Leadership and the Research Productivity of University Departments

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Abstract

Much of human knowledge is produced in the world's universities. There is currently little scientific evidence, however, on the determinants of productivity in those hundreds of thousands of departments. This study constructs a new dataset on departmental chairpersons in 58 US research universities over a 15-year period. One statistically robust predictor of a department's future research output is found. After adjustment for personal and institutional characteristics, departmental productivity improves when the incoming department Chair is himself or herself highly-cited. A one-SD increase in citations is associated with a 0.5-SD later rise in departmental productivity. Possible interpretations are discussed.

Key words: Citations, scientific productivity, department Chairs, expert leaders.
JEL Codes: I12, I23, M51, M54

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1. INTRODUCTION

This paper is an attempt to contribute to the research literatures on university productivity, the bibliometric role of citations data, and the nature of department leadership. The starting point is a belief that the process of the advancement of scientific knowledge is important but still imperfectly understood. Although research is pursued in approximately 300,000 academic departments, housed in more than 20,000 universities worldwide[1], relatively little is currently known about the factors that help to shape the productivity of departments[2].

This paper studies a panel of U.S. economics departments. The paper's analysis appears to be the first to examine the association between the characteristics of an incoming chairperson and the subsequent research productivity of his or her university department. The level of an individual chairperson's citations is found to be a form of predictor of later departmental productivity. In contrast, the quantity of the person's publications in itself is not longitudinally predictive of later organizational success. [3] Although a longstanding literature examines the potentially substantive influence of citations data as informative signals (for example, Hamermesh et al. 1982, Laband 1986, and Laband & Sophocleus 1985, and more recently Ellison 2011), the current paper's concern appears not to have been previously studied.

As is well known, Chairs (or 'Heads of Department') in the United States play a central role in the academic departments that make up universities. They manage daily operations, hire faculty and professional staff, and work closely with senior university administrators, most of whom were themselves once departmental heads. However, because faculty often view the position as a poisoned chalice, these chairpersons can be reluctant leaders, who are selected

[1] Cybermetrics Lab, Consejo Superior de Investigaciones Científicas (CSIC), Spain.
[2] Novel recent work by Adams & Clemmons (2011) explores a different mechanism than the one studied here.
[3] We caution the reader from the outset that our study is not able to establish causality in the way a randomized controlled trial can (Antonakis, Bendahan, Jacquart & Lalive, 2010). It is instead in the spirit of the 'prospective' analysis common in medical science. We return to this issue below.

through moral persuasion and a rotation system that sometimes depends as much on a scholar's age as aptitude for the job (Clotfelter & Rothschild 1993, Ehrenber 1999; 2003).

The aim of this study is to examine the statistical links, in the spirit of Granger causality, between the characteristics of incoming Chairs and the later scientific productivity of their departments. First, data are collected on 169 chairpersons in 58 US university departments over 15 years, for one of the largest university disciplines, and one that sits between the mathematical sciences and non-mathematical social sciences, namely, the field of Economics. Second, over the course of several years, measures of subsequent departmental research success were carefully collected and checked using diverse websites and extensive hard-copy materials. The dependent variable in the regression equations is the change in Economics departments' research output, after the Chair has been appointed, which is constructed as a measure of the relative improvement in departmental productivity. Several independent variables are controlled for, including institutional variables such as income and federal grants, and Chairs' other characteristics, such as their gender, experience and publications. The results suggest a concave relationship between a Chair's citations and the subsequent department performance.

In the next section of this paper we connect the study with the relevant literature and propose a testable hypothesis. The data and descriptive statistics are presented in Section 3, and the econometric analyses and results follow in Section 4. Finally, in Section 5 we revisit the literature and discuss possible explanations for our results.

2. BACKGROUND AND HYPOTHESES

There is a growing research literature on the nature of scientific production and the importance of effective leadership in its success[4]. Recent work suggests that the management of research enterprise has become more complex as modern scientific study is increasingly produced by teams, that have grown in size, are more likely to involve multi-university collaborations, that are ever more geographically dispersed (Adams, Black, Clemmons & Stephan 2005, Wuchty, Jones & Uzzi 2007, Jones, Wuchty & Uzzi 2008). It is not surprising then that management practices, such as rewards and incentives, and research evaluation processes, are found to be associated with the performance of research teams (see Van der Weijden, de Gilder, Groenewegen & Klasen 2008). Academic departments frequently house many (ever-evolving) research teams and the head of these units must manage a larger, more heterogeneous group of faculty who have a broader mission than pure research.

The role of academic departments, and the Chairs who manage them, is particularly critical in research universities that tend to be decentralised with devolved powers going to departments. Their important function is highlighted in a new study that assesses the effect of management practices on the performance of universities (McCormack, Propper & Smith 2013). McCormack, Propper & Smith (2013) examine management procedures in 112 UK universities using the measure of management quality tool developed by Bloom and Van Reenen (2007). McCormack and colleagues (2013) interview 248 department Chairs in the disciplines of Business, Computer Science, Psychology, and English. They find that the quality of management practices can be directly linked to better performance in both research and teaching. The result holds for all types of universities – research or teaching focused, new or old. Of particular relevance to our study is their finding that it is management practised at the level of

[4] Early studies that modern work builds on includes: Pelz, 1956, Andrews & Farris 1967, Blume & Sinclair 1973, among others.

academic departments, not by the centralised human resources, which matters most to research and teaching performance.

Beerkens (2013) reports a similar finding in Australian universities that have been subject to increased competition by government since the mid-1990s. She uses a research management index that aggregates a number of management practices at the institutional, school and individual level. She finds that universities with intensive research management systems are associated with greater research productivity.

A small number of studies have looked at the influence of distinguished scholars on the productivity of their peers and co-authors. Azoulay, Zivin, & Wang (2010) found that the sudden death of a 'superstar' researcher led to the decline in collaborators' quality-adjusted publication rates. Oettl (2012a,b) builds on this work by looking at the social factors that may explain how star scientists affect others. In academic papers produced by highly productive researchers, Oettl assesses the number of acknowledgments to others as a measure of 'helpfulness'. He then examines the future productivity of collaborators following the death of distinguished co-authors. When scientists who acknowledge many people in their academic papers die – the 'highly helpful' – the quality of co-author's papers declines; however, among the collaborators working with top scientists who acknowledge few, productivity is unchanged by their death (Oettl 2012a,b).

Our study focuses on leadership. It builds on earlier longitudinal research using a panel of universities (Goodall, 2006; 2009a,b) that identified a relationship between the research productivity of a university president (over a lifetime) and the research performance of their institution (in later decades). The presidents' study -- one that argued for the idea of 'expert leaders' -- found that presidents with higher levels of life-time citations were associated with universities that went on to perform the best a number of years later.

Chairs generally serve at the discretion of a senior manager (e.g. dean, provost, president) and prior work suggests that there is a systematic pattern to who holds the position. For example, department chairs are disproportionately likely to be white and male, although women and minorities have recently been increasing in number (Carroll & Wolverton 2004, Conrad, Carr, Knight, Renfrew, Dunn & Pololi 2010). It is not unusual for senior administrators to select Chairs who have either undergone a decline in research productivity or made fewer research-specific investments over their careers (McDowell, Singell & Stater 2009, McDowell, Singell & Stater 2011), although it is less common in Tier 1 research universities that assign greater weight to the research productivity of potential departmental Chairs (Moore, Newman & Turnbull 2003; Ness & Samet 2010, Ehrenberg 1999).

Our central research focus can be expressed in the following hypothesis.

Hypothesis: *Academic departments led by Chairs who have accomplished research careers are associated with improved research performance.*

3. DATA AND BASIC STATISTICS

Data are collected on 169 chairpersons in 58 US economics departments over a fifteen-year period, between 1995 and 2010[5]. All sampled chairs are observed in each year following his/her appointment and through the year following the end of the chair term. For instance, a chair whose term encompasses the period beginning Fall 2001 through the end of Spring 2004 (i.e., a three-year appointment) would be observed in our data in the years 2002, 2003, 2004 and 2005. On average, each sampled chair is observed in 4.27 temporal periods. The independent

[5] In the 58 departments, there were a total of 295 individuals who served as either a permanent or interim chair between 1995 and 2010. Our sample excludes all interim chairs, all chairs who were appointed before 1995 or after 2007, and all permanent chairs whose observed chair term (for whatever reason) was less than two years.

variables in the regression equations include career and demographic information about each Chair, and our dependent variable includes measures of subsequent departmental research success. Variable definitions described below and presented in Table 1.

(INSERT Table 1 HERE)

3.1 Dependent Variable

The dependent variable in the model is the change in Economics departments' research output after the Chair has been appointed, which is a measure of the relative improvement in departmental productivity (see Table 1: Variable Definitions). Specifically, departmental research success is calculated as the share of total weighted US Economics Department publications (i.e. 1/n and quality index) measured between the first year (t=0) of the Chair's appointment and the subsequent observed year t, where research output in any specific year t is measured by a 3-yr moving average in years t-1, t, and t+1. As an illustration, the dependent variables associated with a chair whose appointment begins in 2001 and ends in 2004 would be as follows: in the 2002 observation, the dependent variable is measured as the department's share of total Economics Department publications in 2002 minus the share in 2001; in the 2003 observation, the dependent variable is measured as the department's share of total Economics Department publications in 2003 minus the share in 2001; in the 2004 observation, the dependent variable is measured as the department's share of total Economics Department publications in 2004 minus the share in 2001; and in the 2005 observation, the dependent variable is measured as the department's share of total Economics Department publications in 2005 minus the share in 2001. The dependent variable uses publications data (collected annually over the years 1995 through 2010) from 11 of the "most-selective" journals. These include: American Economic

Review, Econometrica, Economic Journal, Economica[6], International Economic Review, Journal of Economic Theory, Journal of Monetary Economics, Journal of Political Economy, Quarterly Journal of Economics, Review of Economics and Statistics, and the Review of Economic Studies. Only data relating to full articles are collected, thus excluding comments, replies and other such shorter forms of communications.

Table 2 presents a ranking of Economics departments over the 15 years (1995-2010) using our dependent variable -- the mean annual research output of total weighted publications authored by individuals with an affiliation in a US Economics department (for the need to be cautious about such rankings, see Laband 2013). Six institutions included in Table 2 are not used in the empirical analysis because: a) no Chair was appointed after 1994 for which at least 3 consecutive years can be observed (Arizona State University and Ohio State); b) issues related to the availability of our university revenue variable, Integrated Postsecondary Education Data (Dartmouth and Rutgers); and c) there were no clearly delineated Economics departments (Caltech and Cornell).

(INSERT Table 2 HERE)

3.2 Independent Variables

Our independent variables include information about the Chairs and their institutions (see Table 1). We include three measures for the Chair's research output, which is our key explanatory variable: Chair's citations represent the cumulative number of citations made to the Chair's five most highly cited articles published prior to his/her Chair appointment (measured as a citations total in the year 2012).

[6] The inclusion of Economica may look surprising, but this is for the historical reason that it was an important journal in the early years in our data collection period.

We also control for the number of years since each of the Chair's five most-cited papers were published (the total number of years are averaged). Finally, we include Chair's cumulative number of total weighted journal publications measured to year t. The weighted measures convert page counts to American Economic Association-equivalent pages, use the 1/n rule for co-authored articles, and apply a quality indexing using the journal "Impact Factors" provided in the various annual editions of the Social Sciences Journal Citation Reports.

Further information about Chairs' characteristics are included in the regressions: gender, whether they were foreign-born, their total experience measured as years since PhD, the years spent at each university, the number of institutions in which he or she had worked, and finally, we include a set of dichotomous variables indicating the Chair's research field (i.e. microeconomics, macroeconomics, history/thought, monetary, quantitative, public finance, international, agriculture/environmental, industrial organization, labor, other).

Controls for the nature of each institution are also incorporated (see Table 1). These measure the department's research output at the start of the Chair's term, the size of each department (we include a proxy for the number of economics PhDs[7]), and the wealth of each university. To capture trends in the US academic markets for economists, we include variables that measure the Chair's institution's share of economics publications that do not go to Economics departments (i.e. business schools), and the share of top publications assigned to authors not affiliated with a US Economics department. Finally, we include a set of dichotomous variables indicating the calendar year (i.e. 1995, 1996, 1997 … 2010).

(INSERT Table 3 HERE)

[7] It might be thought that we should control for the change in the size of department, but we wish to treat that as endogenous to the success of the Chairperson.

4. ECONOMETRIC ANALYSIS AND RESULTS

Summary statistics are presented in Table 3. Table 4 reports the study's key findings. Each rightward column introduces additional controls to a base specification in Column 1 that includes a quadratic in citations as well as the department's research output at the start of the Chair's term. For reasons of brevity, the results are condensed into a single table (a number of alternative variants have been tested and are available upon request). Clustered standard errors are used for the reported t-statistics in parentheses.

In Model 1 of Table 4, a variable for Chair's citations is statistically significant at the 5% level; the coefficient is 0.0001 and the t-statistic is 2.12. The coefficient on the quadratic term (of -0.0624) is negative and significant at the 5% level. It follows that the relationship between a department's research output and a Chair's research citations is estimated to be concave from below.

(INSERT Table 4 HERE)

The curvature can be seen in Figure 1. Departmental performance, shown on the x-axis, maximizes when a Chair has approximately 9,100 citations. With a mean citation number of 2,153 and a standard deviation of 2,873, it is unclear how seriously this exact turning point itself should be treated as there are only 10 departmental heads who have citations in excess of 9,100 (Ioannidis, 2010). Nonetheless, the finding of some form of diminishing returns to a Chair's citations appears to be a robust statistical conclusion.[8] Model 1 also suggests mild evidence that a department's research productivity may exhibit reversion to the mean. The coefficient on a department's research output at the start of a Chair's term is -0.0861 with a t-statistic of -1.86.

[8] We have experimented with other nonlinear functional forms.

(INSERT Figure 1 HERE)

A natural hypothesis is that what matters is a department head's own publishing productivity. Thus, Model 2 introduces controls for the total number of weighted publications and the timing of citations. Importantly, the magnitude, sign, and significance of both the level and quadratic terms on Chair's citations are not affected by the introduction of these controls. Moreover, the coefficient on the level and quadratic terms for the total number of weighted publications are insignificant. This finding implies that it is not the quantity of papers published by a Chair that matters but instead the extent to which the Chair's work has been recognized through cited references to his or her research[9]. In addition, the coefficient on the average number of years since each of the Chair's most-cited papers were published is insignificant and has no effect on the link between the person's citations and the department's research productivity.

Model 3 introduces demographic attributes and other aspects of a Chair's career into the empirical specification. Again, the broad conclusions with regard to the positive and diminishing effect of a Chair's citations on department research output remain, and there is some evidence that the effect actually increases in magnitude and statistical significance. The coefficient is 0.0002, and the t-statistic is 2.89, significant at the 1% level. In addition, now the coefficient on the number of years since the Chair's most cited work is negative and significant at the 10% level, suggesting that Chairs whose reputation is built on more recent work are relatively more effective at improving a department's productivity.

The coefficients on most of the newly introduced controls in Model 3 are insignificant at traditional levels (i.e., the controls for gender, foreign-born, Chair's years at current university,

[9] As an extra check we include a control for the Chair's own publications during his/her term as department head. We found no significance attached to the chair's "own contribution" control.

and number of institutions where Chair has worked). However, there appears to be a non-linear, statistically significant effect associated with experience, suggesting a Chair's years since PhD has a positive net effect after approximately 20.5 years of experience. In other words, all else equal, the tradition of putting more senior faculty in the position of Chair is consistent with a raising of a department's research productivity, although the impact here is smaller relative to the quality of the Chair as measured by citations.

In Model 4 we include a number of variables to control for the size of the Economics department and for university characteristics (see Table 1: Variable Definitions). In general, the conclusions drawn from the previous models are unaltered, although the mean-reversion effect related to departmental productivity increases both in magnitude and significance in the more fully specified model. Many of the newly introduced institutional variables are significant at traditional levels. Specifically, the share of publications to non-US Economics departments has a significantly negative effect; articles that are published to authors outside the US Economics departments reduce the available pool. The institution's share of Economics publications that go to faculty based in non-Economics departments (e.g., business and policy schools) in the Chair's institution is significantly positive; this result suggests a possible complementarity between productive schools that hire economists and Economics departments. The Total Economics PhDs granted at the Chair's university' measures the number of Economics PhDs conferred over the years 1995-2010, which is a proxy for the size of the department. As expected, the coefficient is positive and significant, which suggests that larger departments have higher overall productivity.

The final two variables introduced in Model 4 control for university income. They use data collected from the Integrated Postsecondary Education Data System (IPEDS). The penultimate row has the total current funds in year t. This variable comprises revenues from

tuition and fees, government appropriations (federal, state and local), private gifts, grants and contracts, endowment income, sales and services of educational activities, "auxiliary enterprises", hospitals, "other sources", and "independent operations". The introduction of university income into Model 4 does not alter the previous results. The insignificance of the financial variable in Model 4 suggests that change in departmental quality -- research output -- is not closely tied to aggregate university income. However, perhaps somewhat surprisingly, the Chair's university's share of Federal grants in year t is negative and marginally significant.

The four specifications in Table 4 demonstrate that the citations curve relationship is robust and economically significant. First, evidence for a longitudinal link between a Chair's citations and the later research output of the department is not strongly influenced by changes in the detailed econometric specification. Second, the last row of Table 4 presents the number of citations at which the quadratic reaches its maximum in each model. The point at which the curve turns is numerically approximately the same, at between 9100 and 9800 lifetime citations, across the four columns. If taken literally, the implied effect of Chairs is large. A one standard deviation rise in a chairperson's citations (from a base of zero citations) is associated with a later improvement of approximately one half of a standard deviation in the department's later research productivity. Finally, one last possible criticism is that highly cited Chairs might be found more often in departments with faster growing shares of publications because of a potential willingness of highly cited Chairs to go into leadership positions where department productivity is growing (and not because the highly cited Chairs' brought about the increased productivity). A test was done for this, and no evidence found for it. More exactly, an extra right-hand side variable, in Department Trend, was added to the main econometric specification. This variable was constructed using the coefficients for a linear time trend in department share of publications for each of the economics departments in the sample. The inclusion of this Department Trend

variable did not affect the existence of a quadratic curve in Chair citations. Detailed specifications are available upon request.

Because our study is in the spirit of Granger causality, we wish to emphasize extreme caution in causal interpretation. Nevertheless, in this important area, in which real-life decisions have necessarily to be taken every day by Deans around the world, and about which so little formal evidence exists, the patterns found in this analysis may be of practical interest and may act to spur further research.

5. CONCLUSIONS AND DISCUSSION

The underlying determinants of research productivity are not perfectly understood. Little, in particular, is currently known about the characteristics of successful leaders in the thousands of academic departments that make up the world's universities. In what appears to be the first study of its kind, this analysis is an attempt to compile a detailed new dataset on, and examine the statistical links between, the characteristics of incoming Chairs and the later scientific productivity of their departments.

The paper's results should be treated cautiously. Tools used in natural experiments such as death of a leader (e.g. Jones & Olken 2005) are not possible in our setting because so few Chairs die in post. We are therefore careful -- we wish to emphasize -- not to give a definitive causal interpretation to these patterns in the data. Nevertheless, the econometric analysis finds that one of the very few longitudinal predictors of a department's future research success is the cumulative number of citations to the incoming Chair's own research (that is, the Chair's research done prior to his or her appointment as head of department). This result appears statistically to be a robust one, which suggests it may repay further scrutiny. For example, it holds after controlling for a large variety of factors, including the prior success of the university

department, and institutional variables such as income and federal grants, and variables for Chairs' other characteristics, such as their gender, work experience, and publications. For brevity, we have concentrated our findings into a single table (Table 4). However, a number of variants, with the same conclusion, have been tested and are available upon request. Statistically, it is the Chair's total citations that seem to matter; there is no detectable statistical effect from a Chair's publications.

What might be the mechanism through which Chairs could influence the research output of academic departments? And how might this depend upon citations to their own research? Oettl shows that the death of star researchers who acknowledge many people on academic papers – a measure of helpfulness – has a later effect on the productivity of co-authors (2012a,b). In contrast, scholars who acknowledge few, leave collaborators unaffected when they die. Interestingly, the study also reports that academic paper acknowledgments are correlated with authors' citations. This may be down to sycophancy, although one might expect this characteristic to be less common in research stars. In a later study, Agrawal, McHale, and Oettl (2013) examine the effect of star researchers on the productivity of 255 evolutionary biology departments over a twenty year period. The authors find that the arrival of star researchers attracts subsequent high-quality scientists, which has the most significant effect on future departmental productivity. This finding was strongest in mid-ranking universities. These studies may help us to understand our key finding – that highly cited department Chairs are associated with better future research performance. A Chairs' research citations may signify that they are high on helpfulness (Oettl, 2012a,b), and also, that they are able to recruit other good scholars to their departments (Agrawal, McHale & Oettl 2013). Moreover, academics who have had successful research careers may behave differently when they become department Chairs. Interviews with university presidents (Goodall 2009a,b) revealed that scholar-leaders found it

easier to recruit and retain other top scholars. It was argued there that this may be because of reputational factors (Hamermesh & Pfann 2012), or because a head who is a cited scholar signals to potential recruits that he or she understands how to create the right incentives and work environment for other research-focussed academics (Andrews & Farris1967; Goodall 2009a,b).

McCormack, Propper & Smith (2013) identify the key areas associated with university performance as recruitment, retention, and promotion. McCormack and colleagues, show, in UK universities, that departments which are better managed demonstrate better performance in both research and teaching. Their finding holds across all types of universities, and because of the decentralised nature of academic institutions, they note that it is practices at the department level, not within centralised human resources, that seem to matter most. Importantly, they conclude, as we do, that the results are not driven by differences in resources. Azoulay, Zivin, & Manso (2011) compare outputs from researchers at the Howard Hughes Medical Institute (HHMI) with those funded through the National Institute of Health (NIH). While they do not focus on leadership in these groups, they do call attention to management practices that are associated with high-impact papers. Azoulay and colleagues find that HHMI tolerates early failure, is prepared to reward long-term success, and gives researchers a great deal of autonomy; by contrast, recipients of funding from the NIH are exposed to shorter review cycles, and expected to produce outputs that are predefined, and early failure is tolerated less. The authors show that HHMI investigators produce more novel and more highly cited papers than the comparison group funded by NIH (Azoulay, Zivin & Manso 2011). Given the department Chairs' result, it would be interesting to know whether the decision-makers in the Howards Hughes Institute were themselves more cited researchers than their peers in the National Institute of Health.

As suggested above, our result is consistent, at a different level of aggregation, with an earlier longitudinal analysis of university presidents (Goodall, 2009a,b). The suggestion that

leaders and followers should share equivalent levels of technical expertise has also been examined previously in different settings – for example in basketball (Goodall, Kahn & Oswald, 2011) – and in early cross-sectional studies (e.g. Andrews & Farris 1967, Barnowe 1975, McAuley, Duberley & Cohen 2000, Mumford, Marks, Connelly, Zaccaro & Reiter-Palmon 2000). Mumford, Scott, Gaddis, & Strange (2002) summarize these findings: they argue that technical and creative problem-solving skills are necessary when leading creative people, and that the evaluation of researchers and their ideas is best done by individuals who share their competencies. Also, leaders who have the same creative and technical abilities as their followers can communicate clearly and articulate the goals of the organization (Mumford et al., 2002).

The issue of why it is that cited work appears to be such an influential statistical signal cannot be definitively answered by our study. It seems to deserve to be considered, perhaps with a mixture of qualitative and quantitative methods, in future research.

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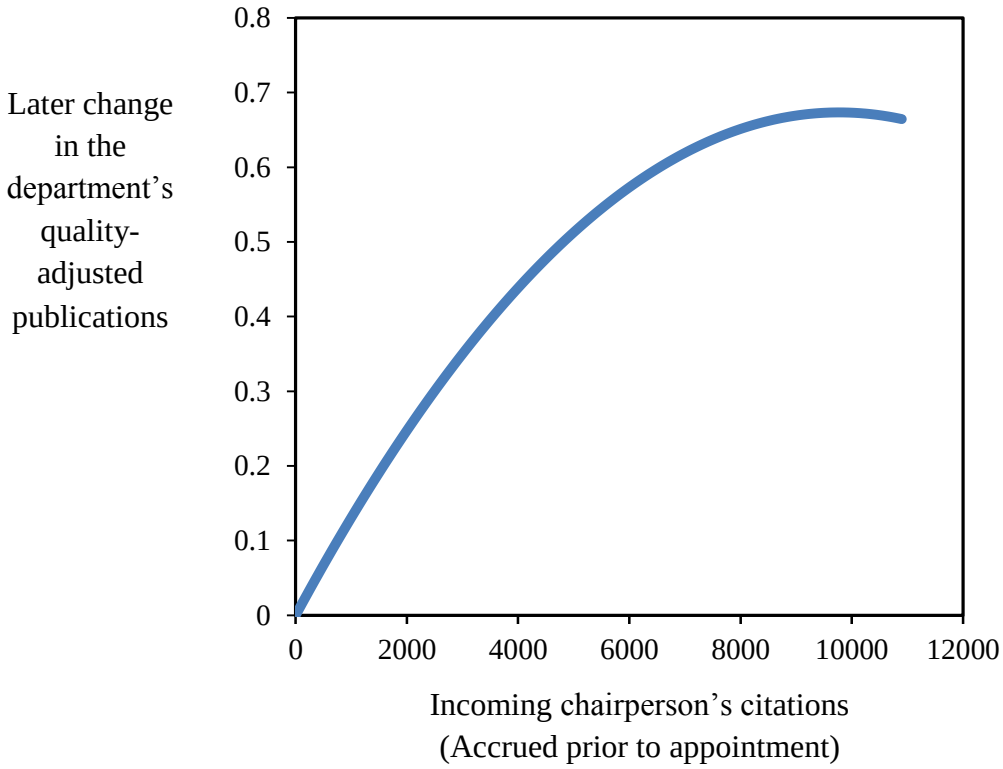
FIGURE 1
The Later Change in Research Output of US University Departments as a Function of the Incoming Department Chair's Citations



Notes: (i) Only 10 of 169 Chairpersons had lifetime citations above the turning point of 9100 citations. (ii) This curve is based on Column 1 in Table 4. (iii) The level of research output is measured as a 3-yr moving average.

TABLE 1
Variable Definitions

Dependent Variable

Change in department's research output: The change in a department's share of total US weighted economics publications (i.e. 1/n and quality index) measured between the first year (t=0) of the Chair's appointment and the current year t, where research output in year t is measured by a 3-yr moving average in years t-1, t, and t+1.

Publications data is collected annually over the years 1995 through 2010 from the following select journals: American Economic Review, Econometrica, Economic Journal, Economica, International Economic Review, Journal of Economic Theory, Journal of Monetary Economics, Journal of Political Economy, Quarterly Journal of Economics, Review of Economics and Statistics, and the Review of Economic Studies. Only data relating to full articles are collected, thus excluding comments, replies and other such shorter forms of communications.

Independent Variables

(1) Chair's research output

Chair's citations: The cumulative number of citations made to the Chair's five most highly cited articles that were published prior to his/her Chair appointment (measured in 2012).

Number of years since Chair's most cited work: The number of years since each of the Chair's five most cited papers were published; the total number of years are averaged.

Chair's total weighted publications: Chair's cumulative number of total weighted (i.e. 1/n and quality index) journal publications measured to year t.

The weighted measures convert page counts to AEA-equivalent pages, use the 1/n rule for coauthored articles, and apply a quality indexing using the journal "Impact Factors" provided in the various annual editions of the Social Sciences Journal Citation Reports.

(2) Chair Characteristics

Female Chair: Dichotomous variable = 1 if the Chair is female.

Foreign-born Chair: Dichotomous variable = 1 if the Chair has a non-US birthplace.

Chair's years since PhD: The number of years since the Chair received his/her PhD.

Chair's years at university: The number of years that the Chair has worked at the university prior to his/her Chair appointment.

Number of institutions where Chair has worked: The number of institutions the Chair has had a permanent appointment measured from the PhD year to the year of the Chair's appointment.

(3) Institution Controls

Department's research output at the start of the Chair's term: The department share of total weighted US economics publications in the first year of chair's term (this is an average of weighted publications in the year immediately prior to the Chair appointment, in the year of the appointment, and the first year after).

Share of world publications to non-US Economics departments: The share of all weighted publications in year t that are authored by individuals with a non-US economics department affiliation over the years 1995-2010.

Institution's share of economics publications to business and policy schools: The Chair's institution's share of all weighted publications in year t that are authored by individuals in a US non-Economics department (e.g. business schools, policy schools, etc.) over the years 1995-2010.

Total economics PhDs granted at Chair's university: The total number of economics PhDs granted by the Chair's university over the years 1995-2010.

University revenue: Total current fund revenues in year t (millions). This variable includes: tuition and fees, government appropriations (federal, state and local), private gifts, grants and contracts, endowment income, sales and services of educational activities, "auxiliary enterprises", hospitals, "other sources", and "independent operations". Data collected from the Integrated Postsecondary Education Data System (IPEDS).

University's share of federal grants: The Chair's university's share (%) of the total (i.e., in sampled institutions) federal grants in year t. Data collected from the Integrated Postsecondary Education Data System (IPEDS).

(4) Field dummies

Set of dichotomous variables indicating the Chair's research field (i.e. microeconomics, macroeconomics, history/thought, monetary, quantitative, public finance, international, agriculture/environmental, industrial organization, labor, other).

(5) Year dummies

Set of dichotomous variables indicating the calendar year (i.e. 1995, 1996, 1997 … 2010).

TABLE 2
Economics Department Rankings

Economics Department Rankings based on the Mean Annual Research Output of Total Weighted Publications Authored by Individuals with an Affiliation in an Economics Department at a US University (publication counts measured over 1995-2010 in 11 select journals)[1, 2]

	Annual Research Output In All Years 1995 through 2010					Aggregate Research Output Shares in the Years		
	Rank[3]	Mean	St. d.	Min	Max	1995-02	2003-10	Change
Harvard	1	7.72	1.50	5.22	10.40	7.53	7.86	0.32
M.I. T.	2	7.03	1.49	4.39	9.99	7.85	6.45	-1.40
Princeton	3	5.33	2.06	2.07	8.12	5.76	4.76	-1.00
Univ. of Calif., Berkeley	4	4.32	2.21	0.73	8.45	3.14	5.76	2.61
Chicago	5	4.23	1.96	2.09	8.98	4.76	3.61	-1.14
New York University	6	3.67	1.44	0.93	6.31	3.24	4.07	0.82
Yale	7	3.44	1.44	1.50	6.60	3.22	3.63	0.40
Stanford	8	3.38	1.56	1.26	7.58	2.60	4.39	1.78
Northwestern	9	3.25	1.12	1.60	5.83	2.65	3.86	1.21
Pennsylvania	10	3.16	1.27	0.97	5.33	3.08	3.02	-0.06
Univ. of Calif., Los Angeles	11	2.91	1.09	1.14	4.13	2.33	3.66	1.32
Columbia	12	2.67	1.56	1.02	5.49	1.99	3.64	1.64
Michigan	13	2.17	0.86	0.76	3.85	2.41	1.82	-0.59
Univ. of Calif., San Diego	14	2.15	1.32	0.91	6.01	2.26	1.90	-0.36
Wisconsin	15	2.06	0.97	1.04	4.88	2.24	1.81	-0.43
Brown	16	1.98	0.89	0.61	4.02	1.82	2.16	0.34
Minnesota	17	1.74	1.04	0.59	5.03	1.65	1.82	0.17
Boston University	18	1.71	0.80	0.68	3.01	2.14	1.17	-0.96
Maryland	19	1.55	0.97	0.39	4.47	1.15	1.82	0.66
Texas, Austin	20	1.24	0.88	0.18	3.65	1.80	0.69	-1.10
Rochester	21	1.24	0.58	0.41	2.45	1.61	0.88	-0.73
Cornell	22	1.17	0.50	0.15	1.89	1.24	1.04	-0.20
Cal Tech	23	1.15	0.75	0.00	2.47	1.06	1.32	0.26
Duke	24	1.11	0.60	0.36	2.27	0.74	1.54	0.79
Ohio State	25	1.11	0.48	0.28	2.02	1.25	0.90	-0.34
Dartmouth	26	0.99	0.69	0.00	2.35	0.70	1.31	0.61
Johns Hopkins	27	0.96	0.55	0.21	2.04	1.15	0.70	-0.45
Carnegie-Mellon	28	0.90	0.41	0.00	1.71	0.71	1.09	0.38
Pittsburgh	29	0.90	0.68	0.09	2.23	1.10	0.61	-0.49
Penn State	30	0.90	0.53	0.21	2.02	0.92	0.85	-0.07
Illinois	31	0.86	0.61	0.06	2.36	0.96	0.84	-0.12
Univ. of Calif., Davis	32	0.85	0.52	0.13	1.90	0.83	0.91	0.07
Virginia	33	0.83	0.42	0.12	1.64	1.16	0.56	-0.59
Boston College	34	0.78	0.41	0.25	1.66	0.72	0.87	0.15
Georgetown	35	0.77	0.56	0.00	1.84	0.75	0.81	0.06
USC	36	0.75	0.59	0.05	2.38	0.66	0.73	0.06
Iowa	37	0.71	0.53	0.00	2.19	0.97	0.42	-0.54
Michigan State	38	0.70	0.45	0.16	1.67	0.80	0.56	-0.23
Univ. of Calif., Santa Barbara	39	0.67	0.53	0.04	1.68	0.71	0.65	-0.06

Arizona State University	40	0.63	0.52	0.00	1.51	0.66	0.74	0.08
Washington, St. Louis	41	0.53	0.37	0.00	1.17	0.46	0.64	0.18
Univ. of Calif., Santa Cruz	42	0.50	0.41	0.00	1.58	0.38	0.59	0.21
Florida	43	0.45	0.44	0.00	1.75	0.65	0.22	-0.42
Rutgers	44	0.43	0.39	0.00	1.43	0.69	0.24	-0.45
Univ. of Calif., Irvine	45	0.42	0.39	0.00	1.52	0.30	0.53	0.23
University of Arizona	46	0.41	0.22	0.00	0.90	0.44	0.39	-0.05
North Carolina, Chapel Hill	47	0.40	0.43	0.00	1.58	0.48	0.29	-0.18
Vanderbilt	48	0.40	0.20	0.00	0.79	0.44	0.36	-0.08
Texas A&M	49	0.39	0.46	0.00	1.71	0.54	0.23	-0.31
Houston	50	0.39	0.28	0.00	0.89	0.46	0.30	-0.16
Rice	51	0.37	0.37	0.00	1.15	0.38	0.28	-0.10
Washington	52	0.36	0.39	0.00	1.25	0.59	0.14	-0.45
Purdue	53	0.35	0.32	0.00	1.29	0.43	0.30	-0.13
Oregon	54	0.33	0.25	0.00	0.84	0.39	0.26	-0.12
Iowa State	55	0.32	0.28	0.07	1.23	0.20	0.49	0.29
Colorado	56	0.32	0.26	0.00	0.89	0.30	0.38	0.08
Indiana	57	0.30	0.20	0.00	0.61	0.39	0.23	-0.16
Emory	58	0.25	0.23	0.00	0.73	0.19	0.31	0.12
SUNY, Albany	59	0.24	0.24	0.00	0.84	0.29	0.22	-0.06
SMU	60	0.21	0.14	0.00	0.50	0.24	0.18	-0.06
Delaware	61	0.20	0.41	0.00	1.66	0.24	0.11	-0.13
VPI	62	0.16	0.20	0.00	0.58	0.26	0.05	-0.21
Notre Dame	63	0.16	0.23	0.00	0.62	0.11	0.23	0.12
George Mason	64	0.12	0.29	0.00	1.14	0.04	0.24	0.20

[1] Publication data is collected annually over the years 1995 through 2010 from the following 11 selected journals: *American Economic Review, Econometrica, Economic Journal, Economica, International Economic Review, Journal of Economic Theory, Journal of Monetary Economics, Journal of Political Economy, Quarterly Journal of Economics, Review of Economics and Statistics, and the Review of Economic Studies.* Only data relating to full articles are collected, thus excluding comments, replies and other such shorter forms of communications.

[2] The weighted measures convert page counts to AEA-equivalent pages, use the 1/n rule for coauthored articles, and apply a quality indexing using the journal "Impact Factors" provided in the various annual editions of the Social Sciences *Journal Citation Reports*.

[3] To be included in these rankings, an institution's Department of Economics must have had one of the top-60 research outputs during either the 1995-2002 period or the 2003-2010 period (or both).

TABLE 3
Descriptive Statistics

	Mean	Std. Dev.	Min	Max
Dependent Variable				
Change in department's research output:	$-9.88E^{-6}$	0.629	-2.817	3.369
Independent Variables				
(1) Chair's research output				
Chair's citations (to 5 most cited articles)	2153.1	2873.3	10	17603
Years since Chair's most cited work	12.97	4.79	2	33
Chair's total weighted publications	22.87	17.70	2.16	111.52
(2) Chair Characteristics				
Female Chair	0.067	0.250	0	1
Foreign born Chair	0.290	0.454	0	1
Chair's years since PhD	24.33	6.55	10	48
Chair's years at university	14.55	8.61	0	42
Number of institutions where Chair has worked	2.10	1.09	1	6
(3) Institution Controls				
Department's research output at the start of the Chair's term	1.531	1.763	0.000	8.562
Share of world publications to non-US Economics departments (%)	55.08	2.63	50.93	61.19
Institution's share of economics publications to business and policy schools (%)	1.73	3.08	0	14.48
Total economics PhDs granted at Chair's university	208.5	124.4	42	555
University revenue (100 millions)	18.311	13.654	1.002	101.599
University's share of federal grants (%)	1.64	1.13	0.06	5.72
(4) Field Dummies				
Microeconomics	0.158	0.365	0	1
Macroeconomics	0.108	0.310	0	1
History/Thought	0.044	0.204	0	1
Quantitative	0.102	0.303	0	1
Public Finance	0.050	0.217	0	1
Monetary	0.121	0.327	0	1
International	0.093	0.291	0	1
Agriculture/Environment	0.040	0.196	0	1
Industrial Organization	0.080	0.271	0	1
Labor	0.168	0.375	0	1
Other	0.036	0.187	0	1
(5) Time Dummies				
1996	0.019	0.138	0	1
1997	0.035	0.184	0	1

1998	0.052	0.222	0	1
1999	0.063	0.243	0	1
2000	0.068	0.252	0	1
2001	0.078	0.270	0	1
2002	0.081	0.272	0	1
2003	0.082	0.275	0	1
2004	0.079	0.270	0	1
2005	0.075	0.264	0	1
2006	0.084	0.277	0	1
2007	0.088	0.284	0	1
2008	0.076	0.266	0	1
2009	0.067	0.250	0	1
2010	0.051	0.220	0	1

TABLE 4
Regression Equations for the Later Improvement in Department Research Performance

(The dependent variable is the change in a department's research output measured between the first year of the incoming Chair's appointment and the current observed year. Research output of a department is measured by a 3-yr moving average of quality-weighted publications)

Explanatory variable	Model 1	Model 2	Model 3	Model 4
Chair's citations	0.0001** (2.12)	0.0001** (2.28)	0.0002*** (2.89)	0.0001*** (2.82)
Chair's citations squared (scaled by 10 million)	-0.0624** (-1.96)	-0.0671** (-2.11)	-0.0851*** (-2.57)	-0.0705*** (-2.86)
Department's research output at the start of the Chair's term	-0.0861* (-1.86)	-0.0873* (-1.90)	-0.0726* (-1.70)	-0.2331*** (-5.61)
Number of years since Chair's most cited work		-0.0080 (-0.68)	-0.0253* (-1.71)	-0.0205* (-1.72)
Chair's total weighted publications		-0.0058 (-0.73)	-0.0087 (-1.12)	-0.0083 (-1.07)
Chair's total weighted publications squared		0.0001 (0.71)	0.0001 (0.71)	0.0000 (1.03)
Female Chair			0.1348 (0.82)	0.1337 (0.86)
Foreign-born Chair			0.0085 (0.10)	0.0023 (0.03)
Chair's years since PhD			-0.0655** (-1.94)	-0.0436 (-1.59)
Chair's years since PhD squared			0.0016*** (2.52)	0.0011** (2.02)
Chair's years at current university			0.0048 (0.67)	0.0037 (0.55)
Number of institutions where Chair has worked			0.0667 (1.07)	0.0589 (1.07)
Share of world publications to non-US Economics departments				-0.1520** (-2.45)
Institution's share of publications to business and policy schools				0.0533** (2.14)
Total economics PhDs granted at the Chair's university				0.0014*** (2.64)
University revenue[a]				0.0057 (1.51)
University's share of federal grants				-0.0636* (-1.68)

FIELD DUMMIES	YES	YES	YES	YES
YEAR DUMMIES	YES	YES	YES	YES
R^2	0.075	0.081	0.126	0.224
Citations number at which the quadratic reaches its maximum	9,094	9,389	9,194	9,773

n=825; *** - significant at 0.01 level; ** - significant at 0.05 level; * - significant at 0.10 level;
Clustered t-statistics in parentheses.
Field dummies are dummy variables for the Chair's sub-specialty.
[a] If we instead use the 'c*hange* in revenue' in the model, the financial variable remains statistically insignificant. This variable includes revenues from tuition and fees, government appropriations (federal, state and local), private gifts, grants and contracts, endowment income, sales and services of educational activities, "auxiliary enterprises", hospitals, "other sources", and "independent operations".
The mean of Chairs' citations is 2153.1; the standard deviation is 2873.3; the minimum is 10; the maximum is 17603.