to make sure that the process is done efficiently and to the best standard possible."

Vice chancellors interviewed for this study believe they play an important role in how well their universities do in the UK Research Assessment Exercise -- which is the performance measure used in the longitudinal analyses[18]. It is interesting now to find out whether a VC's own level of scholarly achievement, or lifetime citations, is correlated with future RAE outcomes.

4.2 Statistical Results

Here I present evidence showing that universities led by more cited vice chancellors *go on* to perform better in the Research Assessment Exercise. First, I

[18] Because of space constraints only a small number of interview statements have been included.

collect and tabulate information about how each of the 55 universities performed in the Research Assessment Exercises of 1992, 1996 and 2001. As explained above, performance is being measured by attainment of the highest RAE grades (5A*, 5B* and 5A). The data are then analyzed in two different ways. I start by looking at the number of excellent scores each institution acquired in the research exercises in 1996 and 2001. These numbers are then correlated with vice chancellors' (VCs) normalized lifetime citations in time periods 1992 and 1996 -- allowing for a lag. Second, I measure the extent to which each university actually improves its performance, or not, by examining the changes in RAE scores across the three time periods. The figures depicting institutional change in RAE, up or down, are again correlated with earlier vice chancellors' P-scores.

Causality in social science can be more readily tested longitudinally; the action, it might be reasoned, must precede the outcome. Central to the analysis in this paper is the important role of time lags. These allow me to make some judgments about future performance whilst also somewhat protecting against reverse causality. If, for example, I include the lifetime citations of leaders in 2001, and correlate these numbers against performance in RAE from 1992-2001, then the results would not allow any causal relationship to be deduced.

Before presenting the statistical findings, three questions need to be addressed: First, how easy or hard is it to reveal shifts in the performance of a university? The answer is that trying to explain change, or difference, is demanding. Patterns are more easily found in cross-sectional data. Measurement error is intrinsically more of a problem in change equations. This is particularly problematic for social scientists with small sample sizes.

The second question is about the lags in time between a leader's influence and a change in university performance: How long does it take for a vice chancellor or president to alter a university? Specifically, how much time should I allow in the regression equations between the inputs of VCs lifetime citations and the performance outputs of RAE scores? This is not a question that can be answered with complete certainty. Nevertheless, in my data the minimum period is 4 years, between 1992 and 1996 RAE, or 5 years, between 1996 and 2001 RAE. Can a leader increase the number of top departments in the RAE after 4 or 5 years? The evidence presented below does suggest that there is some movement in the shorter time periods. But it is likely that leaders require more time to improve university performance significantly,

where performance is represented in this case by attainment of the highest scores in RAE submissions. Therefore, the later equations that include a *nine year lag* between the input of vice chancellors P-scores (around 1992), and the outcome of RAE grades (in 2001), may offer the most convincing evidence.

The final question pertains to the quality of each university at the start of my analysis. It asks: will the initial strength or weakness of a university not affect the ease with which an institution can change? For example, a university with 95% of its departments with a top grade in 1992 does not have much room for improvement. Alternatively, a university with 1 top department that moves to 2 departments has improved its performance by 100%. Later I perform a test for this potential distortion, and I find that institutions that improve the most are not doing so merely because they had the furthest scope to change.

4.2 Cross-Sectional Analysis with Lags

The descriptive data are given in Table 1. They include means and standard deviations for presidents' citation scores and the university performance variable -- the number of departments that scored an excellent grade in Research Assessment Exercises 1992, 1996 and 2001.

Initial results can be found in the simple cross-sectional bar diagram in Figure 2. The focus here is on the presidents of those universities that made the greatest gains, and the smallest gains, in the number of submissions graded excellent between RAE 1992 and 2001. The presidents' citations -- on the Y axis -- represent the means in P-score between 1992 and 1996. By design, this allows for a lag.

As can be seen in Figure 2, the universities that advanced the most during this period -- increasing their number of excellent-rated departments -- were disproportionately led by presidents with higher lifetime citations. The mean citation P-score of leaders running the UK's top five mover-universities at the start is 13.6 and the mean P-score of those heading the top ten mover-universities is 9.6. However, of the universities that accumulated the least number of improved scores across the nine year period -- indeed some actually reduced their number -- the citation P-score of leaders for both the lowest 5 and 10 universities is 3.1. Therefore, presidents leading the top twenty per-cent of mover-institutions are three times more highly cited, and

those leading the top ten per-cent of mover-institutions have over four times the lifetime citations of those who led the universities that performed least well.

Tables 2 - 7 report the regression equations. These attempt to establish more carefully whether a statistically significant relationship exists between organizational performance, the dependent variable, and president's P-score, among other independent variables. In the following tables the effect of the independent variables is measured by the coefficients, and the level of significance is given by the t-statistic. Results are presented for three time periods. The first is 1992 to 1996, followed by 1996 to 2001, and finally the full 9 years, 1992 to 2001. Given the likely importance of lags, the last of these, incorporating two research exercises that span just under a decade, would seem to be the most robust.

Table 2 gives simple equations where the dependent variable is the level, or number, of excellent departments, or top-fives, in 1996 in the RAE, and reports the effects of the independent variables in 1992.

As can be seen, the P-score of a president in 1992 is statistically significantly related to the number of top-five departments later on in 1996. The coefficient is 0.30 (t-statistic = 2.29) which is significantly different from zero at the 5% level. Table 2 also shows that organizational income is statistically significant at the 1% level. The coefficient is 0.10 (t-statistic = 6.27). But age and discipline of president are not here statistically significant[19].

Table 3 gives instead results for the number of top-five departments in the 2001 RAE and reports the effects of the independent variables in 1996, again allowing for a lag of five years. In 2001 data the P-score coefficient is 0.53 (t-statistic = 3.04) which is statistically significant at the 1% level. Again, the finance variable correlates with organizational performance. The coefficient is 0.09 (t-statistic = 7.28). However, there is no statistically significant relationship with either age of leader or their academic discipline. The size of the coefficient on P-score is somewhat mediated by adding the extra variables (comparing column 1 to column 4 in Table 3).

Table 4 again presents cross-sectional evidence but now with a longer lag. Results are given for the number of top-five departments in the 2001 RAE and the effects on that of the independent variables in 1992. This time I allow for a lag of

[19] When I enter P-score into the equations after the other independent variables, therefore reversing the process shown in these tables, the results stay the same. This holds for all regression equations presented in this paper.

nine years. Here a leader's P-score, the key independent variable, has been averaged between years 1990-94. By averaging P-scores over four years I hope to reduce some measurement error insofar as the results are less likely to be driven by one year of observation. Table 4 reports that P-score is statistically significant -- at the 1% level -- after all independent variables have been included. Again the finance variable correlates with university performance.

In terms of the size of the effect of P-score, the first column in Table 4 illustrates that one extra point on a president's P-score (averaged 1990-1994) raises the number of top-five or excellent departments in 2001 by 0.4. In other words, a hypothetical 10 point move up in a president's P-score is estimated to generate four excellent departments in 2001; or three extra departments when other variables are included. These are, of course, associations rather than clear cause and effect.

Although lags are used, the results so far are fundamentally cross-sectional. Now we turn to longitudinal analysis where the dependent variable is the change, up or down, in performance.

4.3 Longitudinal Analysis

Table 5 gives regression equations in which the dependent variable is the change in the number of top-five, or excellent, departments, in the Research Assessment Exercise between 1992 and 1996. As can be seen in all columns in Table 5, the association between P-score in 1992 and the later performance in 1996 is statistically significant at the 1% level. The coefficient is approximately 0.13 (t-statistic = 3.43). University income does not now, in columns 2-4 of Table 5, have a significant effect on the changes over time in the number of top-five departments. It is likely that money is more significant in equations correlating P-score with the number of top 5 departments, because income is a proxy for the size of an institution. A large university will tend to have more departments. When focusing on the change however, income or size appears less important.

Columns 3 and 4 of Tables 5 show that, again, there is no well-determined effect from the age of a president or the academic discipline to which they belong.

Table 6 shows a slightly different pattern. In 2001 the number of top-fives is statistically unaffected by presidents' P-scores five years earlier in 1996. However, although the coefficients on P-score across the four columns are not significantly

different from zero, they remain positive. Again, there is no significant effect from income or from the age or discipline of a leader.

A statistically significant relationship between performance and leaders' lifetime citations is reinstated again in Table 7 when a longer time perspective is adopted. As suggested earlier, this 9-year interval may be a more realistic reflection of the length of time needed to improve RAE performance. Presidents' P-scores have again been averaged between years 1990-94 as with the previous nine year equation.

As can be seen in Table 7, P-scores are correlated with growth in the number of excellent departments obtained nine years later in the 2001 RAE. The coefficient in the first column of Table 7 is 0.24 (t-statistic 3.27) and statistical significance is established at the 1% level. Noticeably, the coefficient is double that of the 1992-1996 result reported in the earlier Table 5. Finance, age and discipline are not correlated with university performance. In columns 2-4 of Table 7, their inclusion in the regression equation leaves the coefficient on P-score approximately unaffected.

The results presented in Tables 2 through 7 show that a president's lifetime citations score, or past success as a scholar, is significantly correlated with the future number of top grades that a university attains in the RAE. Conversely, university revenue does not affect growth performance. A measure that follows the growth in departments rated excellent may be a particularly appropriate gauge of RAE performance, because excellence must be reached across all faculty in a given unit of assessment.

The results presented in this paper illustrate the relevance of presidents' P-scores when explaining universities' performance in the UK Research Assessment Exercise. In other words, there is evidence consistent with a statistical, and perhaps even causal, relationship between the past level of scholarship attained by a president and the future performance of their university.

4.4 Checking for Distortions and for Reverse Causality

As mentioned above, these kinds of regression equations may 'favor' institutions that have further to move. A test for this is to include a variable controlling for an institution's original position[20]. This check was done by entering

[20] Thanks to Ronald Ehrenberg for this suggestion.

the number of top-five grades that an institution had in 1992 into a regression equation where the dependent variable is the change in top departments from 1992 to 2001. When this is done, the results reveal that there is no difference in the statistical significance of presidents' P-scores, or in the other independent variables of income, age and discipline (table not reported). Therefore, institutions that improve the most are not doing so merely because they had the furthest scope to change.

Checks for reverse causality are done by introducing a series of lags. These allow for a delay between a leader being in place, and the future performance of his or her institution. Another test, in the style of Granger causality[21], can be applied that answers the question: *are today's leaders not merely a reflection of yesterday's performance?* So, for example, a distinguished scholar could join a university after, and possibly as a result of, past good performance. This causal chain is different from my hypothesis that scholar leaders actually improve performance.

To safeguard against this, the leaders' P-scores in 2001 are, as a statistical check, regressed on universities' RAE performance in 1992. In an equation of this type where the independent variable is the number of top-five, or excellent, departments the coefficient is 0.035 (t = 0.80). Thus, encouragingly, there is no statistically significant relationship. This test goes some way to disproving the argument that the cross-sectional correlations, showing that top universities appoint top scholars, are merely a result of assortative matching -- put simply, that top universities select distinguished researchers as a matter of course, or because they can.

The strongest case for a causal interpretation of my data is perhaps Table 7. The nature of the leader in the early 1990s helps predict how that institution will have changed by 2001.

4.5 Measuring Change on Change

A full fixed-effects test to examine the impact of leaders on the performance of universities would be to regress the change in performance on the change in leader. In my study I show, in a number of ways, that those universities that were consistently led by better scholars went on to perform better in attaining the highest scores in the UK Research Assessment Exercise (RAE). The paper cannot completely show that a

[21] Granger and Newbold, 1974.

change in leadership produces a change in performance, because to present such evidence would require an extension beyond the nine years lag included in the data. Early bibliometric data on university leaders are not currently available in ISI Web of Knowledge, the source used in this study. Eventually this problem should be solvable when further data become available[22].

5. Part Two -- Qualitative Evidence

5.1 Why Scholar-Leaders Might Improve the Performance of Research Universities

The quantitative evidence above suggests that hiring scholar-leaders into research universities can result in improved research performance. In this section I will draw upon interview material with US presidents and UK vice chancellors to try to bring us closer to potential explanations about why scholar-leaders might improve the performance of their universities. It is interesting to hear from leaders themselves and to conjecture why it might be beneficial for universities to select presidents with strong research records. The full qualitative material exceeds the space available; therefore, only a representative sample of interviewees' statements appears (for list of interviewees, see Figure 1).

Four explanations emerge from interviews with the twenty-six heads -- that better scholars appear more credible as leaders, that they have expert knowledge of the core business of universities, that they are standard bearers, and finally, that leaders who are scholars signal organizational priorities. Each will be dealt with separately.

5.2 Credible Leadership

"You have to know the game; if not you lack credibility. Being a distinguished researcher gives you legitimacy in either a business school or a university. And legitimacy gives you authority as a leader."[23]

That leaders must be credible to followers was the most common assertion made by those I interviewed. It was suggested that, in the context of a university, an

[22] At the time of writing, the RAE 2008 results had just been released. In future work I hope to explore these new data, although the assessment process is again quite different.

accomplished scholar communicates his or her credibility, and specifically, that he or she shares the same value system and priorities as those who are being led. As suggested by one leader, credibility legitimizes authority. This approach focuses on the social interactions between leaders and their followers[24].

In the words of one US dean:

- *"You need to engage the hearts and minds of faculty. Being a researcher means you have equal status, offer faculty support, speak the same language, have academic resonance and credibility, and finally, trust; trust is very important to have as a leader."*

Credibility can perhaps be defined as an external factor in that it must be assigned by others. It is noticeable that all those who emphasized credibility and intellectual values were leaders with traditional academic backgrounds. None of the non-academic leaders presented these kinds of arguments. The noted educationalist Birnbaum[25] claims that presidential candidates with a traditional academic career path confer the greatest legitimacy. This is particularly true for those being selected into the most prestigious institutions.

One US university president put the same argument in terms of gaining faculty respect:

- *"The rationale for ranking academic excellence very highly is the enormous importance we place on the president having the respect of the faculty. Without that, it is very difficult to lead a research university."*

A president being credible and also having empathy for the life of scholars was viewed as important by a majority of interviewees. Five statements are presented below; the first is from a US president.

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[23] Former UK business school dean and university president.
[24] This reflects the early work of Bass, 1985 and Bennis & Nanus, 1985.
[25] Birnbaum & Umbach, 2001. The importance of 'legitimacy in the academic presidency' is a key theme of Bornstein, 2003, and the idea of credible leadership is also raised by Kouzes & Posner, 2003.

- *"An academic researcher-leader understands the culture of the place and particularly he or she understands the incentives. What motivates faculty and how one can get them to do what you want them to do - which is what leaders have to do."*

A UK vice chancellor said:

- *"It is important that a leader's value system is not too far from the values of those who are being led."*

From a second UK vice chancellor:

- *"Non-researchers do not have an affinity with researchers – they have little understanding of the culture, no credibility and therefore an engagement problem, and, finally, they cannot talk research."*

Again, a US president focuses on shared culture and values:

- *"The best universities tend to have the best faculty and shared values of excellent research and teaching. If the president is a scholar they have a better sense of the culture of the academy and also they are perceived as being better able to create the right climate for academics."*

The link with credibility and power is made by a UK vice chancellor:

- *"Having a relatively distinguished research history makes a difference to the job of VC for two reasons; you carry more weight and authority with colleagues, and second, you have an understanding of the world of research and all the pressures researchers are under."*

One US dean suggested that the benefits of scholarship gave him confidence as a leader:

- *"Being a good scholar means that I can look a Nobel or Pulitzer Prize winner in the eye. It is very important to have been a researcher or to have entered deeply into scholarly enterprise."*

Very often, interviewees stated that credibility is enhanced if the head of a research university is a respected scholar. As suggested earlier, credibility is bestowed upon an individual by others. The next factor suggests that committed scholars have a greater understanding of the core business of universities that arises from their extended period as researchers.

5. 3 Expert Knowledge

"Being a good researcher I have scholarly values, a deep understanding of the academic world and substantial networks"[26]

This factor, expert knowledge, is internal or behavioral. As suggested earlier, I propose that, in the context of a knowledge-intensive organization like a university, having been an expert or top scholar provides one with a deep understanding of the organization's core business, which may in turn helpfully influence the behavior of leaders. It could be argued that this inherent expertise and learning shapes the way she or he sees the world and, therefore, affect a leader's decision-making preferences and priorities[27]. It is also possible that having expert knowledge allows presidents who were better scholars to develop superior strategies for their organization since they may be able to understand universities in ways that others cannot.

One UK vice chancellor refers specifically to his internal knowledge and motivation:

- *"Because I am an academic I am driven by the academy and the development of ideas and knowledge. It is my business. It is not possible for someone external to the academy to understand this."*

[26] A dean from the UK.

[27] This draws from Hambrick & Mason's, 1984, Upper Echelons (UE) Theory. UE theory argues that top managers make strategic choices that are reflections of their own values and cognitions, and that members of the top management team will be influenced in their decision-making by individual and

A statement from a former UK head illustrates this also:

- *"I really know about the social sciences; being an expert in this field helps with being a leader. I have mastery of the subject and therefore I can grasp what is going on."*

As does a comment from another UK vice chancellor:

- *"I am driven by a passion for science and technology. This passion influences my world."*

It is likely that top scholars have prioritized scholarship in their lives, and, furthermore, that they may continue to emphasize activities related to scholarship once becoming a leader. Expert knowledge of the core business may influence a leader's inherent preferences causing a scholar-leader to prioritize, over other activities, those related to research. So, for example, a president may trade off activities so that he or she can perform a central role in faculty appointments and tenure decisions, and may favor the raising of research funds over other forms of income and expenditure. Thus, a leader continues to align his or her strategic preferences with research oriented activities once a scholar becomes head. There is evidence to suggest that strategic decisions which have been prioritized are more likely to yield successful outcomes[28]. One statement from interview points this out:

- *"The best president is he or she whose scholarly priorities don't change."*

The longitudinal results presented earlier might be explained by such factors. The bulk of research money from the UK government is allocated via the Research Assessment Exercise (RAE). For a university to increase or maintain its share requires dedication and focus. The central areas are in attracting new distinguished scholars to an institution and encouraging faculty already in place to produce vibrant research. It is unlikely that a university will perform well in the RAE unless the vice

group demographic factors (such as age, education, functional track and top management team heterogeneity).

[28] See Hickson, Miller & Wilson, 2003.

chancellor makes that objective a priority. Leaders who are better scholars may be more likely to focus on the RAE. This appeared evident from the earlier interviews with UK vice chancellors (section 4.1). The top 10% of institutions that achieved the greatest RAE success over the period 1992-2001 were all led by distinguished scholars. Many institutions also put in place other noted scholars to head-up, internally, the university's RAE strategy[29].

The attraction and retention of outstanding faculty is central to the success of research universities. Interviewees acknowledged that accomplished or up-and-coming professors are attracted to institutions because of other top people already there.

A former UK vice chancellor said:

- *"When I contacted top scholars many would ask, 'Who else is in the department?"*

A second UK head commented:

- *"Good people only ever want to work with other good people."*

One president of a US university puts it differently:

- *"Top scholars can be challenging people. They ask a lot of questions. The alternative is to shelter behind mediocrity."*

Scholar-leaders may be more likely to make it a priority to hire other top researchers into their university. Similarly, if an institution is led by an eminent academic, it may look more attractive to new recruits. This point is clearly made by a former UK head:

[29] The top 5 movers, or 10%, are Cardiff, Bristol, Southampton, Sheffield and York universities. At Cardiff University Brian Smith a cited chemist (VC from 1992-2001) is credited with greatly improving research performance working with his deputy-VC for research, Hadyn Ellis who was a renowned psychologist. At Southampton Howard Newby (VC from 1994-2001) a distinguished sociologist is credited with lifting their RAE performance. At Bristol John Kingman a distinguished mathematician (VC from 1985-2001) appointed Nigel Thrift, an eminent human geographer, who chaired Bristol's Research Assessment Panel from 1997 to 2001 – the period that Bristol most improved in the RAE. The vice chancellor of Sheffield University 1991-2001, was Gareth Roberts an eminent engineer and Fellow of the Royal Society; and finally, York University was led by Ronald Cooke, between 1993-2002, a distinguished geographer.

- *"A leader who is an academic helps to mobilize people. People are much more important in academic institutions than conditions. Everything in a university flows from the academic value of faculty. My priority was to ensure that we attracted and retained the best academics... I spent much of my time attracting good people and trying to keep our top people."*

A similar comment comes from a US dean:

- *"The most important part of the job of dean is the recruitment and retention of top faculty. Appointing good staff is the key to sustaining the position of a business school or university."*

And by a UK vice chancellor:

- *"I have to inspire and motivate people, and to set targets -- to create a supportive environment and crucially to appoint the best people."*

It is interesting to hear from UK heads about how they directly engaged with the Research Assessment Exercise, the performance measure used in the statistical analyses in Part One:

- *"My own research was 5* quality and I was an expert in my field. It is very important to be a good researcher and to look others in the eye when they say they can't do something or are moaning about having to raise research funding."*

These arguments suggest that having expert knowledge of the core business not only influences leader-behavior towards the prioritizing of research and the selection of faculty, but that it may also instill the confidence to assess quality. However, it is not a zero-sum game -- the false idea that more expert knowledge necessarily equals less managerial ability.

5.4 The Standard Bearer

"Leaders are the final arbiters of quality. Therefore it is right to expect the standard bearer to first bear the standard."[30]

A common theme among interviewees was the importance of the leader in establishing a quality threshold. The setting of an organization's academic standards was viewed as a significant part of the function of president or dean. However, as a number of interviewees suggested, if you have not originally met that standard yourself, this may be difficult to enforce. Some presidents and vice chancellors also argued that it is easier to put pressure on others to perform to a high level if you, as leader, are an accomplished scholar.

One former UK vice chancellor stated:

- *"How can you exhort others if you haven't done it yourself?"*

A similar statement was made by another head:

- *"My job is to lead, to represent the university internally and externally and set the quality threshold. By quality-threshold I mean articulate and decide upon what level of quality the university wants to aspire to. When a quality-threshold is established, it sends out a message that no one below the threshold should be accepted into the university; it sets the quality agenda."*

A US president again states that in order to set the standard you must first meet them:

- *"My job involves broad direction-setting and imposing standards. In order to impose standards it is easier if you have first met them yourself."*

A UK vice chancellor focuses on the institution's research ambitions:

[30] US dean.

- *"I feel that as the VC is the one who sets the quality tone for research and the strategy generally, and also is responsible for raising aspirations, it is important that he or she has been a researcher; particularly to raise the research ambition."*

In my sample, a number of UK vice chancellors had continued to do research in the run up to the recent UK Research Assessment Exercise (2008), because, again, they said it set a standard. One UK vice chancellor said:

- *"I continue to do research now both for myself and also the signal that it sends to others. Academics find it hard to complain about combining the pressures of administration and the demands of research when they hear that I am still managing to publish research as VC."*

A second UK head agreed:

- *"I was submitted to the last RAE, and it gave me extraordinary weight, that I could fulfill the role of VC and still submit research into the RAE. It sends a very strong message to the community."*

Thus, if the head of an institution can have this effect, it makes good sense for the leader of a research university to have been a respected scholar. Also, by continuing to do research, a head enforces a second kind of standard, namely, a demonstration to faculty that despite an enormous workload they can still publish. Probably it is easier for social scientists or those in the humanities to continue with their academic work. Scientists who need labs and grant money may not have this option. This is suggested by the comment of a respected chemist who took up a leadership position:

- *"Once a scientist gets 'off the train' it is irreversible."*

Of the twenty-six leaders interviewed, most of whom were from traditional academic backgrounds, many are still publishing.

5.5 Signaling Effect

"Being a researcher sends a signal to the faculty that you, the president, share their scholarly values and general understanding. It also sends an internal signal to colleagues that research success in the institution is important."[31]

Selecting a noted scholar to lead a university may send out a message to internal and also external stakeholders. A university governing body might wish to use the appointment to signal a change in institutional strategy, or, alternatively, to signal that there will be more of the same. This point is made above by a US president interviewed for this study, and also by Shirley Tilghman, President of Princeton, in the Princetonian newspaper: [32]

- *"By having an academic at the helm, the university is stating clearly what it values most highly."*

A former US dean suggests that the signal can come from those who select university leaders:

- "*An appointing board can signal a sound understanding of the culture of a research university by selecting a recognized scholar with administrative ability to a top leadership position"*.

These messages may be important for fundraising, alumni relations and general PR. It is possible that better scholars raise more money. It has been shown that the top universities in the world are led by more-cited scholars (Goodall 2006); these institutions are also the richest in the world. It is quite usual for faculty who are strong scholars to be heavily engaged in institutional fundraising. It was suggested to me by fundraisers that noted scholars express passion and knowledge about their work, which can be motivating to donors. Also, scholarly-presidents can creatively

[31] US university president.
[32] President Tilghman was not interviewed, however she was asked to comment on my work in The Daily Princetonian (October 24, 2005). See Appendix D.

communicate intellectual visions which inspire alumni to give[33]. Maybe this is partially because active researchers have had to consistently raise research funding during their careers.

Alumni may also approve of having famous scholars at the helm. Distinguished people tend to have their work profiled more regularly in the media. Arguably, individuals get positive feelings from hearing or reading about scholars from one's Alma Mater. Alumni also like to know that the brand value of their former university is being retained or improved.

6. Conclusion

This study examines whether university performance is linked to leadership. It uncovers evidence, both quantitative and qualitative, consistent with the idea that leaders who are better scholars may be able to help improve the later research performance of their universities. This lag is important to the possibility of a causal case. By constructing a new panel data set, the paper shows -- in Part One in figures such as Figure 2 and tables such as Table 7 -- that the characteristics of a leader in position today are correlated with the future performance of the organization. The paper's evidence should be treated cautiously. Nevertheless, it suggests that where the workforce are predominantly experts and professionals, it is specialists, not generalists, who should lead[34].

The paper's hypothesis is tested using multiple regression analysis, with university performance in the UK's Research Assessment Exercise (RAE) as the dependent variable, and presidents' scholarly achievement as the key independent variable. The focus is on changes in university performance over a nine-year period. Control variables for university income, presidential age and discipline are used. Although the dataset is inevitably a fairly small one -- it covers a panel of 55 universities and 157 university presidents -- the inquiry is to my knowledge the first of its kind.

[33] I consulted with a number of senior fundraisers for this research project; in particular, I am grateful to Lisa Boudreau at Harvard, Mary Blair at London School of Economics and Paula Marshall a fundraising consultant.

[34] This pattern has also been found in a different dataset. Using data on the outcomes of approximately 15,000 US professional basketball games, it has been shown that top players go on to make the best coaches (Goodall et al., 2008).

The question of why scholar-leaders might improve performance is addressed in Part Two using interview data with twenty-six heads in US and UK research universities. Four key explanations are raised by interviewees: First, scholar-leaders are thought to be more credible leaders in universities. Greater respect is bestowed on distinguished researchers by their academic peers, which enhances a president or vice chancellor's influence. A second argument, one that is internal or behavioral, is that scholar-leaders have expert knowledge. In the context of a knowledge-intensive organization like a research university, having been an expert or top scholar may provide a head with a deep understanding of the organization's core business, which may have some bearing on the behavior of leaders. Third, it was argued that leaders must establish the quality threshold of their institution. The setting of an organization's academic standards was viewed by those interviewed as a significant part of the function of president or dean, and, therefore, one should expect the standard bearer to first bear the standard. Finally, it was suggested that a leader who is an established scholar signals the institution's priorities, internally to its faculty and externally to potential new academic recruits, students, alumni, donors and the media.

This paper argues that in knowledge-intensive organizations, such as research universities, where the core workers are experts, hiring leaders who are also experts may improve organizational performance[35]. It is important to emphasize that scholarship cannot be viewed as a proxy for either management experience or leadership skills. An 'expert' leader must have expertise in areas other than scholarship. Before their step to the top position, most university presidents have gained management experience as provosts, pro-vice chancellors or deans, or by running major research centers or labs[36]. Also, it should not be assumed that all outstanding researchers will inevitably go on to make good managers or leaders. They will not. The central argument in this paper is that where expert knowledge is the key factor that characterizes an organization, it is expert knowledge that should also be key in the selection of its leader. The paper's findings have policy implications for universities, R&D units, and other research and knowledge-intensive organizations. The evidence suggests that there may be a direct pay-off from having leaders who are technical experts in their field.

[35] Other similar organizations are professional service firms, such as law, accounting and architecture practices, R&D units or hospitals – a setting I am currently researching.
[36] This was the case with virtually all of the leaders examined in this study.

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FIGURE 1

Interviews with Leaders in Universities

US UNIVERSITIES

Derek Bok, Former President, Harvard

Kim Clark, Dean, Harvard Business School

Amy Gutmann, President, U of Pennsylvania

Patrick Harker, Dean, Wharton School

John Heilbron, Former Vice Chancellor Berkeley

Jeremy Knowles, Former Dean, Harvard

Paul Nurse, President, Rockefeller U

Henry Rosovsky, Former Dean, Harvard

David Skorton, President, Cornell

Lawrence Summers, President, Harvard

Shirley Tilghman*, President, Princeton

UK UNIVERSITIES

George Bain, Former Vice Chancellor, Queen's U, Belfast

Glynis Breakwell, Vice Chancellor, Bath U

Bob Burgess, Vice Chancellor, Leicester U

Yvonne Carter, Dean, Warwick Medical School

Ivor Crewe Vice Chancellor, Essex U

Howard Davies, Director, LSE

Anthony Giddens, Former Director, LSE

Alan Gilbert, President, Manchester U

David Grant, Vice Chancellor, Cardiff U

John Hood, Vice Chancellor, Oxford U

Andrew Pettigrew, Dean, Bath School of Management

Richard Sykes, Rector, Imperial

Eric Thomas, Vice Chancellor, Bristol

Nigel Thrift, Vice Chancellor, Warwick U

Bill Wakeham, Vice Chancellor, Southampton U

* I did not interview Shirley Tilghman; instead she was asked questions about my research by the Princetonian Newspaper, where statements are drawn from.

TABLE 1
Descriptive Statistics: Data over Three Research Assessment Exercises

Means
(and standard deviations)

Variables	1992	1996	2001
President's lifetime citations normalized into a P-score	5.15 (7.47)	4.62 (5.94)	7.13* (21.56)
Number of excellent departments in the university	5.82 (6.82)	6.13 (7.43)	9.6 (8.13)
# Universities	n = 55	n = 55	n = 55

*One president has exceptionally high citations (Anthony Giddens). When I exclude this observation, the P-score mean is 4.38, standard deviation is 6.92. The highly cited president does not influence the paper's results. The key correlations are not affected by this outlier because the calculations in the paper allow for lags. Hence, only presidents' P-scores in 1992 and 1996 are used. The mean P-score of presidents in 1992 is 5.15 and the mean P-score of presidents in 1996 is 4.62.

FIGURE 2
Universities that Improved the Most in the RAE Between 1992-2001 Were Led by Presidents With Higher Lifetime Citations 1992-1996
(n=55 universities)

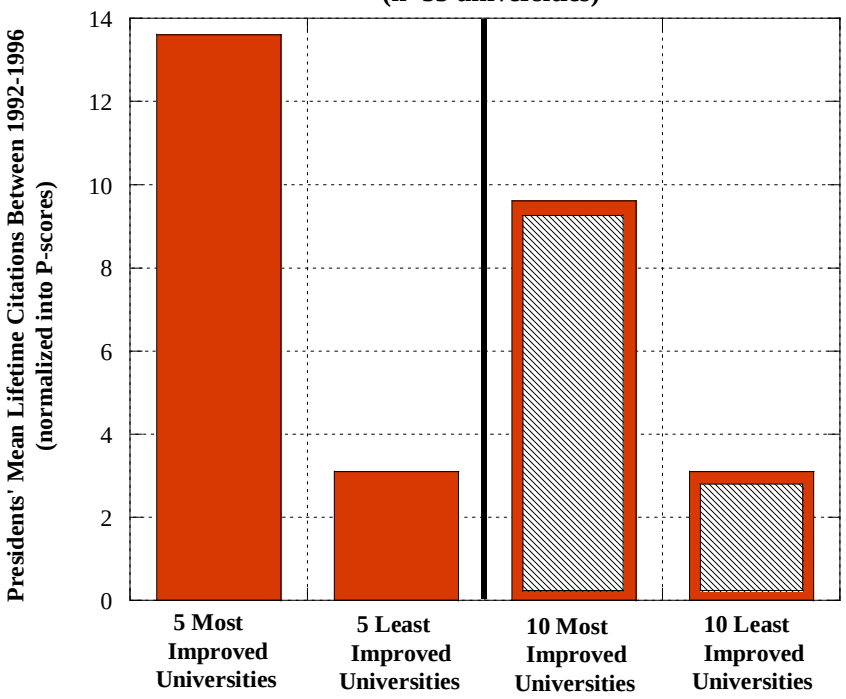

TABLE 2
Regression Equations where the Dependent Variable is the Number of Top Departments in the UK Research Assessment Exercise in 1996

Independent Variables	**1**	**2**	**3**	**4**
P-score of president in 1992	0.30*	0.21*	0.20*	0.20*
	(2.29)	(2.05)	(1.98)	(1.96)
University income in 1992/93		0.10**	0.11**	0.11**
		(6.27)	(6.56)	(6.28)
Age of president in 1992			0.25	0.26
			(1.58)	(1.53)
Discipline of president in 1992[1]				0.30
				(0.16)
R^2	0.09	0.54	0.57	0.57
Constant	4.58	-4.55	-19.05	-19.57
	(3.87**)	(-2.71**)	(-2.05*)	(-1.97*)
n=55				

Coefficients are shown with t-statistics in parentheses; **p<0.01 *p<0.05
0 = Sciences, 1 = Social Sciences and Humanities

TABLE 3
Regression Equations where the Dependent Variable is the Number of Top Departments in the UK Research Assessment Exercise in 2001

Independent Variables	**1**	**2**	**3**	**4**
P-score of president in 1996	0.53**	0.33**	0.33**	0.33**
	(3.04)	(2.58)	(2.54)	(2.49)
University income in 1996/97		0.09**	0.09**	0.09**
		(7.28)	(7.06)	(6.87)
Age of president in 1996			0.04	0.04
			(0.21)	(0.21)
Discipline of president in 1996[1]				0.11
				(0.07)
R^2	0.15	0.63	0.62	0.62
Constant	7.17	-3.08	-5.38	-5.61
	(5.53**)	(-1.84)	(-0.49)	(0.48)
n=55				

Coefficients are shown with t-statistics in parentheses; **p<0.01 *p<0.05
0 = Sciences, 1 = Social Sciences and Humanities

TABLE 4
Regression Equations where the Dependent Variable is the Number of Top Departments in the UK Research Assessment Exercise in 2001

Independent Variables	**1**	**2**	**3**	**4**
P-score of president average 1990-94	0.42**	0.30**	0.29**	0.29**
	(2.70)	(2.61)	(2.57)	(2.54)
University income in 1992/93		0.12**	0.11**	0.11**
		(6.96)	(6.95)	(6.69)
Age of president in 1992			0.20	0.19
			(1.20)	(1.11)
Discipline of president in 1992[1]				-0.14
				(-0.07)
R^2	0.12	0.59	0.60	0.61
Constant	7.48	-2.83	-14.47	-14.21
	(5.76**)	(-1.62)	(-1.48)	(-1.35)
n=55				

Coefficients are shown with t-statistics in parentheses; **p<0.01 *p<0.05
0 = Sciences, 1 = Social Sciences and Humanities

TABLE 5
Regression Equations where the Dependent Variable is the Change in the Number of Top Departments in the UK Research Assessment Exercises 1992-1996

Independent Variables	**1**	**2**	**3**	**4**
P-score of president in 1992	0.13**	0.13**	0.12**	0.12**
	(3.43)	(3.07)	(2.93)	(2.90)
University income in 1992/93		0.00	0.00	0.00
		(0.55)	(0.64)	(0.65)
Age of president in 1992			0.02	0.02
			(0.36)	(0.29)
Discipline of president in 1992[1]				-0.11
				(-0.15)
R^2	0.18	0.20	0.20	0.20
Constant	-0.37	-0.61	-2.01	-1.81
	(-1.09)	(-0.90)	(-0.52)	(-0.43)
n=55				

Coefficients are shown with t-statistics in parentheses; **p<0.01 *p<0.05
0 = Sciences, 1 = Social Sciences and Humanities

TABLE 6
Regression Equations where the Dependent Variable is the Change in the Number of Top Departments in the UK Research Assessment Exercises 1996-2001

Independent Variables	**1**	**2**	**3**	**4**
P-score of president in 1996	0.08	0.06	0.05	0.04
	(1.03)	(0.64)	(0.53)	(0.40)
University income in 1996/97		0.00	0.00	0.00
		(0.97)	(0.86)	(0.59)
Age of president in 1996			-0.00	0.06
			(-0.02)	(0.43)
Discipline of president in 1996[1]				1.97
				(1.64)
R^2	0.02	0.04	0.03	0.09
Constant	3.08	2.18	2.53	-1.44
	(5.07**)	(1.80)	(0.32)	(0.18)
n=55				

Coefficients are shown with t-statistics in parentheses; **p<0.01 *p<0.05
0 = Sciences, 1 = Social Sciences and Humanities

TABLE 7
Regression Equations where the Dependent Variable is the Change in the Number of Top Departments in the UK Research Assessment Exercises 1992-2001

Independent Variables	**1**	**2**	**3**	**4**
P-score of president average 1990-94	0. 24**	0.22**	0.22**	0.22**
	(3.27)	(2.75)	(2.76)	(2.72)
University income in 1992/93		0.01	0.01	0.01
		(1.49)	(1.30)	(1.36)
Age of president in 1992			-0.01	-0.03
			(-0.14)	(-0.28)
Discipline of president in 1992[1]				-0.62
				(-0.46)
R^2	0.16	0.21	0.21	0.21
Constant	2.56	1.17	2.19	3.29
	(4.14)	(0.96)	(0.31)	(0.44)
n=55				

Coefficients are shown with t-statistics in parentheses; **p<0.01 *p<0.05
0 = Sciences, 1 = Social Sciences and Humanities

APPENDIX A.

Universities in the Sample*

1.	Birkbeck College, London	29.	University of Exeter
2.	Brunel University	30.	University of Glasgow
3.	City University	31.	University of Hull
4.	Goldsmiths' College, London	32.	University of Keele
5.	Herriot-Watt University	33.	University of Kent at Canterbury
6.	Imperial College, London		
7.	King's College, London	34.	University of Lancaster
8.	London School of Economics	35.	University of Leeds
9.	Open University	36.	University of Leicester
10.	QMW College, London	37.	University of Liverpool
11.	Queens College Belfast	38.	Loughborough University
12.	Royal Holloway, London	39.	University of Manchester
13.	UMIST	40.	University of Newcastle
14.	University College London	41.	University of Nottingham
15.	University of Wales, Bangor	42.	University of Oxford
16.	University of Wales, Swansea	43.	University of Reading
17.	Wales, Aberystwyth	44.	University of Salford
18.	University of Aberdeen	45.	University of Sheffield
19.	University of Bath	46.	University of Southampton
20.	University of Birmingham	47.	St Andrews University
21.	University of Bradford	48.	University of Stirling
22.	University of Bristol	49.	University of Strathclyde
23.	University of Cambridge	50.	University of Surrey
24.	University of Dundee	51.	University of Sussex
25.	University of Durham	52.	University of Ulster
26.	University Of East Anglia	53.	University of Wales, Cardiff
27.	University of Edinburgh	54.	University of Warwick
28.	University of Essex	55.	University of York

* Aston University was excluded from the sample because of their small number of submissions into the RAE over the 9 year period, making comparison and performance measurement difficult.

APPENDIX B.

Description of the Data (Means) Across Three Time Periods

University Presidents	1980's	1990's	2000-2005
Number of male presidents	54	54	50
Number of female presidents	1	1	5
Age of accession to president	52 years	52 years	53 years
President's lifetime citations normalized into a P-score	4.59	7.80*	5.12
Length of president's tenure	10	8	N/A
Presidents who were scientists	41	28	24
Presidents who were social scientists	7	15	17
Presidents who were humanities	5	10	10
Presidents who were non-academics	2	2	4
# Universities	n = 55	n = 55	n = 55

*One president has exceptionally high citations (Anthony Giddens). When we exclude this observation the P-score mean is 5.06. Omitting this president from the analysis leaves the paper's conclusions unaffected.

APPENDIX C.

Citation Normalization Process

The discrepancies in citation levels across disciplines are demonstrated in the number of new cited references that appear in ISI every week (see over). The sciences generate approximately 350,000 new cited references weekly, the social sciences 50,000, and the humanities 15,000[37]. Although the presidents have different disciplinary backgrounds, that require normalization, they are from a single country, which presumably improves validity when using citations data as a comparative measure. Language biases have been shown to exist within ISI (van Leeuwen et al., 2001) but this should not be a problem with a UK cohort.

The P-score produced through a normalization process makes it possible to do like-for-like comparisons between individuals from different disciplines (Goodall, 2006). To obtain a P-score, the individual presidential citations were hand-counted, totalled, and then divided by the ISI Highly Cited disciplinary thresholds shown above. The thresholds are dominated by science subjects, totalling 19. The social sciences are also covered, but there are only two social science subject areas, namely 'Economics and Business' and 'Social Sciences – General'. Currently, no 'Highly Cited' category exists for authors in the arts or humanities.

The humanities score was created by the author using the previously mentioned 'new cited references' generated by ISI each week. If we divide the social science weekly score of 50,000 by the humanities score of 15,000 we get a figure of 3.33. The author then divided the 'Social Sciences, General' score of 117 by 3.33 which creates a score of 35.13. The number 35 has been used here as the 'Humanities, General' score. Using citation thresholds produced by ISI HiCi, a normalized citation score has been produced in this paper for 23 subject areas.

An effort has been made to try to assign accurately citation numbers to people's names. Though some measurement error must be presumed, two studies that adopt different counting methods -- Seng and Willett (1995) who use a very precise method on the one hand, and Oppenheim (1995) who assigned citations more approximately on the other -- report similar correlations.

[37] Figures date from October 2004.

Citation Thresholds for Scientists in Different Disciplines

Subject area	Scientist
Agricultural Sciences	154
Biology and Biochemistry	780
Chemistry	648
Clinical Medicine	1095
Computer Science	84
Economics and Business	169
Engineering	182
Environment/Ecology	248
Geosciences	433
Humanities, General*	35
Immunology	763
Materials Science	219
Mathematics	130
Microbiology	534
Molecular Biology and Genetics	1234
Multidisciplinary	123
Neuroscience and Behaviour	908
Pharmacology and Toxicology	312
Physics	1832
Plant and Animal Science	292
Psychiatry/Psychology	393
Social Sciences, General	117
Space Science	1301

Thomson ISI Highly cited, available from http://in-cites.com/thresholds-citation.html

* Humanities score created by Amanda H. Goodall (in Goodall, 2006).

Note to Table: The above citation thresholds represent approximately the top 250 authors in each disciplinary field between 1994 - 2004.

APPENDIX D.

Qualitative Methodology

The qualitative data consist of 26 interviews with leaders -- both university heads and deans -- in universities in the US and UK (see Figure 1). Among the primary dataset of 26 interview participants there are 19 university heads, three of whom were retired. Thirteen are UK vice chancellors and 6 are US presidents. In the case of one US head, Shirley Tilghman, President of Princeton, material has been included in this paper even though I did not interview her. My first working paper on this topic[38] was picked up by the 'The Daily Princetonian' (October 24, 2005). The Princeton based newspaper interviewed President Tilghman and also me. This material is used. Interview data with 7 deans are also included. Three were deans of business schools, two in the US and one in the UK -- although 1 former UK vice chancellor also previously led two business schools. Finally, there were two interviews with former deans of the Faculty of Arts and Sciences at Harvard, and one with a former vice chancellor of Berkeley.

With some exceptions, interviews with leaders in the US took place in 2005, between March and May, and UK interviews took place in 2006, between January and June. A semi-structured interview method was used. Interviews were documented by transcribing what was heard by hand into a notebook. They were not tape-recorded. I felt that university leaders would be both more candid and more at ease if a voice recorder was not used. Responses were color coded and grouped into two-clusters. The first level clustered interviewees' responses around interview questions. The second level clustered interview material around the key themes that emerged from the data. In all interviews between the author and university leaders, there was an agreement that no names would be attributed to statements in any materials or publications (unless, in a few cases, approval from participants had first been sought). Therefore, in this paper, no names are assigned to interview statements. Only information on their position -- for example, 'former president' or 'dean' -- accompanies the statements.

[38] Goodall, 2006.