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The resilience of university departments in the United States

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Contents

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Abstract

Faculty, housed in disciplinary departments, are the core of universities and the engines of university research. National narratives suggest upheaval, with traditional disciplines losing faculty as universities chase limited funds. But universities are staid institutions that are responsive to their existing structures and research metrics, so they may not easily transform their disciplinary areas of focus. Using new data on faculty at U.S. research universities (and comparison data for college faculty nationwide), we demonstrate that university department faculty sizes change slowly and may respond more to research production than grant availability. Inertia and the logic of academic professionalism may slow disciplinary transformations, even overcoming incentives in the research economy.

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Introduction

The humanities and social sciences are dying as universities follow the money to the hard sciences and applied fields. At least that is the conventional wisdom in the United States and a concern shared in numerous higher education systems worldwide. As American universities face pressure to improve their bottom lines and respond to efficiency and marketability concerns, they are said to be decimating some fields—with traditional disciplines threatened and new academic jobs rare. The power of market incentives for chasing scarce funds, the story goes, is overtaking the role of core subjects in general education and basic research. Building on examples at U.S. research universities, scholars and popular commentators see a brave new world of competition over a shrinking pie of resources.

But this conventional wisdom would require a lot of active prioritisation on the part of academic administrators, with universities intervening regularly to reward money-making disciplines and shrink others. There are reasons that academic departments at U.S. universities may be more resilient than often suggested. Bureaucratic inertia and a large base of tenured faculty means that most departments at most universities are unlikely to rise and fall drastically in any given year, even with financial pressure. And departments may not be standing still: they can adapt to new metrics universities use, with each arguing that they are a center of research excellence.

Using new data on American research universities, and drawing from intuitional logics theory, we show that changes in department faculty sizes are slow and do not match the conventional wisdom. Disciplines rise and fall over long periods with modest turnover because most departments have long-term faculty. Stories based on grant chasing cannot explain the decisions universities make. To the extent they change focus, universities may recognize research metrics in allocating faculty, investing in their strengths.

That hardly means that it is easy on the academic job market. Faculty sizes are not growing quickly, while the expectations for academic research production are rising.

Research universities have aging faculty and constitute only one sector of higher education, with some falling disciplines now concentrated at two-year institutions. Understanding patterns of faculty allocation is important for any clear view of how universities operate. Even if the aggregate patterns suggest a shift in the status of disciplines, the logics used by university organizations may temper the rise of market incentives in their restructuring.

Rise and Fall of Disciplines

Universities are stable organizations, but over long periods the curriculum changes substantially. In the 18th and 19th centuries, U.S. universities emphasized fields such as Greek, Latin, theology, medicine, and law. Relative emphasis on science and research at U.S. universities began when a national market for higher education developed and the dominance of classical fields faded. Political economy and moral philosophy divided into specialized fields, each housed in separate departments. Universities selected faculty within disciplines based on expertise and scholarly accomplishments (Urquiola, 2020). After the Second World War, the United States invested in expanded access to higher education. The research mission blossomed, enrollments swelled, new intuitions were founded, and new fields of study established. They often specialized in applied topics and vocations (Labaree, 2017).

More recently, the notion that higher education's purpose is to promote individual mobility and collective prosperity through preparation for work has become a dominate goal, displacing the prioritization of intellectual and moral formation though the liberal arts. In the United States, going to college to get a good job has become an article of civic faith (Gurbb & Lazerson, 2005). Humanists fear they may lose space in the academy if administrators, students, and the public think the humanities have diminished value (Schmidt, 2018). Finkelstein, Conley, and Schuster (2016) find that humanists and social scientists face longer odds of securing tenure track jobs than do academics in other fields, their salaries tend to be lower, and they are more likely to be hired on part-time and contingent contracts.

Although such concerns are widespread, overall assessments of the liberal arts do not paint a picture of total decline (Geiger, 2010). The share of degrees awarded in the humanities is down from historic peaks, but humanities programs have not collapsed (Pippins, Belfield, & Baily 2019). But studies of academic program closure show that some humanities fields, such as foreign languages, are more suspectable to termination than other program types (Brint, et al., 2012a). Research grant income and tuition dependence are also associated with a decline in humanities degree production (Taylor, Cantwell, & Slaughter, 2013) and university historical mission shapes disciplinary emphasis (Hearn, & Belasco, 2015). Overall, program expansion is a function of both the internal complexity of intuitions and external forces (Brint, et al., 2012b). Universities that prioritize interdisciplinarity attract more research funding (Leahey & Barringer, 2020), potentially indicative of market incentives for applied, problem-oriented, programs. Even so, most interdisciplinary departments fail to get a strong toehold in universities and those that are established are now longstanding mainstream fields such as business and education (Jacobs, 2014).

How Disciplines Gain Within Universities

Disciplines gain and lose faculty if and when universities allocate resources that follow similar logics, or the bundles of values, believes, routines, and expectations about organisational procedures and goals that shape individual and collective decision making. Disciplinary departments are the building blocks of universities, which contribute to disciplines by appointing faculty (Clark, 1984). Departmental faculty deliver education programs and advance academic fields through teaching, research, and service. Faculty "lines" are coveted resources by academic units. Departments are reluctant to surrender existing faculty lines and commonly petition administrators such as deans and provosts for additional lines. Universities are multi-product organizations that can simultaneously engage in many activities (Brint, 2019). Filling, or adding, faculty lines is a choice universities make to invest in one among many available emphases. University internal structures reflect resource pressures and institutionalised norms and values, as well existing size and scope of programmatic offerings (Brint, et al., 2009; Hearn & Belasco, 2015; Slaughter & Leslie, 1997). Facing budgetary restrictions and the apparent need to establish strategic priorities (Eckel & Trower, 2018), faculty appointment patterns may reveal organisational priorities.

Higher education researchers have identified factors associated with academic program expansion and contraction (Brint, et al., 2012a; 2012b; Eckel, 2002; Osley-Thomas, 2020), faculty rewards (Fairweather, 1993; Melguizo & Strober, 2007), the changing composition of the faculty, and growth in part-time and adjunct appointments (Finkelstein, Conley, & Schuster, 2016; Kezar, 2013). The overall composition of the faculty now includes a larger share of contingent and other non-tenure-track appointment types, but tenure-track appointments are not necessarily shrinking.

University priorities may have shifted. Paula Stephan (2012) argues that university leaders increasingly stress grant income as a top priority and expectation for faculty. University administrators now emphasize academic programs with clear vocational links and fields of study that attract significant research grant funding (Gurbb & Lazerson, 2005; Volk, Slaughter, & Thomas, 2002; Taylor, Cantwell, & Slaughter, 2013). Case study research shows that research university executives lead the change to promote revenue generation and entrepreneurial activities (McClure, 2016). Even doctoral students at research universities are socialized to assess the value and status of work by how well it is funded (Szelény, 2013). Regionally focused university campuses have also sought to elevate research and grant activities (Gonzales, 2013).

Recent organizational studies of higher education identify a shift in priorities reflected through changing internal structures. University administrators have emphasized grant funding and applied activities with ostensive economic and vocational returns (e.g., Barringer, Leahey, & Salazar, 2020; Cantwell, 2015; Gonzales, 2014; McClure, 2016; Rosinger, et al., 2016; Torres-Olave, et al., 2020; Vican, Freidman, & Andersen, 2019). This primarily qualitative literature has produced consistent findings: faculty experience administrative prioritization of grant generation, which manifests in stronger support for applied and interdisciplinary projects and fields of study that have more research funding. Faculty at U.S. research universities describe intense pressure to generate research income and unequal working conditions based on field prioritization.

Critics of these perceived shifts in university values argue that higher education has abandoned a commitment to self-directed scholarly values in favour of market considerations (Newfield, 2018; Fitzpatrick, 2019). Reports of dramatic organizational reforms lend credence to the claim that research universities are undergoing profound restructuring. In April 2019, The University of Tulsa, a private research university, announced plans to close dozens of academic programs and invest in other programs targeted for growth. Tulsa's administration selected programs in the humanities and social science disciplines for closure. Those identified for expansion were largely vocationally oriented, such as cybersecurity and health sciences (Fisher, 2019).

The Tulsa case was a pronounced example of organizational change described variously as vocationalism (Grubb & Lazerson, 2005), privatization (McClure, Barringer, & Brown, 2019; Morphew & Eckel, 2009), academic capitalism (Slaughter & Leslie, 1997; Slaughter & Rhoades, 2004), and the adoption of corporate and market logics of higher education (Berman, 2012; Gumport, 2000; 2019; Kirp, 2003). Tulsa's plan was especially notable because the university held a substantial endowment relative to its size and did not face declining enrolments. Restructuring was a choice, signifying the priorities of the university's administration, rather than a response to financial pressure. Tulsa did not fire any tenured faculty members, but its restructuring will result in faculty growth in some departments and shrinkage in others.

Given documented tightening academic labour markets, one might assume that faculty appointment trends by discipline reflect financial priorities. Yet there is surprisingly little research on how faculty appointments in academic departments support (or contradict) these views of university priorities. Even program closure studies, which provide a proxy for understating organizational priorities, rely on data from nearly two decades ago (e.g., Osley-Thomas, 2020). Studies of search committee evaluations of faculty candidates find that committee members rely on idiosyncratic individual preferences rather than a systematic framework for evaluating job–candidate alignment (White-Lewis, 2020). But these studies do not examine the factors associated with continuing or establishing faculty lines.

Perhaps because of the lack of systematic evidence, splashy restructuring efforts like Tulsa's attract attention. But researchers may be attracted to dramatic examples that are atypical at staid American universities. And some research findings counter the conventional wisdom and suggest stability and organizational inertia still rule the day.

Competing Institutional Logics in Higher Education

We conceptualize new faculty appointments as organizational priority indicators. Labour costs consume the majority of college and university budgets (Desroches & Kirshstein, 2014) and faculty appointments are often multiyear commitments with the prospect of career-long tenure. The organization of departments and their relative size reflect institutional values within specific universities and across higher education (Frank & Meyer, 2020). Faculty determine who is hired to new academic appointments, but administrators determine which academic units can hire. Given administrative discretion over which units are able to replace or expand faculty lines, we assume the growth or decline of disciplinary departments reflects, at least in part, the operating logics used by campus leaders when making decisions on where to invest resources. We examine variation across disciplines in faculty growth and the correlates of department growth. We draw on the institutional logics' perspective to explain the link between abstract organizational priorities and the concrete action of making departmental faculty appointments.

Institutional logics are "the socially constructed, historical patterns of material practices, assumptions, values, beliefs, and rules by which individuals produce and reproduce their material subsistence" (Thorton & Ocasio, 1999, p. 804). Complex organizations like universities face considerable ambiguity in how to both establish goals and the appropriate means of goal attainment (Cohen, March, & Olsen, 1972; DiMaggio & Powell, 1983). An institutional logics framework is attuned to the link between cultural preferences and narratives and tangible decisions that drive change in organizations.

Institutional logics facilitate decision-making and change in higher education. Through an in-depth case study of the Massachusetts Board of Higher Education, Bastedo (2009) showed rationalization processes, rather than apparent boisterous partisan politics, drove restructuring of Massachusetts' public higher education system. The convergence of system design logics and business discipline logics allowed the board to implement reforms. Posselt's (2015) study of graduate admission committees found disciplinary logics at play. Committees were able to make decisions about student selection by drawing upon the shared values and beliefs that organized their academic discipline's scholarly work. Researchers have also identified the rise of corporate logics in university decision making. Gumport's (2019) study of public research universities identified how corporate logics displaced academic professional and bureaucratic logics in motiving administrative decision making. Vican, Freidan, and Andersen (2019) found that faculty work was situated between competing logics. Professional logics that prioritized specialized knowledge and defined standards of assessment were often misaligned with university corporate logics that emphasized standardized assessments of output and revenue generation. The tension between competing logics restrained faculty decisions and dampened work satisfaction.

Logics operate within the constraints of organizations (Sauermann & Stephan, 2013). Logics are symbolic and cognitive frames but not independent of material reality. Logics are both means and ends – they provide actors with a method of action and establish goals. Multiple logics circulate in institutional fields and specific organizations at once. Over time, some logics can become dominant in particular settings, but not necessarily across all organizational levels. Some logics may inform overall strategic action (such as university strategic planning) while others could drive local decision making (e.g., department faculty hiring).

We evaluate three different institutional logics that may drive research university decisions. *A research economy logic* would suggest that marketization has taken the form of seeking externally funded research (Slaughter & Rhoades, 2004; Stephan, 2012). Operating under such a logic, universities would allocate faculty to departments who have proven they can generate grant funding, leading disciplines that generate grant funding to grow across universities, likely explaining a decline in the humanities relative to a gain in the applied natural sciences.

An academic professional logic would suggest that departments have successfully insulated themselves from organizational pressure by appealing to their place in the hierarchy of their disciplines (Sauermann & Stephan, 2013). Following this logic, disciplinarily specific standards of scholarly accomplishment would guide university investments. As the faculty in disciplinary departments publish research, they should be rewarded with faculty lines (whether or not they are self-funding). The result might be universities specializing in their areas of greatest strength.

An inertial logic would suggest that bureaucratic incentives to maintain current structures overwhelm other incentives. Instead of rewarding departments who succeed in grants or publishing, universities would simply allocate additional faculty to current departments, reproducing existing organization (Grossman, 2021). This logic might preserve humanities departments and others that earn limited research income while making it difficult for new disciplines to rise within existing universities.

We see reasons to expect all of these logics to operate at research universities. Faculty allocation decisions will be made in the context of current units, which have incentives to maintain themselves and grow—so any change should be slow. Universities should respond to opportunities to gain new sources of funding, which might mean rewarding departments who bring in external dollars. But universities are also responsive to calls for academic excellence and might learn to target resources to departments who are succeeding in research.

Data and Methods

Our principal analysis uses a unique and proprietary data panel from Academic Analytics (AA) to analyse faculty appointments over time by disciplinary department across American research universities. To check the reliability of the AA data, we then use a new panel combining federal data on the entire U.S. higher education system at the national level. This data tracks a larger sample of universities over a longer period but lacks AA's organizational specificity.

Academic Analytics

AA is an analytics and data firm that provides data and evaluation services to the higher education sector. AA has developed an extensive database of faculty appointments within academic departments along with measures of scholarly productivity including publications and grant activity. AA data are restricted to institutional subscribers and primarily used for benchmarking and to inform internal decision making. We have access to AA data through a modification of their agreement with Michigan State University, including cooperation with their internal research centre, where we obtained data directly.

AA data are suitable for use in research. Ali and colleagues (2010) analysed faculty-level AA data from 2004 to estimate the relationship between faculty publication outputs and grant activity. Since 2019, AA has hosted the Academic Analytics Research Center (AARC) to make data AA data available to researchers. AARC features published articles and working papers that use AA data.[1] Examples include a study of women faculty in finance (Getmansky & Tookes, 2020) and patterns in open access publishing (Olejniczak & Wilson, 2020).

AA data include comprehensive publication and citation counts for individual faculty members, nested in academic departments across U.S. research universities. These data permit analysis of academic production at individual, departmental, university, and disciplinary levels. AA data feature several advantages over other common bibliometric data sources such as the Web of Science, Google Scholar, and Scopus.

[1] The AA research centre can be accessed online: https://academicanalytics.com/aarc-scholarly-research/page.

AA data are hand verified, which means that they do not suffer from name disambiguation problems that are known to occur in other sources. While other sources include information about the field of a publication and authors' affiliations, they are not directly linked to departmental appointments like AA data are, making them unsuitable for assessing faculty appointment trends. Similarly, AA data are notable in their coverage relative to other sources. Google Scholar uses self-enrolment and both the Web of Science and Scopus use automated machine techniques to identify authors, with the possibility of omissions. Faculty members who have not published, or have not published recently, are likely to be omitted from Scopus and the Web of Science. Finally, AA has gained widespread adoption by university administrations that use AA data to make decisions.

Our AA data include 30,748 department-year observations nested in 330 universities over the period 2009 – 2018. Universities that consume AA data overwhelmingly tend to be research universitas active in national and international publishing and grant seeking activities. These universities are not representative of higher education in the United States on the whole, but capture a large share of the campuses that contribute to the U.S. academic research enterprise. AA data capture only research faculty, the large majority of whom hold tenure track appointments. We use the faculty count as our dependent variable to measure faculty appointments within departments. AA data include several other variables that allow us to analyze the logics underlying faculty appointments. Our data include article counts, book counts, citation counts, grants awarded, and grant dollars awarded,[2] all aggregated at the department-year level. Because AA offers longitudinal faculty appointment counts nested within disciplinary departments and universities, we can assess trends in faculty within universities and across the research university sector.

Some critics see AA as an unwelcome development because it reduces faculty work to quantifiable outputs and could be used by university administration to assert greater managerial control over academic work (AAUP, 2016). Pervious iterations of the AA database also had gaps in coverage and did not include all faculty published

[2] We convert all grant dollar values to 2010 US dollars to account for inflation.

work, especially in the social sciences and humanities. Academic Analytics has acknowledged this concern and says that it has improved coverage.[3]

AA data have limitations. Faculty with appointments in two or more departments might be counted in each unit. AA data do not include enrolments, even though faculty appointments may be related to student demand. AA do not use the same organizational codes as National Center for Education Statistics (NCES), making it difficult to accurately link federal enrolment data. AA data also include only a limited number of higher education institutions over a limited period.[4] The 330 universities included in AA data account for approximately 7.6 percent of all postsecondary institutions in the country, though the coverage of faculty is much greater because research universities tend to have far larger faculties. Given these limitations, we supplement our analysis of AA data with data derived from several U.S. federal government sources.

National Data as a Check

To check the reliability of our AA findings, we assembled a panel of discipline-year observations using federal data sources. It cannot show within-department changes but does allow us to track faculty employment by discipline, research by discipline, and degree production by discipline over time. This allows us to assess national faculty employment trends and estimate their relationship to overall funding levels and degree production by discipline.

As part of their routine national data collection, the U.S. Bureau of Labor Statistics (BLS) collects information on American occupations. Though not focused on higher education, BLS data enables us to estimate the number of college teachers and faculty in academic disciplines. These data are more extensive, covering community colleges, proprietary colleges, and small four-year institutions not available in AA. Since public survey respondents determine their occupation in the BLS data, it also

[3] Research universities in the United States widely subscribe to Academic Analytics. AA is marketed as a business tool to allow administers to benchmark departmental performance relative to other research universities. Faculty have pushed back against the use of AA, including at Rutgers University (Flaherty, 2016). AA data now provide the most complete source of publication data available, but objections to quantification and treating publications equally remain.

[4] Estimates are from NCES "The Condition of Education" report, updated in May 2020. Available from: https://nces.ed.gov/programs/coe/indicator_csa.asp.

includes many more non-tenure-track faculty and adjunct instructors who identify themselves as teachers or researchers of a particular subject in universities or colleges. We use annual BLS data by discipline from 1997 through 2018.

National data allow us to incorporate data on research expenditures and—unique to this part of the analysis—student data. We obtain the research expenditures data from the Higher Education Research and Development (HERD) survey, which tracks all research and development spending at colleges and universities that spend at least $150,000 in the fiscal year. The U.S. National Center for Science and Engineering Statistics, a unit within the National Science Foundation (NSF), has administered the survey annually since 1973. HERD data report expenditures by the source of funds (federal, state and local, business, and non-profit) and by broad research discipline. We match disciplines to the BLS data (using a hand coded crosswalk in Appendix A-11), including annual counts of research expenditures, estimating the level of grant support directed to each of the disciples. In order to adjust for inflation, we convert all spending to 2010 US dollars.

Enrolment data by discipline are not available, but we use degree production data as a proxy for student interest. We use data from the U.S. Department of Education's National Center for Education Statistics (NCES), which tracks degrees awarded at U.S. universities and colleges. Because most students are undergraduates, we gathered information on associates and baccalaureate degrees by discipline from every degree-granting institution in the U.S. between 1988 and 2018. We match these data to disciplines in the BLS and HERD data.

We thus have national data to corroborate some of the trends and dynamics observed in the AA data. But the BLS data do not include intuitional identifiers and the NSF and HERD data are aggregated by institution and difficult to match to universities, much less departments, because of treatment of multi-campus systems (Jaquette & Parra, 2014). But these data all cover a longer time period than the AA data (all since at least 1997, if not longer), enabling tracking of longer-running national trends.

Methods of Analysis

We analyze data using descriptive and panel regression methods. Using the AA data, we track trends over time in faculty count within departments, as well as trends in research funding and outputs. To examine the logics associated with faculty employment, we fit panel regression models. Our preferred models use fixed-effects (year and discipline-year effects in separate models) and standard errors clustered on university-disciplines. Because adding new faculty lines in response to within-department differences does not occur immediately, we lag covariates by two years. Counts of research grants awarded to disciplinary departments, and the dollar amount of grants awarded were included to test the research economy logic. Journal articles, books, and citation counts allow us to assess the influence of the academic professional logic. Previous faculty counts allow us to assess the inertia of academic appointments. As robustness tests, we fit models with alternative specifications that use a one-year lag (A-2 and A-3) and include both discipline and year fixed effects (A-4 and A-5) along with models of year-to-year changes across variables (A-7, A-8, and A-9) and we test specifications with indicators of production per faculty (A-11, A-12, and A-13).

We analyze the federal panel data using the same approach. Changes over time in faculty within disciplines are assessed descriptively. We then fit regression models to the federal data, using faculty counts across discipline-years as the dependent variable. Consistent with the AA models, we lag covariates by two years and estimate models with both year and discipline fixed effects. We cluster standard errors on disciplines. Covariates include research and development expenditures by discipline, the number of associates and bachelor's degrees awarded, and the discipline’s faculty count from two years prior. We provide additional models in the appendix that use a one-year lag but are otherwise identical (A-6) as well as models of year-to-year change (A-10). We also provide descriptive data (A-1) and note all major differences in the text.

Disciplinary Trends at Research Universities

Which disciplines are rising and falling at American research universities? Figure 1 tracks research faculty counts at the average research university department in seven broad fields: arts, engineering and computer science, humanities, medical sciences, natural sciences, physical sciences, and social sciences. In the popular imagination, the humanities and social sciences are falling while engineering and medical sciences are growing. In our data, most of the disciplinary categories follow the same broad trends, dipping after the Great Recession and maintaining relative stability since then. Engineering has closed the gap with physical sciences and slight upward trends are apparent in later years in the natural and medical sciences.
How do these trends match overall changes in the research and funding production of these disciplines? The academic professional logic suggests that departments publish or perish. The first panel of Figure 2 tracks average article production across the same broad categories. There are mostly monotonic increases across most fields, with the sciences leading the way. The changes do not alter the ordering, with the natural, physical, medical, and engineering sciences publishing far more articles per department (all more than doubling the production of social sciences, humanities, and arts departments).

The second panel of Figure 2 provides context for the research economy logic. In contrast to publishing trends, grant awards were stable, with a slight downward trend. Notably, grants decreased over the period in several disciplinary categories, including high-flyers like the natural and physical sciences. But the clear hierarchy of resource-heavy science and engineering fields and resource-light social sciences, arts, and humanities disciplines remains.

Despite the changes, there is a lot of stability in departments. Figure 3 is a histogram of faculty changes from one year to the next in each department (including the middle 99% of cases to exclude outliers and visualize the most common gains and losses). In contrast to the time series plots, which used a small number of aggregate categories of disciplines for illustration, these data now track individual departments. The modal department stays exactly the same from one year to the next, with gains or losses of one faculty member next most common; larger gains or losses become less frequent monotonically and few departments gain or lose more than five faculty in a year. The inertial logic is important.

Figure 4 illustrates relative stability among the disciplines over time. The first panel tracks the mean time since doctoral degree (averaged across faculty) for each disciplinary category. The mean time since degree is over 20 years, meaning that most faculty have been in academia for decades. That longevity seems to be increasing, especially in the arts but also in the sciences and humanities. In any year, a department is mostly hanging on to the same faculty, with additional hires not moving the needle that much—perhaps replacing relatively rare departures.
The second panel helps illustrate faculty longevity in another way, tracking the mean number of faculty at each tenure-track rank: assistant, associate, and (full) professor. Professors constitute nearly half of the average department, with assistants the least numerous. Matching the data on time since degree, this suggests that new junior faculty hiring may not change the composition of departments much. Inertia may dominate due to the length of faculty careers.

Models of University Faculty Allocation

How are national trends manifested within universities that make faculty hiring decisions and thus allocate gains and losses across their departments? A discipline could be gaining nationwide but still losing faculty at some universities as each responds to productivity by their own faculty rather than by a nationwide discipline. Table 1 models faculty counts at each department at each university in each year. All models include a lagged dependent variable to assess inertia. We use two-year lags to account for the extended time in the faculty hiring process: universities allocate jobs to advertise and hire based on their prior performance; those new hires would then show up in faculty counts only two years later. Models using one-year lags (in A-2 and A-3) show our lag decision made little difference.

To test the research economy logic, we use two separate grant indicators from Academic Analytics: total grants per department (columns 2 and 4) and inflation-adjusted dollars from those grants (columns 1 and 3) because universities might be interested in the capacity for any external funding or the specific dollars they bring. To assess the academic professional logic, we include three research productivity measures: number of articles, number of books, and number of citations to recent articles (in columns 3 and 4).

All models suggest the same influential determinants: prior faculty, articles, and books. We find no evidence that university departments that accumulate more grants or grant dollars are rewarded. In fact, the relationships are negatively signed for grants and grant dollars. We also find no evidence that citations matter. Instead, departments seem to be rewarded for quantity of research output, but this does not come at the expense of book-heavy departments.

We provide a sense of the substantive implications of these findings by generating the predicted number of departmental faculty members by the lagged number of articles published. We sample the distributions of model 1's coefficients 1,000 times and vary values of yearly articles published[5] while keeping the other covariates at their observed values. This calculates the average effect of article publications. We estimate the uncertainty of these predictions by creating confidence intervals that represent the middle-95% of the 1,000 predicted values. We visualize the results of this procedure in Figure 5. The predicted number of faculty increases as the number of article publications increases. But first differences suggest that moving from the 10^{th} to the 90^{th} percentile results in a gain of only about one faculty member.

Table 2 provides models of faculty count by department including discipline-year fixed effects. These models are accounting for the aggregate trends in Figure 1 separately, concentrating on decision-making across universities based on their own departments' performance. Compared to Table 1, these models cannot help explain the nationwide trends but show how universities are responding to their own

[5] We use the middle 99% of observed values.

departments' productivity. The models show few differences. We also model changes in faculty count from one year to the next with changes in research and grant production (A-7, A-8, and A-9); the models show no positive effects. Many variables are now negatively signed, suggesting that departments are not rewarded for short-term gains. The faculty gains in earlier models thus likely reward high productivity, rather than new signs of success. Prior faculty count is also not significant or positive in the change models, suggesting that the strong relationship with prior faculty count in Tables 1 and 2 is driven by persistence rather than rewarding large departments (in fact, large departments may be more likely to lose faculty than small departments, though not enough to equalize gains over time). Finally, we also check models predicting faculty count with prior research production and grant indicators measured on a per faculty basis (A-11, A-12, and A-13). Those models continue to show strong persistence, book, and article effects. These models are the first to show grant effects, suggesting that per faculty grant production (though not dollars) may be rewarded. But as in Figure 5, no effects are large enough for major shifts in department size.

The Rise and Fall of Disciplines Nationwide

Moving to a wider scope, we sought to assess trends across all U.S. faculty (not just those at research universities) across a longer time period. The first panel of Figure 6 charts changes in total faculty in each disciplinary category since the 1990s from the BLS. We use slightly different categories here, based on different data.

Since we are now including community college professors, instructors at other college types, and non-tenure-track faculty (not present in the Academic Analytics data), we are now talking about a lot more people. Here the trends are mostly upward for the humanities until the last few years. Growth in the humanities until recently is likely attributed to the teaching-focus of the national data sample and the prevalence of humanities fields in general education courses. Business and communication, social work and education, and math and computer science are also growing, but began at much lower levels. But humanities disciplines, such as English and History, still dominate.

The national data also allows us to evaluate an enrolment economy logic: colleges may be following student interest. The second panel of Figure 6 tracks associates and bachelor's degrees awarded by the same broad fields. Humanities and arts associate degrees are rising sharply over time. Life sciences degrees grew for both associates and bachelor's degrees while business and communications bachelor's degrees increased.

Despite student growth, there is still a lot of stability in disciplinary faculty. Figure 7 presents a histogram of faculty count changes from one year to the next nationwide in the BLS data, mirroring the department-level histogram for the AA data in Figure 3. Here, we see most disciplines gaining a small number of faculty each year, with only a few disciplines making large jumps upward—and fewer still declining rapidly. The comparison to Figure 3 suggests that disciplines may be slowly gaining faculty more from the expansion of educational providers over time than from growth within departments, perhaps via non-tenured faculty.

Table 3 systematically assesses the relationship between students, grant dollars, and faculty. Here we predict BLS faculty count data by discipline and year accounting for the number of degrees awarded two years before as well as the research expenditures reported in that discipline. Since the BLS data is not disaggregated by university, we model the nationwide effects of research dollars and student degrees, rather than how each university responds. There is a strong relationship between faculty count two years earlier and the current year. The results also show that research dollars are unrelated to faculty growth (in fact negatively signed and far from significance). Associates degrees awarded do predict faculty growth, but it is negatively signed; bachelor’s degrees awarded have no effect. Models with a one-year lag (A-6) show no major differences. Models assessing changes in disciplines’ faculty counts from one year to the next (A-10) show no gains from year-to-year shifts in degrees or grant dollars. Prior faculty counts are positive without field effects but negative with field effects, suggesting that large fields are growing overall but not due to their recent growth. Overall, colleges and universities nationwide do not appear to be following research dollars or student interests. Uncoordinated change in the disciplinary composition of faculty nationwide likely reflects the heterogeneity of U.S. higher education. The instructional needs of intuitions vary by type and mission.

Reconciling the Findings

The BLS and AA data converge on some key findings. Although the BLS data cover many more years and many more faculty, both suggest stability in disciplinary employment. For the most part, university faculty counts are stable and self-perpetuating. Real trends in the rise and fall of disciplines do occur, but they tend to be slow and do not necessarily reflect money chasing incentives.

The dynamics underlying the two data sources differ. Disciplines may grow from new programs or new colleges, rather than changes in faculty sizes; both would be more visible in the BLS data. They may also grow in college teachers, without affecting tenure track faculty counts. But disciplines are not rising and falling based on grant dollars in either dataset.

Our best evidence on the internal logics used by research universities comes from the AA data, where we can track year-to-year changes in the faculty counts at each university and assess the factors that cause individual universities to allocate faculty resources. In that analysis, popular stories are not fully supported. Research universities do not seem to be chasing grants or substantially undercutting existing departments. Instead, most departments (and most national disciplines) are quite stable.

Other popular narratives gain more support. Departments have aging faculty, with rising average time since faculty received their doctorates and many places “top heavy” with mostly (full) professors. The aggregate stability can thus still produce dire stories about the academic job market. Disciplines may seem to decline if they are producing more PhDs than available new faculty positions, regardless of whether they are growing.

Although one story of academic marketization and neoliberalism—that universities are following the money to grant-heavy departments—does not gain support here, a perspective emphasizing research metrics is somewhat more consistent with our findings. University use of AA is part of a broader movement demanding metrics for assessing academic performance. Universities that contract with AA are sensitive to research metrics. And universities could be following these numbers, rewarding departments for producing more journal articles and books as total research production grows nationwide. That could be seen as an acquiescence toward the professional logic of disciplines, but it is also consistent with a commodification of research into discrete publishable units (regardless of how often they are cited), with universities demanding more production and disciplines adapting by touting their publications. Here, traditional academic logics that have long operated following the publish or perish rule may be converging with administrative preferences for applying business intelligence and metrics in decision making (Gumport, 2019). Even so, the response to increased publication activity is slow. The average department in the AA data with approximately 28 faculty members would need 80 publications, or approximately 2.9 papers per faculty member, in one year to grow to 29 faculty members two years later.

Implications and conclusion

Our evidence suggests some limitations to the marketization story of American universities. Disciplines can adapt to universities' standards by marketing their research success, emphasizing metrics and research commodities. Previous research found strong evidence that grant availability influences the organization of academia and universities (Slaughter & Leslie, 1997; Stephan, 2012). Examples of dramatic restructuring to emphasize vocationally oriented programs capture headlines. But stories based on pressure to obtain external grants and restructure

departments gain less purchase here. We find more accord with accounts of stability in U.S. higher education (Labaree, 2017; Brint, 2019).
Universities are mostly maintaining departments with similar faculty resources to those they have had in the past. A logic of disciplinary stability prevails, even as we uncover some evidence that scholar outputs are rewarded. Campus leaders who stress the importance of research funding (McClure, 2016) may be articulating wishes or defaulting to boilerplate rhetoric rather than projecting the logics used to make actual decisions. At first glance, our findings appear to contradict a large body of qualitative research; but a closer reading shows points of agreement. A case study showed that academic leaders in highly funded disciplines at the most research-intensive universities understand expressed grant expectations as “clearly not” attainable (Cantwell, 2015, p. 494). A logic of organizational inertia and reproduction is operating behind outward market focused rhetoric.

Our evidence is imperfect. We rely on a private company hired by universities for our data, despite checking it where possible with federal data. If AA data is error prone, our evidence might even suggest universities are relying on imprecise or biased information about research, rather than research success itself.

But there is also danger in relying too much on examples consistent with popular storytelling that fit conventional wisdom. The University of Tulsa, for example, may have gained notoriety primarily for how it stood out from the wider patterns in its willingness to undergo major restructuring. Likewise, stories of terrible humanities job markets can be accurate without implying that research universities are decimating their departments; instead, they may be slowly aging without growth. Stable departments populated by faculty with long careers can leave little room for new faculty, which reasonably could make the disciplines feel in crisis, and contribute to professional crises for individuals. The stability of departments and disciplines coincides with the build-up of a large pool of contingent instructors (Kezar, 2013).

The aftermath of the COVID-19 pandemic is likely to bring more pressures for universities to change their focus. New federal research funding may open new grant chasing incentives, while declining student bodies force cuts and scale back opportunities for growth. But our data suggests that may not be as inevitable as feared. Despite the headlines, most departments may take advantage of their existing positions to retain their share of the pie. Although economic incentives are difficult to avoid, disciplines may be more resilient than commentators imply. And attempts to manage universities out of economic pressure may be ineffective (e.g., Hearn, & Burns, 2021).

Relying on research metrics could produce results that are nominally consistent with traditional academic values, such as rewarding departments for academic publications. But following metrics also cedes decision making from academic judgments to third-party venders that quantify academic performance. Attention to metrics potentially creates bad incentives to thinly slice publications to get more articles out of a single project and for the proliferation of low-quality (or even fraudulent) journals. Prioritizing metrics could also increase the expectations for faculty work, which might partly produce the anxiety reported by faculty members in case studies of university marketization (Vican, Friedman, & Andreasen, 2019).

Even as our study provides some evidence that research universities respond to publication metrics, stability and organizational inertia is the more dominant theme of the story. As demonstrated by the rapid transition to remote instruction during the COVID-19 pandemic, universities are capable of rapid decision making. But the composition of departments changes more slowly, with most tenure-track faculty enjoying long careers. Such stability buffers universities from volatility and allows them to predictably offer degree programs and advance knowledge within disciplines. But it also may mean universities are less able to respond to new opportunities or to address emergent problems. Administrators may support the growth of departments that prove successful at generating research outputs, but change occurs on the margins. Academic leaders may have few effective levers to pull when it comes to setting an agenda for the academic enterprise.

Figure 1: Faculty Changes Across Time for Broad Disciplinary Categories

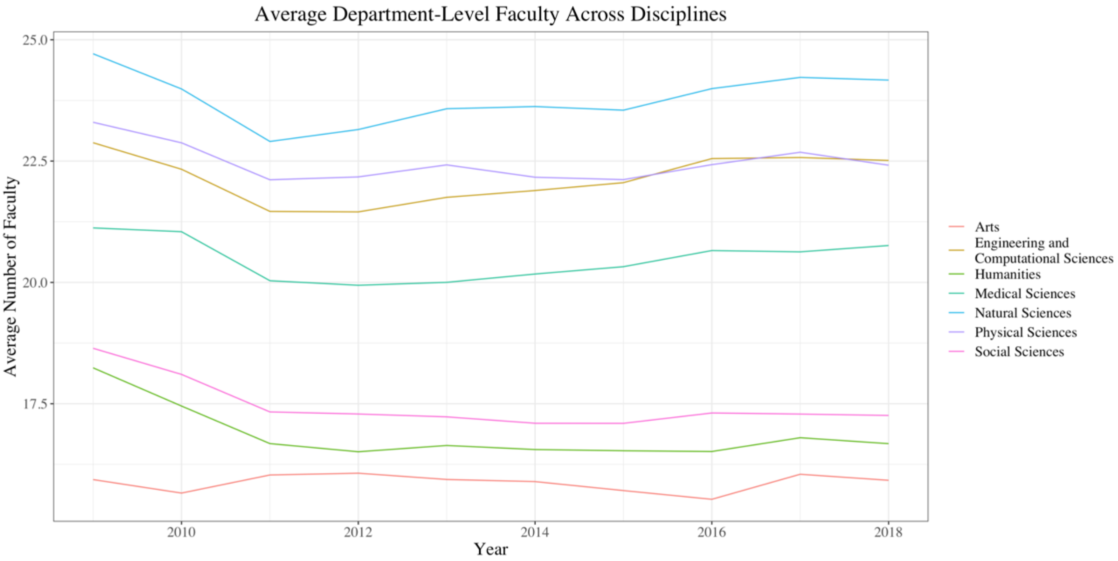

Figure 2: Publishing and Grants Across Time for Broad Disciplinary Categories

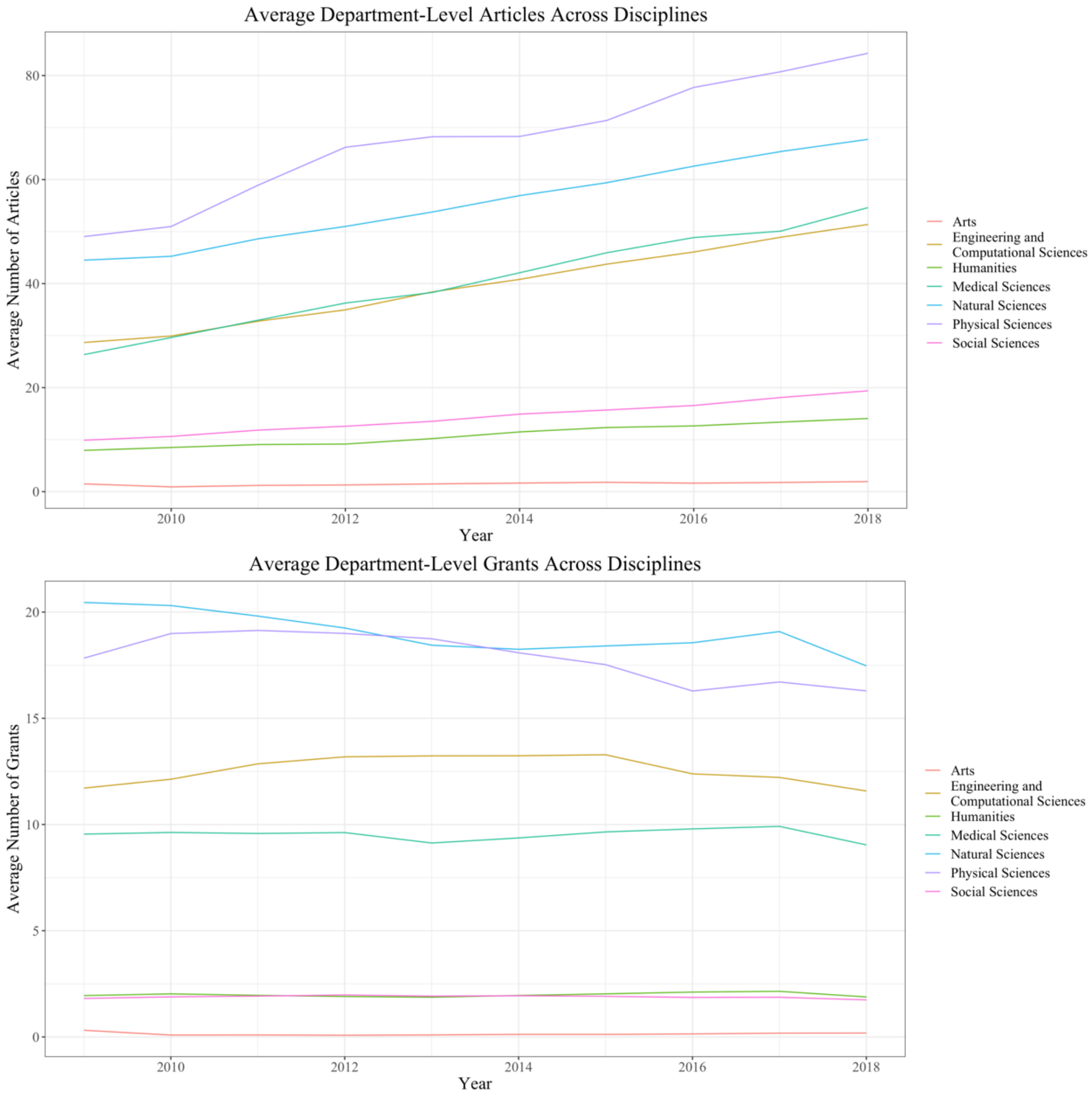

Figure 3: Persistence of Faculty in Departments, Academic Analytics Data

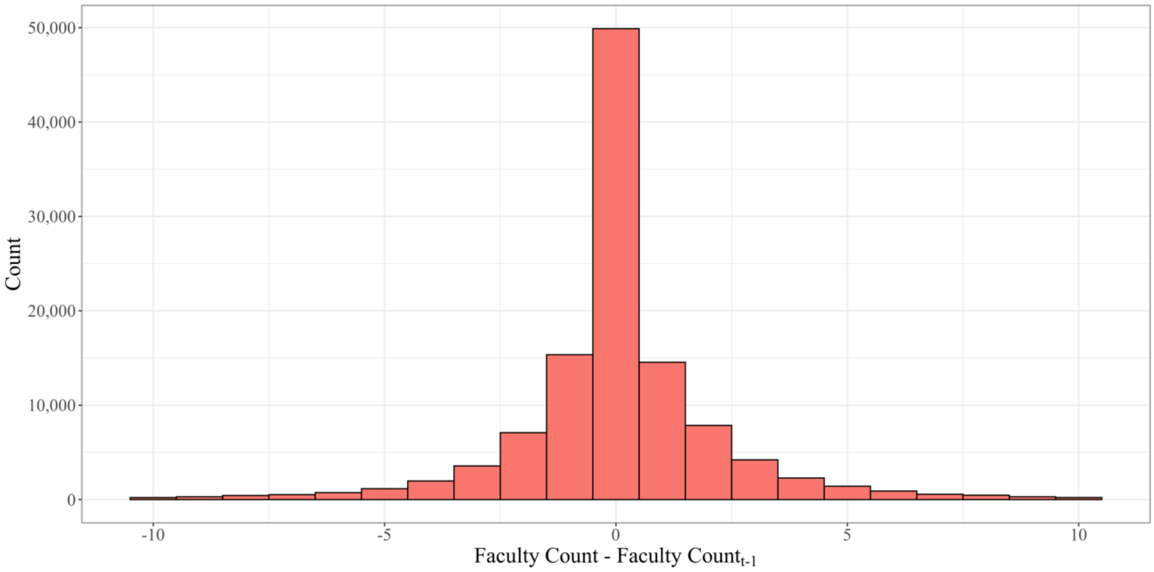

Figure 4: Advanced Faculty Predominance, Academic Analytics Data

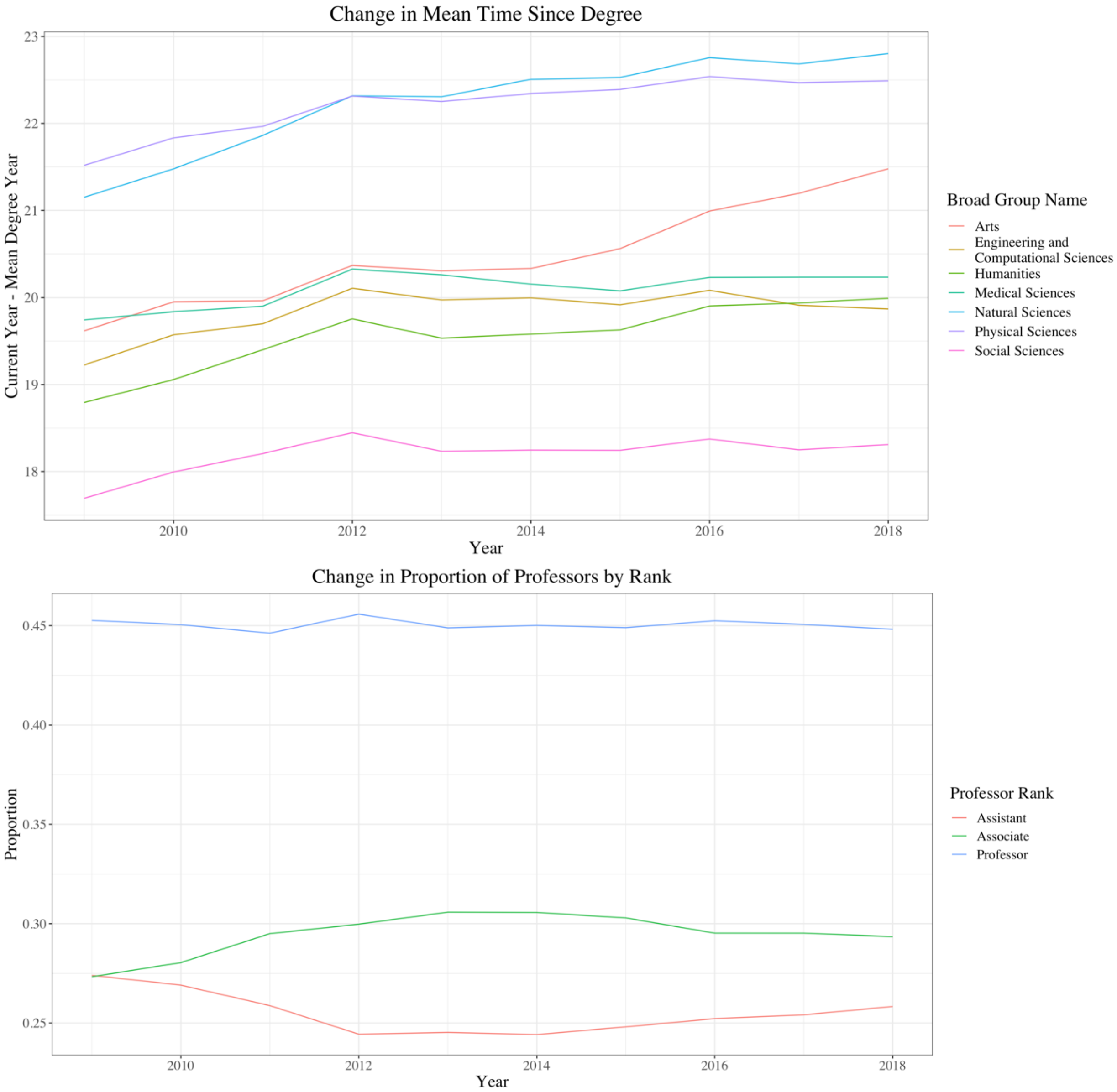

Figure 5: Predicted Departmental Faculty Across Range of Article Publications (AA Data, using Model 1)

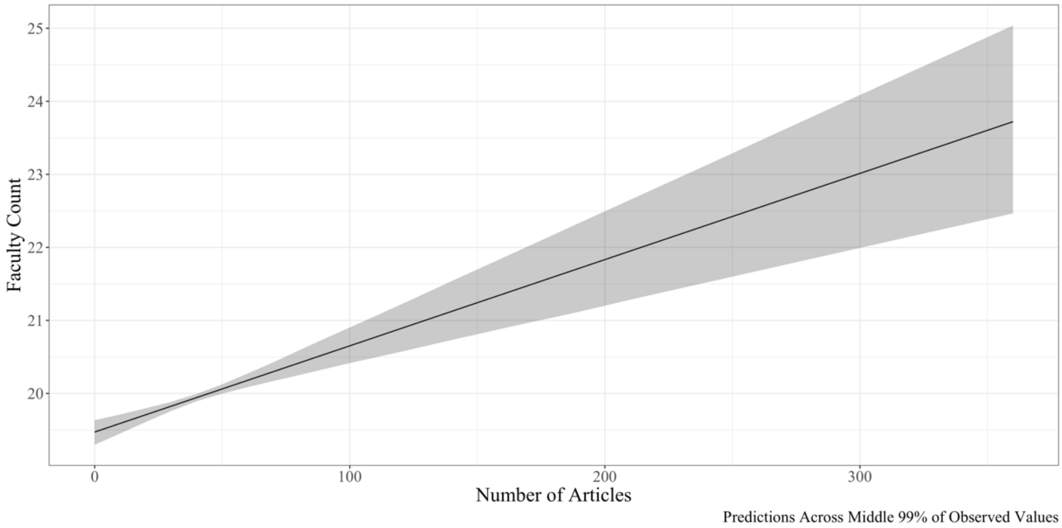

Figure 6: Changes for Disciplinary Categories, Other Data

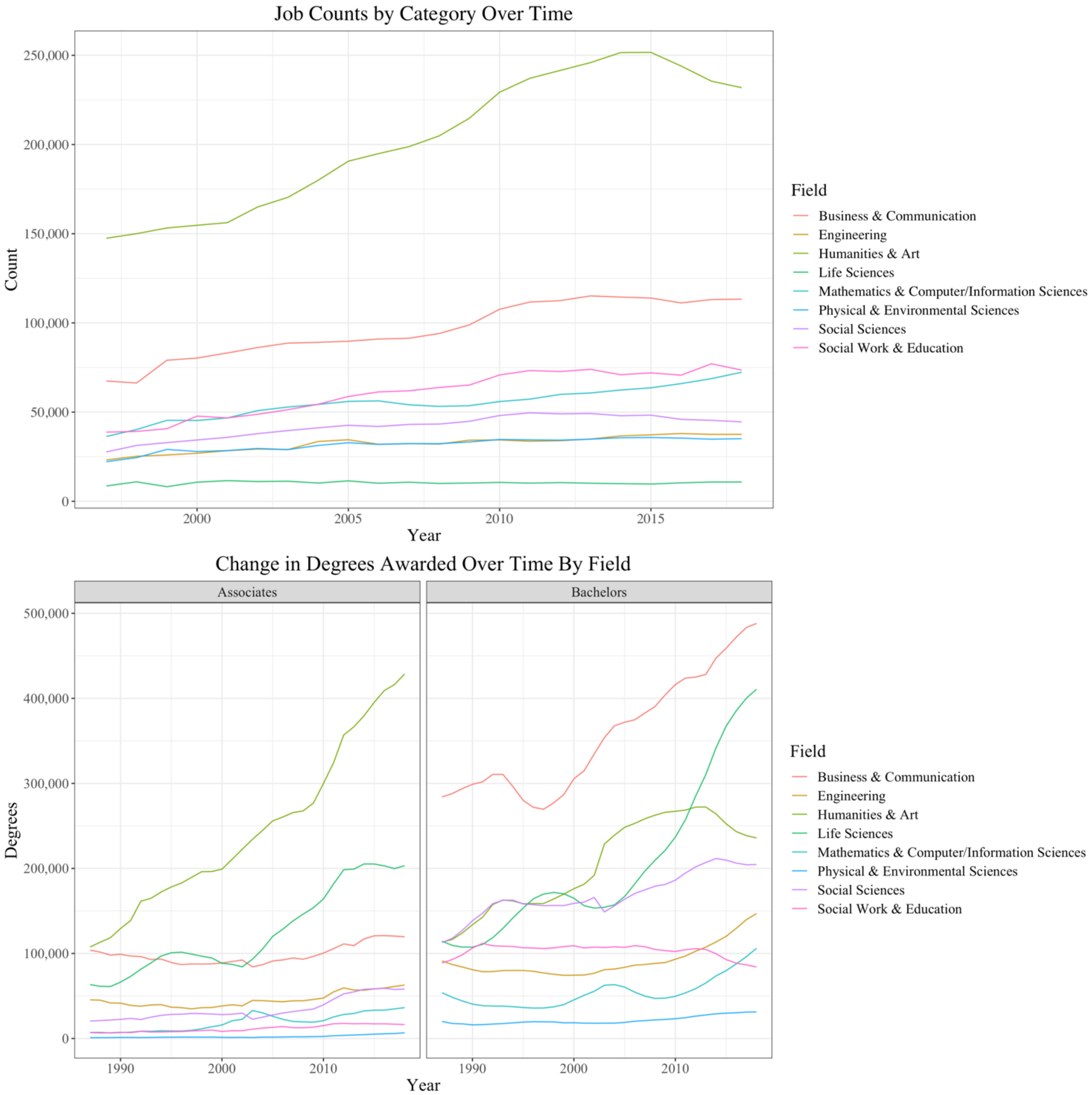

Figure 7: Persistence of Faculty in Fields, BLS Data

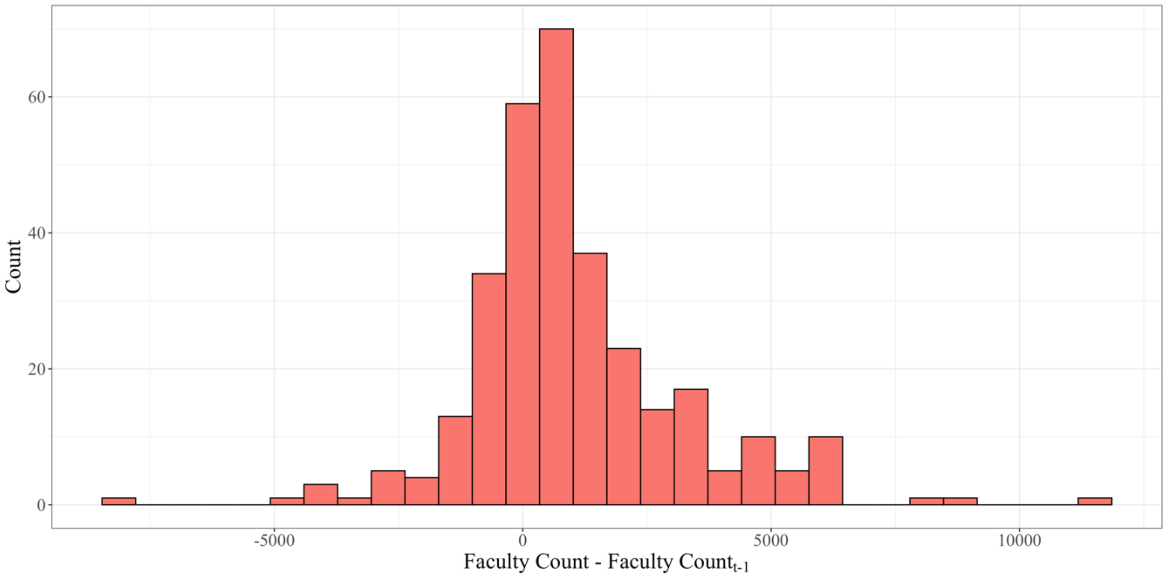

Table 1: Determinants of Faculty Counts in Departments, Academic Analytics Data (Year Effects)

	(1)	(2)	(3)	(4)
	Faculty Count	Faculty Count	Faculty Count	Faculty Count
Faculty $Count_{t-2}$	0.911***	0.912***	0.910***	0.909***
	(157.39)	(163.15)	(150.11)	(152.34)
$Articles_{t-2}$	0.0118***	0.00831***	0.0124***	0.0105***
	(7.18)	(4.90)	(6.31)	(4.93)
$Books_{t-2}$	0.0762***	0.0800***	0.0731***	0.0782***
	(4.42)	(4.62)	(4.20)	(4.45)
Grant $Dollars_{t-2}$	-5.04e-08***		-4.60e-08**	
	(-2.74)		(-2.47)	
$Grants_{t-2}$		-0.00393		-0.00150
		(-0.63)		(-0.24)
$Citations_{t-2}$			-0.0000293	-0.0000690**
			(-1.08)	(-2.54)
Constant	0.869***	0.876***	0.852***	0.881***
	(9.58)	(9.59)	(8.76)	(8.80)
Observations	98067	98067	90734	90734

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

Year Fixed Effects, SEs Clustered on University-Departments

Table 2: Determinants of Faculty Counts in Departments (Discipline-Year Effects)

	(5) Faculty Count	(6) Faculty Count	(7) Faculty Count	(8) Faculty Count
Faculty $Count_{t-2}$	0.904***	0.906***	0.903***	0.904***
	(144.33)	(151.01)	(137.45)	(141.24)
$Articles_{t-2}$	0.0110***	0.00853***	0.0112***	0.00989***
	(6.05)	(4.62)	(5.23)	(4.37)
$Books_{t-2}$	0.108***	0.111***	0.105***	0.109***
	(5.34)	(5.43)	(5.13)	(5.22)
Grant $Dollars_{t-2}$	-4.79e-08**		-4.57e-08**	
	(-2.50)		(-2.33)	
$Grants_{t-2}$		-0.00846		-0.00670
		(-1.17)		(-0.93)
$Citations_{t-2}$			-0.0000101	-0.0000405
			(-0.36)	(-1.44)
Constant	0.767**	0.760**	0.452	0.455
	(1.99)	(1.98)	(1.01)	(1.01)
Observations	98067	98067	90734	90734

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

Discipline-Year Fixed Effects, SEs Clustered on University-Departments

Table 3: Determinants of Disciplinary Faculty Counts Nationwide, BLS Data

	(9) Faculty Count (BLS) (Year Effects)	(10) Faculty Count (BLS) (Year & Field Effects)
Faculty Count $(BLS)_{t-2}$	1.053***	0.809***
	(90.91)	(8.75)
Associate $Degrees_{t-2}$	-0.0162***	-0.0686**
	(-3.32)	(-2.86)
Bachelor's $Degrees_{t-2}$	0.000763	0.0483
	(0.31)	(1.54)
R&D $Expenditures_{t-2}$	-0.0000171	-0.0000823
	(-0.87)	(-0.85)
Constant	2109.2	7163.7
	(1.48)	(0.63)
Observations	198	198

t statistics in parentheses
* p<0.10, ** p<0.05, *** p<.01
SEs Clustered on Field

Table A-1: Descriptive Statistics

Statistic	N	Mean	St. Dev.	Median
Academic Analytics Data (Number)				
Faculty Count	98,067	19.91	14.14	16
Articles_{t-2}	98,067	37.14	59.39	16
Books_{t-2}	98,067	1.26	2.34	0
Grants_{t-2}	98,067	10.39	19.62	2
Citations_{t-2}	90,734	1,220.79	2,976.43	250.00
Grant Dollars $\text{(2010 Dollars)}_{t-1}$	98,067	2,591,454.00	6,942,282.00	239,006.2
Academic Analytics Data (Proportion)				
Articles_{t-2} / Faculty Count_{t-2}	98,067	1.57	1.68	1.00
Books_{t-2} / Faculty Count_{t-2}	98,067	0.06	0.11	0.00
Grants_{t-2} / Faculty Count_{t-2}	98,067	0.41	0.60	0.14
Citations_{t-2} / Faculty Count_{t-2}	90,734	47.02	91.80	15.80
Grant Dollars $\text{(2010 Dollars)}_{t-2}$ / Faculty Count_{t-2}	98,067	98,088.45	202,116.70	15,295.54
Academic Analytics Data (Change)				
$\text{Articles}_{(t-2)-(t-3)}$	88,272	2.67	19.66	1.00
$\text{Books}_{(t-2)-(t-3)}$	88,272	0.03	1.91	0.00
$\text{Grants}_{(t-2)-(t-3)}$	88,272	0.05	6.24	0.00
$\text{Citations}_{(t-2)-(t-3)}$	76,579	−103.56	1,459.90	−5.00
Grant $\text{Dollars}_{(t-2)-(t-3)}$	88,272	56,802.05	2,601,872.00	0.00
Federal Data				
Faculty Count (BLS)	203	43,646.45	34,986.86	33,520
Associate Degrees_{t-2}	203	42,538.56	73,911.85	17,532
Bachelor's Degrees_{t-2}	203	93,569.98	85,333.16	83,722
R&D Expenditures $\text{(2010 dollars, thousands)}_{t-2}$	203	7,050,720.00	10,481,961.00	1,823,600.00

Table A-2: Determinants of Faculty Counts in Departments, Academic Analytics Data (Year Effects, One-Year Lag)

	(1a) Faculty Count	(2a) Faculty Count	(3a) Faculty Count	(4a) Faculty Count
Faculty Count_{t-1}	0.943***	0.944***	0.942***	0.943***
	(255.10)	(278.79)	(239.74)	(255.37)
Articles_{t-1}	0.00731***	0.00548***	0.00810***	0.00707***
	(6.44)	(5.09)	(6.28)	(5.20)
Books_{t-1}	0.0509***	0.0520***	0.0500***	0.0519***
	(4.76)	(4.89)	(4.60)	(4.78)
Grant Dollars_{t-1}	-4.07e-08***		-3.65e-08**	
	(-2.68)		(-2.42)	
Grants_{t-1}		-0.00707		-0.00502
		(-1.44)		(-1.08)
Citations_{t-1}			-0.0000330**	-0.0000564***
			(-2.00)	(-3.46)
Constant	0.758***	0.764***	0.758***	0.779***
	(11.58)	(11.56)	(10.81)	(10.68)
Observations	115838	115838	107071	107071

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

Year Fixed Effects, SEs Clustered on University-Departments

Table A-3: Determinants of Faculty Counts in Departments, Academic Analytics Data (Discipline-Year Effects, One-Year Lag)

	(5a) Faculty Count	(6a) Faculty Count	(7a) Faculty Count	(8a) Faculty Count
Faculty $Count_{t-1}$	0.939***	0.941***	0.938***	0.939***
	(234.65)	(260.67)	(220.59)	(240.58)
$Articles_{t-1}$	0.00691***	0.00561***	0.00765***	0.00697***
	(5.77)	(4.85)	(5.61)	(4.83)
$Books_{t-1}$	0.0704***	0.0723***	0.0703***	0.0725***
	(5.47)	(5.53)	(5.34)	(5.41)
Grant $Dollars_{t-1}$	-4.05e-08**		-3.71e-08**	
	(-2.54)		(-2.32)	
$Grants_{t-1}$		-0.0103*		-0.00846
		(-1.79)		(-1.52)
$Citations_{t-1}$			-0.0000263	-0.0000445***
			(-1.47)	(-2.59)
Constant	0.750***	0.735***	0.586**	0.578**
	(2.94)	(2.88)	(2.03)	(2.00)
Observations	115838	115838	107071	107071

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

Discipline-Year Fixed Effects, SEs Clustered on University-Departments

Table A-4: Determinants of Faculty Counts in Departments, Academic Analytics Data (Discipline & Year Effects, Two-Year Lag)

	(9a) Faculty Count	(10a) Faculty Count	(11a) Faculty Count	(12a) Faculty Count
Faculty Count$_{t-2}$	0.904***	0.905***	0.902***	0.903***
	(143.48)	(150.43)	(136.58)	(140.60)
Articles$_{t-2}$	0.0113***	0.00900***	0.0118***	0.0106***
	(6.23)	(4.91)	(5.57)	(4.75)
Books$_{t-2}$	0.109***	0.112***	0.107***	0.110***
	(5.36)	(5.45)	(5.18)	(5.27)
Grant Dollars$_{t-2}$	-5.00e-08**		-4.64e-08**	
	(-2.57)		(-2.34)	
Grants$_{t-2}$		-0.00981		-0.00748
		(-1.35)		(-1.03)
Citations$_{t-2}$			-0.0000205	-0.0000493*
			(-0.74)	(-1.79)
Constant	0.283**	0.265**	0.207*	0.210*
	(2.54)	(2.36)	(1.67)	(1.68)
Observations	98067	98067	90734	90734

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

Discipline & Year Fixed Effects, SEs Clustered on University-Departments

Table A-5: Determinants of Faculty Counts in Departments, Academic Analytics Data (Discipline & Year Effects, One-Year Lag)

	(13a) Faculty Count	(14a) Faculty Count	(15a) Faculty Count	(16a) Faculty Count
Faculty $Count_{t-1}$	0.939***	0.941***	0.938***	0.939***
	(232.04)	(258.27)	(218.22)	(238.49)
$Articles_{t-1}$	0.00709***	0.00584***	0.00790***	0.00720***
	(5.89)	(5.07)	(5.86)	(5.13)
$Books_{t-1}$	0.0706***	0.0726***	0.0708***	0.0730***
	(5.47)	(5.54)	(5.37)	(5.43)
Grant $Dollars_{t-1}$	-4.17e-08***		-3.77e-08**	
	(-2.58)		(-2.33)	
$Grants_{t-1}$		-0.0110*		-0.00889
		(-1.90)		(-1.59)
$Citations_{t-1}$			-0.0000302*	-0.0000470***
			(-1.77)	(-2.89)
Constant	0.429***	0.412***	0.400***	0.396***
	(5.85)	(5.58)	(5.02)	(4.92)
Observations	115838	115838	107071	107071

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

Discipline & Year Fixed Effects, SEs Clustered on University-Departments

Table A-6: Determinants of Disciplinary Faculty Counts Nationwide (One-Year Lag), BLS Data

	(17a) Faculty Count (BLS) (Year Effects)	(18a) Faculty Count (BLS) (Year & Field Effects)
Faculty Count $(BLS)_{t-1}$	1.027***	0.926***
	(150.95)	(17.16)
Associate $Degrees_{t-1}$	-0.00838***	-0.0367**
	(-3.14)	(-2.88)
Bachelor's $Degrees_{t-1}$	0.000192	0.0240
	(0.15)	(1.65)
R&D $Expenditures_{t-1}$	-0.00000712	-0.0000365
	(-0.75)	(-0.80)
Constant	1823.7***	3121.4
	(4.03)	(0.58)
Observations	211	211

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

SEs Clustered on Field

Table A-7: Determinants of Faculty Change in Departments, Academic Analytics Data (Year Effects)

	(19a)	(20a)	(21a)	(22a)
	Faculty $\text{Count}_{t-(t-1)}$	Faculty $\text{Count}_{t-(t-1)}$	Faculty $\text{Count}_{t-(t-1)}$	Faculty $\text{Count}_{t-(t-1)}$
Faculty Count_{t-2}	-0.0147***	-0.0149***	-0.0152***	-0.0149***
	(-8.49)	(-8.63)	(-7.84)	(-7.71)
$\text{Articles}_{(t-2)-(t-3)}$	-0.00365*	-0.00177	-0.00146	-0.00352
	(-1.74)	(-0.79)	(-0.58)	(-1.45)
$\text{Books}_{(t-2)-(t-3)}$	-0.0273***	-0.0267**	-0.0234**	-0.0243**
	(-2.61)	(-2.56)	(-2.19)	(-2.26)
Grant $\text{Dollars}_{(t-2)-(t-3)}$	1.23e-09			-2.88e-09
	(0.12)			(-0.27)
$\text{Grants}_{(t-2)-(t-3)}$		-0.00882*	-0.0126**	
		(-1.79)	(-2.43)	
$\text{Citations}_{(t-2)-(t-3)}$			-0.0000128	-0.0000158
			(-0.73)	(-0.90)
Constant	0.299***	0.303***	0.332***	0.329***
	(6.65)	(6.73)	(6.30)	(6.24)
Observations	88272	88272	76579	76579

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

Year Fixed Effects, SEs Clustered on University-Departments

Table A-8: Determinants of Faculty Change in Departments, Academic Analytics Data (Discipline & Year Effects)

	(23a)	(24a)	(25a)	(26a)
	Faculty $\text{Count}_{t-(t-1)}$	Faculty $\text{Count}_{t-(t-1)}$	Faculty $\text{Count}_{t-(t-1)}$	Faculty $\text{Count}_{t-(t-1)}$
Faculty Count_{t-2}	-0.0169***	-0.0171***	-0.0167***	-0.0165***
	(-9.06)	(-9.18)	(-8.10)	(-7.99)
$\text{Articles}_{(t-2)-(t-3)}$	-0.00427**	-0.00247	-0.00232	-0.00431*
	(-2.03)	(-1.10)	(-0.92)	(-1.76)
$\text{Books}_{(t-2)-(t-3)}$	-0.0256**	-0.0250**	-0.0226**	-0.0234**
	(-2.46)	(-2.41)	(-2.12)	(-2.19)
Grant $\text{Dollars}_{(t-2)-(t-3)}$	3.21e-09			-1.33e-09
	(0.32)			(-0.13)
$\text{Grants}_{(t-2)-(t-3)}$		-0.00763	-0.0114**	
		(-1.55)	(-2.23)	
$\text{Citations}_{(t-2)-(t-3)}$			-0.00000630	-0.00000876
			(-0.36)	(-0.50)
Constant	0.0817	0.0869	0.0930	0.0869
	(1.31)	(1.40)	(1.22)	(1.14)
Observations	88272	88272	76579	76579

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

Discipline & Year Fixed Effects, SEs Clustered on University-Departments

Table A-9: Determinants of Faculty Change in Departments, Academic Analytics Data (Discipline-Year Effects)

	(27a)	(28a)	(29a)	(30a)
	Faculty $Count_{t-(t-1)}$	Faculty $Count_{t-(t-1)}$	Faculty $Count_{t-(t-1)}$	Faculty $Count_{t-(t-1)}$
Faculty $Count_{t-2}$	-0.0169***	-0.0171***	-0.0168***	-0.0165***
	(-9.02)	(-9.14)	(-8.11)	(-7.99)
$Articles_{(t-2)-(t-3)}$	-0.00433**	-0.00242	-0.00220	-0.00429*
	(-2.05)	(-1.07)	(-0.86)	(-1.74)
$Books_{(t-2)-(t-3)}$	-0.0247**	-0.0241**	-0.0217**	-0.0225**
	(-2.38)	(-2.33)	(-2.04)	(-2.10)
Grant $Dollars_{(t-2)-(t-3)}$	3.39e-09			-7.43e-10
	(0.34)			(-0.07)
$Grants_{(t-2)-(t-3)}$		-0.00804	-0.0116**	
		(-1.63)	(-2.28)	
$Citations_{(t-2)-(t-3)}$			-0.0000104	-0.0000132
			(-0.60)	(-0.76)
Constant	0.0422	0.0439	0.0435	0.0406
	(0.34)	(0.35)	(0.26)	(0.24)
Observations	88272	88272	76579	76579

t statistics in parentheses
* p<0.10, ** p<0.05, *** p<.01
Discipline-Year Fixed Effects, SEs Clustered on University-Departments

Table A-10: Determinants of Changes in Disciplinary Faculty Counts Nationwide, BLS Data

	(31a)	(32a)
	(Year Effects)	(Year & Field Effects)
	Faculty Count $(BLS)_{t-(t-1)}$	Faculty Count $(BLS)_{t-(t-1)}$
Faculty Count $(BLS)_{t-2}$	0.0180***	-0.150***
	(4.58)	(-5.81)
Associate $Degrees_{(t-2)-(t-3)}$	-0.0992***	-0.0393
	(-3.48)	(-0.70)
Bachelor's $Degrees_{(t-2)-(t-3)}$	0.114	0.100
	(1.39)	(1.46)
R&D $Expenditures_{(t-2)-(t-3)}$	-0.000120	-0.0000311
	(-1.09)	(-0.18)
Constant	321.6	11048.0***
	(0.26)	(4.62)
Observations	190	190

t statistics in parentheses
* p<0.10, ** p<0.05, *** p<.01

Table A-11: Determinants of Faculty Counts in Departments Using Proportional Predictors, Academic Analytics Data (Year Effects)

	(33a) Faculty Count	(34a) Faculty Count	(35a) Faculty Count	(36a) Faculty Count
Faculty $Count_{t-2}$	0.927***	0.926***	0.926***	0.926***
	(175.29)	(173.41)	(167.12)	(167.12)
$Articles_{t-2}$ / Faculty $Count_{t-2}$	0.287***	0.220***	0.220***	0.220***
	(13.94)	(10.08)	(7.18)	(7.18)
$Books_{t-2}$ / Faculty $Count_{t-2}$	0.819***	0.914***	0.923***	0.923***
	(5.21)	(5.69)	(5.46)	(5.46)
Grant $Dollars_{t-2}$ / Faculty $Count_{t-2}$	0.000000244			
	(0.89)			
$Grants_{t-2}$ / Faculty $Count_{t-2}$		0.350***	0.364***	0.364***
		(4.10)	(4.53)	(4.53)
$Citations_{t-2}$ / Faculty $Count_{t-2}$			-0.000248	-0.000248
			(-0.49)	(-0.49)
Constant	0.435***	0.406***	0.326***	0.326***
	(4.89)	(4.53)	(3.32)	(3.32)
Observations	98067	98067	90734	90734

t statistics in parentheses
* p<0.10, ** p<0.05, *** p<.01
Year Fixed Effects, SEs Clustered on University-Departments

Table A-12: Determinants of Faculty Counts in Departments Using Proportional Predictors, Academic Analytics Data (Discipline & Year Effects)

	(37a) Faculty Count	(38a) Faculty Count	(39a) Faculty Count	(40a) Faculty Count
Faculty $Count_{t-2}$	0.922***	0.921***	0.922***	0.921***
	(161.50)	(160.67)	(155.59)	(154.81)
$Articles_{t-2}$ / Faculty $Count_{t-2}$	0.307***	0.258***	0.295***	0.255***
	(13.02)	(10.48)	(9.37)	(7.65)
$Books_{t-2}$ / Faculty $Count_{t-2}$	1.036***	1.031***	1.049***	1.042***
	(6.21)	(6.19)	(5.88)	(5.85)
Grant $Dollars_{t-2}$ / Faculty $Count_{t-2}$	0.000000414		0.000000425	
	(1.38)		(1.51)	
$Grants_{t-2}$ / Faculty $Count_{t-2}$		0.377***		0.393***
		(3.56)		(3.93)
$Citations_{t-2}$ / Faculty $Count_{t-2}$			0.000157	-0.000117
			(0.32)	(-0.23)
Constant	0.0125	0.0114	-0.117	-0.114
	(0.11)	(0.10)	(-0.94)	(-0.91)
Observations	98067	98067	90734	90734

t statistics in parentheses
* p<0.10, ** p<0.05, *** p<.01
Discipline & Year Fixed Effects, SEs Clustered on University-Departments

Table A-13: Determinants of Faculty Counts in Departments Using Proportional Predictors, Academic Analytics Data (Discipline-Year Effects)

	(41a) Faculty Count	(42a) Faculty Count	(43a) Faculty Count	(44a) Faculty Count
Faculty $Count_{t-2}$	0.922***	0.921***	0.922***	0.921***
	(162.68)	(161.81)	(156.67)	(155.83)
$Articles_{t-2}$ / Faculty $Count_{t-2}$	0.298***	0.244***	0.274***	0.229***
	(12.69)	(9.85)	(8.61)	(6.74)
$Books_{t-2}$ / Faculty $Count_{t-2}$	1.047***	1.043***	1.051***	1.045***
	(6.28)	(6.27)	(5.89)	(5.87)
Grant $Dollars_{t-2}$ / Faculty $Count_{t-2}$	0.000000460		0.000000427	
	(1.53)		(1.51)	
$Grants_{t-2}$ / Faculty $Count_{t-2}$		0.410***		0.410***
		(3.83)		(4.06)
$Citations_{t-2}$ / Faculty $Count_{t-2}$			0.000529	0.000261
			(1.05)	(0.49)
Constant	0.497	0.514	0.144	0.161
	(1.29)	(1.33)	(0.32)	(0.36)
Observations	98067	98067	90734	90734

t statistics in parentheses

* p<0.10, ** p<0.05, *** p<.01

Discipline-Year Fixed Effects, SEs Clustered on University-Departments

Table A-14: Crosswalk Used to Merge Federal Data Sources (Authors' Categorization)

Field	NCES (CIP Code)	HERD Category	BLS Category
Mathematics and Statistics	27	Mathematics And Statistics / Mathematical And Computer Sciences, All / Mathematical Sciences, All / Mathematics And Statistics, All	Mathematics / Statisticians / Mathematical Science Teachers, Postsecondary
Computer and Information Sciences	11	Computer And Information Sciences / Computer And Information Sciences, All	Computer Science Teachers, Postsecondary / Math And Computer Teachers, Postsecondary
Life sciences, All	NA	Life Sciences, All	Life Sciences Teachers, Postsecondary
Life sciences, Biological/Biomedical	26	Life Sciences, Biological And Biomedical / Life Sciences, Biological And Biomedical Sciences / Life Sciences, Biological Sciences	Biological Science Teachers, Postsecondary / Biochemists And Biophysicists / Zoologists And Wildlife Biologists
Life sciences, Agricultural Sciences	2, 1, 3	Life Sciences, Agricultural Sciences	Agricultural Sciences Teachers, Postsecondary / Animal Scientists / Food Scientists And Technologists / Forestry And Conservation Science Teachers, Postsecondary
Life sciences, Health Sciences	17, 18, 51	Life Sciences, Health Sciences	Health Specialties Teachers, Postsecondary / Health Teachers, Postsecondary / Nursing Instructors And Teachers, Postsecondary
Physical Sciences	40	Physical Sciences, All / Physical Sciences, Astronomy / Physical Sciences, Chemistry / Physical Sciences, Other / Physical Sciences, Physics / Physical Sciences, Astronomy And Astrophysics / Physical Sciences, Materials Science	Astronomers / Astronomers And Physicists / Chemistry Teachers, Postsecondary / Physical Sciences Teachers, Postsecondary / Physics Teachers, Postsecondary
Social sciences	45, 5, 20, 43	Social Sciences, All / Social Sciences, Economics / Social Sciences, Other / Social Sciences, Political Sci / Social Sciences, Sociology / Social Sciences, Anthropology / Social Sciences, Political Science / Social Sciences, Political Science And Government / Social Sciences, Sociology, Demography, And Population Studies / Psychology, All	Social Sciences Teachers, Postsecondary / Social Sciences Teachers, Postsecondary, All Other / Anthropology And Archeology Teachers, Postsecondary / Area, Ethnic, And Cultural Studies Teachers, Postsecondary / Economics Teachers, Postsecondary / Geography Teachers, Postsecondary / Home Economics Teachers, Postsecondary / Political Science Teachers, Postsecondary / Social Sciences Teachers, Postsecondary / Social Sciences Teachers, Postsecondary, All Other / Sociology Teachers, Postsecondary
Other Non-S&E Fields	4, 28, 29, 19, 31, 25, 30	Non-S&E, Other	Architecture Teachers, Postsecondary / Education And Library Science Teachers, Postsecondary / Library Science Teachers, Postsecondary
Visual Art	50	Non-S&E, Visual And Performing Arts	Art, Drama, And Music Teachers, Postsecondary
Business	52, 7, 6, 8	Non-S&E, Business And Management / Non-S&E, Business Management And Business Administration	Business Teachers, Postsecondary
Communication	9, 10	Non-S&E, Communication And Communications Technologies	Communications Teachers, Postsecondary
Education	13	Non-S&E, Education	Education Teachers, Postsecondary
Humanities	23, 16, 54, 24, 38, 39	Non-S&E, Humanities	English Language And Literature Teachers, Postsecondary / Foreign Language And Literature Teachers, Postsecondary / History Teachers, Postsecondary / Philosophy And Religion Teachers, Postsecondary
Law	22	Non-S&E, Law	Law Teachers, Postsecondary
Social work	NA	Non-S&E, Social Work	Social Work Teachers, Postsecondary
Environmental Sciences	NA	Environmental Sciences, All / Environmental Sciences, Atmospheric Sciences / Environmental Sciences, Earth Sciences / Environmental Sciences, Oceanography / Environmental Sciences, Other	Atmospheric, Earth, Marine, And Space Sciences Teachers, Postsecondary / Environmental Science Teachers, Postsecondary

Engineering	46, 14, 15, 47, 49	Engineering, All / Engineering, Aerospace / Engineering, Chemical / Engineering, Civil Eng / Engineering, Electrical / Engineering, Mechanical / Engineering, Metallurgical / Engineering, Other / Engineering, Bioengineering And Biomedical / Engineering, Aeronautical And Astronautical / Engineering, Aerospace, Aeronautical And Astronautical / Engineering, Aerospace, Aeronautical, And Astronautical / Engineering, Bioengineering And Biomedical Engineering / Engineering, Civil / Engineering, Electrical, Electronic, And Communications / Engineering, Electrical, Electronics, And Communications / Engineering, Industrial And Manufacturing / Engineering, Metallurgical And Materials	Engineering And Architecture Teachers, Postsecondary / Engineering Teachers, Postsecondary

Table A-15: Codes Used to Categorize Academic Analytics Disciplines (Authors' Categorization)

Discipline	Comparison Group (AA)
Agriculture	Agricultural Economics / Agricultural/Biological Engineering and Bioengineering / Agriculture, various / Agronomy and Crop Science / Fisheries Science / Forest Resources/Forestry / Horticulture
Anatomy and Physiology	Anatomy / Physiology, General
Anthropology	Anthropology
Architecture	Architecture / Architecture, Design, Planning, various
Arts	Performing and Visual Arts, various / Theatre Literature, History and Criticism
Biology	Biochemistry / Bioinformatics and Computational Biology / Biological Sciences, various / Biology/Biological Sciences, General / Biostatistics / Botany/Plant Biology / Cell Biology / Developmental Biology / Ecology / Entomology / Genetics / Marine Sciences / Microbiology / Molecular Biology / Molecular Genetics / Neurobiology/Neuroscience / Plant Pathology / Plant Sciences / Structural Biology / Wildlife Science / Zoology
Business Studies	Accounting / Business Administration / Business, various / Finance / Information Technology/Information Systems / Management / Management Information Systems / Marketing / Operations Research
Chemistry	Chemical Sciences, various / Chemistry
Classics	Classics and Classical Languages
Communications	Communication and Communication Studies / Communication Disorders and Sciences / Information Science/Studies / Mass Communications/Media Studies
Computer Science	Computer and Information Sciences, various / Computer Engineering / Computer Science
Criminology	Criminal Justice and Criminology
Earth Sciences	Atmospheric Sciences and Meteorology / Environmental Sciences / Geology/Earth Science, General / Oceanography, Physical Sciences / Soil Science
Economics	Applied Economics / Economics, General
Education	Counselor Education / Curriculum and Instruction / Education, General / Educational Evaluation and Research / Educational Leadership and Administration / Educational Psychology / Foundations of Education / Health, Physical Education, Recreation / Higher Education/Higher Education Administration / Mathematics Education / School Psychology / Science Education / Special Education / Teacher Education Specific Levels / Teacher Education Specific Subject Areas
Engineering	Aerospace Engineering / Biomedical Engineering / Chemical Engineering / Civil Engineering / Electrical Engineering / Engineering Mechanics / Engineering, General / Engineering, various / Environmental Engineering / Geological and Mining Engineering / Industrial Engineering / Materials Engineering / Materials Science and Engineering / Mechanical Engineering / Nuclear Engineering / Systems Engineering
English	Comparative Literature / Composition, Rhetoric and Writing / English Language and Literature
Epidemiology	Epidemiology
Geography	Geography
History	History
Interdisciplinary Humanities	Ancient Studies / Art History and Criticism / Asian Studies / Humanities/Humanistic Studies, General
Interdisciplinary Medical Sciences	Environmental Health Sciences / Food Science / Health Professions, various / Health Promotion, Kinesiology, Exercise Science and Rehab / Human and Medical Genetics / Immunology / Medical Sciences, various / Nutrition Sciences / Oncology and Cancer Biology / Oral Biology and Craniofacial Science / Pathology / Public Health / Speech and Hearing Sciences / Toxicology
Interdisciplinary Physical Science	Biophysics / Natural Resources
Interdisciplinary Social Science	American Studies / Area and Ethnic Studies, various / Consumer and Human Sciences, various / European Studies / Family and Human Sciences, various / Gender Studies / Human Development and Family Studies, General / International Affairs and Development / Social Sciences, various / Urban and Regional Planning
Linguistics	Linguistics
Mathematics	Applied Mathematics / Computational Sciences / Mathematics
Medical Biology	Biomedical Sciences, General
Modern Languages	Asian Languages / French Language and Literature / Germanic Languages and Literatures / Italian Language and Literature / Languages, various / Near and Middle Eastern Languages and Cultures / Slavic Languages and Literatures / Spanish Language and Literature
Music	Music specialties / Music, General
Nursing	Nursing
Pharmacology	Molecular Pharmacology / Pharmaceutical Sciences / Pharmacology / Pharmacy
Philosophy	Philosophy
Physics	Applied Physics / Astronomy and Astrophysics / Geophysics / Physics, General
Political Science	Political Science / Public Administration / Public Policy
Psychology	Clinical Psychology / Counseling Psychology / Psychology, General / Psychology, various
Sociology	Social Work/Social Welfare / Sociology
Statistics	Statistics
Theology	Religion/Religious Studies / Theology/Theological Studies
Veterinary and Animal Sciences	Animal Sciences
Veterinary Medicine	Veterinary Medical Sciences

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