Essays on Academic Innovation & Labour Markets

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Durham University

Submitted for the Degree of Doctor of Philosophy in Economics[1]

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September 12, 2023

[1]This work made use of the facilities of the N8 Centre of Excellence in Computationally Inten- sive Research (N8 CIR) provided and funded by the N8 research partnership and EPSRC (Grant No. EP/T022167/1). The Centre is co-ordinated by the Universities of Durham, Manchester and York

Abstract

Academic productivity is an area of study for those who research the economics of innovation. However, understanding of its determinants is still sparse. This thesis aims to broaden current understanding of the factors of production that go into academic innovation as well as how changes in academic trends may influence the careers of researchers. In doing so, this thesis examines productivity and career consequences of academic innovation across departmental and individual levels. More specifically, the first chapter of this thesis examines productivity in regards to a paradigm shift at the departmental level. The second chapter examines productivity at the individual economist level in relation to United States federal government funding. The third chapter uses the before mentioned scientific revolution to examine how changing trends may impact career prospects of junior faculty, and whether or not tenured faculty are biased towards their own methods.

The first chapter of this thesis examines how academic productivity can be influenced by funding and changing trends in economics. In this chapter, I use the Credibility Revolution mentioned in Angrist & Pischke (2010) to examine how the change in economics from being primarily theory based to being an empirical field has affected not only labour markets, but also effects of spending on different types of papers. Much of this work is accomplished with the aid of machine

learning techniques in order to label the large amounts of data necessary for this sort of analysis. The main findings of this thesis are that increased spending at the university level does not lead to the production of more microeconometrics papers, nor does increased expenditure seem to lead to increased impact as measured by citations received, but rather seems to decrease the number of publications as well as citations received. The first chapter also finds that private universities seem to be affected most negatively by increasing expenditures. I also find that there is little difference in the spending efficacy of elite and non-elite universities.

In the second chapter, this thesis examines the impact of National Science Foundation Grants on the productivity of academic economists. I find that the receipt of the first grant has a positive effect on the number of citations received for economists as well as a positive effect on the number of unique co-authors one has throughout their career. However, receipt of a first grant does not cause economists to have more publications, more highly influential publications, or take on more projects. This effect is stronger for empiricists, but less precisely measured. There is also no statistically significant effect of subsequent grants, simply having a grant, or the amount of grant money available. This indicates that the effect of receiving a grant has more to do with network effects or as a signaling mechanism than truly increasing productivity of recipients.

In the third chapter I examine how changing trends in economics has impacted labour markets for academic economists. My findings indicate that conditional on additional measures of academic productivity such as the number of top 5 publications or citations, empirical economists - whether they are microeconometricians or other types of empiricists have a greater probability of tenure than do other economists. I also find that this effect is strongest in mid-ranked universities rather than top or lower ranked universities which may indicate that middle ranked universities are more likely to engage in strategic behaviour. I find no indication that more empiricists in tenured positions has any effect on an empiricist's probability of receiving tenure. This provides some evidence that faculty are aware of trends and seem to make hiring decisions based on them, but do not have any personal bias towards their own style of research by interacting the number of tenured empiricists with whether or not the economist is an empiricist as well. Finally, I find that microeconometricians on average have a hazard to tenure approximately 25% higher than other economists. This chapter provides evidence that changing trends can impact the careers of younger researchers, and also that tenured faculty do not try to stack departments with people who do similar work as them.

This thesis contributes to current economic understanding of innovation, and how innovation can affect labour markets. The first chapter expands understanding of departmental spending and how it contributes to innovation. Specifically, it looks at whether or not spending improves the quantity or quality of papers related to a scientific revolution. The findings themselves provide evidence that spending is negatively related to production and quality of papers related to scientific revolutions. The second chapter takes a closer view and looks at how personal funding for basic research through National Science Foundation (NSF) grants impacts the quality and quantity of papers economists produce. The findings here indicate that NSF grants produce a network effect more so than improving the productivity of economists. The third chapter contributes to understanding of labour markets. In relation to the scientific revolution mentioned prior, this chapter looks at whether or not this impacts the probability of junior economists receiving tenure

based on whether or not they are currently doing fashionable work, the findings indicate that changing tastes in academia can influence career outcomes regardless of one's own performance, and provides some evidence that tenured faculty do not seem to have bias for others doing the same type of research.

JEL Codes: D24, D29, H52, H81, J24, J62, J63

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Declaration

I declare that this work is solely my own as are any errors or mistakes. All writing and interpretation of results are also my own. Any information that is not my own has been cited properly. No part of this thesis has been submitted for any other degree.

Acknowledgements

I'd like to thank my supervisors, Angel Hernando-Veciana, Nejat Anbarci, and Min Liu for taking me on as their PhD student. As well as for their dedication to my progress and endless suggestions and motivations that made the completion of this thesis possible.

I'd also like to thank other faculty at Durham University such as Leslie Reinhorn, Abderahim Taamouti and John Moffat for providing me with feedback on my progress during the course of my PhD.

I'd also like to state my gratitude to Durham University Business school for providing me with the scholarship that made this thesis possible.

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Chapter 1

Effects of R&D Spending on Departmental Productivity During a Paradigm Shift

1.1 Introduction

Scientific productivity has always been of interest to economists (Stephan 1996, 2010).[1] Aside from offering fertile ground for the study of productivity and innovation, the returns from scientific breakthroughs and technological development boost economic growth and raise standards of living (Gruber & Johnson 2019). To this end, universities spend billions of dollars every year on research & development (R&D) to perform basic & applied research. In the case of academia, R&D expenditure refers to all expenditures from R&D labelled accounts related to the production of research, most often journal articles. For instance, the hiring of a re-

[1]For the duration of this thesis scientific productivity will refer to output as measured by publications or citations while departmental productivity will refer to output of specifically the economics department at a university which is the focus of this chapter.

search assistant, the purchase of specialized equipment, or gathering of data. The source of this funding can vary from the federal government, institutional funding, or non-profit backing amongst others. It does not normally include the salaries of faculty.[2] Departments in universities, such as the department of economics find funding from a variety of sources, but unlike individual grants, departments have some discretion in where they invest their money which makes them an ideal study group for whether or not they invest in truly novel research.

Another area of interest is in how funding contributes to research related to a paradigm shift; a major change in the way research is normally conducted in a discipline.[3] During a paradigm shift two changes occur simultaneously: the decline of the old paradigm which becomes increasingly incapable of solving current problems and the emergence of the new paradigm that offers fertile ground to tackle existing problems (Besancenot & Dogguy 2014). One may think that universities which possess greater financial resources would be better equipped to embrace a paradigm shift due to the costs and difficulty in reallocating resources, as well as abandoning old prejudices. Earlier papers (Hull, Tessner & Diamond 1978, Gorham 1991, Levin, Stephan & Walker 1995) have found that older scientists are about as open to new ideas as their younger counterparts. However, (Azoulay, Fons-Rosen & Zivin 2019) find that prominent figures discourage the spread of new ideas through their personal gravitas as well as other avenues such as their collaborators having control over resources and social channels.[4] If this

[2] A more detailed explanation of what academic R&D expenditure entails can be found in Section 1.3.3.

[3] For this chapter and the rest of the thesis, paradigm shift will refer to a paradigm shift in the Kuhnian sense in which new ideas overtake established ones, triggering a scientific revolution which leads to new ground for discovery (Kuhn 1970).

[4] This can make old ideas hard to dislodge even after the superstar has passed on according to the authors as collaborators with positions such as editors of journals or panels for funding will be able to use their position keep out new comers who may disturb the status quo.

were the case, increased funding may actually hinder the embrace of a paradigm shift. With funding being limited (National Science and Technology Council 2008) and paradigm shifts propelling scientific progress (Kuhn 1970), it is a worthy goal to study not just the impacts of funding on common measures of knowledge production such as aggregate publications or citations like Payne & Siow (2003) and Whalley & Hicks (2014), but also how R&D funding affects production of knowledge specifically related to a paradigm shift.

While many have looked at productivity as a measure of output, in this chapter I use a sample of 66 universities' economics departments to examine the effects of spending on ability to embrace a paradigm shift using one such shift in the field of economics known as the credibility revolution (Angrist & Pischke 2010). The department level offers an advantage to studying how funding affects paradigm shifts over other sources of funding such as grants as departments can spend institutional funds on a number of different projects unhindered by commitments to research projects such as the National Science Foundation (NSF) or National Institute of Health (NIH). I find that the effect of aggregate economics R&D spending has a negative effect on the production of those papers that are related to the credibility revolution. This holds true whether I examine the quality of the papers as measured by citations, or the publication of new microeconometric papers.[5] This effect is strongest in the period before 2010, providing support for spending being negative *during* the credibility revolution. These findings indicate that the effect of spending is more heterogeneous than previously believed.

Contrary to my findings, earlier papers that measured the effect of funding

[5]There are also negative and significant effects on citations to other papers although to a lesser extent than for microeconometrics papers.

found that the number of publications increased with more funding, although the size of the effect is disputed. Adams & Griliches (1998) and Jacob & Lefgren (2011) look at universities and individual researchers respectively, and find that the effect of funding is quite small. On the other hand, Payne & Siow (2003), Whalley & Hicks (2014), and Rosenbloom, Ginther, Juhl & Heppert (2015) look at university and department level effects and find that the effect of spending on publications is quite substantial. On the effect of funding on quality, the literature tends to be more mixed, mostly finding small increases to the number of citations, or small negative effects. These papers also focus more on aggregate measures of production such as total papers produced and total citations received.

What sets my study apart is that it focuses specifically on the time period of said paradigm shift and papers that relate *specifically* to it, while others focus only on aggregate measures of productivity irrespective of the time period in question. I find empirical evidence that increased funding leads to a drop in the quality of papers. This effect is specific to microeconometric papers as well. Using advances in natural language processing (NLP) and artificial intelligence (AI), I am able to efficiently classify the papers in my dataset into one of four economic styles to examine the effect of R&D funding on a university's ability to embrace a paradigm shift.

This chapter's main contribution is to the understanding of the knowledge production process and how inputs may influence outputs of this process specifically when fertile new fields of research have appeared. Additional contributions are evidence that the efficacy of spending during a paradigm shift may be dependent on innate characteristics of the academic institutions themselves. Unlike other papers which have found no difference (Whalley & Hicks 2014) or a greater positive effect for private universities (Rosenbloom et al. 2015), I find that the effect is more negative for private universities. A further contribution is regarding the difference between elite and non-elite universities. My findings provide evidence that elite universities do not derive a greater benefit from their funding on topics related to a paradigm shift. My results also affirm the findings of Kim, Morse & Zingales (2009) that traditionally elite universities are finding it harder to compete with others, as I find no difference in spending efficacy between elite and non-elite universities.

The rest of this chapter will proceed as follows: the next section will contain a more in depth look at the literature, Section 3 will contain the empirical setting, sources of data and empirical design. Section 4 will contain the main results. Section 5 will contain several robustness tests, and Section 6 will contain conclusions and directions for future research.

1.2 Academic Innovation - Theory & Evidence

Holmstrom (1989) states that the innovation process is long, unpredictable and labour intensive. As such, performance measures are likely to be extremely noisy. Due to this, Holmstrom recommends instead low powered incentives when performance is difficult to measure or predict such as academic innovation. March (1991) models the innovation process of an organization as a trade-off between either exploration, the discovery of new ideas and exploitation, building off ideas already understood. March finds that exploitation is likely to be advantageous in the short-run but ultimately destructive in the long-run, but there may be a tendency for management to prefer exploitation over the more ambiguous rewards of exploration. Similarly, Amabile (1996) also reaches similar conclusions and states that financial incentives (such as increased funding) may lead researchers to pursue a research agenda that is based more on repetition than exploration. This is further backed up by Kaplan (2005) who claims that due to the NIH preferring safer research with clear cut goals, funding leads to few innovative ideas.

The belief that all scientific ideas arise as a result of some sort of Darwinian mechanism for survival of the fittest has long been a trope of the academic community, but lately it has become more difficult to deny that favouritism exists and is likely to distort career trajectories based on incumbents personal biases (Akerlof & Michaillat 2017). Earlier papers have found that the death of great scientists leads to permanent decreased quality adjusted publication rates for their collaborators (Azoulay, Zivin & Wang 2010, Jaravel, Petkova & Bell 2018). In a similar vein, Azoulay et al. (2019) find that the early death of prominent scientists leads to non-collaborators increasing their status within their chosen discipline as opposed to the scientist's collaborators. The authors take this as evidence that the death of prominent members of a discipline provides opportunities for outsiders to make their mark. Both of these papers indicate that "superstar" researchers can exhibit disproportionate effects upon the innovation process.

Taken together, these conditions may imply that R&D funding may not do much for innovation in a university, especially if the funding body is more conservative or restrictive. On the other hand, institutions that are more focused on groundbreaking discoveries such as elite universities may have an advantage in their funding during a paradigm shift because they may encourage exploration to a greater extent. Similarly, private universities which are less dependent on government funding to conduct research may also have an advantage over their public counterparts because they have more discretion over which projects they fund. On the other hand, private universities may face a disadvantage as lack of external accountability may mean that funding decisions are left up to more senior faculty which may introduce a degree of bias into the funding process that ultimately harms innovation.

1.3 Empirical Setting, Data & Methodology

1.3.1 Empirical Setting - The Credibility Revolution

As stated in Azoulay et al. (2019), paradigm shifts are quite rare. Fortunately, there has been a recent paradigm shift in economics known as the credibility revolution. The credibility revolution refers specifically to the widespread adoption of microeconometric methods.[6] This revolution began in the early to mid 1990s and was in full swing by the mid 2000s (Angrist & Pischke 2010). Angrist, Azoulay, Ellison, Hill & Lu (2020) find that within the six most important journals in economics, the share of publications which they deemed empirical has been steadily rising at the expense of the share of theoretical papers. Econometric theory has largely retained its share. Some fields such as development economics have also significantly broadened the topics studied due to their adoption of these new empirical methods. The growth of microeconometric work can be seen in Figure 1.1.

Due to the recentness of the credibility revolution, it is possible for me to gather data on the affiliations of researchers, and the members of economics

[6] Microeconometrics in this papers refers to methods designed for identification of causal inference. E.g. difference in differences, fixed-effects, instrumental variables, regression discontinuity designs, synthetic controls, and randomized controlled trials.

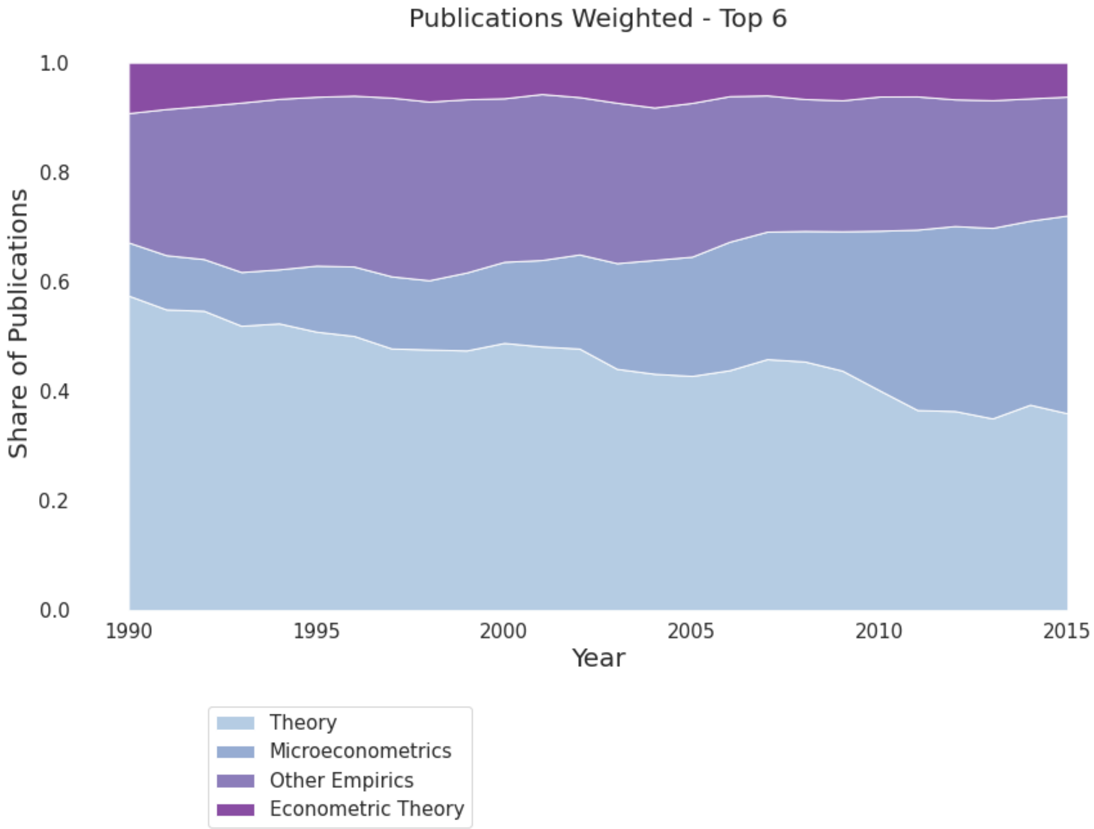

Figure 1.1: Publications in Economics by style weighted by share of citations from the top 6 journals in Angrist et al. (2020) with empirical work broken into microeconometric and other empirical styles.

departments during this time period. Likewise, recent advancements in AI, particularly NLP allow the categorization of vast amounts of data that would otherwise be impossible for a human to accomplish. I believe these factors make the credibility revolution an ideal case study for the effects of R&D during a paradigm shift.

1.3.2 Data & Variables

Departmental Publications

The data for departmental publications comes from Econlit. Econlit is a repository of hundreds of journals published in economics and related subjects. Econlit allows one to download the titles, dates of publication, authors, author affiliations (for papers published on or after 1990), journal of publication, abstracts and Journal of Economic Literature (JEL) code of each paper. For my sample I use the 70 journals mentioned in Angrist et al. (2020) which comprises the 70 journals most cited by the top 6 economics journals.[7] To count the number of publications a university receives, I divide a paper by the number of co-authors and assign credit to universities by year and researcher affiliation. For example, if a paper has three authors from university A, and one from university B, university A gets 0.75 publications, and B gets 0.25.

Departmental Citations

Citations are a common way to measure the quality of an article based on the assumption that more highly cited papers are better/more influential to the field. To obtain citations data I gather data from the Web of Science (WoS). WoS contains the same journals in my Econlit dataset alongside the number of yearly citations received by each paper.

Because there is no common key between the papers in Econlit and those in WoS, I match them on each other using the same method outlined in Angrist et al. (2020) which uses ISSN, publication year, volume, issue, and start and end page numbers. To measure citations received I take the total number of citations received in the first five years after publication to allow the paper to mature. This should serve as a reasonable measure of article impact as Hamermesh (2018) observes that there are few flashes in the pan or what he terms resurrections (papers which later become heavily cited) within economics. Because popularity of economic fields differ (Perry & Reny 2016), I normalize citations by primary economic field by dividing each number of citations by the average number received

[7] In order of importance: *American Economic Review, Journal of Political Economy, Econometrica, Quarterly Journal of Economics, Review of Economic Studies, Review of Economics & Statistics.*

in the field per year.[8]

1.3.3 Department Spending & University Donations

The data on economics R&D spending comes from the National Science Foundation Higher Education Research and Development (NSF HERD) survey. This survey contains information on each universities spending over the years. The data on spending is also broken into each academic discipline they belong to of which economics is one. The HERD survey defines R&D expenditure as being any expenditure related to the production of research that came out of an R&D account including payment for research assistance personnel such as research assistants/associates, project startup or bridge costs, funds set aside by institutions for specific projects, federal and non-federal competitive grants, tuition reimbursements provided to students, the procurement of equipment, development of experiments, costs related to training, and clinical trials.[9]

The NSF notes a difference between basic and applied research. Basic research is the systematic study towards understanding phenomena without any products in mind while applied research is research done to meet a specific need. Unfortunately, the HERD survey does not distinguish between basic and applied research at the discipline level; however, given the nature of economic research, and the use of journals to measure productivity, the vast majority if not all of R&D expenditure is likely to go towards basic research.[10]

[8]Each paper belongs to 1 of 11 primary fields. Primary fields and their associated JEL codes are available in the Appendix.

[9]Faculty salary does not normally come out of an R&D account so is normally excluded unless under certain circumstances. In economics this would be something like a faculty member using part of a grant to supplement their salary the three months out of the year that American faculty do not get paid which is the maximum the NSF allows.

[10]R&D for private firms is also different as this is spending with the tangible goal of making the firm more profitable and/or competitive, such as spending to improve products or services, spending to produce new patents, as well as spending to develop process innovations. This is

My data on private donations received by universities comes from the Integrated Postsecondary Education Data System (IPEDS) Delta Cost survey which contains private donations amongst other variables between 1980-2015.To construct my variable of yearly R&D spending, I take the total amount of R&D spending by year for each university for the field of economics only. For the variable private donations I use the total amount given to each university each year. To account for inflation, all values are adjusted to 2015 values.

Department Faculty

In this empirical analysis, the inclusion of controls for the composition of departments is necessary as increased numbers of microeconometricians will obviously have an impact on the number of publications and citations to microeconometrics papers a university receives. The bulk of my data on faculty comes from the data available freely from Brogaard, Engelberg & Wesp (2018). This data comprises nearly every faculty member to pass through one of the 50 economics departments mentioned in Conroy, Dusansky, Drukker & Kildegaard (1995) during the period of 1998-2014. I further supplement this with hand gathered data on economics departments I found using the Wayback Machine for the next top 19 institutions according to the Tilburg rankings for the period of 1998-2014.[11]

To find the number of faculty, I sum the counts of each unique person ID by university and year they were employed at said school as tenure track faculty (assistant, associate, or full professor). Some universities had to be dropped as I was unable to find consistent data on their publications and R&D expenditure. All

not the same as R&D in the context of an economics department, which is about improving understanding of economic phenomena and tends to have less immediate practical use.

[11] While it would be nice to have earlier data, pages on the Wayback Machine predating 1998 are almost non-existent.

together I am left with data on 66 universities and 1,122 observations. The faculty data is matched with their publications from Econlit. They are then assigned a specialty based on one of four styles used in the majority of their papers.

1.3.4 Identifying Microeconometrics Papers and Primary Field

To examine the credibility revolution in economics I need to determine which papers belong to the style of microeconometrics. Likewise, to normalize citations I need to determine a paper's primary field. Due to the vast number of papers produced by many economics departments each year, labelling all papers in my dataset would be impossible to do in a reasonable amount of time. To get around this I employ AI to handle the labelling portion. To identify papers as relevant to the credibility revolution, I construct a hand-labelled sample of 5,321 papers from a total of over 150,000 into one of four styles, these being theory, microeconometrics, other empirics, or econometric theory. I then train a deep learning model known as a transformer using titles, dates and abstracts when available that will then be used to label the rest of the dataset. The model had an accuracy of over 83% on the test set.[12] I compared my results to the methods used by Angrist et al. (2020) and found that their models had a 61.8% accuracy on articles with abstracts, and 59.1% accuracy on articles without abstracts on the same dataset.

To ensure citations are properly measured, I correct the number received by primary field. In order to determine the primary field I use the first JEL code listed on every paper from 1970-2004 to construct a training sample as these were

[12] For more information on transformer models see Vaswani, Shazeer, Palmer, Uszkoreit, Jones, Gomez, Kaiser & Polosukhin (2017). The particular model I use is sciBERT developed by Beltagy, Lo & Cohan (2019) based off of Google's BERT model (Devlin, Chang, Lee & Toutanova 2019).

the primary field during that time period (Angrist et al. 2020).[13] I then train another transformer model using the same inputs as above. The accuracy of this model is over 81%. This is then used to predict the primary field of the remaining papers in my dataset.

1.3.5 Empirical Design

In this chapter, I am interested in finding the causal effect of R&D funding on production of microeconometric papers as these are the ones that pertain specifically to the credibility revolution. In order to allow the effect of funding to mature, I use the three year lag of R&D funding. To control for other factors that may bias my results I include the number of theorists, microeconometricians, other empiricists and econometricians employed at the university to account for staff specialties. To account for unobservables such as department culture I include a university fixed effect. To account for changes in trends I also include year fixed effects. The equation I am estimating can be written as:

$$Y_{it} = \gamma R_{it-3} + \beta \mathbf{X}_{it} + A_i + T_t + e_{it} \tag{1.1}$$

Where Y_{it} is the productivity measure of department i at time t (either the number of papers produced, or the number of 5-year citations received), X_{it} is a vector of covariates to control for the number of the 4 styles of economists employed at department i at time t, R_{it} refers to the economics R&D expenditure of department i at time t, A_i is the time-invariant department fixed-effect, and T_t

[13] Angrist et al. (2020) first predict 17 fields and then hand label them after clustering their articles into 11 fields. I instead use the Card & Dellavigna (2013) codes with some modifications such as combining microeconomics and microeconomic theory into one field, and adding lab experiments into the other category due to its small size.

is the year fixed-effect.

With any empirical study on observational data it is possible that there are omitted variables which may bias any estimates which makes simple ordinary least squares (OLS) unsuitable for estimating the effect of R&D on productivity such as reputation of the department from faculty actions such as an award or career achievement such as being made editor of a well-known journal. If faculty achieve recognition in their field, it is likely that the department will be viewed more favourably, and find it easier to find funding. Similarly, the department will be viewed more favourably by editors and other economists, increasing the number of publications as well as the number of citations articles receive. To account for potential endogeneity, I adopt a two-stage least squares (2SLS) approach using private donations the year before as an instrument to find the reduced from effect of R&D expenditure. The instrument in Payne & Siow (2003) was found to be quite weak, and endowments stopped being reported for the time period I am looking at. So endowment shocks such as those used by Whalley & Hicks (2014) are not possible.

Therefore, I use variation in private donations received by universities as my instrument. For a 2SLS approach to produce proper estimates, an instrument must be just as good as random as well as being correlated with the endogenous regressor and uncorrelated with the error term. Regarding the relevance assumption, universities can use at least some of the private donations received as they see fit, including funding economics R&D expenditures. Therefore, private donations should be correlated with the amount of economics R&D expenditure at a department. Regarding the exclusion restriction, the amount of donations a university gets should not change the opinions of editors or other economists on an article, so private donations should have no impact on the number of publications produced by a department, nor should they affect the impact of articles. It could be argued that more donations could lead to more endowed chairs as well which would increase productivity of a department. By including faculty controls in my model, I can control for this, and satisfy the exclusion restriction. Regarding the independence assumption, because private donations are given to the school itself, rather than the department, private donations should not be correlated with any unobserved variables such as departmental reputation, satisfying the independence assumption. The equation being estimated in the first stage can be written as:

$$R_{it-3} = \delta Pd_{it-4} + \beta \mathbf{X}_{it} + a_i + T_t + e_{it} \tag{1.2}$$

Where Pd refers to the private donations given to university that department i belongs to at time $t-4$ and all other variables are the same as the equation above.

1.3.6 Descriptive Statistics

Table 1.1 contains the descriptive statistics for my dataset. The statistics show that on average, an economics department publishes 17.3 papers a year and receives close to 43 citations five years after publication in any given year. The mean spending of a university on economics R&D is US$3.2 million. In Table 1.2, I present descriptive statistics for spending, publications and citations between elite and non-elite as well as public and private universities. Private universities actually spend much less than public universities on average, but receive more than twice as many citations and publish almost twice as many articles compared to their public counterparts. This could be an indication that private universities are more efficient with their R&D expenditure, although this could also be because private universities are not dependent on teaching to receive funding like their public counterparts which frees up faculty to pursue greater amounts of research (Payne & Roberts 2010). It could also imply that private universities tend to hire better faculty which public universities try to compensate for by increasing R&D expenditure. Elite universities spend almost twice as much on R&D, publish more than 3 times as many papers and receive almost five times as many citations which could also be an indication that they may be better at spending their money than their non-elite counterparts. Although they may also publish and get more money due to being better staffed.

Table 1.1: Descriptive Statistics of Department Productivity

	Mean	SD
Publications	17.29	14.66
Citations	42.66	54.93
Economics R&D Expenditure Per Year	3.20	4.54

Table 1.2: Descriptive Statistics of Department Productivity and Spending - Private v Public & Elite v Non-Elite

	Mean		SD		Mean		SD	
	Elite v Non-Elite				Private v Public			
	Elite	Non-Elite	Elite	Non-Elite	Private	Public	Private	Public
Publications	33.00	10.45	16.60	5.88	22.19	13.44	18.13	9.61
Citations	94.97	19.92	73.21	17.16	61.14	28.18	70.30	32.17
Economics R&D Expenditure Per Year	4.71	2.54	6.01	3.54	1.60	4.45	2.72	5.24

1.4 Results

1.4.1 Baseline Results

The baseline OLS results are presented in Table 1.3. The OLS estimations do not show any statistically significant effect of economics R&D spending on the microeconometrics style. The other styles of papers aside from microeconometrics are presented for comparison only. The lack of statistical significance of the R&D expenditure holds for all types of papers involved as both the coefficients are low and there is no statistical significance. When examining the impact of papers using the five-year citations, I still find no statistically significant effect of R&D spending. Additional controls do not do much to change either the coefficient or statistical significance of any of the variables of interest as well which suggests that there may not be much relation between faculty and R&D expenditure.

Table 1.3: OLS Estimates of Effect of R&D Expenditures on Publications & Citations

	Total	Micrometrics	Theory	Other Empirics	Econometrics
No Controls-Publications					
R&D Expenditure	-0.052	0.006	-0.065	0.018	-0.012
	(0.284)	(0.183)	(0.081)	(0.046)	(0.023)
	[-0.620, 0.515]	[-0.358, 0.371]	[-0.226, 0.096]	[-0.074, 0.110]	[-0.059, 0.035]
Controls Added-Publications					
# Microeconometricians	0.718***	0.457***	0.124*	0.103***	0.035
	(0.135)	(0.084)	(0.063)	(0.035)	(0.031)
	[0.449, 0.988]	[0.289, 0.625]	[-0.002, 0.249]	[0.033, 0.172]	[-0.026, 0.096]
# Other Empiricists	0.065	0.013	0.059	0.003	-0.010
	(0.151)	(0.109)	(0.066)	(0.054)	(0.040)
	[-0.236, 0.366]	[-0.206, 0.231]	[-0.073, 0.192]	[-0.105, 0.111]	[-0.090, 0.071]
# Theorists	0.425***	0.133***	0.206***	0.015	0.071***
	(0.092)	(0.034)	(0.053)	(0.036)	(0.013)
	[0.242, 0.608]	[0.064, 0.201]	[0.101, 0.311]	[-0.058, 0.087]	[0.045, 0.097]
# Econometricians	0.237	0.038	-0.054	0.015	0.239***
	(0.188)	(0.077)	(0.096)	(0.075)	(0.055)
	[-0.139, 0.613]	[-0.116, 0.191]	[-0.245, 0.138]	[-0.135, 0.164]	[0.128, 0.349]
R&D Expenditure	-0.030	-0.001	-0.045	0.014	0.002
	(0.189)	(0.123)	(0.066)	(0.038)	(0.027)
	[-0.408, 0.348]	[-0.246, 0.244]	[-0.177, 0.087]	[-0.062, 0.091]	[-0.052, 0.056]
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
No Controls-Citations					
R&D Expenditure	-0.128	-0.305	-0.325	0.312	0.190
	(1.729)	(1.190)	(0.304)	(0.247)	(0.223)
	[-3.580, 3.325]	[-2.682, 2.072]	[-0.933, 0.283]	[-0.182, 0.806]	[-0.255, 0.635]
Controls Added-Citations					
# Microeconometricians	3.379***	2.253***	0.481**	0.371**	0.273
	(0.785)	(0.592)	(0.207)	(0.153)	(0.222)
	[1.811, 4.947]	[1.071, 3.436]	[0.067, 0.894]	[0.066, 0.677]	[-0.171, 0.718]
# Other Empiricists	-0.167	-0.061	-0.169	0.065	-0.002
	(1.108)	(0.652)	(0.210)	(0.310)	(0.173)
	[-2.380, 2.045]	[-1.363, 1.242]	[-0.588, 0.249]	[-0.554, 0.685]	[-0.348, 0.343]
# Theorists	2.167***	0.742***	0.732***	0.300***	0.392***
	(0.357)	(0.164)	(0.205)	(0.105)	(0.095)
	[1.453, 2.880]	[0.415, 1.070]	[0.321, 1.142]	[0.091, 0.509]	[0.202, 0.582]
# Econometricians	0.053	-0.014	0.150	-0.182	0.099
	(1.031)	(0.561)	(0.335)	(0.354)	(0.245)
	[-2.006, 2.112]	[-1.135, 1.106]	[-0.519, 0.818]	[-0.888, 0.525]	[-0.390, 0.588]
R&D Expenditure	-0.027	-0.335	-0.249	0.327*	0.230
	(1.237)	(0.902)	(0.256)	(0.192)	(0.200)
	[-2.497, 2.442]	[-2.137, 1.467]	[-0.761, 0.262]	[-0.057, 0.710]	[-0.169, 0.630]
N	1122	1122	1122	1122	1122
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X

R&D expenditure in $US millions. Dep. Variable in the left hand column.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

1.4.2 Instrumental Variable Results

In this section I present results using 2SLS estimations to account for potential endogeneity in estimating the effect of R&D spending. The results for the instrumental variables estimations are presented in Table 1.4. The results of the first stage test show that the first stage F-statistic is well above 10, indicating a strong instrument.

The results of these estimations run contrary to many earlier findings which find a positive effect of R&D expenditure on the total number of papers produced and instead indicate than an additional $1M would produce 1.72 fewer total papers, and surprisingly almost one fewer microeconometrics paper in a given year. There also seems to be a negative but smaller effect for R&D expenditures on the number of econometric theory papers produced. There is also clear evidence that the number of different tenure track faculty employed in a department also has significant effects on the number of papers produced per year. Because the negative effect is largest and most significant for microeconometrics papers, I take this as evidence that additional R&D funding does in fact seem to slow the spread of a revolution in a department rather than aid it.

Table 1.4: 2SLS Estimates of Effect of R&D Expenditure on Publications & Citations

	Total	Micrometrics	Theory	Other Empirics	Econometrics
Publications-No Controls					
R&D Expenditure	-2.885***	-1.395***	-0.742*	-0.256	-0.492**
	(1.038)	(0.388)	(0.407)	(0.242)	(0.215)
	[-4.958, -0.812]	[-2.171, -0.620]	[-1.554, 0.070]	[-0.738, 0.227]	[-0.921, -0.063]
First-Stage F-Stat	47.25	47.25	47.25	47.25	47.25
Publications-Controls					
R&D Expenditure	-1.719**	-0.920***	-0.271	-0.176	-0.352**
	(0.733)	(0.296)	(0.275)	(0.236)	(0.164)
	[-3.183, -0.254]	[-1.512, -0.329]	[-0.819, 0.277]	[-0.648, 0.296]	[-0.679, -0.024]
# Microeconometricians	0.896***	0.554***	0.148**	0.123**	0.072
	(0.249)	(0.128)	(0.067)	(0.059)	(0.062)
	[0.399, 1.394]	[0.298, 0.809]	[0.014, 0.281]	[0.005, 0.241]	[-0.053, 0.197]
# Other Empiricists	0.098	0.030	0.064	0.007	-0.003
	(0.178)	(0.108)	(0.074)	(0.054)	(0.044)
	[-0.257, 0.453]	[-0.186, 0.247]	[-0.084, 0.211]	[-0.102, 0.115]	[-0.090, 0.085]
# Theorists	0.247*	0.036	0.183***	-0.005	0.034
	(0.140)	(0.053)	(0.064)	(0.042)	(0.021)
	[-0.033, 0.527]	[-0.070, 0.142]	[0.055, 0.310]	[-0.089, 0.078]	[-0.007, 0.075]
# Econometricians	0.064	-0.057	-0.077	-0.005	0.202***
	(0.224)	(0.082)	(0.100)	(0.081)	(0.070)
	[-0.384, 0.512]	[-0.220, 0.107]	[-0.277, 0.124]	[-0.167, 0.157]	[0.063, 0.342]
First-Stage F-Stat	40.64	40.64	40.64	40.64	40.64
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
Citations-No Controls					
R&D Expenditure	-15.062***	-7.195***	-3.400**	-2.132**	-2.335***
	(4.753)	(1.950)	(1.469)	(1.059)	(0.835)
	[-24.554, -5.570]	[-11.090, -3.300]	[-6.335, -0.465]	[-4.246, -0.018]	[-4.004, -0.666]
First-Stage F-Stat	47.25	47.25	47.25	47.25	47.25
Citations-Controls					
R&D Expenditure	-9.652***	-4.691***	-1.825**	-1.534*	-1.602**
	(3.340)	(1.474)	(0.901)	(0.857)	(0.667)
	[-16.323, -2.982]	[-7.634, -1.748]	[-3.624, -0.026]	[-3.244, 0.177]	[-2.935, -0.270]
# Microeconometricians	4.395***	2.713***	0.647**	0.568	0.467**
	(1.195)	(0.599)	(0.268)	(0.427)	(0.206)
	[2.008, 6.781]	[1.516, 3.910]	[0.112, 1.182]	[-0.284, 1.420]	[0.056, 0.878]
# Other Empiricists	0.020	0.024	-0.139	0.102	0.033
	(1.124)	(0.629)	(0.237)	(0.307)	(0.191)
	[-2.224, 2.265]	[-1.231, 1.280]	[-0.612, 0.335]	[-0.511, 0.714]	[-0.348, 0.414]
# Theorists	1.153**	0.284	0.566**	0.104	0.199**
	(0.572)	(0.257)	(0.240)	(0.130)	(0.092)
	[0.011, 2.295]	[-0.229, 0.796]	[0.086, 1.045]	[-0.155, 0.364]	[0.015, 0.384]
# Econometricians	-0.933	-0.461	-0.012	-0.372	-0.089
	(1.247)	(0.620)	(0.373)	(0.413)	(0.298)
	[-3.423, 1.556]	[-1.699, 0.778]	[-0.758, 0.734]	[-1.197, 0.453]	[-0.684, 0.506]
First-Stage F-Stat	40.64	40.64	40.64	40.64	40.64
N	1122	1122	1122	1122	1122
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X

R&D expenditure in $US millions. Total Publications refers to total of all styles, other columns refer to publications of each methodology respectively. Robust standard errors are in parentheses. Confidence intervals are in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

When it comes to the effect of R&D funding on impact, I find that the effect for citations is negative on all types of publications. When broken into methodology, I find that increased R&D expenditure has a negative and statistically significant effect on microeconometric and econometric theory papers. I also find a smaller and less precisely measured negative impact on citations to theory and other empirics. This is in line with many earlier papers such as Whalley & Hicks (2014) and Payne & Siow (2003) who also find a negative effect, although my coefficients are much larger. Once again, when papers are divided into respective style it shows that quality of microeconometrics papers is impacted in the worst manner by increased spending, and for each $1M spent by a department, they can expect nearly five fewer citations. Since the credibility revolution is the main concern with this dataset, results going forward will only contain results for microeconometrics production and impact.

1.4.3 Additional Test: Pre and Post-Revolution

The credibility revolution was largely over by the tail end of my dataset. To take a look at how spending influences the production of different papers I split my dataset between pre and post-2010. The decision to use 2010 as a year is based off the publication of Angrist & Pischke (2010) which gives a year by which microeconometrics methods would be ubiquitous and widely adopted. Table 1.5 contains results for Pre-2010 while Table 1.6 contains results for post-2010. The results indicate that the effect is most negative for publication and citations to microeconometric papers prior to 2010. During the credibility revolution, an additional $1M in department R&D spending would produce slightly more than one fewer microeconometrics paper, and nearly four fewer citations to microeconometrics papers which suggests that spending affects both the quantity and quality of the papers in question.

This provides yet more evidence that spending hampers the adoption of revolutionary techniques rather than aids them. These results hold whether or not controls are included, although they are slightly less negative with the addition of controls. The Post-2010 results, on the other hand show that the effect of R&D is not statistically significant at any level.

Table 1.5: 2SLS Estimates of Effect of R&D Expenditure on Publications & Citations, Pre-2010

	Total	Micrometrics	Theory	Other Empirics	Econometrics
Early Publications-No Controls					
R&D Expenditure	-3.249***	-1.470***	-1.118**	0.051	-0.713**
	(1.065)	(0.468)	(0.476)	(0.247)	(0.288)
	[-5.376, -1.123]	[-2.405, -0.535]	[-2.068, -0.168]	[-0.441, 0.544]	[-1.289, -0.137]
First-Stage F-Stat	31.53	31.53	31.53	31.53	31.53
Early Publications-Controls					
R&D Expenditure	-2.169**	-1.029**	-0.696*	0.146	-0.590**
	(0.935)	(0.439)	(0.393)	(0.234)	(0.247)
	[-4.036, -0.302]	[-1.906, -0.151]	[-1.481, 0.089]	[-0.322, 0.614]	[-1.084, -0.096]
# Microeconometricians	0.899***	0.539***	0.172*	0.103**	0.086
	(0.318)	(0.159)	(0.087)	(0.049)	(0.096)
	[0.263, 1.534]	[0.221, 0.856]	[-0.003, 0.346]	[0.005, 0.200]	[-0.107, 0.278]
# Theorists	0.316	0.063	0.199**	0.015	0.038
	(0.192)	(0.088)	(0.082)	(0.041)	(0.045)
	[-0.068, 0.700]	[-0.113, 0.240]	[0.037, 0.362]	[-0.067, 0.098]	[-0.052, 0.128]
# Other Empiricists	-0.226	-0.033	-0.071	-0.008	-0.114
	(0.238)	(0.134)	(0.117)	(0.080)	(0.070)
	[-0.701, 0.249]	[-0.301, 0.235]	[-0.306, 0.163]	[-0.168, 0.153]	[-0.254, 0.026]
# Econometricians	-0.039	-0.031	-0.156	0.027	0.121
	(0.252)	(0.104)	(0.144)	(0.107)	(0.095)
	[-0.543, 0.465]	[-0.238, 0.176]	[-0.443, 0.130]	[-0.187, 0.241]	[-0.068, 0.310]
First-Stage F-Stat	28.83	28.83	28.83	28.83	28.83
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
Early Citations-No Controls					
R&D Expenditure	-14.526***	-5.996***	-3.181**	-2.391*	-2.958***
	(4.403)	(1.808)	(1.295)	(1.270)	(0.966)
	[-23.320, -5.732]	[-9.606, -2.386]	[-5.768, -0.594]	[-4.928, 0.145]	[-4.888, -1.028]
First-Stage F-Stat	31.53	31.53	31.53	31.53	31.53
Early Citations-Controls					
R&D Expenditure	-9.808**	-3.802**	-1.743*	-1.982	-2.282**
	(3.780)	(1.490)	(0.896)	(1.264)	(0.936)
	[-17.357, -2.258]	[-6.778, -0.826]	[-3.533, 0.047]	[-4.506, 0.543]	[-4.150, -0.413]
# Microeconometricians	3.407***	2.318***	0.437**	0.300	0.352
	(1.178)	(0.543)	(0.197)	(0.518)	(0.232)
	[1.054, 5.761]	[1.233, 3.402]	[0.043, 0.832]	[-0.734, 1.335]	[-0.111, 0.815]
# Theorists	1.599**	0.432	0.697***	0.147	0.324**
	(0.687)	(0.317)	(0.238)	(0.174)	(0.145)
	[0.227, 2.972]	[-0.201, 1.064]	[0.223, 1.172]	[-0.202, 0.495]	[0.034, 0.614]
# Other Empiricists	-1.269	-0.169	-0.452	-0.134	-0.513
	(1.231)	(0.451)	(0.318)	(0.523)	(0.308)
	[-3.728, 1.190]	[-1.071, 0.732]	[-1.088, 0.184]	[-1.179, 0.910]	[-1.128, 0.102]
# Econometricians	-0.237	-0.022	0.040	-0.090	-0.165
	(1.077)	(0.476)	(0.391)	(0.500)	(0.415)
	[-2.387, 1.913]	[-0.972, 0.928]	[-0.740, 0.820]	[-1.088, 0.908]	[-0.995, 0.665]
First-Stage F-Stat	28.83	28.83	28.83	28.83	28.83
N	792	792	792	792	792
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$
Robust standard errors are in parentheses. Confidence Intervals are in square brackets. R&D expenditure in $US millions.

Table 1.6: 2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, 2010-onward

	Total	Microeconometrics	Theory	Other Empirics	Econometrics
Publications-No Controls					
R&D Expenditure	1.842	0.546	1.515	-0.334	0.115
	(2.068)	(0.788)	(1.640)	(0.825)	(0.560)
	[-2.288, 5.972]	[-1.028, 2.121]	[-1.760, 4.789]	[-1.982, 1.314]	[-1.003, 1.233]
First-Stage F-Stat	4.12	4.12	4.12	4.12	4.12
Publications-Controls					
R&D Expenditure	1.616	0.468	1.301	-0.320	0.167
	(1.777)	(0.690)	(1.399)	(0.770)	(0.543)
	[-1.934, 5.166]	[-0.909, 1.845]	[-1.493, 4.095]	[-1.858, 1.217]	[-0.917, 1.251]
# Microeconometricians	0.251	-0.010	0.398	-0.045	-0.092
	(0.365)	(0.143)	(0.306)	(0.141)	(0.074)
	[-0.478, 0.980]	[-0.296, 0.276]	[-0.213, 1.008]	[-0.326, 0.237]	[-0.241, 0.057]
# Theorists	0.177	-0.051	0.058	0.175*	-0.004
	(0.245)	(0.114)	(0.186)	(0.093)	(0.062)
	[-0.311, 0.666]	[-0.279, 0.177]	[-0.314, 0.429]	[-0.011, 0.360]	[-0.129, 0.120]
# Other Empiricists	-0.500	-0.128	-0.190	-0.204	0.022
	(0.515)	(0.210)	(0.362)	(0.181)	(0.104)
	[-1.530, 0.529]	[-0.547, 0.291]	[-0.914, 0.533]	[-0.566, 0.157]	[-0.185, 0.230]
# Econometricians	0.131	-0.024	-0.199	0.219	0.136
	(0.597)	(0.292)	(0.366)	(0.304)	(0.176)
	[-1.062, 1.325]	[-0.608, 0.560]	[-0.930, 0.531]	[-0.389, 0.827]	[-0.216, 0.488]
First-Stage F-Stat	4.49	4.49	4.49	4.49	4.49
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
Citations-No Controls					
R&D Expenditure	1.549	4.875	-0.029	-1.782	-1.516
	(5.938)	(5.960)	(1.969)	(4.156)	(2.100)
	[-10.309, 13.408]	[-7.028, 16.779]	[-3.961, 3.904]	[-10.081, 6.518]	[-5.709, 2.677]
First-Stage F-Stat	4.12	4.12	4.12	4.12	4.12
Citations-Controls					
R&D Expenditure	1.821	5.088	-0.331	-1.947	-0.989
	(5.405)	(5.680)	(1.910)	(3.852)	(2.069)
	[-8.974, 12.616]	[-6.257, 16.432]	[-4.146, 3.484]	[-9.640, 5.746]	[-5.121, 3.143]
# Microeconometricians	-0.394	-0.811	0.307	0.274	-0.163
	(1.000)	(1.243)	(0.514)	(0.623)	(0.524)
	[-2.391, 1.604]	[-3.293, 1.670]	[-0.719, 1.333]	[-0.970, 1.518]	[-1.210, 0.884]
# Theorists	1.272	0.157	-0.216	1.022*	0.308
	(1.061)	(0.879)	(0.709)	(0.531)	(0.393)
	[-0.847, 3.391]	[-1.598, 1.912]	[-1.633, 1.201]	[-0.038, 2.083]	[-0.476, 1.092]
# Other Empiricists	-1.135	-0.263	-0.369	-1.333	0.830
	(1.611)	(1.577)	(0.640)	(0.846)	(0.769)
	[-4.352, 2.082]	[-3.413, 2.887]	[-1.647, 0.910]	[-3.023, 0.358]	[-0.707, 2.367]
# Econometricians	1.455	0.000	0.584	1.206	-0.336
	(2.775)	(2.261)	(1.324)	(1.580)	(1.084)
	[-4.087, 6.996]	[-4.516, 4.516]	[-2.060, 3.229]	[-1.950, 4.362]	[-2.501, 1.829]
First-Stage F-Stat	4.49	4.49	4.49	4.49	4.49
N	330	330	330	330	330
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X

R&D expenditure in $US millions. Robust standard errors are in parentheses, confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

1.4.4 Additional Test: Private vs. Public Universities

According to Glaeser (2002) private universities tend to value research over instruction, so hypothetically they may be better at spending than their public counterparts. However, the evidence for this is mixed. Adams & Griliches (1998), Adams (2009), Aghion, Dewatripont, Hoxby, Mas-Colell & Sapir (2010), and Rosenbloom et al. (2015) all find that private or more autonomous universities have better returns to both the number of papers produced or citations received. On the other hand, this is disputed by Whalley & Hicks (2014) who find that the effect in public institutions is more precisely estimated than in private, but there is little evidence of a stronger effect in one or the other. There does seem to be a persistent line of thought though that more autonomous universities can more efficiently allocate resources in comparison to their public counterparts so it is worth considering in this chapter. To test this, I run regressions on both private and public universities only and present my estimates for the two and present these results in Table 1.7.[14]

[14] These are estimates for microeconometric papers only. Results for other types of papers can be found in the Appendix.

Table 1.7: 2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by Private & Public Universities

	Publications	Citations
Private-No Controls		
R&D Expenditure	-2.141**	-10.703**
	(0.946)	(3.896)
	[-4.079, -0.203]	[-18.685, -2.722]
N	493	493
First-Stage F-Stat	18.73	18.73
Private-Controls		
R&D Expenditure	-1.349**	-6.226***
	(0.500)	(2.089)
	[-2.372, -0.326]	[-10.505, -1.948]
# Microeconometricians	0.340**	1.917***
	(0.159)	(0.575)
	[0.014, 0.666]	[0.739, 3.095]
# Other Empiricists	0.276*	1.109
	(0.155)	(0.703)
	[-0.041, 0.594]	[-0.332, 2.549]
# Theorists	0.105	0.606
	(0.071)	(0.377)
	[-0.040, 0.250]	[-0.167, 1.378]
# Econometricians	-0.084	-0.282
	(0.106)	(0.886)
	[-0.301, 0.133]	[-2.098, 1.533]
N	493	493
First-Stage F-Stat	12.42	12.42
Uni Fixed Effect	X	X
Year Fixed Effect	X	X
Public-No Controls		
R&D Expenditure	-0.294	-1.750
	(0.423)	(2.369)
	[-1.152, 0.565]	[-6.554, 3.054]
N	629	629
First-Stage F-Stat	25.73	25.73
Public-Controls		
R&D Expenditure	-0.297	-1.784
	(0.309)	(1.972)
	[-0.925, 0.330]	[-5.783, 2.216]
# Microeconometricians	0.449*	2.071
	(0.224)	(1.326)
	[-0.006, 0.904]	[-0.617, 4.760]
# Other Empiricists	-0.028	-0.282
	(0.131)	(0.810)
	[-0.295, 0.238]	[-1.925, 1.362]
# Theorists	0.028	0.159
	(0.068)	(0.267)
	[-0.110, 0.165]	[-0.382, 0.699]
# Econometricians	0.004	-0.216
	(0.140)	(1.183)
	[-0.280, 0.288]	[-2.616, 2.184]
N	629	629
First-Stage F-Stat	23.52	23.52
Uni Fixed Effect	X	X
Year Fixed Effect	X	X

R&D expenditure in $US millions. Robust standard errors are in parentheses. Confidence intervals are in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

The results from the comparisons show that the effect of spending is negative and statistically significant for only private universities. I can also see that this is the same for the impact of papers produced in a given year. These results run counter to both the findings of Rosenbloom et al. (2015), and Aghion et al. (2010). They are also quite distinct from the findings of Whalley & Hicks (2014). This may be an indication that the funds that public universities receive are more responsibly managed than are the funds at private universities, or maybe private universities engage in riskier research behaviour which may not always pay off. It may also be a sign that because private universities are less dependent on state funding, incumbent faculty have more control over spending and thus decisions are more biased towards their own research preferences. I can also see from the staff coefficients that private universities retain a positive and statistically significant advantage over public universities which may be due to their researchers having more free time to pursue projects, or private universities simply have an advantage in attracting better talent.

1.4.5 Additional Test: Elite vs. Non Elite

Universities that comprise the elite often have the most money available to spend on innovative ideas (Lerner, Schoar & Wang 2008). According to Stephan (2010) schools such as Stanford and Northwestern University receive hundreds of millions of dollars every year. Furthermore, approximately 20% of funds spent by universities each year come from their own reserves. As of 2020, 12 of the top 20 economics departments in the United States are also in the top 20 by endowment sizes.[15] If there is a strong effect of additional research spending on the production of path-

[15]Info comes from Shanghai Ranking (2020) & National Center for Education Statistics (2022). See Appendix for list of universities.

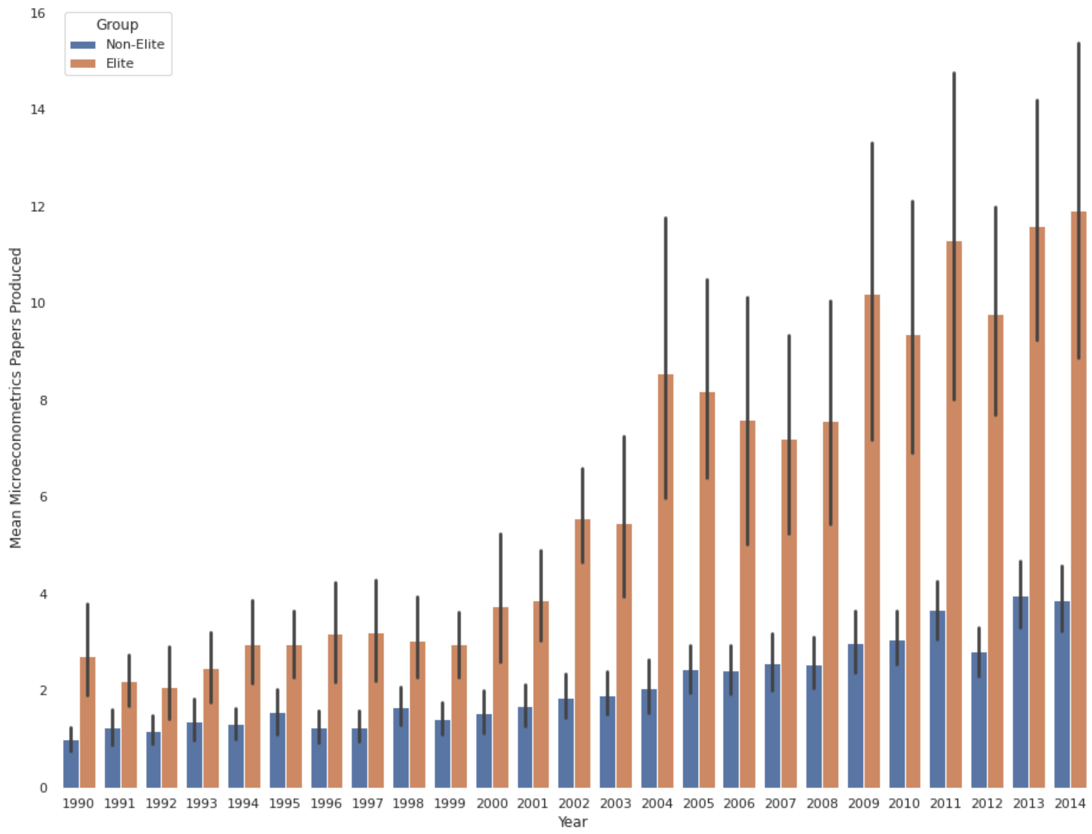

Figure 1.2: Mean production of microeconometrics papers between elite and non-elite universities 1990-2014

breaking ideas, it could be argued that many of the elite universities in the United States hold on to their positions at least partially through their extraordinary wealth largely acquired as a result of being the first universities founded. Mean microeconometrics productivity can be seen in Figure 1.2 and shows that the ratio between the elite and non-elite has been growing quite rapidly. Interestingly, this only holds true for the microeconometrics methodology.[16] Furthermore, according to a recent professional survey by Allgood, Badgett, Bayer, Bertrand, Black & Bloom (2019), there is a persistent belief that elitism is rampant within economics as many of the top journals and positions within the profession dominated by a small cohort of elite schools, and those outside of this cohort find that their work is more often taken less seriously or dismissed outright.[17] If wealth is a significant determinant of capability to produce pathbreaking research, this would exacerbate an already pervasive problem within the field as there is evidence from Rosenbloom & Ginther (2017) that universities which secure funding are more likely to secure further funding over the years.

There is some evidence that elite universities status may be eroding. Agrawal & Goldfarb (2008) and Kim et al. (2009) have found that elite universities seem to be losing their status and middle tier universities are catching up to them. Hamermesh (2018) also finds that economists in lower ranked departments are often as productive as median economists in top departments citation wise. Adams (2009) however, finds that the top 20% obtain greater output from R&D expenditure than others. I look at this as well, and run comparisons between elite and non-elite universities. The elite universities in question come from the top 20 American

[16]The ratios between elite and non-elite universities have remained relatively steady for the other 3 methodologies. These figures can be found in the Appendix.

[17]Ellison (2002) also finds that there seems to have been little "democratization" (Publications from schools outside the traditional elite) for publications within the journals known as the top 5 so this could very well be a long-standing and persistent problem in economics.

universities from Kim et al. (2009) who use a Borda count from several different ranking measures in order to determine the best 20 overall universities. Table 1.8 contains elite vs. non elite university results for publications and citations respectively.[18]

The results of elite vs. non-elite fail to turn up any statistically significant effect of R&D funding. This seems to indicate that the difference in productivity in elite and non-elite economics departments is not due to better spending efficacy. I can also see that when it comes to impact, there is no statistical significance. Together these seem to indicate that there is no significant difference in spending efficacy between elite and non-elite universities. The coefficients for the number of microeconometricians being nearly 3 times higher than those of non-elite producers may instead indicate that the dominance of elite departments is in hiring better faculty.[19]

[18]These estimates are for microeconometrics papers only. Results for other types of papers produced can be found in the Appendix.

[19]An alternative inference from this may instead be that faculty at top departments have networks that make their work easier to publish and more likely to be cited.

Table 1.8: 2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by status

	Publications	Citations
Elite-No Controls		
R&D Expenditure	-0.715	-4.078
	(0.453)	(2.507)
	[-1.662, 0.232]	[-9.325, 1.170]
N	340	340
First-Stage F-Stat	24.97	24.97
Elite-Controls		
R&D Expenditure	-0.377	-2.573
	(0.274)	(1.583)
	[-0.951, 0.196]	[-5.886, 0.740]
# Microeconometricians	0.606***	2.874***
	(0.100)	(0.598)
	[0.397, 0.815]	[1.623, 4.125]
# other Empiricists	-0.089	-1.520
	(0.189)	(1.222)
	[-0.485, 0.306]	[-4.077, 1.038]
# Theorists	0.013	0.071
	(0.050)	(0.242)
	[-0.092, 0.118]	[-0.434, 0.577]
# Econometricians	-0.189	-1.437
	(0.151)	(0.953)
	[-0.505, 0.127]	[-3.432, 0.558]
N	340	340
First-Stage F-Stat	19.09	19.09
Uni Fixed Effect	X	X
Year Fixed Effect	X	X
Non-Elite-No Controls		
R&D Expenditure	-0.220	-0.401
	(0.289)	(1.013)
	[-0.802, 0.361]	[-2.442, 1.640]
N	782	782
First-Stage F-Stat	22.50	22.50
Non-Elite-Controls		
R&D Expenditure	-0.280	-0.669
	(0.262)	(0.887)
	[-0.808, 0.247]	[-2.455, 1.118]
# Microeconometricians	0.212***	0.730***
	(0.047)	(0.197)
	[0.117, 0.306]	[0.333, 1.126]
# other Empiricists	0.001	0.081
	(0.057)	(0.221)
	[-0.113, 0.115]	[-0.363, 0.526]
# Theorists	-0.028	-0.124
	(0.042)	(0.157)
	[-0.112, 0.057]	[-0.439, 0.192]
# Econometricians	0.189***	1.170**
	(0.069)	(0.577)
	[0.049, 0.328]	[0.007, 2.332]
N	782	782
First-Stage F-Stat	20.40	20.40
Uni Fixed Effect	X	X
Year Fixed Effect	X	X

R&D Expenditure in $US millions. Dep. variable is in top of column. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

1.5 Robustness Tests: Alternative Publication and Citation Weightings

In this section I examine some alternative measures of productivity to rule out other ways funding may have an impact. Not all publications are the same. A publication in one of the Top 5 (T5) such as *The American Economic Review* is arguably subject to much more stringent standards as well as being of higher quality.[20] than a publication in *Economic Inquiry* or *National Tax Journal*. It may be that spending may not produce more microeconometrics publications in aggregate, but it does produce more in higher quality journals. To account for difference in publication importance, I next present estimations in which publications have been re-weighted by the importance scores available in Angrist et al. (2020).[21]

Furthermore, there is more than one way to count citations. One of the most prominent methods known is the Hirsch index. Ellison (2013) suggests that fields should use modifications of Hirsch indices in order to evaluate research. Hamermesh (2018) suggests that citations in economics should be re-weighted so that they follow a rule of C/(N/2) where C is the number of citations, and N is the number of authors. Perry & Reny (2016) believe that the proper way to count citations is to use what they call the euclidean index that satisfies a number of axioms for counting citations one of which is depth over breadth.[22] To rule out alternative measures of paper importance, I present results for citations re-evaluated using Hamermesh's suggestion and Perry & Reny's Euclidean index.

[20]Top 5 refers to *American Economic Review, Journal of Political economy, Econometrica, Quarterly Journal of Economics & Review of Economic Studies*. For a more in depth discussion of the Top 5 and quality see Serrano (2018) or Heckman & Moktan (2020).

[21]These scores are based off a journals share of citations from the top 5 and *Review of Economics & Statistics*

[22]It is arguable that two papers with ten citations each does imply greater quality than five papers with four citations each.

1.5.1 Importance Weighted Results

Table 1.9 contains the results for publications of microeconometrics papers reweighted with the importance scores mentioned in Angrist et al. (2020). When examining the effect of R&D spending as it relates to the importance of a publication, the results do not change much if at all. The total effect is still negative and when divided into private and public, and the effect of R&D spending is only negative for private universities. This could indicate that the quality of journals published in also decreases with increased R&D expenditure.

Table 1.9: 2SLS Estimates of effect of R&D Expenditure on Publications Weighted by Importance Score

	Total	Private	Public	Elite	Non-Elite
Importance-No Controls					
R&D Expenditure	-0.097***	-0.139*	-0.025	-0.047	-0.035
	(0.027)	(0.069)	(0.023)	(0.030)	(0.023)
	[-0.151, -0.043]	[-0.280, 0.002]	[-0.072, 0.022]	[-0.109, 0.015]	[-0.082, 0.011]
N	1122	493	629	340	782
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
First-Stage F-Stat	47.25	18.73	25.73	24.97	22.50
Importance-Controls					
R&D Expenditure	-0.073***	-0.106**	-0.025	-0.038	-0.037
	(0.026)	(0.049)	(0.018)	(0.028)	(0.023)
	[-0.126, -0.020]	[-0.208, -0.005]	[-0.061, 0.012]	[-0.097, 0.022]	[-0.084, 0.010]
# Microeconometricians	0.033***	0.019	0.024	0.038***	0.007
	(0.010)	(0.012)	(0.015)	(0.010)	(0.005)
	[0.012, 0.053]	[-0.006, 0.045]	[-0.007, 0.055]	[0.018, 0.058]	[-0.004, 0.018]
# Other Empiricists	-0.001	0.021	-0.011	-0.015	-0.001
	(0.009)	(0.015)	(0.009)	(0.019)	(0.003)
	[-0.019, 0.017]	[-0.010, 0.051]	[-0.029, 0.008]	[-0.055, 0.024]	[-0.007, 0.005]
# Theorists	0.000	0.002	0.005	-0.007	0.000
	(0.005)	(0.008)	(0.004)	(0.007)	(0.003)
	[-0.009, 0.010]	[-0.014, 0.017]	[-0.004, 0.014]	[-0.021, 0.007]	[-0.006, 0.006]
# Econometricians	-0.007	0.001	-0.008	-0.018	0.011
	(0.008)	(0.013)	(0.013)	(0.014)	(0.008)
	[-0.022, 0.008]	[-0.025, 0.027]	[-0.033, 0.018]	[-0.048, 0.012]	[-0.004, 0.027]
N	1122	493	629	340	782
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
First-Stage F-Stat	40.64	12.42	23.52	19.09	20.40

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

1.5.2 Different Measures of Impact

Tables 1.10 & 1.11 contain citations re-weighted using the correction mentioned in Hamermesh (2018) and Perry & Reny (2016) respectively. Using Hamermesh's correction, I still find that there is a negative effect of R&D expenditure on the number of citations given to microeconometrics papers, particularly for private universities. When looking at public or elite vs. non-elite universities I find that there is still no statistically significant effect of R&D expenditure on citations given to microeconometrics papers. When I use the Euclidean index proposed by Perry & Reny (2016) to measure the impact of research I again find that there is a negative effect on citations as well as a possible negative effect for elite universities rather than just private universities, although both of the results are only significant at the 10% level. Overall, these robustness checks reinforce my findings that the effect of R&D expenditure in economics is largely negative for microeconometric work.

Table 1.10: 2SLS estimates of R&D Impact on Citations Corrected Using Hamermesh's Method

	Total	Private	Public	Elite	Non-Elite
Hamermesh-No Controls					
R&D Expenditure	-5.808***	-8.738**	-1.731	-2.992	-1.264
	(1.533)	(3.340)	(2.088)	(1.907)	(1.196)
	[-8.869, -2.747]	[-15.579, -1.897]	[-5.965, 2.503]	[-6.983, 0.998]	[-3.673, 1.145]
N	1122	493	629	340	782
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
First-Stage F-Stat	47.25	18.73	25.73	24.97	22.50
Hamermesh-Controls					
R&D Expenditure	-3.922***	-5.502**	-1.799	-1.822	-1.495
	(1.259)	(2.169)	(1.717)	(1.199)	(1.138)
	[-6.437, -1.408]	[-9.944, -1.059]	[-5.280, 1.683]	[-4.333, 0.688]	[-3.787, 0.797]
# Microeconometricians	2.161***	1.299**	1.878	2.318***	0.691***
	(0.533)	(0.610)	(1.170)	(0.418)	(0.221)
	[1.096, 3.226]	[0.050, 2.548]	[-0.494, 4.250]	[1.442, 3.194]	[0.247, 1.136]
# Theorists	0.172	0.444	0.117	0.022	-0.107
	(0.235)	(0.360)	(0.236)	(0.236)	(0.181)
	[-0.297, 0.641]	[-0.292, 1.181]	[-0.361, 0.596]	[-0.472, 0.515]	[-0.471, 0.257]
# Other Empiricists	-0.055	0.910*	-0.332	-1.095	-0.026
	(0.472)	(0.493)	(0.703)	(0.842)	(0.221)
	[-0.998, 0.889]	[-0.100, 1.920]	[-1.757, 1.093]	[-2.857, 0.667]	[-0.471, 0.419]
# Econometricians	-0.287	0.003	-0.352	-1.192	1.005**
	(0.468)	(0.640)	(0.997)	(0.777)	(0.454)
	[-1.221, 0.647]	[-1.309, 1.314]	[-2.374, 1.671]	[-2.819, 0.435]	[0.091, 1.919]
N	1122	493	629	340	782
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
First-Stage F-Stat	40.64	12.42	23.52	19.09	20.40

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 1.11: 2SLS Estimates of R&D Impact on Citations Using Euclidean Index

	Total	Private	Public	Elite	Non-Elite
Euclidean-No Controls					
R&D Expenditure	-19.020***	-28.749*	-3.543	-11.569*	-0.659
	(6.413)	(15.719)	(6.279)	(5.723)	(4.166)
	[-31.828, -6.212]	[-60.949, 3.451]	[-16.277, 9.191]	[-23.548, 0.410]	[-9.050, 7.732]
N	1122	493	629	340	782
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
First-Stage F-Stat	47.25	18.73	25.73	24.97	22.50
Euclidean-Controls					
R&D Expenditure	-13.495***	-19.854*	-3.534	-9.675*	-1.522
	(5.044)	(10.026)	(5.575)	(4.693)	(3.755)
	[-23.568, -3.423]	[-40.391, 0.683]	[-14.841, 7.774]	[-19.497, 0.146]	[-9.084, 6.040]
# Microeconometricians	6.663***	3.435	4.725	5.840**	2.756***
	(1.801)	(2.233)	(2.819)	(2.154)	(0.790)
	[3.067, 10.260]	[-1.140, 8.009]	[-0.992, 10.443]	[1.332, 10.347]	[1.164, 4.347]
# Theorists	0.297	1.251	0.219	-0.634	-0.226
	(0.857)	(1.366)	(0.804)	(0.926)	(0.638)
	[-1.414, 2.008]	[-1.548, 4.050]	[-1.411, 1.849]	[-2.572, 1.304]	[-1.511, 1.060]
# Other Empiricists	0.923	4.434**	0.099	-1.732	0.202
	(1.642)	(2.087)	(2.137)	(3.080)	(0.929)
	[-2.357, 4.203]	[0.160, 8.708]	[-4.236, 4.433]	[-8.178, 4.715]	[-1.669, 2.073]
# Econometricians	-0.669	-0.964	0.730	-5.361*	4.343**
	(2.037)	(2.473)	(3.419)	(2.790)	(1.920)
	[-4.738, 3.400]	[-6.029, 4.101]	[-6.204, 7.664]	[-11.200, 0.479]	[0.476, 8.210]
N	1122	493	629	340	782
Uni Fixed Effect	X	X	X	X	X
Year Fixed Effect	X	X	X	X	X
First-Stage F-Stat	40.64	12.42	23.52	19.09	20.40

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

1.6 Discussion, Limitations & Future Directions

Overall, these findings seem to show the opposite of what many earlier papers have found. They indicate that spending more money on research actually hampers a universities ability to produce research, particularly of microeconometric work. This holds whether one examines quantity or quality of publications. My results also indicate that this effect is strongest during the credibility revolution. This would indicate that during a paradigm shift, increased spending in fact leads to decreased researcher productivity.

A possible explanation is that universities determine funding based on the preferences of more senior members. This may lead then to bias in which projects are funded (Akerlof & Michaillat 2017) making the effect of spending negative rather than positive, although this is more likely to boost other styles of paper which is not noticed. Alternatively, spending may have a negative effect as too many research assistants or postdocs may hamper productivity by taking up scarce resources.[23] This may be a more likely explanation than the previous. Another possible reason that spending shows a negative effect is the possibility of increased administrative costs. Increased funding may require researchers to take on additional administrative responsibilities, such as ensuring the training of new personnel that takes away from their time to do proper research, reducing both the number and quality of publications. It may also be that departments which receive a lot of funding have faculty who use more of their time to write grant proposals. Writing grant proposals takes time away from research, and this could be an unproductive use of an economist's time. This may be another reason why departments with higher R&D expenditure produce fewer papers, and receive fewer citations.

Unlike Payne & Siow (2003), Whalley & Hicks (2014) and Rosenbloom et al. (2015) I find that increased spending decreases both quality and quantity of microeconometrics papers for private institutions compared to public ones. More surprisingly, I find that this affects microeconometric style papers the most. The fact that the coefficients for faculty controls are larger for private vs public universities seems to indicate that faculty in private universities do have an advantage over public universities, but it is not in the way they spend money. This could be because public universities have their funding tied to explicit goals of research while private universities spend on ideas that are not as clear cut. Many public

[23] Such as secure connections to government data, or space to run experiments in the department.

funding bodies are also less interested in investing in novel research, which private universities may be more willing to fund (Stephan 2010, Azoulay, Zivin & Manso 2011, Ayoubi, Pezzoni & Visentin 2021). I also see that elite universities have significantly larger coefficients for production of microeconometric papers based on the number of faculty they employ. These would be in line with the findings of Kim et al. (2009) who also conclude that elite status is due to elite schools being able to attract and retain top talent. Future directions for research in this regard should look at how elite and/or private universities manage to obtain top talent in economics.

The overall small and negative effect of Economic R&D expenditure may be due to a number of reasons. The most obvious of these of course is that economics may simply not benefit as much from R&D expenditures compared to the harder sciences (Cochrane 2012). This would be supported by the findings of Arora & Gambardella (2005) who find that the effects of grants on economics researchers are also quite modest although positive. Further reasons for the smaller magnitudes may be that economics has an incredibly long publication time as indicated in Ellison (2002), and Hadavand, Hamermesh & Wilson (Forthcoming) so I may just be observing the continued elongation of the economics publishing process, although this is unlikely to be the case as economists tend to work on several projects at a time.[24] This may just be due to the fact that economists don't publish very often compared to others. Future research could look at whether funding has any association with the time to publications or helps reduce the number of revisions requested by editors.

[24] Longer lags presented in the appendix still show a negative effect of R&D, however, so this is unlikely

There are limitations to this study. The metrics I use for determining productivity are not necessarily flawless measures. Citations can be impacted by a number of factors such as network effects. Publications as well may hide certain benefits to funding that are not explored in this chapter. For instance, funding may be important for the recruitment of research assistants and post-docs and thus help train a new generation of economists. Furthermore, the focus on economics may mask the efficacy of funding for revolutions in other disciplines. Future research could explore which sections are cited, or the number of citations in other highly influential works. Likewise, rather than publications, future research could focus only on publications that lead to prestigious rewards such as the Nobel Prize.

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Chapter 2

The Effect of NSF Grants on Basic Research: Evidence From Economics

2.1 Introduction

Every year, the United States (US) federal government spends billions funding grants for basic research. One of the primary arms of federal funding is the National Science Foundation (NSF) which serves as the largest federal funding bodies of basic research in a number of subjects including the social sciences (Harris 2021), spending over $5 billion in 2020 alone. Investments in basic research are made because it is believed that the production of scientific knowledge is essential to the development of society. Public funding of science has been credited with both the rise of American universities as the top centers of research in the world to even producing the scientific and technological developments that propelled the US economy to its position as the world's largest (Aghion, Dewatripont, Hoxby, Mas-Colell & Sapir 2010, Cole 2009, Gruber & Johnson 2019). Supporters of funding have also pointed out that many influential papers have been published with assistance from NSF grants (Moffit 2016) and argue that this justifies continued support from the NSF. There are of course opponents to funding who have argued that the NSF is inefficient compared to the free market (Friedman 1981). Others have claimed that the NSF only funds research that is mainstream as the committees are made up of the most prestigious researchers in their discipline, and many of the papers would be published anyways (Cochrane 2012). Other opponents of funding government research claim that the money would be better spent in replication studies, or through innovation prizes (Cowen & Tabarrok 2016).

In the social sciences, the NSF is projected to increase funding from $280,000,000 in 2021 to over $330,000,000 by 2023 (National Science Foundation 2023). However, findings on the effects of government funding on researcher productivity are mixed. Some have found that the receipt of funding can in fact be quite substantial whether looking at the number of publications or the impact of the research (Laband, Piette, Ralston & Tollison 1994, Payne & Siow 2003, Whalley & Hicks 2014). Others have found that the effects of grants are in fact rather modest and suggests that government funding may not contribute all that much to researcher productivity (Arora & Gambardella 2005, Jacob & Lefgren 2011, Ghirelli, Meroni, Havari & Verzillo 2023). Jacob & Lefgren, however, study the National Health Institute (NIH) which almost exclusively conducts health research, and provides different perks to recipients.[1] Payne & Siow have a weak instrument, Whalley & Hicks look at total university spending, Laband et al. do not have an identification strategy, and Arora & Gambardella have an unconvincing identification strategy that relies on the assumption that there is

[1] For instance, researchers may buy their way out of teaching with NIH grants (Cochrane 2012) and NIH grants have specific and clearly defined objectives.

no unobserved heterogeneity across the researchers they observe, and themselves state that if there are other confounding factors not included, their estimates are not identified. In the previous chapter it was found that the effect of R&D in economics departments had a negative effect on empirical work. It may be that department funding which comes from a variety of sources can have a negative impact on research, but direct funding to researchers for projects may in fact be beneficial. Therefore, I look at the direct effects of government funding by using a subset of economists as a case study on the effects of receiving an NSF grant on researcher productivity in this chapter.

In this chapter I present event studies alongside two-stage least squares (2SLS) estimates that identify the causal effect of NSF funding on the productivity of economists. I present results on the effect of receiving a first grant, subsequent grants, simply having a grant as well as the amount of grant money received on an economist's basic research productivity. My findings indicate that there is no statistically significant effect of receiving an NSF grant on the number of publications produced, nor do recipients publish in better journals or produce more highly influential papers and do not take on a greater number of research projects. However, there is a statistically significant effect on the number of citations received as well as the number of unique co-authors one has published with during their research career after receipt of the first NSF grant. This effect only holds for the first NSF grant received by an economist. Tests that examine subsequent grants, whether an economist had a grant three years ago, and the effect of grant money three years ago find no statistically significant effect of grants.

These findings indicate that Cochrane (2012) is at least somewhat correct in claiming that the papers would be published regardless of the grant, but also corroborate the findings of Laband et al. (1994) who find that NSF grants are associated with higher numbers of citations. Furthermore, they provide no support for the assertions of Moffit (2016) as economists do not publish more highly influential papers due to grants. Given that the results show that earning a first grant show a positive effect on citations, but effects of having had a grant three years have little to no effect nor does grant money or receipt of a second grant, these findings suggest that the effects of winning a grant are more about network effects than any increase to productivity. Moffit (2016) also argues that the efficacy of grants is not fully understood and suggests finding a way to determine whether empiricists or theorists benefit more. Using the deep learning model sciBERT (Beltagy, Lo & Cohan 2019), I am able to distinguish between theoretical and empirical economists. My findings indicate that the citation effects of receiving a first grant are significant only for empiricists, although it is less precisely measured than the full sample.

There are certain policy implications of these findings. Given that the first grant only affects the number of citations received and the number of co-authors, it may be wise to give younger researchers priority for NSF grants or expand existing early career programs such as the NSF early career research program, as this would allow them to grow their co-author network, and get their research noticed by the wider academic community. Another implication from my results is that if the goal is to allow younger researchers to grow their networks, the recipients should be those who are doing empirical work, as they are the ones who benefit from the effects. This may sideline some economists, but given the scarcity of funding available already, it should be directed to where it can have the greatest impact.

My findings contribute to the literature on the effect of researcher funding and in particular, the ongoing debate surrounding the efficacy of NSF funding within economics by providing direct causal evidence of its impact. This chapter also contributes to the literature on who benefits by using deep learning methods to find whether empirical or theoretical economists benefit more from NSF grants, a suggestion made by Moffit (2016). A third, and final contribution is to studies on productivity and gender in academia. Lawson, Geuna & Finardi (2021) find that women receive less funding than male counterparts, and produce fewer publications although citations are not affected. My findings indicate that there is little difference in the effects of receiving a first grant on citations or publications between males and females, although the effect on citations for males is more precisely estimated. Neither seems to receive much benefit from simply having a grant or the amount of grant money awarded.

The next section of this chapter will provide some background information on the NSF process as well as background on the determinants of productivity in academia. Section 3 will explain the data and methodology used. Section 4 will contain the results for receipt of a first grant alongside robustness tests and additional tests. Section 5 will contain my conclusions and discussion.

2.2 NSF Selection Process & Determinants of Economist Productivity - Theory & Evidence

2.2.1 Selection Process

There are two ways to apply for an NSF grant. The first is that the NSF itself will put out a solicitation for proposals related to a certain topic. The second is to send in an unsolicited proposal. NSF grants go through a number of rounds. The first round of the NSF selection process is through administrative channels and is commonly called "STOP" because proposers are urged to stop and consider if their proposal meets the criterion. In this portion of the application process proposals are considered on a number of technical criteria. These criteria are: does the proposal provide sufficient technical substance to enable review, does the proposal meet the topic/subtopic limitations, and is appropriate research proposed in science engineering or education. Additionally, proposals will be rejected if they pertain to weapons research, biomedical research or classified research.

If the proposal meets the criteria in the STOP section they move on to the second portion of the NSF review process known as the merit review. The merit review lists six criteria to determine through a competitive process whether or not funding should be received for a grant proposal. These criteria are: the scientific, engineering or educational significance of the proposed research, the soundness of the research plan to establish technical and commercial feasibility of the concept, uniqueness or innovative merit of the proposed concept or technological innovation, the potential of the proposed concept for commercial application, education and professional experience of the principal investigator(s), and past commercialization progress or success.

After these two stages, the proposals are ranked against one another in the same category to prepare for the final funding decisions. There are more often than not more proposals that are sound than can be funded. Program officers will then review proposals and consider the past performance, commercial potential, emphasis areas and program balance in addition to the technical factors to make a final decision on whether or not to fund a proposal. In addition, proposers receive a verbatim report of the review along with detailed summaries and the context of the award or rejection. Declined proposals can not be resubmitted under the same program solicitation, but can be submitted again after revision to new solicitations or revise and submit an unsolicited proposal (National Science Foundation 1997).

2.2.2 Research Productivity - Theory & Evidence

March (1991) develops a model where organizations can engage in exploration (discovery of new ideas) or exploitation (taking advantage of current ideas). In his model, Marsh finds that exploitation yields high short-term benefits, but poor long-term ones. This is further refined by Manso (2011) in which innovation is a result of experimentation. Because of this, the optimal way to produce innovative work is with a tolerance for early failure and long term success. This model shows that an agent is more likely to have long-term success if tolerance for early failure allows them to engage in exploration in the early stages of research. By having a more tolerant attitude towards failure, it is then possible for a principal such as the NSF to motivate an agent to engage in more innovative research than would happen under a less failure tolerant setup.

Empirical evidence for the knowledge production process can be found in Aghion, Bloom, Blundell, Griffith & Howitt (2005) who find that laggards are less likely to engage in innovation, but neck and neck firms are more likely to engage. Hashmi (2013) expands on the work of Aghion et al. and finds that where groups are less technologically similar, the relationship between competition and innovation is actually negative. Tian & Wang (2014) find that corporate lab heads engage in more innovative processes when there is greater tolerance for failure.

There is also evidence from the academic life sciences, which more closely mirror the innovation process from Azoulay, Zivin & Manso (2011) who find that funding structures that are more tolerant of early failure do actually lead to researcher producing more high quality papers. In another vein, Defazio, Lockett & Wright (2009) find that in the EU, applying for research funding improves author collaboration. Similarly, Baruffaldi, Marino & Visentin (2020) find that publication quantity does not increase due to a mobility grant, however, the impact factor of journals they publish in does see a modest increase. There is comparatively little literature on the effects of NSF funding which is less defined in proposal objectives and committed to all science in the United States. However, despite the competitive nature of NSF grants and potential for collaboration, there are likely incentives for a researcher to engage in safer, less innovative research.

As mentioned before in Holmstrom (1989), research is long, unpredictable and labour intensive. As such, pay for performance may not be the best method due to the noisy signal research generates. This is supported by psychological research which finds that when cash incentives are tied to metrics that are noisy such as research performance, it is more likely that researchers will pursue more repetitive research rather than anything innovative (Amabile 1996). Likewise, Akerlof & Michaillat (2017) develop a model where incumbents are more likely to favour ideas that already conform to their beliefs. This could provide another incentive to engage in incremental work as it is less likely that novel work will be selected.

Despite the theoretical and empirical literature, government funding from organizations such as the NSF tends to be short-term and often fund the summer salaries of research staff. Regarding federal funding in particular, there has been a good deal of criticism that the funding cycles do not support researchers in pursuing riskier or more novel work, but rather incentivises them to pursue work that is safer and more repetitive (Kaplan 2005) while also taking up significantly larger amounts of researcher's time (Ioannidis 2011). Because of the short time frames involved with NSF funding, it seems that it would be unlikely that grant recipients produce more highly influential papers and benefits to productivity measures in general may in fact be quite small. This should provide additional evidence that short-term funding contracts do not lead to the outcomes expected (increased productivity). Likewise, although the research funding process is different from the EU studied in Defazio et al. (2009), it is likely that grant recipients will see greater expansion of their co-author network compared to non-recipients.

2.3 Data & Methodology

2.3.1 Data

Economists

My dataset is composed of an unbalanced panel of researchers from Brogaard, Engelberg & Wesp (2018). It contains the affiliations, and names of nearly every economist to pass through the top 50 departments listed in Conroy, Dusansky, Drukker & Kildegaard (1995).[2] I determine the gender of the economists by first applying a list of all the female names of people born in the USA starting in the 19th century, and then hand label the remaining names that did not appear. To ensure the robustness of my results, I only select economists who have *never* taken an academic position outside of the United States.[3]

[2]This is the same dataset mentioned in the previous chapter.

[3]Different geographic regions e.g. Canada, the United Kingdom or Europe have their own funding agencies, so this may bias the results if I include economists who primarily work outside the United States.

Economist's Publications

Publications are one of the most common ways to measure academic productivity. My publication data come from Econlit, an online repository with data on every article published in hundreds of economics and related field journals. The journals used in this analysis are the 70 journals mentioned in Angrist, Azoulay, Ellison, Hill & Lu (2020) which are the top 70 journals measured by citations from the top six journals in economics.[4] Regarding measuring by top six citations, in Angrist et al. (2020), *The American Economic Review* has an importance score of 0.261 as it receives 26.1% of the citations from the top six. *Econometric Theory*, the lowest, has an importance of 0.001 as it barely receives any citations from the top six. Outside of these 70 journals, the percentages are even smaller, and therefore receive little attention from the top journals. The data in Econlit contains author names, affiliations (from 1990 onward), the date of publication, journal of publication, and pages. This data is matched by author name in the economists dataset to get the publishing productivity of economists in my dataset. To account for additional authors, papers are divided by the number of authors to grant equal credit.

Economist's Citations

The second metric used is the number of citations five years after publication each author receives.[5] The citations data comes from Web of Science (WoS). WoS contains citations data on papers in the same journals from Econlit. Because there is no common identifier amongst articles in econlit and WoS I match these

[4]Citations from *American Economic Review, Journal of Political Economy, Econometrica, Quarterly Journal of Economics, Review of Economic Studies*, and *Review of Economics & Statistics*. These are the same journals mentioned in the previous chapter for computing importance scores.

[5]According to Hamermesh (2018) there are few flashes in the pan in economics nor are there many resurrections. So the five year citations should act as a good measure of a paper's quality or at the very least, its "market value".

articles on journal ISSN, publication year, volume, issue, and the start and end page numbers.[6] Citations are normalized by their primary field to account for differences in citations received as some fields gain more citations on average than others (Perry & Reny 2016).

Grants to Economists

The data on grants comes from the NSF archive. It contains author names, their unique ID, the grant catalog of federal domestic assistance (CFDA) code, the year awarded, the year it expires, and the amount of grant money available. Grants data is cleaned by using the appropriate CFDA tag, and then matched with the researchers in my dataset using name, year and affiliated institution.[7]

2.3.2 Methodology

Identifying Empiricists and Theorists

To examine differences between theorists and empiricists, it's necessary to have knowledge of what type of papers economists typically produce. To do this, I take a hand-labelled sample of 5,321 papers from my publications dataset and then label them as belonging to one of four styles: microeconometrics, theory, econometric theory, or other empirics. I then train a transformer model (Vaswani, Shazeer, Palmer, Uszkoreit, Jones, Gomez, Kaiser & Polosukhin 2017).[8] I use the title, abstracts, date and journal an article is published in as inputs, and train the model on my sample that will later be applied to the rest of the publications in my

[6] This is the same method used in Angrist et al. (2020) and the previous chapter.

[7] The CFDA tag used is 47.075: social, behavioral and economic sciences.

[8] The specific model in question is the sciBERT model Beltagy et al. (2019), a variation of Google's BERT Devlin et al. (2019) model trained on the Semantic Scholar corpus. This is the same model from the previous chapter.

dataset. The model has an accuracy greater than 83% on the training dataset.[9] I then match the articles in my datset and match them to the researcher's names. I then use which method makes up the majority of an economist's publications to determine whether they are empiricists or theorists.[10]

Correcting for Primary Field Citations

Different fields of economics receive different numbers of citations (Perry & Reny 2016). For instance, labour economics may receive more citations on average compared to industrial organization. To account for this I normalize citations by one of eleven primary fields, which are separate from the 4 styles mentioned above. To determine the primary field I use the method outlined in Angrist et al. (2020), and build a training dataset from all papers between 1970-2004 where the first code was also the primary field. I next train a transformer model using the same inputs as above and then apply the predictions to papers after 2004. the model I train has an accuracy greater than 81%. These fields are then used to normalize the citations received by each economist to account for differences received by work in separate fields.

Empirical Strategy

I am interested in finding the causal effect of NSF grants on economist productivity. To find the effect of a first grant, I take all the researchers in my dataset whose first year of employment was 1990 or later and assemble an unbalanced panel. I first present event studies to show the impact of a grant. After receipt of a first grant, the economist in question is assumed to be treated for the rest of the

[9]All papers in the 70 journals used are classified as belonging to only one of either microeconometrics, theory, other empirics, or econometric theory.

[10]Econometric theory as a whole makes up a very small part of the dataset; approximately 10% of economists.

panel. The identifying assumption is that absent the receipt of a grant, researchers would otherwise be on the same trajectory. Because two way fixed-effects (TWFE) estimates can be biased with staggered adoption, I use the correction method in Sun & Abraham (2021) which is easily implemented in the fixest (Berge 2020) package for R.

There may be omitted variables that affect the receipt of a grant which would bias my estimates, like whether or not an economist presents their paper at a prestigious conference. By presenting at a conference, the economist would receive feedback from well-known economists, many of whom are also editors of top journals, increasing their publications, and their citations. By being invited to one of these conferences, the economist would also signal that the people who decide which papers get presented (largely also well-known in the profession) believe that their research is worth considering, impacting their chances of receiving a grant. Another omitted variable is whether an economist was made to retract a paper. Retracting a paper would signal that the economist does not conduct their research properly, which would make their work harder to publish and less likely to be cited. It may also signal to any funding panel that funding said economist would be a poor decision. To account for this potential endogeneity, I also adopt a two-stage least squares (2SLS) approach using the number of grants received the previous year by other non-economist social scientists at the researchers institute as an instrument.[11]

2SLS requires that the instrument be as good as random, uncorrelated with the error term and correlated with the endogenous regressor. It is likely that

[11] Other social scientists refers to sociologists, political scientists, psychologists and any other faculty in social science departments aside from the economics department.

the receipt of other social science grants is correlated with efforts by the NSF to improve the quality of social science research at certain schools, satisfying the relevance assumption. My instrument should not be correlated with the error term due to the insularity of economics (Fourcade, Ollion & Algan 2015, Angrist et al. 2020). Economists rarely cite other social scientists, and are rarely cited by other social scientists in return. Because other social sciences are not related in any meaningful way to economics research, other social science grants should not have any effect on the number of economics papers produced by an economist, nor should they affect the number of citations their papers receive. Regarding the independence assumption, the number of grants that a sociology or psychology department receives is largely dependent on how many grants that particular department has applied for, so shouldn't be correlated with any unobserved productivity factors for economists. The number of grants other social scientists receive would also depend on what topics the NSF is soliciting proposals for at the time which may play to certain school's strengths over others with no real way to plan for this, which should satisfy the independence assumption.

Additional controls in my estimates are the tenured status of researchers in my dataset, number of years employed, individual fixed effects, university fixed-effects and yearly fixed-effects. The 2SLS equation can be written as:

$$Y_{it} = \gamma G_{it} + \beta \mathbf{X}_{it} + A_i + U_{it} + T_t + \epsilon_{it} \tag{2.1}$$

where Y_{it} is the productivity measure, in this case either number of papers published, or the number of citations received five years after publications. G_{it} is the indicator variable for whether or not the economist i in question has received their first grant at year t, X_{it} is a vector of controls that consists of the number of years employed as well as an indicator variable for whether or not economist i at time t is tenured. A_i is the individual time invariant fixed effect of economist i, U_{it} is the university economist i is employed at time t and T_t is the year fixed-effect to account for any changes in trends. The first stage model of the regression can be written as:

$$G_{it} = \delta OG_{it-1} + \beta \mathbf{X}_{it} + A_i + U_{it} + T_t + e_{it} \tag{2.2}$$

where G_{it} is a dummy variable for whether or not the economist in question has received his or her first grant, OG_{it-1} is the one year lag of the other social science grants received by the university, and the other variables are the same as the variables listed in the equation above.

2.3.3 Trends & Descriptive Statistics

Trends

Figure 2.1 contains the amount of NSF spending towards economics over the years. It can be seen from the data that the amount of NSF grant money given to economists in my sample has been growing steadily since 1990. Figure 2.2 contains spending to styles of economic research over the years. When examining the amount of spending to various methodologies in economics, the amount of grant money given to theoretical and empirical work is growing much faster than it is towards econometrics work. Funding to theoretical work also seems to be declining rapidly after reaching a peak in 2010, although this seems to be part of a general trend of decreased grant funding after 2010 in the dataset.

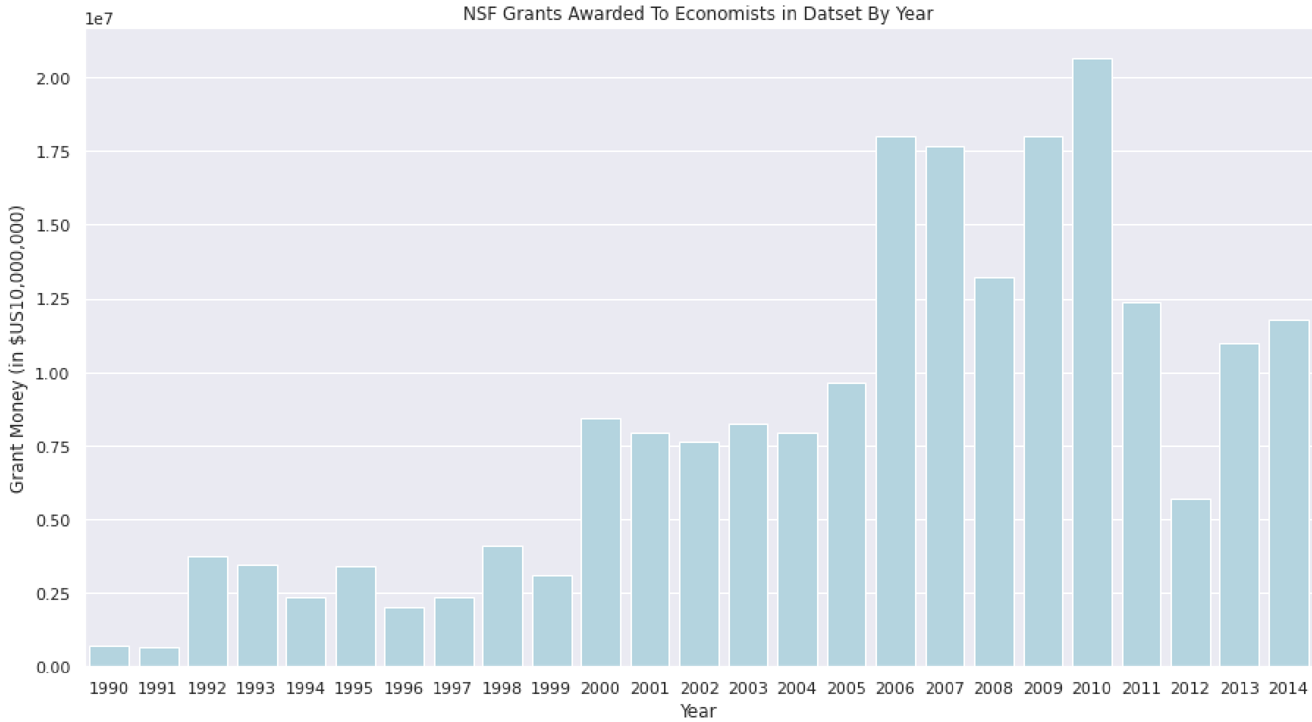

Figure 2.1: Total NSF Spending Towards Economics in Dataset, Values are in $US 10,000,000s.

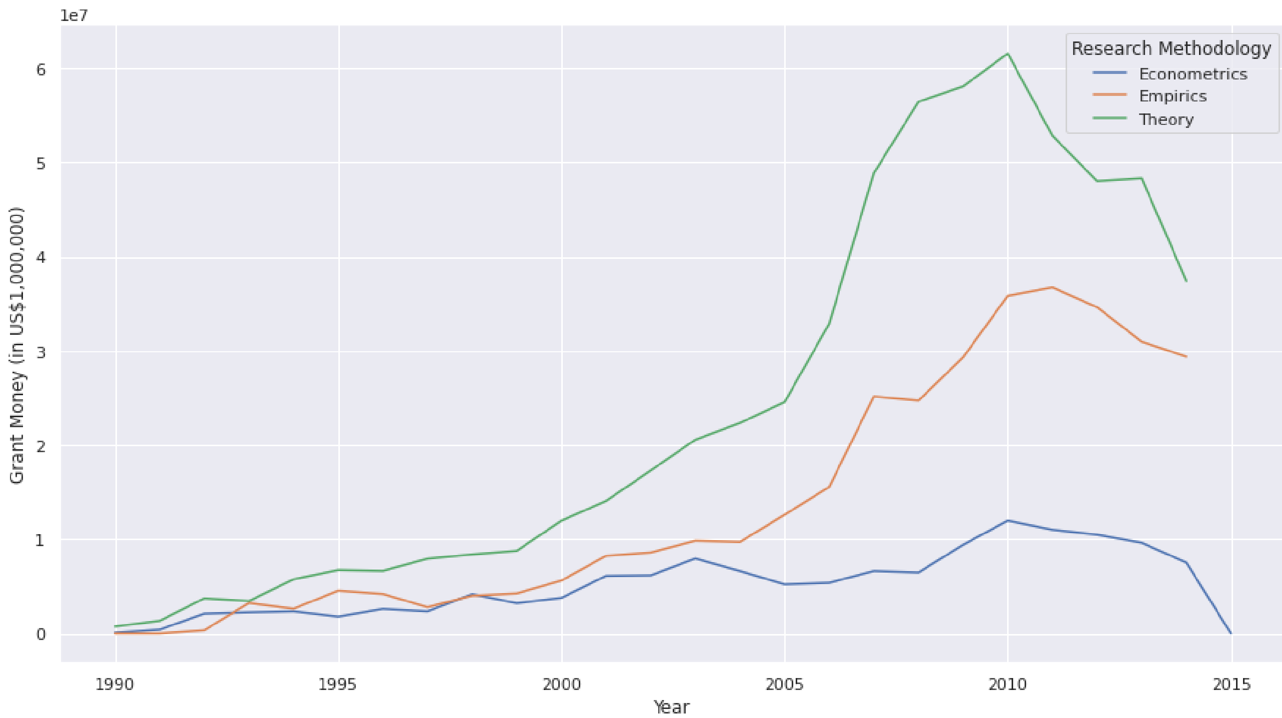

Figure 2.2: Total NSF Spending on Economics to Various Methodologies in Dataset, Grant $ values are in $US 1,000,000s.

Descriptive statistics

Table 2.1 contains the descriptive statistics. The descriptive statistics show that the average grant is approximately US$270,000 with a standard deviation of $1,540,000. The number of papers published by the mean economist is 0.42 papers per year. However, the median economist does not publish any papers per year. Likewise, the mean number of citations after five years is quite low. The average paper in my dataset is cited approximately once in five years, and the lowest half get none at all.[12] The descriptive statistics show that all of the variables I am looking at are right skewed as well.

Table 2.1: Descriptive Statistics For Grant Money Received, Papers Published, and Citations

	Mean	Median	SD
Grant Money Available (US$1,000,000s)	0.27	0.00	1.54
Yearly Papers Published	0.42	0.00	0.66
5-Year Citations	1.05	0.00	2.74

Table 2.2: Descriptive Statistics - Differences Between Grant Winners and Non-Winners

	Mean		Median		SD	
	No Grant	Grant	No Grant	Grant	No Grant	Grant
Publications	0.38	0.56	0.00	0.33	0.64	0.72
Citations	0.88	1.70	0.00	0.12	2.41	3.69

Table 2.3: Descriptive Statistics - Before & After Receipt of First NSF Grant

	Mean		SD	
	Before	After	Before	After
Publications	0.57	0.56	0.76	0.69
Citations	1.47	1.86	3.59	3.75

Table 2.2 contains results that show the differences in productivity between

[12]This is consistent with the findings of Hamermesh (2018) who finds that many papers in even the top five journals in economics are rarely cited.

grant recipients and those who have never received a grant. When looking at the difference between those who won grants, and those who did not, it can be seen that those who win grants are more productive than those who do not. However, this is not evidence of grants boosting productivity as there is a significant selection bias issue. The median grant recipient also publishes a third of a paper annually while the median non-recipient doesn't publish annually at all. Table 2.3 contains publications and citations before and after winning a first grant for researchers that only won a grant. These statistics seem to show that winning a grant does not do much for publications, although there may be an effect on the number of citations received.

2.4 Results

2.4.1 Event Studies

The first part of the results section contains the results from my event studies where the dependent variables are the number of publications per year and citations received five years after publication. These rely on the assumption that absent a grant, researchers who did and did not receive an NSF grant would remain on the same publication/citation trajectory. The results indicate that receiving an NSF grant may in fact be beneficial for both the number of publications a researcher produces as well as the quality of the publications a researcher produces as measured by the five-year citations. The impact of receiving a grant on citations does not seem to be permanent however, and disappears approximately ten years after receipt. This may be because an economist who receives a grant is considered more capable and thus more likely to be cited than those that do not receive grants.

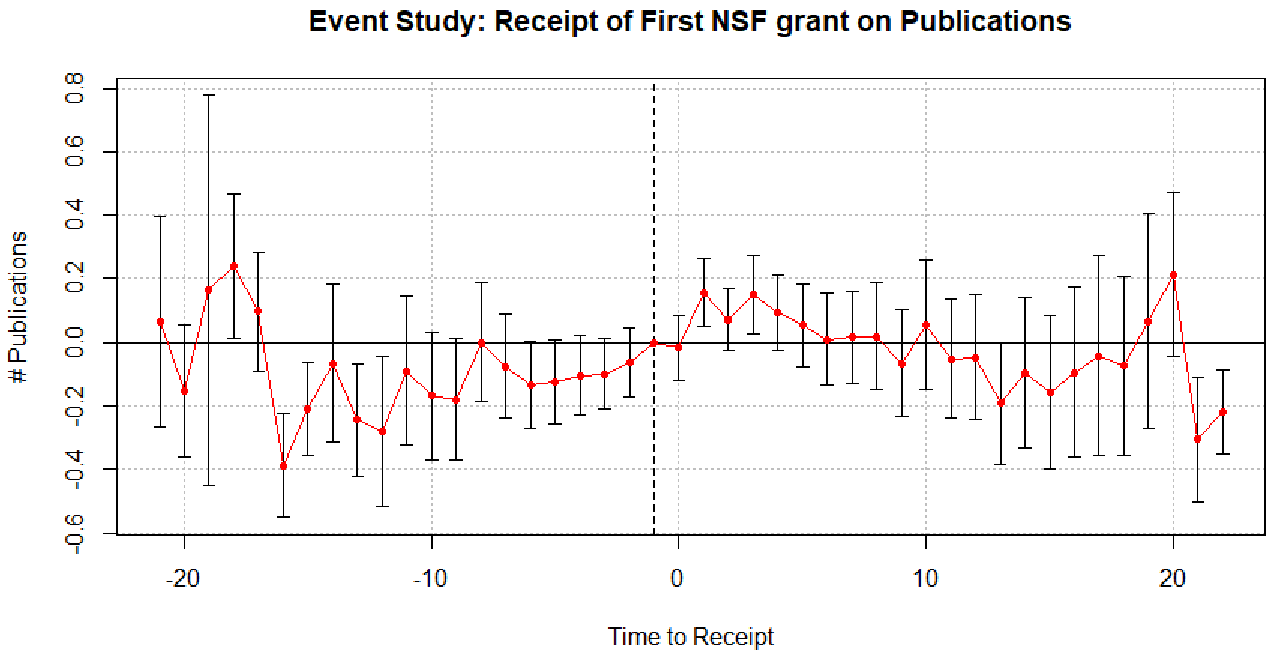

Figure 2.3: Effects of First NSF Grant on Number of Publications

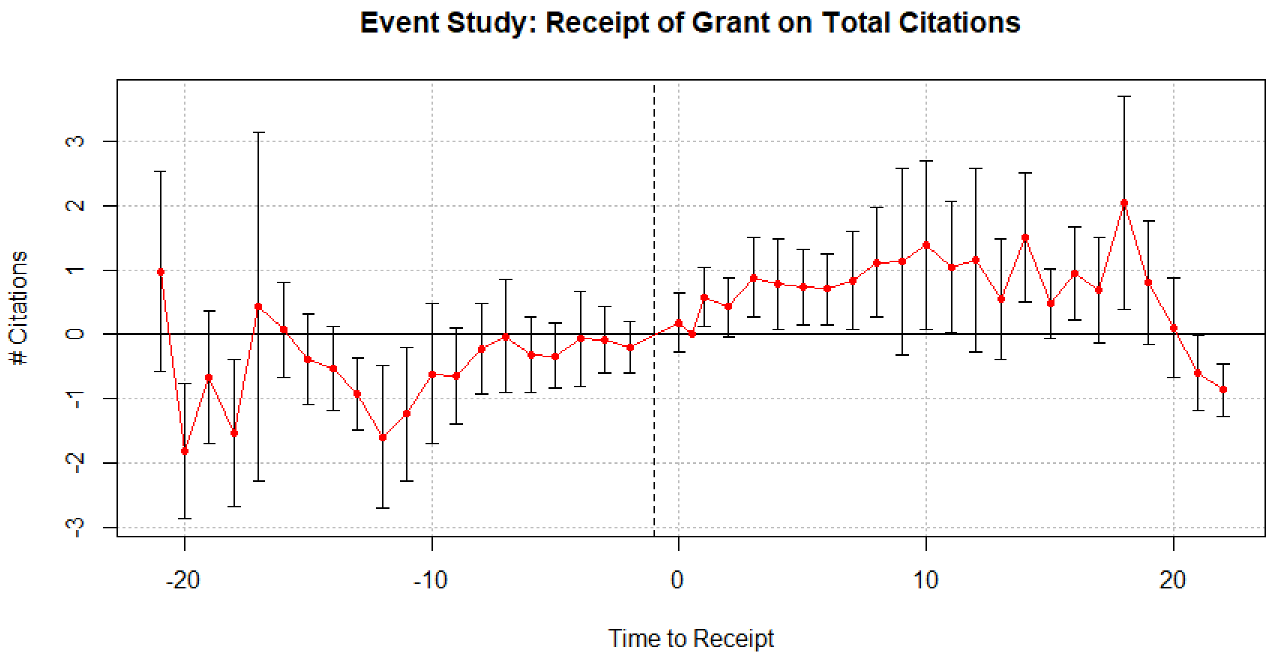

Figure 2.4: Effects of First NSF Grant on 5-Year Field adjusted Citations

Further Tests: Receipt of First Grant Empiricists vs. Theorists

Not all economists do the same style of work. Many work on theoretical problems, while an increasing number focus on empirical work. About half the economists in my dataset are theorists, and half are empiricists.[13] This can cause heterogeneity in the effect of NSF grants on researcher output. For further analysis I also look at the effect on publications and citations when my data is divided into both empiricists and theorists. Figures 2.5 & 2.6 contain the results for empiricists and Figures 2.7 & 2.8 contain the results for theorists.

The results seem to indicate that only empirical economists benefit from receipt of an NSF grant. This would indicate that the production functions of different economic styles are noticeably different. It seems from the event studies that receipt of a grant increases publications by approximately 0.25 papers for several years if one is an empiricist. Likewise, an empiricist is likely to see additional citations to their work following receipt of an NSF grant. Theorists on the other hand, see no statistically significant effect. This is not too surprising however. Theoretical work is much different than empirical, and often relies on formal mathematical models which likely do not require extensive, and often expensive data collection, while grants to empiricists are more likely to be used to fund the running of experiments.

[13] Around 10% of economists in the sample work on econometric theory.

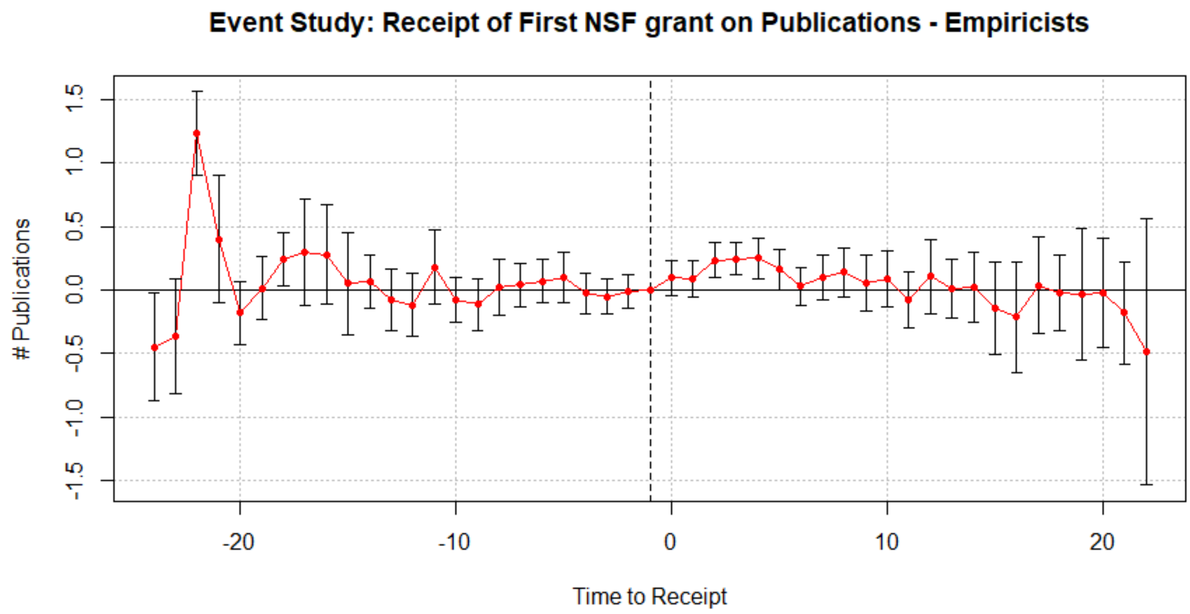

Figure 2.5: Effect of Receiving First NSF Grant on Publications: Empiricists Only

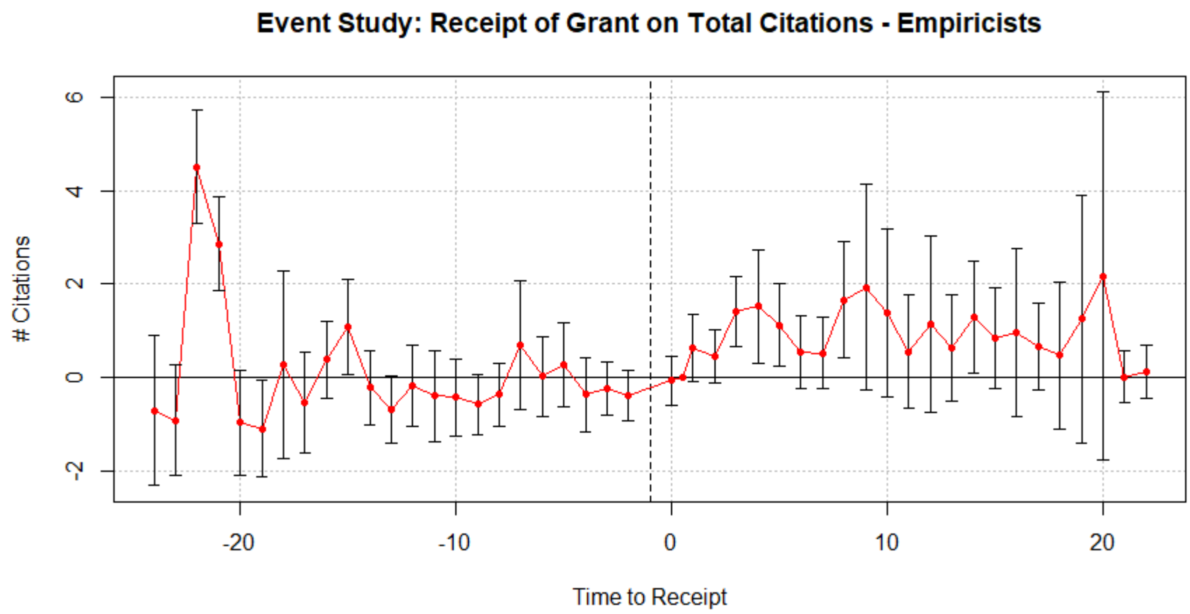

Figure 2.6: Effect of Receiving First NSF Grant on 5-Year Field adjusted Citations: Empiricists Only

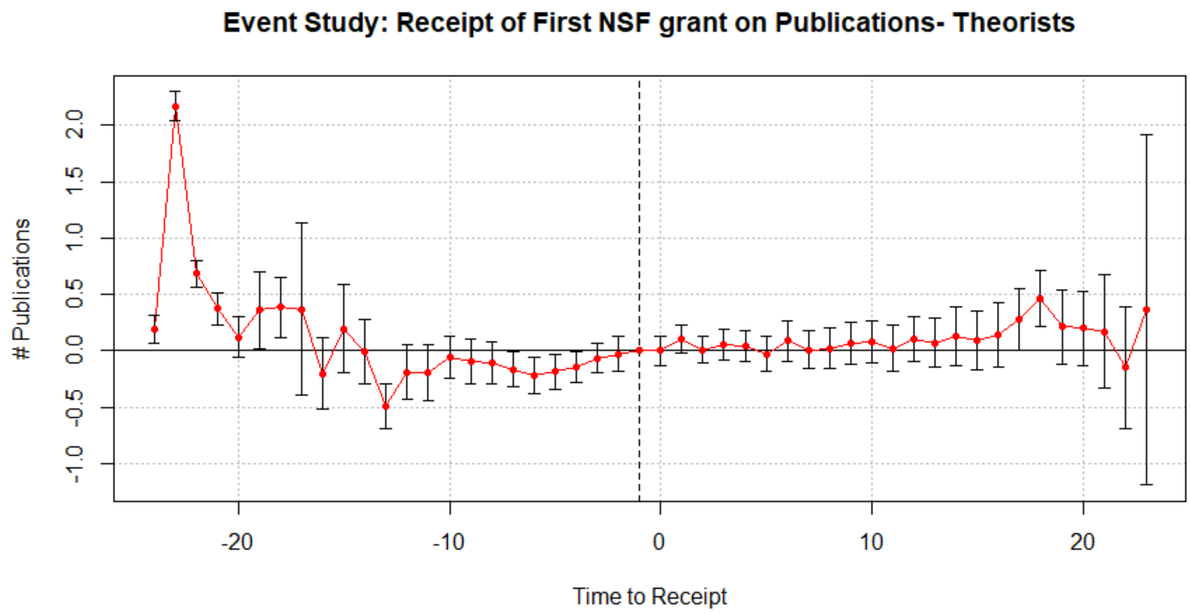

Figure 2.7: Effect of Receiving First NSF Grant on Publications: Theorists Only

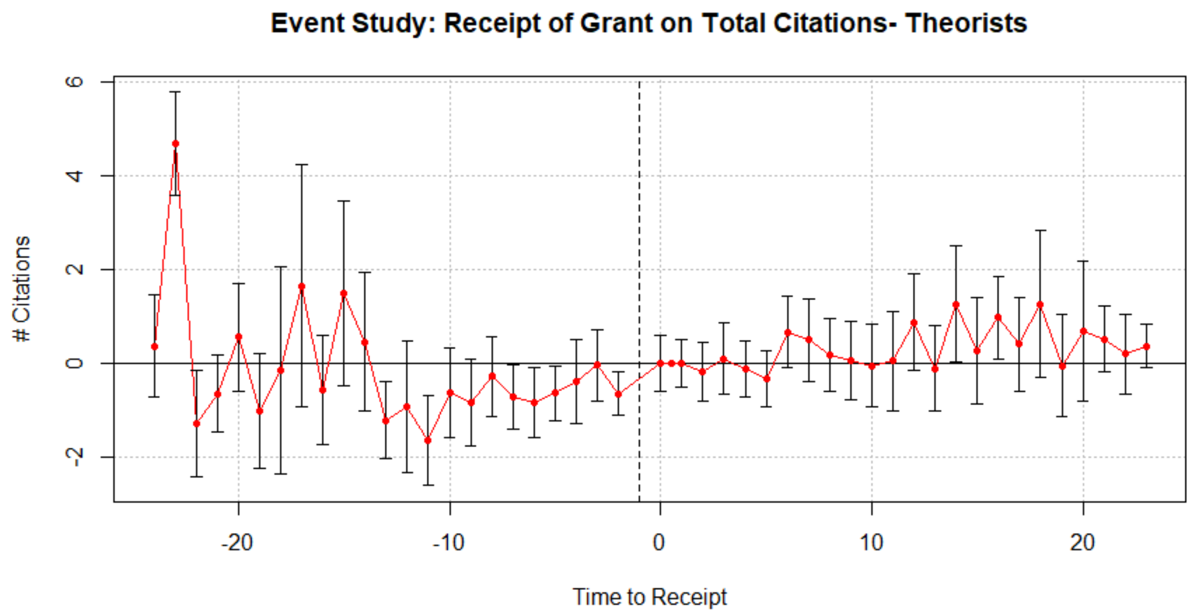

Figure 2.8: Effect of Receiving First NSF Grant on 5-Year Field Adjusted Citations: Theorists Only

Gender Heterogeneity

This part of the results contains the results for receipt of a first grant when researchers are divided into male and female. Figures 2.9 & 2.10 show the results of a first NSF grant on publications while Figures 2.11 & 2.12 show results for citations for male and female economists respectively. The event study results indicate that there may be a slight bonus to publishing and citations for males, but not for females. On average, it seems men net approximately 0.2 publications more for a few years while women do not publish more. Likewise, men who receive NSF grants receive at least 1 more citation a year, while women see no statistically significant effect.

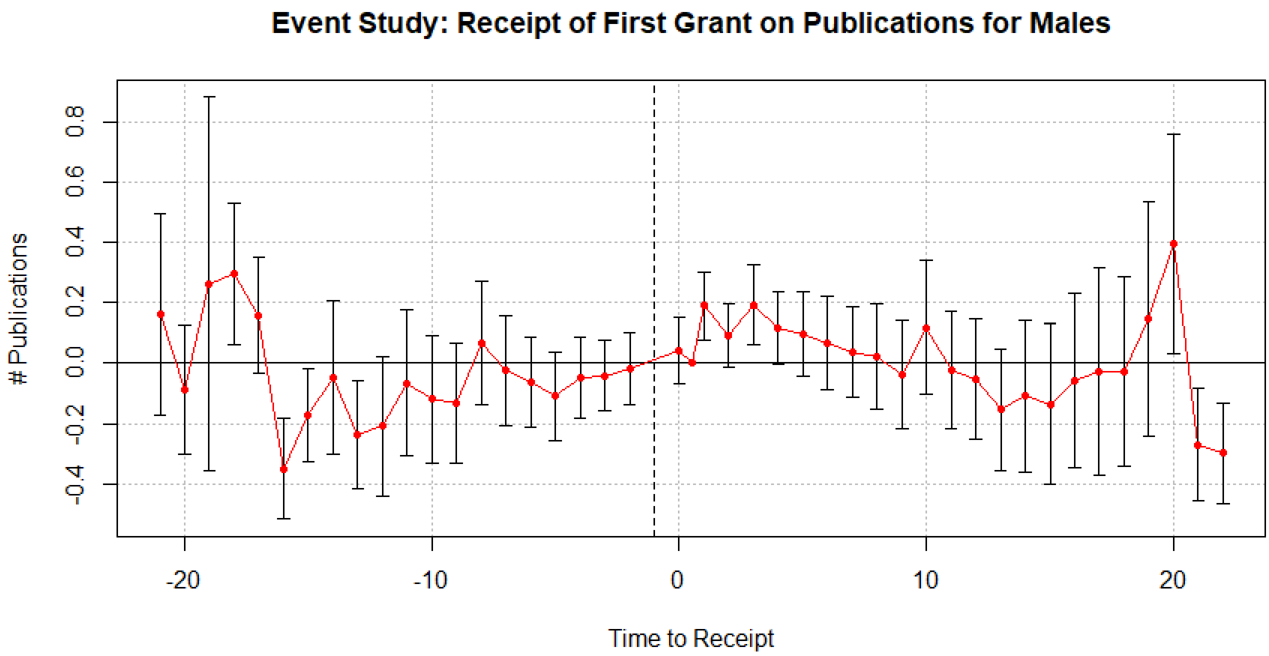

Figure 2.9: Receipt of First Grant if Male-Publications

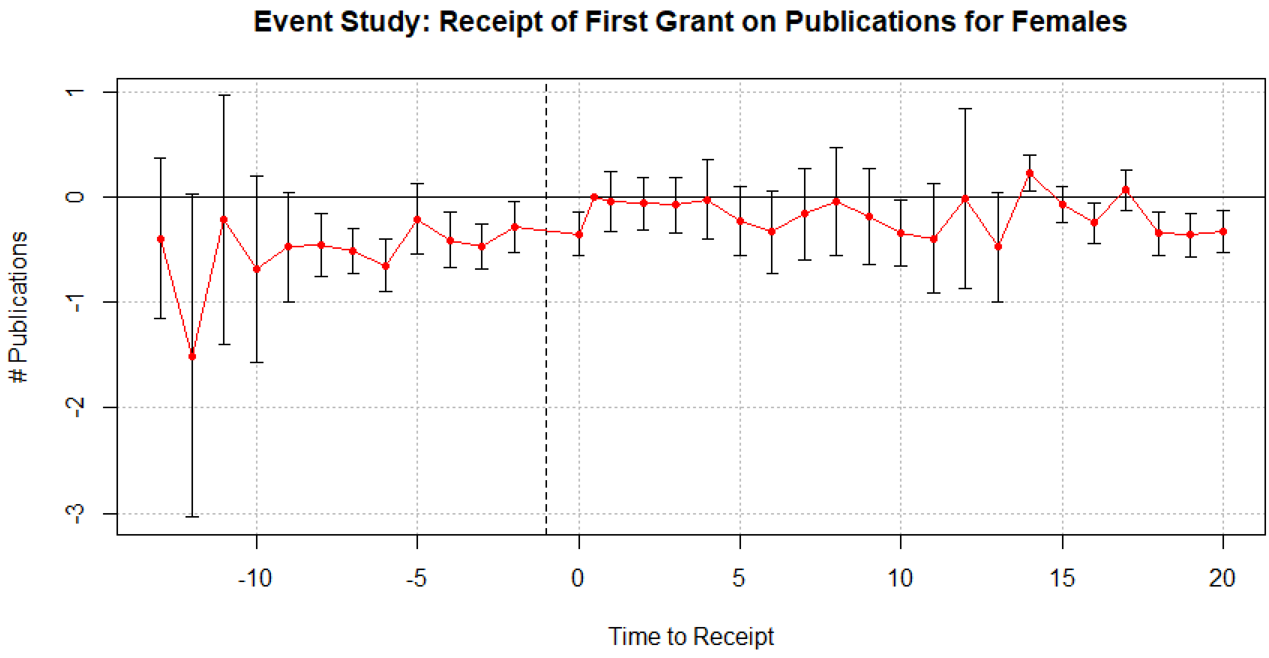

Figure 2.10: Receipt of First Grant if Female-Publications

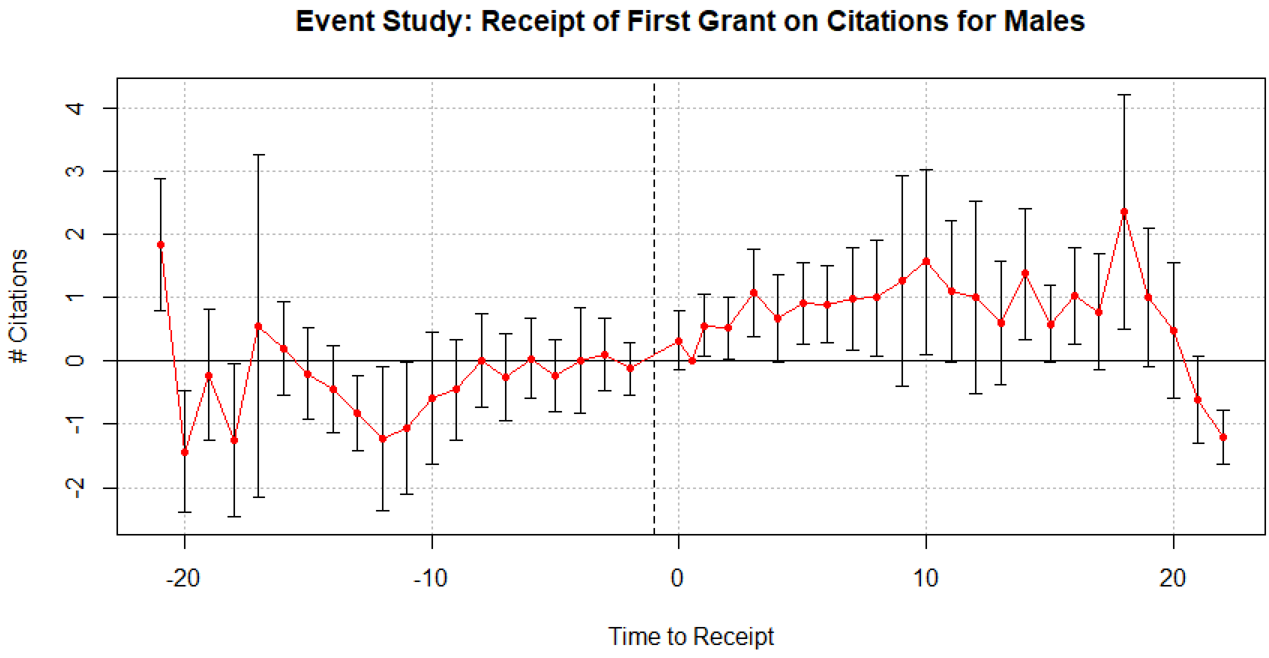

Figure 2.11: Receipt of First Grant if Male-Citations

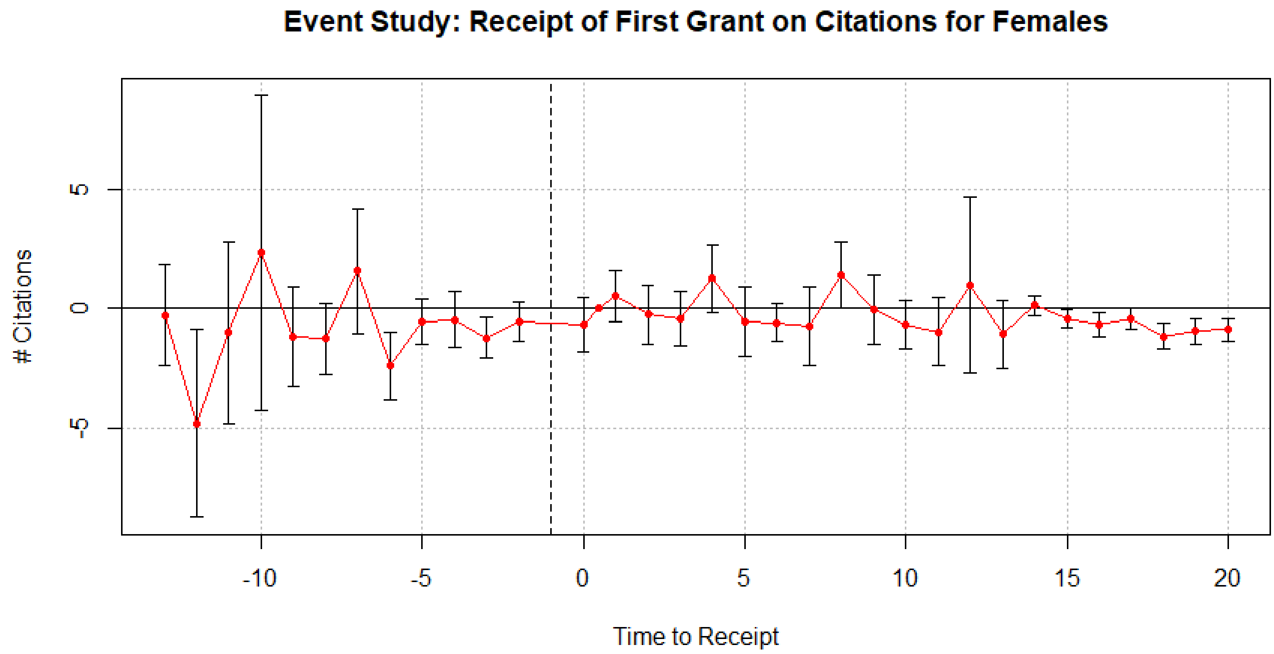

Figure 2.12: Receipt of First Grant if Female-Citations

2.4.2 2SLS results: First Grant

As mentioned before, the receipt of an NSF grant is not a random occurrence. There is significant selection bias involved in whether or not one receives one or not. This creates endogeneity concerns and may bias my estimates. To account for this I also adopt an instrumental variables (IV) approach. The instrument I use in this case is the number of grants to other social sciences the researcher's university has received from the NSF. The number of grants other social sciences has received should fulfill the criteria of a proper instrument as it would indicate that the government is interested in spending more on the social sciences at the researcher's current university in general. Grants to other social sciences should also not have an effect on the citations received by economists or the number of papers produced due to the insularity of economics as a discipline.[14]

[14]The insularity of economics as a discipline is well noted. See Pieters & Baumgartner (2002), Fourcade et al. (2015) or Angrist et al. (2020), although Angrist et al. (2020) note that economics is not uniquely insular compared to other social sciences. In any case, the insularity of all social

Table 2.4: 2SLS Estimates - First Grant

	Publications	Citations
First Grant-No Controls		
Has Received First Grant	0.295	6.407**
	(0.483)	(2.936)
	[-0.653, 1.242]	[0.645, 12.169]
N	11287	11287
Year Fixed Effects	X	X
Researcher Fixed Effects	X	X
University Fixed Effects	X	X
First-Stage F-Stat	38.22	38.22
First Grant-Controls		
Has Received First Grant	0.285	6.392**
	(0.481)	(2.928)
	[-0.660, 1.230]	[0.647, 12.138]
Tenured	-0.074***	0.107
	(0.025)	(0.160)
	[-0.123, -0.026]	[-0.207, 0.422]
Years Employed	0.000	-0.358
	(0.024)	(0.257)
	[-0.048, 0.048]	[-0.862, 0.147]
N	11287	11287
Year Fixed Effects	X	X
Researcher Fixed Effects	X	X
University Fixed Effects	X	X
First Stage F-Stat	38.28	38.28

Robust standard errors in Parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments are in the row First-Stage F-Stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.4 contains the total sample results for the effect of receiving a first NSF grant on economist productivity. The results indicate that there is little statistical significance of receiving a first NSF grant regarding the number of publications an economist makes. The effect on citations received however is significant at the 5% level, which provides strong evidence that receipt of a first NSF grant improves the quality or at least the perceived quality of a paper published by an economist by over six additional citations within five years of publication.

Table 2.5 contains the results for the effect of a first NSF grant on economists when split into theorists and empiricists. The split results still show that there is no statistically significant effect on the number of publications produced. However, it shows that the effect on citations is larger for empiricists than the pooled model and empiricists who have received a first grant receive on average receive 11 more citations five years after publishing. It should be noted that the estimated effect is less precisely estimated, so the larger coefficient may not be all that different from the pooled sample results.

Finally, Table 2.6 contains the results for the effect of a first NSF grant when the data is split between male and female researchers. The results indicate that there is no statistically significant effect for receipt of a grant for female economists, males may see a benefit to the quality of their publications from receiving their first NSF grant although the effect is less precisely estimated than it was for the total sample model, only showing significance at the 10% level.

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sciences towards each other should only make my exclusion assumptions stronger.

Table 2.5: 2SLS Estimates for Receipt of First NSF Grant for Empiricists and Theorists

	Pubs-Empiricists	Cites-Empiricists	Pubs-Theorists	Cites-Theorists
Speicalties-No Controls				
Has Received First Grant	0.874	11.542*	-0.634	-1.144
	(0.690)	(6.024)	(0.751)	(2.198)
	[-0.482, 2.230]	[-0.295, 23.380]	[-2.112, 0.843]	[-5.463, 3.176]
N	5033	5033	4734	4734
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	19.08	19.08	15.89	15.89
Specialties-Controls				
Has Received First Grant	0.889	11.606*	-0.653	-1.130
	(0.685)	(6.014)	(0.747)	(2.159)
	[-0.457, 2.236]	[-0.212, 23.424]	[-2.121, 0.815]	[-5.373, 3.113]
Tenured	-0.042	0.296	-0.083	-0.103
	(0.050)	(0.392)	(0.051)	(0.225)
	[-0.140, 0.057]	[-0.475, 1.066]	[-0.183, 0.016]	[-0.545, 0.339]
Years Employed	0.008	0.015	-0.003	-0.022
	(0.006)	(0.045)	(0.009)	(0.033)
	[-0.004, 0.020]	[-0.073, 0.104]	[-0.022, 0.015]	[-0.086, 0.043]
N	5033	5033	4734	4734
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	19.25	19.25	16.41	16.41

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-Stat.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.6: 2SLS Estimates of Effect of Receipt of First NSF Grant, by Sex

	Male-Pubs	Male-Cites	Female-Pubs	Female-Cites
Male-Female-No Controls				
Has Received First Grant	0.187	6.457*	0.967	6.186
	(0.565)	(3.547)	(1.292)	(4.681)
	[-0.923, 1.297]	[-0.506, 13.420]	[-1.580, 3.514]	[-3.041, 15.412]
N	9024	9024	2263	2263
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	28.32	28.32	5.65	5.65
Male-Female-Controls				
Has Received First Grant	0.197	6.436*	0.663	6.052
	(0.570)	(3.567)	(1.195)	(4.649)
	[-0.921, 1.315]	[-0.566, 13.437]	[-1.692, 3.018]	[-3.112, 15.215]
Tenured	-0.023	0.230	-0.173**	-0.010
	(0.030)	(0.218)	(0.077)	(0.313)
	[-0.081, 0.035]	[-0.199, 0.658]	[-0.325, -0.021]	[-0.628, 0.608]
Years Employed	0.005	0.022	0.015*	0.037
	(0.005)	(0.036)	(0.008)	(0.029)
	[-0.005, 0.015]	[-0.048, 0.092]	[-0.001, 0.031]	[-0.020, 0.093]
N	9024	9024	2263	2263
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	28.08	28.08	6.03	6.03

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments are in the row First-Stage F-Stat.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Further Tests: Subsequent Grants

In this section I examine the causal impact of a second grant on economist productivity. It has been argued in Baruffaldi et al. (2020) that first grants produce stronger effects to researcher productivity than do additional grants. The effect of subsequent grants on previous winners also provides stronger evidence for the first grant only being significant and helps me untangle the effect of NSF grants on basic research. In this section, I use a smaller version of my unbalanced panel where economists have already been awarded their first grant. Table 2.7 contains the results for winning a subsequent grant on for researchers who were awarded a first grant. Because the number of economists who have won a second grant in my dataset is quite small, I only present the total sample estimates. The results provide further evidence that gains are most likely a network effect as there is no statistical significance for either publications or citations.

Table 2.7: 2SLS Estimates For Subsequent Grant

	Publications	Citations
Subsequent Grant- No Controls		
Grant after First	-0.249	6.406
	(0.701)	(4.351)
	[-1.629, 1.131]	[-2.163, 14.975]
N	3335	3335
Year Fixed Effect	X	X
Researcher Fixed Effect	X	X
University Fixed Effect	X	X
First-Stage F-Stat	16.37	16.37
Subsequent Grant-Controls		
Grant after First	-0.228	6.400
	(0.707)	(4.427)
	[-1.620, 1.165]	[-2.319, 15.119]
Tenured	-0.011	0.203
	(0.058)	(0.340)
	[-0.125, 0.104]	[-0.467, 0.873]
Years Employed	0.007	0.025
	(0.008)	(0.046)
	[-0.008, 0.022]	[-0.066, 0.116]
N	3335	3335
Year Fixed Effect	X	X
Researcher Fixed Effect	X	X
University Fixed Effect	X	X
First-Stage F-Stat	16.00	16.00

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-stat.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.4.3 Further Tests: Had Grant Available Three Years Ago

In this section I examine the causal impact of simply having a grant on the entirety of my dataset, rather than just researchers whose first year was 1990 or later. This is to further show that the effect of an NSF grant is limited only to the first, and there is little gain in productivity from simply having a grant. I am estimating the model:

$$Y_{it} = \gamma H_{it-3} + \beta_t \mathbf{X}_{it} + A_i + U_{it} + T_t + e_{it}. \tag{2.3}$$

Where Y_{it} is the productivity measure of either citations or publications of economist i at time t, H_{it} is a binary variable for whether or not economist i had a grant available three years ago, the other controls are the same as those mentioned earlier. Table 2.8 contains the results for the entire dataset and indicate that there isn't any statistically significant effect of having a grant whether one looks at quantity of publications or quality. Table 2.9 contains results for empiricists and theorists, and Table 2.10 contains results for male and female economists. The results do not show any statistically significant effect of having a grant available three years prior.[15]

[15] Additional lags of up to six years are available in the Appendix. There is no statistically significant effect either.

Table 2.8: 2SLS Estimates for the Effect of Having a Grant

	Publications	Citations
Has Grant-No Controls		
Has Received Grant	-0.224	-1.096
	(0.300)	(1.669)
	[-0.812, 0.364]	[-4.369, 2.177]
N	22959	22959
Year Fixed Effect	X	X
Researcher Fixed Effect	X	X
University Fixed Effect	X	X
First-Stage F-Stat	81.39	81.39
Has Grant-Controls		
Has Received Grant	-0.209	-1.112
	(0.302)	(1.679)
	[-0.801, 0.383]	[-4.405, 2.182]
Tenured	-0.125***	0.140
	(0.028)	(0.140)
	[-0.180, -0.070]	[-0.133, 0.414]
Years Employed	0.001	-0.001
	(0.001)	(0.006)
	[-0.002, 0.004]	[-0.013, 0.011]
N	22959	22959
Year Fixed Effect	X	X
Researcher Fixed Effect	X	X
University Fixed Effect	X	X
First-Stage F-Stat	80.79	80.79

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments are in the row First-Stage F-Stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.9: 2SLS Estimates for the Effect of Having a Grant Theorists vs. Empiricists

	Papers-Empiricist	Citations-Empiricist	Paper-Theorists	Citations-Theorist
Has Grant- No Controls				
Had Grant 3 Years Ago	-0.880	0.699	0.438	-0.534
	(0.642)	(4.278)	(0.600)	(2.416)
	[-2.143, 0.383]	[-7.710, 9.108]	[-0.743, 1.618]	[-5.285, 4.217]
N	3687	3687	3463	3463
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	16.57	16.57	14.61	14.61
Has Grant-Controls				
Had Grant 3 Years Ago	-0.876	0.689	0.433	-0.598
	(0.646)	(4.339)	(0.614)	(2.488)
	[-2.146, 0.394]	[-7.841, 9.218]	[-0.774, 1.640]	[-5.489, 4.294]
Tenured	-0.057	0.133	-0.143***	-0.288
	(0.056)	(0.283)	(0.049)	(0.238)
	[-0.167, 0.053]	[-0.423, 0.689]	[-0.240, -0.046]	[-0.756, 0.181]
Years Employed	-0.002	0.004	-0.004	-0.028
	(0.007)	(0.037)	(0.008)	(0.034)
	[-0.016, 0.012]	[-0.069, 0.077]	[-0.019, 0.011]	[-0.094, 0.039]
N	3687	3687	3463	3463
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	16.32	16.32	14.11	14.11

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-Stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.10: 2SLS Estimates of the Effect of Having a Grant, by sex

	Male-Pubs	Male-Cites	Female-Pubs	Female-Cites
Has Grant-Male and Female-No Controls				
Had Grant 3 Years Ago	-0.220	-0.350	0.010	-9.518
	(0.312)	(1.772)	(1.272)	(8.548)
	[-0.832, 0.392]	[-3.826, 3.127]	[-2.494, 2.515]	[-26.349, 7.314]
N	20115	20115	2844	2844
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	76.43	76.43	4.32	4.32
Has Grant-Male and Female-Controls				
Had Grant 3 Years Ago	-0.174	-0.399	-0.153	-9.088
	(0.318)	(1.816)	(1.227)	(7.864)
	[-0.799, 0.451]	[-3.962, 3.163]	[-2.569, 2.263]	[-24.572, 6.397]
Tenured	-0.129***	0.139	-0.132**	0.357
	(0.032)	(0.168)	(0.064)	(0.464)
	[-0.192, -0.066]	[-0.191, 0.468]	[-0.258, -0.006]	[-0.557, 1.271]
Years Employed	0.001	0.000	0.000	-0.013
	(0.002)	(0.006)	(0.007)	(0.033)
	[-0.002, 0.004]	[-0.013, 0.012]	[-0.013, 0.014]	[-0.079, 0.053]
N	20115	20115	2844	2844
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	73.39	73.39	4.71	4.71

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-Stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.4.4 Effects of Grant Money

In this section I examine the impacts of the amount of money available from a grant on researcher productivity to further determine the true impact of an NSF grant on basic research. To determine the amount of grant money available I take the amount of money awarded for grants three years ago and instrument the results with the number of grants to other social sciences awarded to the economist's university.[16] The model I am estimating in this section is:

$$Y_{it} = \gamma M_{it-3} + \beta_t \mathbf{X}_{it} + A_i + U_{it} + T_t + e_{it}. \tag{2.4}$$

In which Y_{it} is the same productivity measure, and M_{it-3} is a variable for the amount of money available to economist i at time $t-3$ years ago. The other variables are again same as those mentioned previously.

The results of the grant money regressions shown in Table 2.11 still indicate that there is no statistically significant causal impact of money on economist productivity. In addition, Tables 2.12 & 2.13 show the regressions when my data is split into empiricists and theorists as well as when split into male and female. Both also show that there is no statistically significant causal effect of money on economist productivity, providing yet more evidence that the effect of an NSF grant is limited to the first.

[16] My data only contains the original grant amount given. This may introduce some measurement error as the researchers may have already spent some of their grant money in the years after receiving said grant, but I do not believe this will impact the results too much.

Table 2.11: 2SLS Estimates of the Effect of NSF Grant Money Awarded

	Publications	Citations
Grant Money-No Controls		
Grant $	-0.037	-0.183
	(0.052)	(0.291)
	[-0.139, 0.065]	[-0.753, 0.387]
N	22959	22959
Year Fixed Effect	X	X
Researcher Fixed Effect	X	X
University Fixed Effect	X	X
First-Stage F-Stat	82.91	82.91
Grant Money-controls		
Grant $	-0.035	-0.184
	(0.052)	(0.290)
	[-0.136, 0.067]	[-0.753, 0.386]
Tenured	-0.132***	0.103
	(0.023)	(0.107)
	[-0.176, -0.088]	[-0.108, 0.313]
Years Employed	0.000	-0.003
	(0.002)	(0.008)
	[-0.003, 0.004]	[-0.019, 0.012]
N	22959	22959
Year Fixed Effect	X	X
Researcher Fixed Effect	X	X
University Fixed Effect	X	X
First-Stage F-Stat	83.31	83.31

Grant Amounts are in $US millions and refer to three-year lags of grants. Robust standard errors in parentheses. Confidence intervals in square brackets. The results of the first stage F test are presented in the row First-Stage F-Stat.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.12: 2SLS Estimates of the Effect of NSF Grant Money Awarded Between Empiricists and Theorists

	Theorist-Pubs	Empiricist-Pubs	Theorist-Cites	Empiricist-Cites
Grant Money-No Controls				
Grant $	0.017	0.472*	0.087	0.133
	(0.112)	(0.263)	(0.471)	(0.875)
	[-0.204, 0.237]	[-0.045, 0.988]	[-0.837, 1.011]	[-1.586, 1.851]
N	10875	9335	10875	9335
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	17.17	10.93	17.17	10.93
Grant Money-Controls				
Grant $	0.014	0.465*	0.084	0.126
	(0.111)	(0.264)	(0.466)	(0.887)
	[-0.204, 0.232]	[-0.054, 0.984]	[-0.832, 1.000]	[-1.615, 1.867]
Tenured	-0.127***	-0.239***	-0.092	0.029
	(0.042)	(0.073)	(0.183)	(0.203)
	[-0.209, -0.045]	[-0.383, -0.096]	[-0.453, 0.268]	[-0.369, 0.428]
year_of_employment	0.004	0.002	0.008	-0.004
	(0.003)	(0.005)	(0.014)	(0.012)
	[-0.002, 0.010]	[-0.007, 0.012]	[-0.019, 0.035]	[-0.027, 0.020]
N	10875	9335	10875	9335
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	17.50	10.79	17.50	10.79

Grant Amounts are in $US millions and refer to three-year lags. Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test can be found in the row First-Stage F-stat.
* p < 0.1, ** p < 0.05, *** p < 0.01

Table 2.13: 2SLS Estimates of the Effect of NSF Grant Money, by sex

	Pubs-Male	Cites-Male	Pubs-Female	Cites-Female
Grant Money-No Controls				
Grant $	-0.034	-0.055	0.004	-3.599
	(0.051)	(0.280)	(0.481)	(4.763)
	[-0.134, 0.065]	[-0.605, 0.495]	[-0.943, 0.951]	[-12.977, 5.780]
N	20115	20115	2844	2844
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	81.67	81.67	2.86	2.86
Grant Money-Controls				
Grant $	-0.027	-0.062	-0.057	-3.412
	(0.051)	(0.284)	(0.462)	(4.293)
	[-0.126, 0.072]	[-0.618, 0.495]	[-0.968, 0.853]	[-11.865, 5.041]
Tenured	-0.135***	0.125	-0.131*	0.410
	(0.026)	(0.128)	(0.068)	(0.603)
	[-0.185, -0.084]	[-0.127, 0.377]	[-0.266, 0.003]	[-0.777, 1.597]
Years Employed	0.001	-0.001	0.000	-0.015
	(0.002)	(0.008)	(0.007)	(0.045)
	[-0.003, 0.004]	[-0.016, 0.014]	[-0.013, 0.014]	[-0.105, 0.074]
N	20115	20115	2844	2844
Year Fixed Effect	X	X	X	X
Researcher Fixed Effect	X	X	X	X
University Fixed Effect	X	X	X	X
First-Stage F-Stat	80.43	80.43	3.16	3.16

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-Stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.4.5 Robustness Tests - Publication Importance

Not all journals in economics are equal. Publications in the top five journals in economics are arguably of better quality and reflect greater effort than publications in lower ranked journals. Additionally, Baruffaldi et al. (2020) find that recipients of a Swiss mobility grant increase the average impact factor of the journals they publish in. To account for this possibility, I present results using the importance scores from Angrist et al. (2020) to weight the value of publications.[17] Table 2.14 shows the effects of a first grant, having a grant and grant money on the number of importance adjusted publications. The results indicate that there is little evidence of an effect of NSF grants on improving the quality of the journal an economist publishes in, indicating that grants do not in any way improve the quality of publication outlets for economists.

[17]These are the same weightings from the previous chapter that use the six journals mentioned.

Table 2.14: 2SLS Estimates of the Effect of NSF Grants for Publications Adjusted for Importance

	Importance-First	Importance-Money	Importance-Has Grant
Importance Adjusted-No Controls			
Has Received First Grant	-0.051		
	(0.044)		
	[-0.137, 0.034]		
Grant $		-0.006	
		(0.005)	
		[-0.016, 0.004]	
Has Grant			-0.037
			(0.028)
			[-0.092, 0.017]
N	11287	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	38.22	82.91	81.39
Importance adjusted-Controls			
Has Received First Grant	-0.052		
	(0.044)		
	[-0.138, 0.034]		
Tenured	-0.003	-0.006***	-0.005*
	(0.003)	(0.002)	(0.003)
	[-0.009, 0.002]	[-0.010, -0.002]	[-0.010, 0.001]
Years Employed	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)
	[-0.001, 0.001]	[0.000, 0.000]	[0.000, 0.000]
Grant $		-0.006	
		(0.005)	
		[-0.016, 0.004]	
Has Grant			-0.037
			(0.028)
			[-0.092, 0.018]
N	11287	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	38.28	83.31	80.79

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.4.6 Effects of Grants on Highly Influential Papers

Moffit (2016) contends that NSF funding has been critical to the publishing of highly influential papers in economics. In this section I present results for a first grant, having a grant and the amount of grant money available on the production of highly influential papers. Highly influential papers are constructed using the proportionate publications of papers that are in the top 90% of five year citations in my entire dataset.[18] Table 2.15 contains these results and shows that there is no statistically significant impact of NSF funding on the production of highly influential papers. Table 2.16 relaxes the definition of highly influential papers and instead has results for the number of highly influential papers published where the cutoff point is the 75th percentile of citations and is also statistically insignificant. These results overall provide little evidence for the assertions made in Moffit (2016) that NSF grants contribute to production of highly influential papers.

[18]This percentile is taken from the entire dataset of 150,000 papers, not just the one matched on researchers.

Table 2.15: 2SLS Estimates of the Effects of NSF Grants on Highly Influential Papers

	First Grant	Has Grant	Grant Money
Highly Influential-No Controls			
Has Received first Grant	0.270		
	(0.195)		
	[-0.113, 0.653]		
Had grant 3 Years Ago		-0.242*	
		(0.128)	
		[-0.494, 0.010]	
Grant $			-0.040
			(0.027)
			[-0.093, 0.012]
N	11287	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	38.22	81.39	82.91
Highly Influential-Controls			
Has Received First Grant	0.271		
	(0.195)		
	[-0.113, 0.654]		
Tenured	0.008	0.012	0.004
	(0.012)	(0.011)	(0.010)
	[-0.015, 0.032]	[-0.010, 0.034]	[-0.015, 0.023]
Years Employed	0.000	0.000	-0.001
	(0.002)	(0.001)	(0.001)
	[-0.003, 0.004]	[-0.001, 0.001]	[-0.002, 0.001]
Had grant 3 Years Ago		-0.243*	
		(0.129)	
		[-0.497, 0.010]	
Grant $			-0.040
			(0.027)
			[-0.093, 0.012]
N	11287	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	38.28	80.79	83.31

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-stat.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.16: 2SLS Estimates of the Effect of NSF Grants on Highly Influential Papers-75th Percentile

	First Grant	Has Grant	Grant Money
Highly Influential-No Controls			
Has Received First Grant	0.240		
	(0.260)		
	[-0.270, 0.750]		
Had grant 3 Years Ago		-0.347*	
		(0.179)	
		[-0.699, 0.004]	
Grant $			-0.058
			(0.038)
			[-0.132, 0.016]
N	11287	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	38.22	81.39	82.91
Highly Influential-Controls			
Has Received First Grant	0.240		
	(0.260)		
	[-0.270, 0.751]		
Tenured	-0.002	-0.012	-0.024*
	(0.016)	(0.016)	(0.014)
	[-0.032, 0.029]	[-0.044, 0.020]	[-0.051, 0.003]
Years Employed	0.003	0.001	0.000
	(0.002)	(0.001)	(0.001)
	[-0.001, 0.007]	[-0.001, 0.002]	[-0.002, 0.002]
Had grant 3 Years Ago		-0.347*	
		(0.180)	
		[-0.700, 0.007]	
Grant $			-0.057
			(0.038)
			[-0.131, 0.016]
N	11287	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	38.28	80.79	83.31

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-stat.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.4.7 Effects of Grants on Co-Authorship and Non-Proportional Publication

There is evidence that receiving a grant causes researchers to expand their co-author networks (Baruffaldi et al. 2020). It may also be the case that those with grants may not publish more proportionately, but may take on additional projects.[19] To account for this I present results in Table 2.17 here that show the change in the size of the number of unique co-authors an author has ever published with as well as results that look at each paper as if it simply counts as one publication for the author in question. The findings indicate that receiving a first grant increases the size of an author's co-author network quite substantially averaging approximately 13 new co-authors. However, there is little evidence that they take on additional projects as the results are statistically insignificant. Additional results for subsequent grants, having a grant, and grant money are presented in Table 2.18, Table 2.19 and Table 2.20 respectively. These results provide strong evidence that there is little if any benefit to coauthor networks from receiving subsequent grants nor is there any benefit to simply having a grant or the amount of money awarded. These seem to indicate that the expansion of coauthor networks is a single event due to receipt of a prestigious award such as an NSF grant. Table 2.21 shows theory vs empiricists and also shows evidence that only empiricists benefit, although the result is less precisely measured than the full sample.

[19] They may publish two four person papers rather than one two author paper for instance.

Table 2.17: 2SLS Estimates of the Effect of a First Grant on Co-Authors and Projects

	Co-Authors	# Projects	# Projects-Importance Adjusted
Co-Authors & Projects-No Controls			
First Grant	12.077***	1.347	0.006
	(4.243)	(0.837)	(0.074)
	[3.752, 20.403]	[-0.295, 2.988]	[-0.140, 0.152]
N	11287	11287	11287
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	38.22	38.22	38.22
Co-authors & Projects-Controls			
First Grant	12.208***	1.345	0.006
	(4.254)	(0.838)	(0.075)
	[3.861, 20.555]	[-0.299, 2.990]	[-0.140, 0.152]
Tenured	0.975***	-0.019	0.001
	(0.330)	(0.052)	(0.005)
	[0.328, 1.622]	[-0.120, 0.083]	[-0.008, 0.010]
Years Employed	0.080	0.011	0.000
	(0.069)	(0.008)	(0.001)
	[-0.056, 0.215]	[-0.005, 0.026]	[-0.001, 0.002]
N	11287	11287	11287
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	38.28	38.28	38.28

Robust standard errors in parentheses. Confidence intervals are in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.18: 2SLS Estimates of the Effect of Subsequent Grants on Co-Authors and Projects

	Co-Authors	# Projects	# Projects Importance Adjusted
Subsequent Grant-No Controls			
Grant after First	1.568	-0.026	-0.102
	(4.663)	(1.190)	(0.118)
	[-7.615, 10.751]	[-2.370, 2.319]	[-0.334, 0.131]
N	3335	3335	3335
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	16.37	16.37	16.37
Subsequent Grant-Controls			
Grant after First	1.565	0.009	-0.101
	(4.704)	(1.203)	(0.120)
	[-7.699, 10.829]	[-2.360, 2.377]	[-0.339, 0.136]
Tenured	1.282**	-0.011	0.021
	(0.569)	(0.107)	(0.013)
	[0.163, 2.402]	[-0.223, 0.200]	[-0.005, 0.046]
Years Employed	0.172	0.012	0.003
	(0.132)	(0.015)	(0.002)
	[-0.089, 0.433]	[-0.018, 0.042]	[-0.001, 0.006]
N	3335	3335	3335
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	16.00	16.00	16.00

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-stat

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.19: 2SLS Estimates of the Effect of Having a Grant on Co-authors and Projects

	Co-Authors	Non-Prop Publications	Non-Prop Importance
Has Grant-No Controls			
Has Grant	5.795	-0.010	-0.035
	(3.882)	(0.508)	(0.051)
	[-1.819, 13.409]	[-1.006, 0.985]	[-0.135, 0.066]
N	22959	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	81.39	81.39	81.39
Has Grant-Controls			
Has Grant	5.779	0.002	-0.034
	(3.889)	(0.511)	(0.052)
	[-1.849, 13.408]	[-1.001, 1.004]	[-0.136, 0.067]
Tenured	1.054***	-0.102**	-0.001
	(0.317)	(0.044)	(0.005)
	[0.432, 1.677]	[-0.189, -0.015]	[-0.010, 0.008]
Years Employed	-0.078***	0.001	0.000
	(0.024)	(0.002)	(0.000)
	[-0.126, -0.031]	[-0.004, 0.005]	[0.000, 0.000]
N	22959	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	80.79	80.79	80.79

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-stat.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.20: 2SLS Estimates of the Effect of NSF Grant Money Awarded on Co-Author Networks and Projects Undertaken

	# Co-Authors	# Projects	# Projects-Importance Adjusted
Money-No Controls			
Grant $	0.965	-0.002	-0.006
	(0.728)	(0.085)	(0.009)
	[-0.462, 2.393]	[-0.168, 0.164]	[-0.023, 0.012]
N	22959	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	82.91	82.91	82.91
Money-Controls			
Grant $	0.956	0.000	-0.006
	(0.725)	(0.085)	(0.009)
	[-0.466, 2.378]	[-0.166, 0.166]	[-0.023, 0.012]
Tenured	1.250***	-0.102***	-0.002
	(0.253)	(0.035)	(0.004)
	[0.755, 1.746]	[-0.170, -0.033]	[-0.009, 0.005]
Years Employed	-0.068**	0.001	0.000
	(0.027)	(0.003)	(0.000)
	[-0.122, -0.014]	[-0.004, 0.006]	[-0.001, 0.000]
N	22959	22959	22959
Year Fixed Effect	X	X	X
Researcher Fixed Effect	X	X	X
University Fixed Effect	X	X	X
First-Stage F-Stat	83.31	83.31	83.31

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 2.21: 2SLS Estimates of the Effect of First Grant on Projects and Co-Authors Between Empiricists and Theorists

	# Co-Auth-Emp	# Projects-Emp	#Projects-Importance-Emp	# Co-auth-Theory	# Projects-Theory	# Projects-Importance-Theory
Specialties-No Controls						
First Grant	15.566**	2.262*	0.100	6.663	-0.874	0.100
	(7.461)	(1.308)	(0.126)	(4.262)	(1.190)	(0.126)
	[0.905, 30.227]	[-0.309, 4.833]	[-0.148, 0.348]	[-1.714, 15.040]	[-3.212, 1.465]	[-0.148, 0.348]
N	5033	5033	5033	4734	4734	5033
Year Fixed Effect	X	X	X	X	X	X
Researcher Fixed Effect	X	X	X	X	X	X
University Fixed Effect	X	X	X	X	X	X
First-Stage F-Stat	19.08	19.08	19.08	15.89	15.89	19.08
Specialties-Controls						
First Grant	15.953**	2.299*	0.104	6.848	-0.885	0.104
	(7.459)	(1.305)	(0.126)	(4.222)	(1.178)	(0.126)
	[1.294, 30.611]	[-0.266, 4.863]	[-0.144, 0.353]	[-1.451, 15.147]	[-3.201, 1.431]	[-0.144, 0.353]
Tenured	1.238**	0.029	0.007	0.564	-0.120	0.007
	(0.587)	(0.094)	(0.009)	(0.444)	(0.091)	(0.009)
	[0.084, 2.393]	[-0.155, 0.214]	[-0.011, 0.025]	[-0.309, 1.437]	[-0.300, 0.059]	[-0.011, 0.025]
Years Employed	0.114	0.014	0.002	-0.006	-0.012	0.002
	(0.121)	(0.011)	(0.001)	(0.089)	(0.016)	(0.001)
	[-0.124, 0.352]	[-0.008, 0.036]	[-0.001, 0.004]	[-0.182, 0.169]	[-0.045, 0.020]	[-0.001, 0.004]
N	5033	5033	5033	4734	4734	5033
Year Fixed Effect	X	X	X	X	X	X
Researcher Fixed Effect	X	X	X	X	X	X
University Fixed Effect	X	X	X	X	X	X
First-Stage F-Stat	19.25	19.25	19.25	16.41	16.41	19.25

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-stat.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.5 Discussion & Conclusions

The effect of NSF grants on basic research productivity in economics seems to be statistically insignificant for the productivity of economists, and instead works more as a signalling mechanism. Similarly, there is no evidence that those who receive NSF grants publish in better journals in any way which is contrary to more recent findings such as Baruffaldi et al. (2020), nor do they produce more influential papers which contradicts the main thrust of Moffit (2016), although they do support the findings of Ghirelli et al. (2023) who find little statistical significance for the effects of European Research Council Grants.

This is likely because Baruffaldi et al. (2020) examine the effects of a Swiss mobility grant for postdocs to travel abroad rather than an NSF grant. The NSF presents grants to fund basic research in a given field. This highlights how different funding regimens can impact the career trajectory of researchers. Because only receipt of a first NSF grant has an effect on the number of citations received, and the effect of grant money or having a grant are statistically insignificant, this seems like strong evidence that the impact of an NSF grant is due more to a network effect than it is to any increase in quality. An alternative explanation could also be that NSF grants may increase the perceived quality of papers produced by economists. An additional reason for the effect of grants being small may be because NSF grants are often used as a supplement to incomes in the United States as tenure track contracts only cover salary for nine months out of the year.

Economists who receive NSF grants also expand their co-author networks much more rapidly than do those who do not receive grants. This is consistent with earlier findings such as Ayoubi, Pezzoni & Visentin (2019) and Baruffaldi et al. (2020) who also find that grant recipients expand their co-author networks. Because I use only the cumulative number of co-authors in a researcher's life time, I am unable to tell if the network of co-authors an economist currently publishes with is in fact larger, or if they simply make more acquaintances as they move through their careers.

A limitation of this study in particular is the use of citations to measure the quality of a publication. Citations are at best an imperfect indicator, and there are plenty of arguments for or against their use as a metric. Similarly, citations do not truly reflect the quality of a work, but could be better thought of as the "market value" of the work (Hamermesh 2018). Despite these arguments, citations are probably the best metric available to gauge quality or academic influence. There are also further limitations here to the external validity of my study. Because this analysis focuses solely on economics, it may be that other disciplines derive greater benefits from NSF grants than do economists. As Cochrane (2012) mentions, the only thing many economists need is a computer and a quiet office so these results may not generalise entirely to the wider academic community. Although the findings of Jacob & Lefgren (2011) seem to indicate that NIH grants only produce modest results for life science researchers as well.

There are some interesting directions future research can take. In regards to co-authorship, future research could look at if the "active" size of co-author networks is actually larger for grant recipients than it is for others. In a similar vein, future research could also look at whether grant recipients work on a wider variety of problems than do those who do not receive grants (do they branch out into different fields of economics, do they adopt new methods etc.). Other directions for this would be to expand the sample size to either include other social scientists or those in the natural sciences. This would make the research and findings more robust.

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Chapter 3

Changing Trends and Academic Labour Market Outcomes in Economics: How Changing Tastes May Impact the Careers of Young Researchers

3.1 Introduction

Does science advance one funeral at a time? Is the old guard actually hostile to new ideas? Early studies on paradigm shifts (Hull, Tessner & Diamond 1978, Gorham 1991, Levin, Stephan & Walker 1995) have found that older scientists are actually quite open to new ideas, or at the very least least not hostile. Azoulay, Fons-Rosen & Zivin (2019) on the other hand use more robust methods and provide evidence for the opposite, finding that the deaths of prominent scientists increase citations and thus attention to scientists outside of their network. These scientists according to the authors are more often than not also less active in the superstar's field of interest prior to the death of the superstar. According to the authors, established researchers and collaborators may even be hostile to new ideas and may erect intellectual, social and resource barriers of entry to new ideas.[1] If Azoulay et al. (2019) are correct, then researchers in positions of authority such as tenured faculty may block the spread of new ideas such as when deciding which projects to fund and discourage less established researchers from bringing forth their own ideas. However, it may be possible that established faculty are less hostile and even open to new ideas in other senses such as the hiring and promotion of junior researchers.

In the American academic system, tenure status is considered to be one of the ultimate rewards in one's academic career. Those who receive tenure can look forward to indefinite employment and increased freedom to pursue their research agendas. The tenure system also serves as a guarantee of academic freedom and in theory protects academics from arbitrary dismissal. Of course with such desirable employment status, obtaining tenure can be quite difficult, especially within top departments. According to Macleod & Urquiola (2021), the tenure system is actually integral to academic success of universities in the United States as the system allows researchers of similar ability to cluster within departments. Proponents of the tenure system claim that it encourages researchers to enhance performance due to the "up or out" rewards system and encourages faculty to invest in their universities and contribute to improving their institution. A final benefit of the tenure system is that it allows incumbents to make fair assessments of junior faculty since

[1] This may even be true after death of a superstar if the superstar's collaborators are still in positions of power.

their permanent employment status means they don't have to worry about being displaced by younger upstarts who may threaten to overturn the status quo or findings of established researchers (Carmichael 1983, 1988).

Economics has undergone a major methodological change from being largely a theoretical discipline to now being largely empirical (Kim, Morse & Zingales 2006, Angrist & Pischke 2010, Hamermesh 2013, 2018). This change; known as "the credibility revolution" has resulted in not only the majority of publications in top journals in economics being empirical, but has also resulted in an increasing number of citations (an indicator of academic interest) going to empirical papers (Angrist, Azoulay, Ellison, Hill & Lu 2020). It may be possible that much like the top five (T5) becoming popular in the early 2000s (Serrano 2018), the increasing prominence of empirical work will also influence the evaluation of junior faculty and impact their career trajectories.[2] In this way, the credibility revolution and its immediate aftermath can be used as a case study to examine whether changing trends within a discipline can influence the career trajectories of junior academics as well as a way to investigate if incumbents are hostile to new methods.

Chapter One showed that increased spending hampers production of revolutionary papers. In this chapter I present results showing that changing trends in economics may affect the tenure probabilities of tenure track faculty in the top 50 American universities mentioned in Conroy, Dusansky, Drukker & Kildegaard (1995). In particular I look at whether being an empiricist affects the probability of an assistant professor receiving tenure. I find that when controlling for a variety of productivity factors as well as gender, being an empirical economist increases

[2]Top five refers to *American Economic Review, Journal of Political Economy, Econometrica, Quarterly Journal of Economics* & *Review of Economic Studies.*

the probability of tenure by approximately 9%. These results suggest that the tenure system in academia may be much faster to conform to changes in research trends than funding decisions at the department level. This effect is strongest in the middle tier universities where the marginal effect is nearly 20%. To separate the relation between pre and post-change in trends I also examine tenure probabilities before and after 2010. I find that the marginal effect of being an empiricist is only statistically significant post change. When examining based on rankings, being an empiricist is still associated with higher probabilities of tenure in middle tier universities both pre and post-change, however, the relationship between being an empiricist and tenure probability is more than two times larger post-change.

This suggests that middle ranked universities are the ones most sensitive to changes in trends. My findings provide some evidence then that there may be less bias in tenure and hiring decisions than there is in funding decisions. In particular, staff making tenure decision are aware of what is new and in vogue, and as such may base their decisions on what they believe will keep their institutions competitive. This is reinforced by my findings that there is little statistical significance for the probability of an empiricist receiving tenure as the number of empiricists increases, contradicting the model of Akerlof & Michaillat (2017). When looking at the time to tenure, I also find that microeconometricians receive tenure approximately 25% faster than other types of economists.

The main contributions of this chapter are to the study of academic labour markets and how changing trends may influence how an academic's work is evaluated. In particular, it provides some evidence that tenure decisions do tend to keep up with trends in the research community. Furthermore, it provides evidence that tenured faculty are not biased towards their own style of work and may make decisions with the university's best interests at heart. Further contributions are to the heterogeneity in productivity evaluations based on the reputations of the institution offering tenure, and heterogeneity in receipt of tenure based on gender.

The rest of this chapter will proceed as follows: the next section will take a deeper look at the literature on the theory and evidence on tenure decisions, Section 3 will describe my data and methodology, in Section 4, I present the main findings of whether being an empiricist improves the chances of receiving tenure alongside robustness tests. In Section 5 I present results for how being an empiricist affects time to tenure. Section 6 contains conclusions and further discussion of the results.

3.2 Determinants of Tenure - Theory & Evidence

With the rewards offered by the tenure system, economists have become increasingly interested in what determines tenure decisions. There is evidence that citation counts are associated with one's tenure status (Ellison 2013, Perry & Reny 2016). Hamermesh (2018) somewhat disputes the importance of citations, finding instead that while citations are associated with salary, the relation with the salary of an economist is at best quite small.[3] Instead, Hamermesh finds that salaries are much more affected by publications in top journals. Top journals also play a massive role in labour market outcomes for economists. Where it has been found that publication in the T5 is essential for either career advancement or receipt of tenure where those with more prestigious publications work at better schools, are more likely to receive tenure and receive tenure faster which has led to a distortion

[3] Salary could easily be seen as a measure for how valued faculty are, particularly in the American system of universities.

of academic evaluation and research agendas (Serrano 2018, Heckman & Moktan 2020).

Kuhn (1970) develops a theory of scientific revolutions which arise from what he refers to as a paradigm shift. In this model, revolutionary science steadily overtakes older science and eventually replaces it when the current paradigm can no longer stand up to scrutiny from the new paradigm. Bramoulle & Paul (2010) further refine this and develop a model of scientific progress. In this model, science moves through phases of revolutionary and normal science. Researchers either work within the established paradigm or outside of it and engage in revolutionary science. According to the model, scientists are motivated by a desire for recognition from their peers and this leads to the possibility of innovation fads to emerge. Besancenot & Vranceanu (2015) develop a model for why research occurs in structural breaks. According to the authors, because the rewards of adopting new ideas are uncertain, scientific progress proceeds in a disjointed manner of structural breaks followed by long periods in which new ideas are unsuccessful. Other, more recent empirical work has found that in top journals, the number of mentions of empirical methods and demand for greater transparency and credibility has risen rapidly since the 90s (Currie, Kleven & Zwiers 2020). Additionally, a recent survey has found that most economists are upset with status quo in economics, and think that their work should be more policy relevant (Andre & Falk 2021).

Changing fads in science has important consequences for researcher's careers. Akerlof & Michaillat (2017) develop a model in which scientists belong to either paradigm supporters or paradigm opposed with the aim of discussing the receipt of tenure based on whether one does research that has support from faculty. The model goes on to claim that research that is opposed to the current agenda of incumbent faculty will experience difficulty securing a position with tenure. According to the authors, this has the possibility of encouraging the persistence of false paradigms. The empirical evidence seems to offer some support for this such as findings that publication bias is perpetual in the peer review system (Mahoney 1991, Travis & Collins 1991). Lamont (2009) conducts a survey of tenured university staff and similarly presents a good deal of evidence that tenured professors do in fact show favoritism towards their own ideas, and suggests this is present at every level of academia. This chapter contributes to this conversation by providing evidence of little methodological favouritism amongst researchers when it comes to tenure decisions.

3.3 Data & Methodology

3.3.1 Data

Economists

My data on economists comes from the dataset available from Brogaard, Engelberg & Wesp (2018). This is the same dataset used in the previous chapters. This data is used to determine whether or not the researcher obtained tenure at their university within seven years.

Economist Publications

Data on researcher publications comes from Econlit. The journals used here are the top 70 of those listed in Angrist et al. (2020) as well as those listed in Heckman & Moktan (2020). Journals are divided into T5s, Second tier General Interest (*Review of Economics & Statistics, Economic Journal, European Economic Review,* *Journal of Economic literature, Journal of Economic Perspectives*), Field A, and Field B. Field A and Field B papers are taken from Heckman & Moktan (2020). Papers are counted as one paper for each author regardless of number of coauthors for my first results, and later results where papers are divided by number of co-authors are also presented in the Appendix.

Economist Citations

Citations data is also utilized to account for the impact the economist has had by the time of tenure. Data on citations are taken from Web of Science. Because all fields in economics receive different numbers of citations, I normalize my data by primary field as suggested in Perry & Reny (2016).[4] Econlit data and citation data are then matched to author's using author names and years active.

The data from Brogaard et al. (2018), Econlit and WoS is then used to assemble a cross-section for every untenured faculty member employed at one of these 50 departments. Controls include the number of T5s, top fields, secondary general interest, and B field publications the economist has at the time of the tenure decision, citations at the time of their tenure decision, whether they are male or female alongside year and department fixed effects. The primary variable of concern is a binary indicator for whether or not the economist is an empiricist.[5]

NSF Grants

National Science Foundation (NSF) grants may also impact the tenure decisions of economists. To account for this, I also include the number they had before their

[4]Primary economic field comes from the fields suggested in Card & Dellavigna (2013). This is the same method from the previous chapters.

[5]Gender was inferred using a list of boy and girl names dating back to the early 20th century in America and then hand-labelled for those still not labelled. There were no people in my dataset found to have a name that could be unisex.

tenure decision in this analysis. The grants data comes from the same source as mentioned previously in Chapter Two.

Determining Tenure Decisions

The dependent variable in my dataset is whether or not an economist received tenure in their first spell of employment. Since untenured researchers can move around a lot I use the methods outlined in Heckman & Moktan (2020) to determine if the researcher was granted tenure at their university. **1. Researcher is at same school when given tenure:** This is the easiest to determine the tenure status of the researcher. If they were at the same school and received tenure, it is obvious they were granted tenure. **2. Researcher receives tenure at school no more than five spots below previous school in year 6/7:** If a researcher receives tenure at a school no more than five spots below the school they previously were employed at in year 6/7 I assume that their previous school also offered them tenure.[6] **3. Researcher is given tenure at a school ranked above previous school in year 6/7:** If a researcher takes a tenured position at a school ranked above their previous school in year 6/7 of their employment I also make the assumption that they were offered tenure at the previous school.[7] **4. Leaves academia:** If a researcher leaves their academic institution for either a government, non government organization, or private company in year 6/7 of academic employment I assume that they were denied tenure at the school they previously worked at. The tenure variable is coded as 1 if the result is either 1-3 and 0 otherwise. If a researcher left before that, I do not include them in my dataset.

[6] For instance if a researcher at school ranked one ends up at school ranked five I assume that the school ranked one also offered them tenure.

[7] For instance if a researcher was at school ranked seven and ends up tenured at school ranked six I assume they were offered tenure at the rank seven school as well.

Identifying Empiricists

The main variable of interest in this chapter is whether an economist does empirical work or not and how this impacts his or her probability of receiving tenure. To identify empiricists I need to determine which "style" of research they favour. To do this I train a transformer model trained on a small hand labelled sample to determine the primary methodology used in each paper.[8] The hand labelled sample numbers 5,321 papers and is divided into theory, microeconometrics, other empirics and econometric theory. The transformer model had an accuracy of over 83%.[9] This model is then used to predict the style of each paper in my publications dataset. Next I matched papers to authors by name.[10] I then assigned author specialties based on what the majority of papers they produced were. If an author was either a microeconometrician or worked with other empirical work, I assigned them as empiricists otherwise they were either a theorist or econometrician. For robustness checks, I also divide empiricists into specifically microeconometricians and other types of empiricists.[11]

3.3.2 Methodology

The goal of my analysis is to determine whether conducting research that is considered fashionable has a positive effect on the probability of receiving tenure for an early career economist. To control for confounding I include a number of other

[8] For more on transformer models see Vaswani, Shazeer, Palmer, Uszkoreit, Jones, Gomez, Kaiser & Polosukhin (2017).

[9] This is significantly better compared to the top methodology used in Angrist et al. (2020) which only posted an accuracy of approximately 60% on my sample. The particular transformer model in question used was SciBERT (Beltagy, Lo & Cohan 2019) a modified form of Google's BERT transformer model (Devlin, Chang, Lee & Toutanova 2019) trained on academic text from Semantic Scholar. It is freely available to use from the Transformers library for Python. This is the same deep learning model from previous chapters.

[10] Names were hand cleaned and checked against the people in the Brogaard et al. (2018) dataset to confirm they were accurate.

[11] Other empiricists in this case refers to those who use methods such as structural vector autoregression, structural estimation methods or methods similar to such.

covariates. I estimate the following model:

$$ln(\frac{Pr(Tn_i = 1)}{1 - Pr(Tn_i = 1)}) = \gamma E_i + \mathbf{X}\beta \quad (3.1)$$

Where Tn is an indicator for receiving tenure for the first spell of academic employment. **X** refers to a vector of controls which are the number of Top 5 publications, the number of secondary general interest publications, the number of top field generals, the number of B field journals, the gender of the economist, a university fixed-effect for the university making the decision at the time of tenure review, a time fixed-effect for the year that the decision is made, the number of NSF grants the economist had won before the tenure decision, and the number of field corrected citations. My main variable of interest is E_i which is a dummy variable indicating whether the economist in question is an empiricist or not. Unlike the previous chapters, I do not include an instrumental variables strategy for whether or not one is an empiricist. This is because what determines whether one does empirical or theoretical work is largely up to one's own research interests which are innate. It could be argued that certain advisors or mentors are able to influence a potential student, but students also choose advisors whose research interests match their own. Therefore, whether or not an economist is an empiricist can be treated as exogenous, and the use of an instrumental variables approach is unnecessary.

3.3.3 Trends & Descriptive Statistics

Figure 3.1 shows the moving average of economists given tenure over the years. There is a clear trend in my dataset that over time the percentage of economists receiving tenure has been trending downwards. This likely reflects increased competition for tenure-track positions at universities, especially elite ones such as those in my dataset. When looking at theorists, it can be seen that the percentage of theorists given tenure has also been steadily declining even faster than the total from a peak of approximately 80% receiving tenure to now fewer than 64% receiving tenure. This likely coincides with the credibility revolution, and the rising popularity of empirical methods in economics, particularly natural and random experiments. When I look at the percentage of empiricists given tenure, it is much harder to find a trend, although it looks like there may be declining numbers receiving tenure as well, the percentage who receive tenure each year is still well above the average compared to the total or compared to theorists. Figure 3.2 shows the change in styles of research in economics over time.[12]

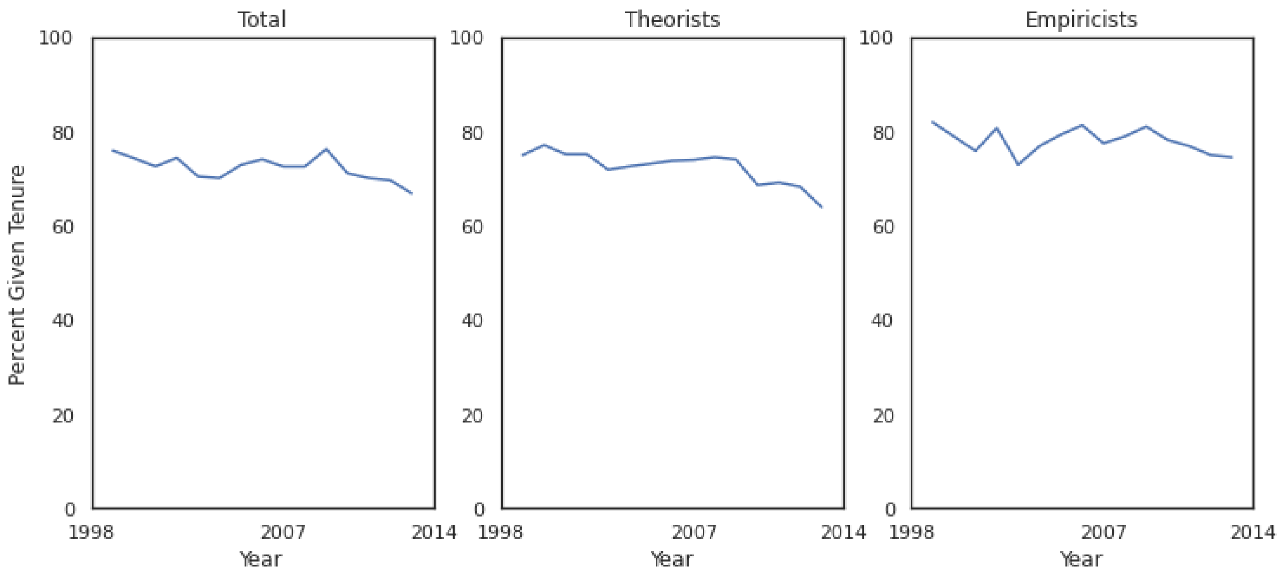

Figure 3.1: Five-Year Moving Average of Total Given Tenure Over the Years

[12]This is the same figure from the first chapter, outlining the credibility revolution.

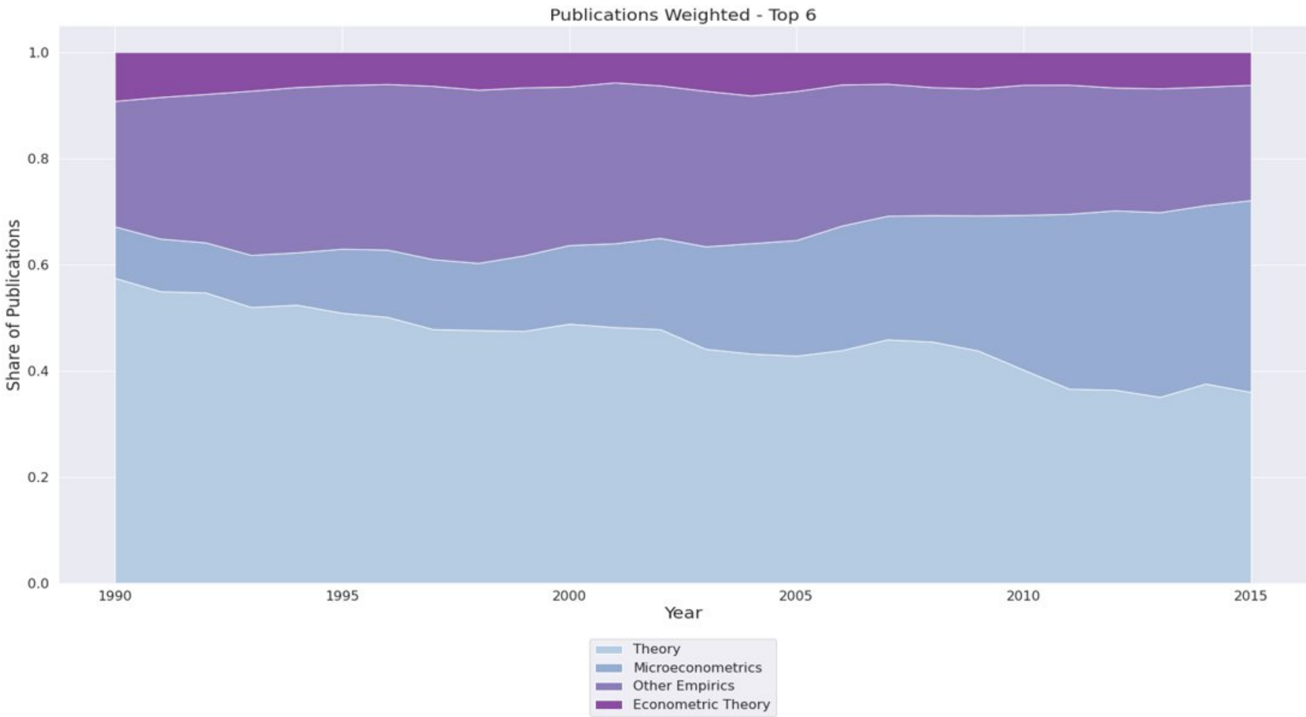

Figure 3.2: Methodologies in the Top 70 Economics Journals Over Time - Weighted by Share of Top Six Citations (T5 Plus *Review of Economics & Statistics*)

Table 3.1 contains descriptive statistics for tenure decisions. The descriptive statistics show that 39% of those who received tenure in my dataset were empiricists and 47% were theorists. Of those who failed to receive tenure within the first spell of the tenure clock, nearly half were theorists, while a little over a quarter were empiricists. The difference in means show that a statistically significantly higher number of empiricists received tenure compared to theorists. The data also shows that those who receive tenure publish more, which isn't surprising (Ellison 2013, Heckman & Moktan 2020).

Table 3.1: Summary Statistics and Difference in Means Whether or Not Tenure Granted

	Denied (N=285)		Granted (N=578)			
	Mean	Std. Dev.	Mean	Std. Dev.	Diff. in Means	p
Is Empiricist	0.27	0.45	0.39	0.49	0.12***	<0.01
Is Theorist	0.49	0.50	0.47	0.50	-0.02	0.64
Top 5s	1.00	1.30	1.72	1.82	0.72***	<0.01
Top Fields	1.34	1.63	1.64	1.59	0.30*	0.01
B Fields	0.54	0.91	0.60	1.00	0.06	0.41
Secondary Gen. Interest	0.42	0.80	0.57	0.95	0.14*	0.02
Citations	2.57	4.93	2.86	4.36	0.29	0.40
NSF Grants	0.10	0.35	0.17	0.40	0.07*	0.01

* p<0.1, ** p<0.05, *** p<0.01

3.4 Results

In this section I present the results for logit models with a simple binary variable of whether or not an economist is an empiricist at the time of tenure. Controls included are the number of T5s, top fields, secondary general interest and B field publications, the number of field adjusted citations they have by the time of tenure, whether they are male or female, and the number of NSF grants they have received. It can be see from the results that when I control for a number of different factors, simply being an empiricist increases the probability of tenure by approximately 9% compared to not being an empiricist. The addition of various controls does seem to change the marginal effect of being an empiricist somewhat which could indicate some correlation between the controls and the variable of interest.

Table 3.2: Average Marginal Effects of Being an Empiricist on Tenure Probability

	No Controls	With Controls
Is an Empiricist	0.112***	0.094***
	(0.032)	(0.034)
	[0.049, 0.176]	[0.029, 0.160]
# Top 5 Publications		0.094***
		(0.015)
		[0.065, 0.123]
# Top Field Publications		0.021*
		(0.011)
		[-0.001, 0.043]
# Secondary		0.027
		(0.023)
		[-0.018, 0.072]
# B Class Field Publications		0.004
		(0.018)
		[-0.031, 0.039]
Citations		-0.010**
		(0.004)
		[-0.019, -0.002]
Male		0.080*
		(0.043)
		[-0.005, 0.165]
NSF Grants		0.062
		(0.047)
		[-0.030, 0.153]
N	863	863

Other controls are university and year fixed effects. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.4.1 Additional Tests

To account for the potential heterogeneity based on whether a tenure-track economist is male or female, I also estimate logit models divided by gender for whether or not tenure is received.[13] Women make up approximately 1/4 of the economists in my dataset so there should be enough to conduct this test. The results indicate that only men receive a benefit from being an empiricist while women derive no statistically significant benefit from doing applied work. The marginal effect does not seem to be particularly higher than that found in the total sample either. Men are 9.9% more likely to receive tenure if they are empiricists compared to women.

[13] There is a good deal of research that shows male and female researcher's work is valued differently (Heckman & Moktan 2020, Kleemans & Thornton 2021).

I also present results for whether or not tenure is received with the deciding departments broken into the top 15, 16-30 and 30+.[14] My estimates show that the effect of being an empiricist is only statistically significant at departments ranked 16-30 in my sample where an empiricist is nearly 20% more likely to receive tenure. The addition of controls does not change the coefficient much for the middle ranked universities either, although the coefficient is noticeably larger in the top 15 without controls, it is still insignificant. These results suggest that middle tier universities may be most likely to engage in strategic behavior and pursue trends. It may also indicate that universities in the lower end of the rankings may not be as acutely aware of changing trends in economics as other universities.

[14] Heckman & Moktan (2020) note that different department ranks value publications differently, it may be the case that different departments may also be more eager to get fashionable research.

Table 3.3: Average Marginal Effects of the Effect of Being an Empiricist on Tenure Probability, by sex

	Male(1)	Male(2)	Female(1)	Female(2)
Is an Empiricist	0.136***	0.099***	0.110	0.037
	(0.036)	(0.034)	(0.071)	(0.032)
	[0.065, 0.206]	[0.033, 0.165]	[-0.029, 0.249]	[-0.025, 0.099]
# Top 5 Publications		0.077***		0.058***
		(0.014)		(0.016)
		[0.049, 0.106]		[0.028, 0.089]
# Top Field Publications		0.011		0.032***
		(0.011)		(0.010)
		[-0.010, 0.033]		[0.012, 0.052]
# Secondary		0.010		-0.005
		(0.023)		(0.019)
		[-0.036, 0.056]		[-0.043, 0.033]
# B Class Field Publications		0.006		-0.006
		(0.018)		(0.023)
		[-0.030, 0.042]		[-0.051, 0.039]
Citations		-0.008*		-0.006
		(0.004)		(0.005)
		[-0.016, 0.001]		[-0.016, 0.005]
NSF Grants		0.067		0.003
		(0.048)		(0.034)
		[-0.027, 0.162]		[-0.064, 0.071]
N	674	674	189	189

Other controls are university and year fixed effects. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.4: Average Marginal Effect of Being an Empiricist on The Probability of Receiving Tenure, by ranking

	T15(1)	T15(2)	T16-30(1)	T16-30(2)	T31+(1)	T31+(2)
Is an Empiricist	0.090*	0.053	0.199***	0.194***	0.029	-0.001
	(0.046)	(0.054)	(0.055)	(0.056)	(0.077)	(0.015)
	[-0.001, 0.181]	[-0.053, 0.159]	[0.091, 0.306]	[0.085, 0.304]	[-0.122, 0.181]	[-0.030, 0.028]
# Top 5 Publications		0.103***		0.164***		-0.001
		(0.018)		(0.039)		(0.010)
		[0.068, 0.138]		[0.087, 0.240]		[-0.021, 0.019]
# Top Field Publications		0.000		0.057**		0.008*
		(0.016)		(0.025)		(0.005)
		[-0.031, 0.031]		[0.008, 0.105]		[-0.001, 0.017]
# Secondary		0.015		0.023		0.014
		(0.032)		(0.061)		(0.009)
		[-0.049, 0.078]		[-0.098, 0.143]		[-0.003, 0.031]
# B Class Field Publications		0.028		0.038		-0.011*
		(0.029)		(0.034)		(0.006)
		[-0.029, 0.086]		[-0.028, 0.105]		[-0.023, 0.001]
Citations		-0.011**		-0.005		0.001
		(0.005)		(0.010)		(0.002)
		[-0.021, -0.001]		[-0.025, 0.014]		[-0.004, 0.006]
Male		0.095		0.081		0.004
		(0.068)		(0.080)		(0.017)
		[-0.038, 0.228]		[-0.075, 0.238]		[-0.029, 0.038]
NSF Grants		0.046		0.056		0.035
		(0.060)		(0.117)		(0.034)
		[-0.072, 0.165]		[-0.174, 0.285]		[-0.031, 0.102]
N	430	430	274	274	159	159

Other controls are year and university fixed effects. (1) and (2) specify models with and without controls respectively. Robust Standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Results with Empiricists Divided into other Empiricists and Microeconometricians

Much of the movement in economics towards the empirical concerns the increased use of reduced form causal methods that are often known as microeconometric methods.[15] I consider the difference between this and other types of empirical research in this section by including indicators for whether the economist in question at the time of tenure had published mostly microeconometric work or his/her empirical work was in the category of other empirical research. My results are rather surprising in a sense. Not only do microeconometricians get a bonus to tenure probabilities, it seems that other types of applied economists do as well. It would have instead been expected that it would only be microeconometricians as it is their work that has largely driven the credibility revolution, and which makes up an increasing share of empirical research today. When I examine the partitions by rankings I again find that this is concentrated in the middle tier universities. This gives further credence to the idea that middle tier universities are most sensitive to trends.

[15]There are a number of names one could give these methods. In this chapter, as in previous ones, I will refer to them as microeconometrics.

Table 3.5: Average Marginal Effect of Being a Microeconometrician or Other Empiricist on Receiving Tenure

	Total	T15	T16-30	31+
# Top 5 Publications	0.095***	0.103***	0.162***	-0.002
	(0.015)	(0.018)	(0.040)	(0.010)
	[0.066, 0.124]	[0.069, 0.138]	[0.084, 0.240]	[-0.022, 0.018]
# Top Field Publications	0.022**	-0.001	0.063**	0.008*
	(0.011)	(0.016)	(0.025)	(0.004)
	[0.000, 0.044]	[-0.032, 0.031]	[0.014, 0.112]	[-0.001, 0.017]
# Secondary	0.030	0.019	0.014	0.013
	(0.023)	(0.032)	(0.061)	(0.009)
	[-0.015, 0.075]	[-0.044, 0.082]	[-0.107, 0.134]	[-0.004, 0.030]
# B Class Field Publications	0.004	0.033	0.034	-0.012*
	(0.018)	(0.029)	(0.034)	(0.006)
	[-0.031, 0.038]	[-0.024, 0.090]	[-0.032, 0.100]	[-0.024, 0.000]
Micrometrician	0.058	0.014	0.134**	0.008
	(0.037)	(0.062)	(0.059)	(0.013)
	[-0.014, 0.131]	[-0.108, 0.136]	[0.018, 0.251]	[-0.016, 0.033]
Other Empiricist	0.002	-0.127	0.160**	-0.013
	(0.053)	(0.093)	(0.064)	(0.027)
	[-0.102, 0.106]	[-0.310, 0.055]	[0.035, 0.286]	[-0.066, 0.041]
Citations	-0.010**	-0.011**	-0.003	0.002
	(0.004)	(0.005)	(0.011)	(0.002)
	[-0.018, -0.001]	[-0.021, -0.001]	[-0.024, 0.018]	[-0.003, 0.006]
NSF Grants	0.058	0.041	0.062	0.037
	(0.047)	(0.062)	(0.116)	(0.030)
	[-0.035, 0.151]	[-0.081, 0.163]	[-0.166, 0.290]	[-0.022, 0.095]
N	863	430	274	159

Other controls are university and year fixed-effects. Robust standard errors in parentheses. Confidence intervals in square brackets.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Additional Tests: Pre and Post-Credibility Revolution

The credibility revolution mentioned in Angrist & Pischke (2010) refers to the growing use of empirical methods in economics. It may be that probabilities of receiving tenure for empiricists are greater after the revolution as people chase after the "flavour of the week". I now present results showing the difference for tenure probabilities pre-2010 and 2010-onwards. Table 3.6 contains the pooled sample, and Table 3.7 contains the results broken down into rankings. The results for the pooled sample show that the probability of receiving tenure increases after the revolution has ended which strengthens the argument that changing trends can influence tenure probabilities. The rankings breakdown also shows that both pre and post-revolution, mid tier universities are much more likely to give tenure to empiricists.

Table 3.6: Average Marginal Effect of Being an Empiricist on Probability of Receiving Tenure for Pre and Post 2010

	Pre	Post
Is an Empiricist	0.033*	0.125***
	(0.018)	(0.043)
	[-0.003, 0.069]	[0.041, 0.209]
# Top 5 Publications	0.037***	0.090***
	(0.008)	(0.020)
	[0.021, 0.053]	[0.051, 0.129]
# Top Field Publications	0.008	0.017
	(0.006)	(0.014)
	[-0.004, 0.020]	[-0.011, 0.044]
# Secondary	0.034***	-0.034
	(0.013)	(0.029)
	[0.009, 0.059]	[-0.090, 0.022]
# B Class Field Publications	-0.005	0.025
	(0.009)	(0.028)
	[-0.022, 0.012]	[-0.028, 0.079]
Citations	-0.004	-0.006
	(0.003)	(0.004)
	[-0.009, 0.001]	[-0.015, 0.003]
Male	0.038	0.066
	(0.029)	(0.063)
	[-0.020, 0.096]	[-0.057, 0.190]
NSF Grants	0.041	0.044
	(0.025)	(0.060)
	[-0.008, 0.091]	[-0.073, 0.162]
N	521	342

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.7: Average Marginal Effect of being an Empiricist on Probability of Tenure for Pre and Post-2010, by rankings

	T15(1)	T15(2)	T16-30(1)	T16-30(2)	31+(1)	T31+(2)
Is an Empiricist	0.013	0.124	0.056**	0.115**	0.000	0.665*
	(0.059)	(0.081)	(0.023)	(0.052)	(0.000)	(0.373)
	[-0.103, 0.128]	[-0.035, 0.284]	[0.010, 0.102]	[0.013, 0.217]	[0.000, 0.000]	[-0.066, 1.395]
# Top 5 Publications	0.085***	0.112***	0.040**	0.116***	0.000	0.220*
	(0.020)	(0.028)	(0.016)	(0.043)	(0.000)	(0.115)
	[0.045, 0.125]	[0.057, 0.167]	[0.008, 0.072]	[0.031, 0.201]	[0.000, 0.000]	[-0.005, 0.446]
# Top Field Publications	-0.006	0.006	0.019*	0.025	0.000	-0.026
	(0.017)	(0.020)	(0.010)	(0.022)	(0.000)	(0.059)
	[-0.040, 0.027]	[-0.033, 0.046]	[-0.001, 0.038]	[-0.018, 0.067]	[0.000, 0.000]	[-0.142, 0.090]
# Secondary	0.061	-0.050	0.039**	-0.044	0.000	-0.065
	(0.039)	(0.052)	(0.018)	(0.040)	(0.000)	(0.059)
	[-0.015, 0.137]	[-0.153, 0.052]	[0.004, 0.074]	[-0.121, 0.034]	[0.000, 0.000]	[-0.181, 0.051]
# B Class Field Publications	0.012	0.058	0.005	0.021	0.000	0.018
	(0.027)	(0.050)	(0.010)	(0.032)	(0.000)	(0.049)
	[-0.042, 0.065]	[-0.041, 0.156]	[-0.014, 0.024]	[-0.041, 0.083]	[0.000, 0.000]	[-0.078, 0.114]
Citations	-0.007	-0.012*	-0.006*	0.021**	0.000	0.033
	(0.008)	(0.007)	(0.003)	(0.010)	(0.000)	(0.030)
	[-0.023, 0.009]	[-0.025, 0.001]	[-0.012, 0.000]	[0.001, 0.042]	[0.000, 0.000]	[-0.025, 0.092]
Male	0.028	0.197	0.039	0.011	0.000	-0.762**
	(0.075)	(0.128)	(0.041)	(0.071)	(0.000)	(0.323)
	[-0.119, 0.174]	[-0.054, 0.449]	[-0.041, 0.120]	[-0.128, 0.151]	[0.000, 0.000]	[-1.395, -0.130]
NSF Grants	0.066	0.007	-0.001	0.113**	0.000	0.069
	(0.074)	(0.084)	(0.032)	(0.050)	(0.000)	(0.052)
	[-0.078, 0.210]	[-0.157, 0.171]	[-0.064, 0.062]	[0.014, 0.212]	[0.000, 0.000]	[-0.032, 0.171]
N	270	160	150	124	101	58

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Additional Results: Empiricists Interacted with Tenured Empiricists

It may be that some departments with a large proportion of tenured empiricists may put a premium or discount on the work of certain economists due to ideological bias (Akerlof & Michaillat 2017). In this section I look at whether having more than the average proportion of tenured empiricists has an effect on the probability of empirical researchers receiving tenure. For robustness, I also look at how this changes with the proportion and absolute number of tenured empiricists. The equation I am estimating can be written as:

$$ln(\frac{Pr(Tn_i = 1)}{1 - Pr(Tn_i = 1)}) = \gamma_1 AtnE : E_i + \gamma_2 E_i + \gamma_3 AtnE_i + \mathbf{X}\beta \tag{3.2}$$

Where $\gamma_1 ATn : E$ is an indicator that the department has an above average number of empiricists tenured at the time of tenure decisions interacted with whether or not the economist is an empiricist. E_i is simply an indicator that the economist is an empiricist, $AtnE$ is whether or not the university has an above average number of tenured empiricists, and $\mathbf{X}$ is a vector of control variables mentioned earlier in this chapter.

The results in Table 3.8 indicate that there is no statistically significant effect for whether a school has an above or below average proportion of empiricists, nor do interactions between the proportion and number of tenured empiricists in Tables 3.9 & 3.10 show any statistical significance between composition of the department and whether one is an empiricist. This indicates that the positive effect of being an empiricist isn't related to the number of empiricists already located in the department, and gives additional support for incumbents being unbiased towards their own style of research when evaluating tenure decisions.

Table 3.8: Average Marginal Effect of Being an Empiricist on Tenure Probability Interacted With Above or Below Average Tenured Empiricists in Department

	Total	T15	T16-30	T31+
Is an Empiricist	0.067	0.010	0.166*	0.001
	(0.047)	(0.075)	(0.089)	(0.018)
	[-0.025, 0.159]	[-0.138, 0.158]	[-0.008, 0.340]	[-0.033, 0.036]
Empiricist x Above Avg.	0.053	0.083	0.051	-0.005
	(0.062)	(0.090)	(0.132)	(0.029)
	[-0.068, 0.175]	[-0.094, 0.260]	[-0.208, 0.309]	[-0.062, 0.051]
Above Avg.	-0.019	-0.187	0.110	0.009
	(0.066)	(0.118)	(0.124)	(0.021)
	[-0.148, 0.111]	[-0.419, 0.044]	[-0.133, 0.353]	[-0.031, 0.049]
# Top 5 Publications	0.094***	0.102***	0.158***	-0.001
	(0.015)	(0.018)	(0.039)	(0.010)
	[0.065, 0.123]	[0.066, 0.137]	[0.080, 0.235]	[-0.021, 0.020]
# Top Field Publications	0.021*	0.002	0.060**	0.008*
	(0.011)	(0.016)	(0.025)	(0.005)
	[-0.001, 0.043]	[-0.029, 0.033]	[0.010, 0.110]	[-0.001, 0.017]
# Secondary General Interest Publications	0.027	0.018	0.025	0.014*
	(0.023)	(0.032)	(0.061)	(0.008)
	[-0.018, 0.072]	[-0.046, 0.081]	[-0.095, 0.145]	[-0.002, 0.030]
# B Class Field Publications	0.004	0.027	0.036	-0.011*
	(0.018)	(0.030)	(0.035)	(0.006)
	[-0.031, 0.040]	[-0.032, 0.085]	[-0.032, 0.104]	[-0.023, 0.001]
Citations	-0.010**	-0.012**	-0.006	0.001
	(0.004)	(0.005)	(0.010)	(0.002)
	[-0.018, -0.002]	[-0.022, -0.002]	[-0.025, 0.014]	[-0.004, 0.005]
Male	0.077*	0.085	0.089	0.005
	(0.043)	(0.069)	(0.081)	(0.017)
	[-0.008, 0.163]	[-0.051, 0.220]	[-0.070, 0.249]	[-0.028, 0.038]
NSF Grants	0.059	0.049	0.047	0.035
	(0.047)	(0.061)	(0.121)	(0.033)
	[-0.033, 0.152]	[-0.071, 0.168]	[-0.190, 0.284]	[-0.030, 0.099]
N	863	430	274	159

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.9: Average Marginal Effect of Being an Empiricist on Tenure Probability Interacted With Proportion of Tenured Empiricists in Department

	Total	T15	T16-30	T31+
Is an Empiricist	0.075	0.070	0.125	0.005
	(0.115)	(0.200)	(0.225)	(0.032)
	[-0.151, 0.300]	[-0.323, 0.462]	[-0.316, 0.567]	[-0.059, 0.068]
%Empiricists	0.002	-0.013	0.003	0.001
	(0.003)	(0.009)	(0.007)	(0.001)
	[-0.005, 0.008]	[-0.030, 0.004]	[-0.010, 0.016]	[-0.001, 0.003]
Empiricist x %Empiricists	0.000	0.000	0.002	0.000
	(0.003)	(0.005)	(0.006)	(0.001)
	[-0.006, 0.007]	[-0.011, 0.010]	[-0.010, 0.014]	[-0.002, 0.002]
# Top 5 Publications	0.094***	0.104***	0.161***	0.001
	(0.015)	(0.018)	(0.039)	(0.011)
	[0.065, 0.123]	[0.069, 0.139]	[0.084, 0.239]	[-0.020, 0.023]
# Top Field Publications	0.021*	0.001	0.058**	0.008*
	(0.011)	(0.016)	(0.025)	(0.004)
	[-0.001, 0.043]	[-0.030, 0.032]	[0.009, 0.107]	[-0.001, 0.016]
# Secondary General Interest Publications	0.028	0.015	0.024	0.016*
	(0.023)	(0.032)	(0.063)	(0.009)
	[-0.018, 0.073]	[-0.048, 0.078]	[-0.099, 0.147]	[-0.002, 0.034]
# B Class Field Publications	0.004	0.028	0.038	-0.011*
	(0.018)	(0.030)	(0.035)	(0.006)
	[-0.031, 0.039]	[-0.030, 0.086]	[-0.030, 0.106]	[-0.023, 0.001]
Citations	-0.010**	-0.012**	-0.006	0.001
	(0.004)	(0.005)	(0.010)	(0.002)
	[-0.019, -0.002]	[-0.022, -0.002]	[-0.025, 0.014]	[-0.004, 0.006]
Male	0.081*	0.095	0.088	0.005
	(0.043)	(0.069)	(0.081)	(0.017)
	[-0.004, 0.166]	[-0.040, 0.229]	[-0.071, 0.246]	[-0.028, 0.038]
NSF Grants	0.061	0.052	0.052	0.035
	(0.047)	(0.060)	(0.119)	(0.032)
	[-0.030, 0.153]	[-0.067, 0.170]	[-0.182, 0.285]	[-0.028, 0.097]
N	863	430	274	159

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3.10: Average Marginal Effect of Being an Empiricist on Tenure Probability Interacted With Number of Tenured Empiricists in Department

	Total	T15	T16-30	T31+
Is an Empiricist	0.124*	0.049	0.168	0.010
	(0.071)	(0.152)	(0.150)	(0.019)
	[-0.015, 0.263]	[-0.249, 0.347]	[-0.126, 0.463]	[-0.027, 0.048]
Tenured Empiricists	0.010	-0.007	0.003	0.010*
	(0.009)	(0.014)	(0.019)	(0.005)
	[-0.008, 0.027]	[-0.035, 0.021]	[-0.033, 0.040]	[0.000, 0.019]
Empiricist x #Empiricists	-0.003	0.000	0.003	-0.001
	(0.006)	(0.009)	(0.017)	(0.003)
	[-0.013, 0.008]	[-0.017, 0.018]	[-0.030, 0.036]	[-0.007, 0.004]
# Top 5 Publications	0.094***	0.103***	0.162***	0.001
	(0.015)	(0.018)	(0.040)	(0.010)
	[0.065, 0.122]	[0.068, 0.139]	[0.084, 0.241]	[-0.019, 0.021]
# Top Field Publications	0.020*	0.000	0.058**	0.007*
	(0.011)	(0.016)	(0.025)	(0.004)
	[-0.002, 0.042]	[-0.031, 0.032]	[0.009, 0.107]	[-0.001, 0.015]
# Secondary General Interest Publications	0.028	0.015	0.023	0.013
	(0.023)	(0.032)	(0.062)	(0.009)
	[-0.018, 0.073]	[-0.049, 0.078]	[-0.099, 0.145]	[-0.004, 0.030]
# B Class Field Publications	0.005	0.028	0.038	-0.010*
	(0.018)	(0.029)	(0.034)	(0.006)
	[-0.030, 0.040]	[-0.029, 0.086]	[-0.029, 0.105]	[-0.022, 0.002]
Citations	-0.010**	-0.011**	-0.006	0.001
	(0.004)	(0.005)	(0.010)	(0.003)
	[-0.019, -0.002]	[-0.021, -0.001]	[-0.025, 0.014]	[-0.004, 0.006]
Male	0.081*	0.095	0.082	0.005
	(0.043)	(0.068)	(0.080)	(0.016)
	[-0.004, 0.166]	[-0.039, 0.228]	[-0.075, 0.240]	[-0.027, 0.037]
NSF Grants	0.058	0.048	0.052	0.035
	(0.046)	(0.061)	(0.118)	(0.032)
	[-0.032, 0.148]	[-0.071, 0.167]	[-0.179, 0.283]	[-0.029, 0.098]
N	863	430	274	159

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Proportion of Empirical Papers

It may also be the case that the number of empirical papers may impact the probability of an economist receiving tenure. To test for this, I run a logit regression where the variable of interest is instead what proportion of papers an economist has written are empirical. The results in this section indicate that a 1% increase in the proportion of empirical papers is associated with a 0.1% in the probability of receiving tenure. This effect is still strongest in the middle ranked universities which shows a 0.2% increase in the probability of receiving tenure for each additional percentage of papers produced that are empirical.

Table 3.11: Average Marginal Effect of Proportion of Empirical Papers on the Probability of Tenure

	Total	T15	T16-30	31+
Proportion Empirics	0.001**	0.000	0.002***	0.000
	(0.000)	(0.001)	(0.001)	(0.000)
	[0.000, 0.002]	[-0.001, 0.002]	[0.001, 0.004]	[0.000, 0.000]
# Top 5 Publications	0.093***	0.103***	0.155***	-0.003
	(0.015)	(0.018)	(0.041)	(0.010)
	[0.064, 0.122]	[0.068, 0.138]	[0.074, 0.235]	[-0.022, 0.017]
# Top Field Publications	0.020*	-0.001	0.057**	0.007
	(0.011)	(0.016)	(0.025)	(0.005)
	[-0.002, 0.042]	[-0.032, 0.030]	[0.009, 0.105]	[-0.002, 0.016]
# Secondary General Interest Publications	0.026	0.017	0.014	0.012
	(0.023)	(0.033)	(0.060)	(0.009)
	[-0.019, 0.071]	[-0.047, 0.081]	[-0.104, 0.133]	[-0.005, 0.029]
# B Class Field Publications	0.004	0.030	0.030	-0.010*
	(0.018)	(0.029)	(0.033)	(0.006)
	[-0.031, 0.039]	[-0.028, 0.087]	[-0.035, 0.095]	[-0.023, 0.002]
Citations	-0.011**	-0.011**	-0.005	0.001
	(0.004)	(0.005)	(0.011)	(0.002)
	[-0.019, -0.002]	[-0.021, -0.001]	[-0.025, 0.016]	[-0.004, 0.005]
Male	0.083*	0.088	0.081	0.008
	(0.044)	(0.068)	(0.080)	(0.021)
	[-0.003, 0.169]	[-0.045, 0.220]	[-0.076, 0.238]	[-0.033, 0.048]
NSF Grants	0.062	0.043	0.058	0.039
	(0.047)	(0.060)	(0.114)	(0.037)
	[-0.030, 0.153]	[-0.075, 0.162]	[-0.165, 0.281]	[-0.033, 0.111]
N	863	430	274	159

Other controls are university and year effect. Robust standard errors in parentheses. Confidence intervals in square brackets.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3.5 Hazard of Tenure

The probability of tenure in the first spell of tenure-track employment is not the only way to measure how changing trends can influence careers. The amount of time it takes to make it to any tenured position is arguably an equally important metric. In this section I present results for the hazard rate of receiving tenure tenure based on whether one is an empiricist or theorist. I also present results for empiricists being divided into microeconometricians and other types of theorists. The model I use here is a Cox regression model where the dependent variable is receiving tenure. The model can be written as:

$$h_i(t) = h_0(t)(exp(\beta_1 E_{it} + \beta_2 T_{it} + \beta \mathbf{X}_{it})) \tag{3.3}$$

Where $h(it)$ is the hazard of said economist i receiving tenure at time t, E_{it} and T_{it} are indicators for whether or not the economist in question is an empiricist or a theorist respectively. $\mathbf{X}_{it}$ is a vector of controls same as those in the previous section. The results in Figure 3.3 indicate that empiricists are not more likely to receive tenure than others. However, the results with empiricists divided into microeconometricians and other empiricists in Figure 3.4 indicate that microeconometricians are more likely to receive tenure than others, with being a microeconometrician associated with a 25% increase in the hazard of receiving tenure at a given time, having not received tenure up to that point.[16] Additionally, I look at whether or not males or females benefit more from this. The results in Figure 3.5 indicate that males benefit from being microeconometricians, but

[16] The group they are being compared to here is economists who work in econometric theory, but given that all others are not statistically significant, it seems as if only microeconometricians are more likely to achieve tenure.

females do not.

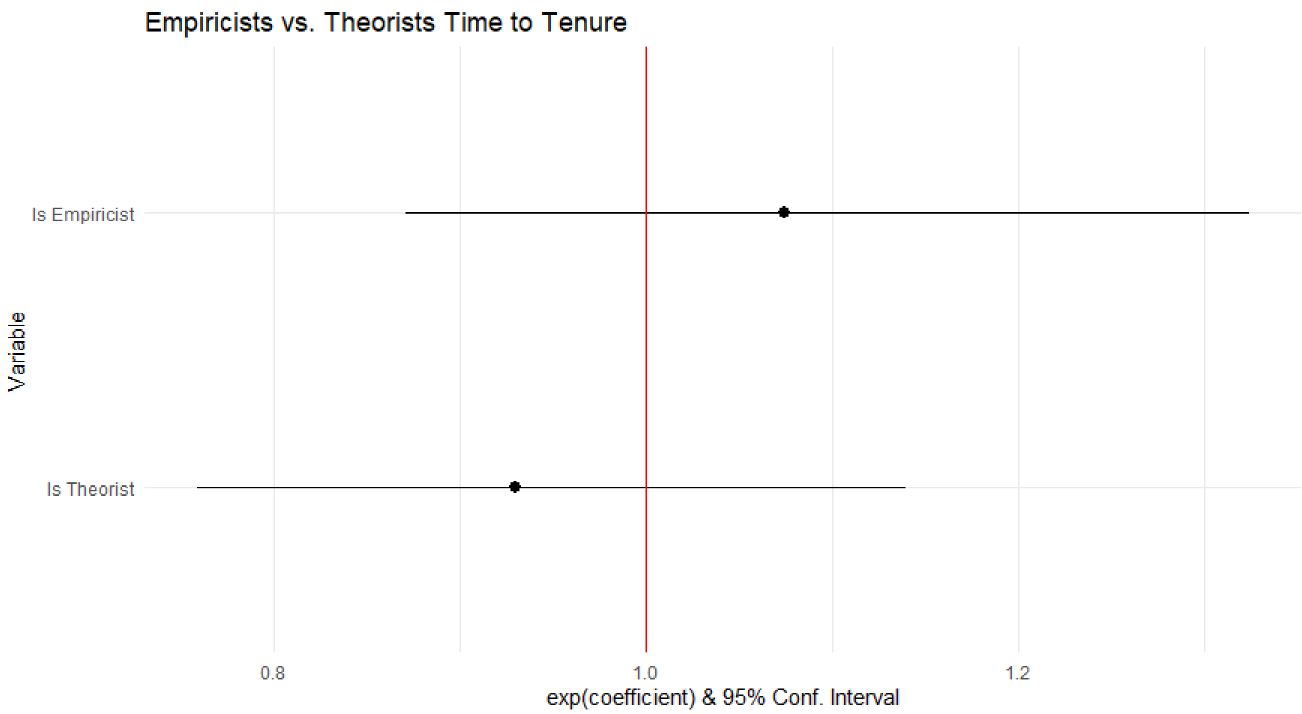

Figure 3.3: Hazard of Achieving Tenure, Theorists & Empiricists

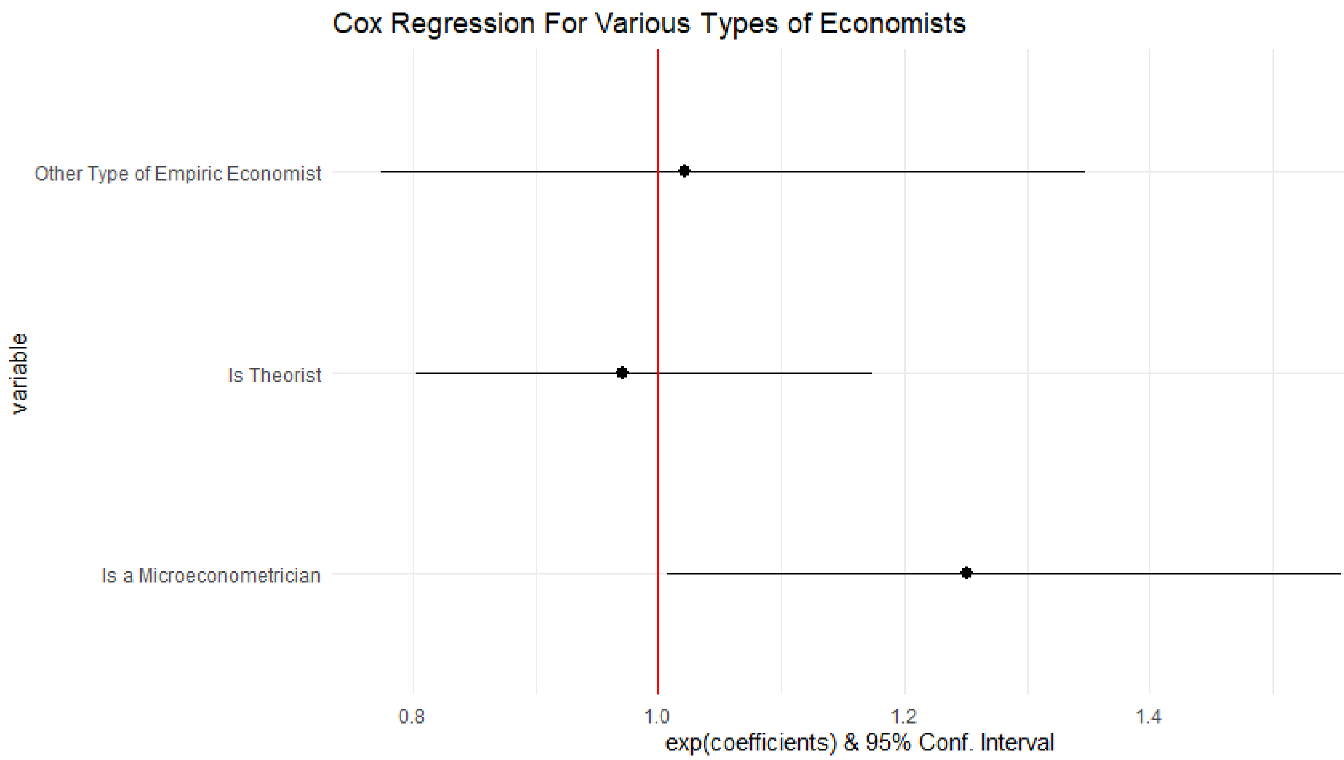

Figure 3.4: Hazard of Achieving Tenure, Empiricists Divided Into Microeconometricians & Other Empiricists

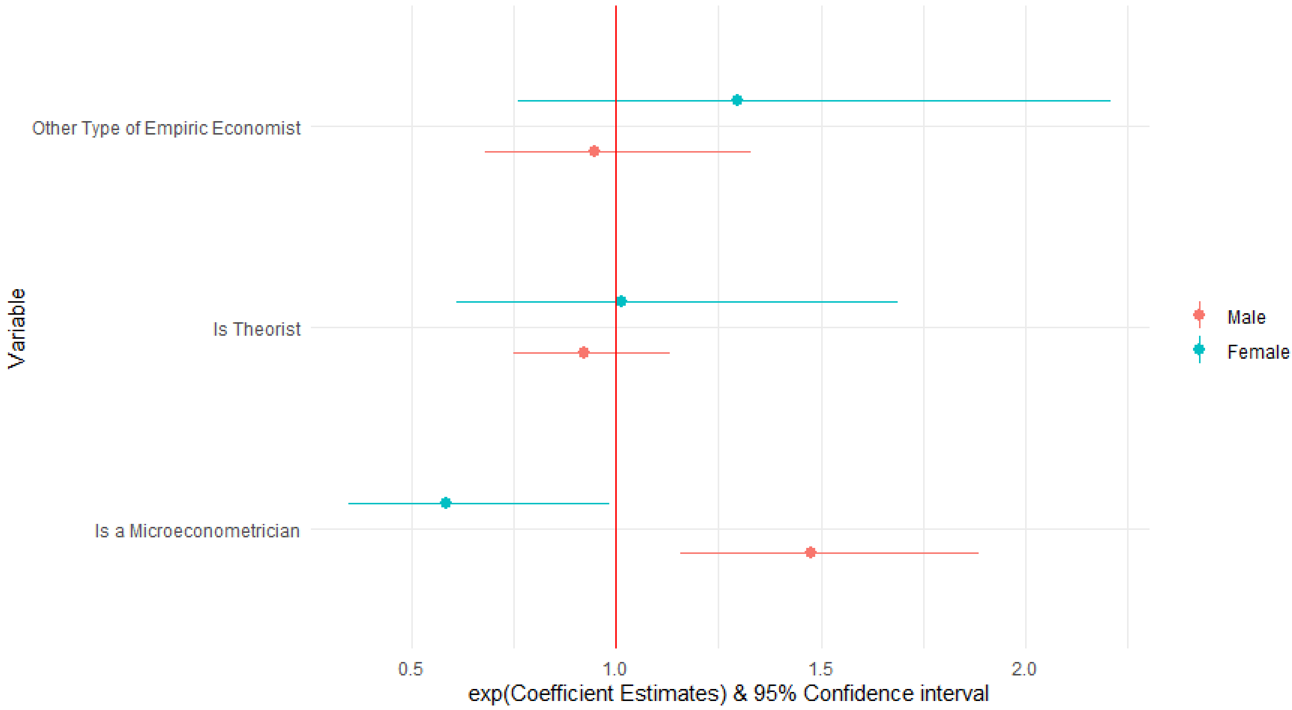

Figure 3.5: Hazard of Achieving Tenure for Types of Economists, by sex

3.6 Discussion, Limitations & Future Directions

My findings indicate that there does seem to be a positive impact on tenure probabilities if one does research that is currently fashionable. This relationship also seems to be focused mostly on schools within the middle rankings of my dataset. These results differ from Chapter One as Chapter One finds evidence of a negative effect of spending *during* the paradigm shift and no effect afterwards while the strongest effect in this chapter occur *after* the shift has occurred as well as a slighter positive effect in the middle ranked schools during the paradigm shift. I also find that there is a strong relation between the speed of receiving tenure and whether or not one does microeconometrics style research. This relation also appears to be exclusive to males as females do not derive any benefit from the type of work they engage in. Additionally, I find little evidence to support Akerlof & Michaillat (2017) as there is no evidence that more empiricists impact the probability of either empiricists or non-empiricists from receiving tenure. It seems likely that this is because tenured faculty are actually interested in hiring and promoting people who will do cutting edge research and benefit their institution. This would provide support for Carmichael (1988) that the tenure system does remove the threat incumbents may feel about new faculty outshining them.

Because my partition results only show that this relation is statistically significant in middle tier universities, it may be an indication that middle ranked universities engage in strategic behavior more so than other universities. This may reflect that these universities are acutely aware of trends in economics, and pursue these to a higher degree in order to break into the top ranks of economics departments. It might also be evidence that middle ranked universities serve as incubators for new ideas rather than top universities. My results might also suggest that faculty in lower ranked departments are not as aware of trends in economics, or are incapable of finding sufficient talent to pursue these trends.

The limitations of this chapter are that due to the difficulty in actually establishing whether one truly received tenure or not, I make several assumptions on whether one was actually rejected which may lead to estimation bias. Still, this research shows that trends have the potential to make a strong impact on labour market outcomes. Future studies could look to find a way to establish some sort of causal inference on whether or not being an empiricist improves probability of tenure receipt.

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Bibliography

Adams, J. D. (2009), Is the U.S. losing its preeminence in higher education?, Technical Report 15233, NBER.

URL: *https://www.nber.org/papers/w15233*

Adams, J. D. & Griliches, Z. (1998), 'Research productivity in a system of universities', *Annales d'Économie et de Statistique* **49**, 127–162.

Aghion, P., Bloom, N., Blundell, R., Griffith, R. & Howitt, P. (2005), 'Competition and innovation: An inverted-u relationship', *Quarterly Journal of Economics* **120**(2), 701–728.

Aghion, P., Dewatripont, M., Hoxby, C., Mas-Colell, A. & Sapir, A. (2010), 'The governance and performance of universities: evidence from Europe and the US', *Economic Policy* **25**(61), 7–59.

Agrawal, A. & Goldfarb, A. (2008), 'Restructuring research: Communication costs and democratization of university innovation', *American Economic Review* **98**(4), 1578–1590.

Akerlof, G. & Michaillat, P. (2017), Beetles: Biased promotions and persistence of false belief, Technical Report 23523, NBER.

URL: *https://www.nber.org/papers/w23523*

Allgood, S., Badgett, L., Bayer, A., Bertrand, M., Black, S. & Bloom, N. (2019), AEA professional climate survey: Final report.

URL: *https://www.aeaweb.org/resources/member-docs/final-climate-survey-results-sept-2019*

Amabile, T. M. (1996), *Creativity in context*, Westview Press.

Andre, P. & Falk, A. (2021), What's worth knowing? economists' opinions about economics, Technical Report 14527, IZA.

URL: *https://docs.iza.org/dp14527.pdf*

Angrist, J., Azoulay, P., Ellison, G., Hill, R. & Lu, S. (2020), 'Inside job or deep impact? extramural citations and the influence of economic scholarship', *Journal of Economic Literature* **58**(1), 3–52.

Angrist, J. & Pischke, J. (2010), 'The credibility revolution in empirical economics: How better research design is taking the con out of economics', *Journal of Economic Perspectives* **24**(2), 3–30.

Arora, A. & Gambardella, A. (2005), 'The impact of NSF support for basic research in economics', *Annales d'Economique Statistique* **79/80**, 91–117.

Ayoubi, C., Pezzoni, M. & Visentin, F. (2019), 'The important thing is not to win, it is to take part: What if scientists benefit from participating in research grant competitions?', *Research Policy* **48**(1), 84–97.

Ayoubi, C., Pezzoni, M. & Visentin, F. (2021), 'Does it pay to do novel science?', *Science and Public Policy* **48**(5), 635–648.

Azoulay, P., Fons-Rosen, C. & Zivin, J. S. (2019), 'Does science advance one funeral at a time?', *American Economic Review* **109**(8), 2889–2920.

Azoulay, P., Zivin, J. S. G. & Manso, G. (2011), 'Incentives and creativity: Evidence from the academic life sciences', *The RAND Journal of Economics* **42**(3), 527–554.

Azoulay, P., Zivin, J. S. G. & Wang, J. (2010), 'Superstar extinction', *Quarterly Journal of Economics* **125**(2), 549–589.

Baruffaldi, S., Marino, M. & Visentin, F. (2020), 'Money to move: The effect on researchers of an international mobility grant', *Research Policy* **49**(8), 1–18.

Beltagy, L., Lo, K. & Cohan, A. (2019), 'Scibert: A pretrained language model for scientific text'.
URL: *https://arxiv.org/abs/1903.10676v3*

Berge, L. (2020), 'Fast fixed-effects estimations [r package fixest version 0.11.0]', *The Comprehensive R Archive Network. Comprehensive R Archive Network (CRAN)* .
URL: *https://cran.r-project.org/web/packages/fixest/index.html*

Besancenot, D. & Dogguy, H. (2014), 'Paradigm shift: A mean field game approach', *Bulletin of Economic Research* **67**(3), 289–302.

Besancenot, D. & Vranceanu, R. (2015), 'Fear of novelty: A model of scientific discovery with strategic uncertainty', *Economic Inquiry* **53**(2), 1132–1139.

Bramoulle, Y. & Paul, G. S. (2010), 'Research cycles', *Journal of Economic Theory* **145**(5), 1890–1920.

Brogaard, J., Engelberg, J. & Wesp, E. V. (2018), 'Do economists swing for the fences after tenure?', *Journal of Economic Perspectives* **32**(1), 179–194.

Card, D. & Dellavigna, S. (2013), ‘Nine facts about top journals in economics’, *Journal of Economic Literature* **51**(1), 144–161.

Carmichael, H. L. (1988), ‘Incentives in academics: Why is there tenure?’, *Journal of Political Economy* **96**(3), 453–472.

Carmichael, L. (1983), ‘Firm-specific human capital and promotion ladders’, *Bell Journal of Economics* **14**(1), 251–258.

Cochrane, J. (2012), ‘Susbsidies for economists?’.
URL: *https://johnhcochrane.blogspot.com/2012/08/subsidies-for-economists.html.*

Cole, J. R. (2009), *The great American university: its rise to preeminence, its indispensable national role, why it must be protected*, New York: Perseus Books Group.

Conroy, M. E., Dusansky, R., Drukker, D. & Kildegaard, A. (1995), ‘Productivity of economics departments in the US: Publications in the core journals.’, *Journal of Economic Literature* **33**(4), 1966–1971.

Cowen, T. & Tabarrok, A. (2016), ‘A skeptical view of the National Science Foundation’s role in economic research’, *Journal of Economic Perspectives* **30**(3), 235–248.

Currie, J., Kleven, H. & Zwiers, E. (2020), Technology and big data are changing economics: Mining text to track methods, Technical Report 26715, NBER.
URL: *https://www.nber.org/papers/w26715*

Defazio, D., Lockett, A. & Wright, M. (2009), ‘Funding incentives, collaborative dynamics and scientific productivity: Evidence from the EU framework program', *Research Policy* **38**(2), 293–305.

Devlin, J., Chang, M., Lee, K. & Toutanova, K. (2019), 'Bert: Pre-training of deep bidirectional transformers for language understanding', *Proceedings of the 2019 Conference of the North American Chapter of the Association for Computational Linguistics: Human Language Technologies* **1**, 4171–4186.

Ellison, G. (2002), 'The slowdown of the economics publishing process', *Journal of Political Economy* **110**(5), 947–993.

Ellison, G. (2013), 'How does the market use citation data? the Hirsch index in economics', *American Economic Journal: Applied Economics* **5**(3), 63–90.

Fourcade, M., Ollion, E. & Algan, Y. (2015), 'The superiority of economists', *Journal of Economic Perspectives* **29**(1), 289–114.

Friedman, M. (1981), 'An open letter on grants'.
URL: *https://miltonfriedman.hoover.org/objects/56773/an-open-letter-on-grants*

Ghirelli, C., Meroni, E., Havari, E. & Verzillo, S. (2023), The long-term causal effects of winning an ERC grant, Technical Report 16108, IZA.
URL: *https://docs.iza.org/dp16108.pdf*

Glaeser, E. L. (2002), The governance of not-for-profit firms, Technical Report 8921, NBER.
URL: *https://www.nber.org/papers/w8921*

Gorham, G. (1991), 'Planck's principle and Jeans's conversion', *Studies in History and Philosophy of Science Part A* **22**(3), 471–497.

Gruber, J. & Johnson, S. (2019), *Jump-starting America: How breakthrough science can revive economic growth and the American dream.*, New York, NY: Public Affairs.

Hadavand, A., Hamermesh, D. & Wilson, W. (Forthcoming), 'Publishing economics: How slow? why slow? is slow productive? fixing slow?', *Journal of Economic Literature* .

Hamermesh, D. (2013), 'Six decades of top economics publishing: Who and how?', *Journal of Economic Literature* **51**(1), 162–172.

Hamermesh, D. (2018), 'Citations in economics: Measurement, uses, and impacts', *Journal of Economic Literature* **56**(1), 115–156.

Harris, L. A. (2021), The National Science Foundation: An overview, Technical report.
URL: *https://crsreports.congress.gov/product/pdf/R/R46753*

Hashmi, A. R. (2013), 'Competition and innovation: The inverted-u relationship revisited', *The Review of Economics and Statistics* **95**(5), 1653–1668.

Heckman, J. J. & Moktan, S. (2020), 'Publishing and promotion in economics: The tyranny of the top five', *Journal of Economic Literature* **58**(2), 419–470.

Holmstrom, B. (1989), 'Agency costs and innovation', *Journal of Economic Behavior and Organization* **12**, 305–327.

Hull, D. L., Tessner, P. D. & Diamond, A. M. (1978), 'Planck's principle', *Science* **202**(4329), 717–723.

Ioannidis, J. P. A. (2011), 'Fund people not projects', *Nature* **477**, 529–531.

Jacob, B. A. & Lefgren, L. (2011), 'The impact of research grant fiunding on scientific productivity', *Journal of Public Economics* **95**(9), 1168–1177.

Jaravel, X., Petkova, N. & Bell, A. (2018), 'Team specific capital and innovation', *American Economic Review* **108**(4), 1034–1073.

Kaplan, D. (2005), 'How to improve peer review at NIH', *Scientist* **19**, 10.

Kim, E., Morse, A. & Zingales, L. (2006), 'What has mattered to economics since 1970?', *Journal of Economic Perspectives* **93**(3), 189–202.

Kim, E., Morse, A. & Zingales, L. (2009), 'Are elite universities losing their competitive edge?', *Journal of Financial Economics* **93**(3), 353–381.

Kleemans, M. & Thornton, R. (2021), 'Who belongs? the determinants of selective membership into the National Bureau of Economic Research', *AEA Papers and Proceedings* **111**, 117–122.

Kuhn, T. S. (1970), *The structure of scientific revolution*, University of Chicago.

Laband, D. N., Piette, M. J., Ralston, S. & Tollison, R. D. (1994), 'Correspondence: National Science Foundation grants for economists', *Journal of Economic Perspectives* **8**(1), 199–205.

Lamont, M. (2009), *How professors think: Inside the curious world of academic judgement*, Cambridge, MA: Harvard University Press.

Lawson, C., Geuna, A. & Finardi, U. (2021), 'The funding-productivity-gender nexus in science, a multistage analysis', *Research Policy* **50**(3), 104182.

Lerner, J., Schoar, A. & Wang, J. (2008), 'Secrets of the academy: The drivers of university endowment success.', *Journal of Economic Perspectives* **23**(3), 207–

222.

Levin, S. G., Stephan, P. E. & Walker, M. B. (1995), 'Planck's principle revisited: A note', *Social Studies of Science* **25**(2), 275–283.

Macleod, W. B. & Urquiola, M. (2021), 'Why does the United States have the best research universities? incentives, resources, and virtuous circles', *Journal of Economic Perspectives* **35**(1), 185–206.

Mahoney, M. J. (1991), 'Publication prejudices: An experimental study of confirmatory bias in the peer review system', *Cognitive Therapy and Research* **1**, 161–175.

Manso, G. (2011), 'Motivating innovation', *The Journal of Finance* **66**(5), 1823–1860.

March, J. (1991), 'Exploration and exploitation in organizational learning', *Organization Science* **2**(1), 71–87.

Moffit, R. A. (2016), 'In defense of the NSF economics program', *Journal of Economic Perspectives* **30**(3), 213–234.

National Center for Education Statistics (2022), 'Fast facts: Endowments'.
URL: *https://nces.ed.gov/fastfacts/display.asp?id=73*

National Science and Technology Council (2008), The science of science policy: A federal research roadmap, Technical report.
URL: *https://apps.dtic.mil/dtic/tr/fulltext/u2/a496840.pdf*

National Science Foundation (1997), 'Selection process & evaluation criteria'.
URL: *https://www.nsf.gov/pubs/1997/nsf9764/sb02016.htm*

National Science Foundation (2023), 'Assistance listings: Social, behavioral and economic sciences'.

URL: *https://sam.gov/fal/5e9b7427b0e34d2abbdff399219e086b/view*

Payne, A. A. & Roberts, J. (2010), 'Government oversight of public universities: Are centralized performance schemes related to increased quantity or quality?', *Review of Economics and Statistics* **92**(1), 207–212.

Payne, A. & Siow, A. (2003), 'Does federal research funding increase university research output?', *Advances in Economic Analysis and Policy* **3**(1), 1–24.

Perry, M. & Reny, P. J. (2016), 'How to count citations if you must', *American Economic Review* **106**(9), 2722–2741.

Pieters, R. & Baumgartner, H. (2002), 'Who talks to whom? intra- and interdisciplinary communication of economics journals', *Journal of Economic Literature* **40**(2), 483–509.

Rosenbloom, J. & Ginther, D. (2017), 'Show me the money: Federal R&D support for academic chemistry, 1990–2009', *Research Policy* **46**(8), 1454–1464.

Rosenbloom, J., Ginther, D., Juhl, T. & Heppert, J. (2015), 'The effects of research and development funding on scientific productivity: Academic chemistry, 1990-2009', *PLOS One* **10**(9), e0138176.

Serrano, R. (2018), 'Top5itis', *SSRN Electronic Journal* .

Shanghai Ranking (2020), 'Global ranking of academic subjects: Economics'.

URL: *https://www.shanghairanking.com/rankings/gras/2020/RS0501*

Stephan, P. (1996), 'The economics of science.', *Journal of Economic Literature*

34(3), 1199–1235.

Stephan, P. (2010), The economics of science - funding for research, *in* B. H. Hall & N. Rosenberg, eds, ‘Handbook of the Economics of Innovation’, Elsevier, chapter 5, pp. 217–273.

Sun, L. & Abraham, S. (2021), ‘Estimating dynamic treatment effects in event studies with heterogeneous treatment effects’, *Journal of Econometrics* **25**(2), 175–199.

Tian, X. & Wang, T. Y. (2014), ‘Tolerance for failure and corporate innovation’, *Review of Financial Studies* **27**(1), 211–255.

Travis, G. D. L. & Collins, H. M. (1991), ‘New light on old boys: Cognitive and institutional particularism in the peer review system’, *Science, Technology & Human Values* **16**(3), 322–341.

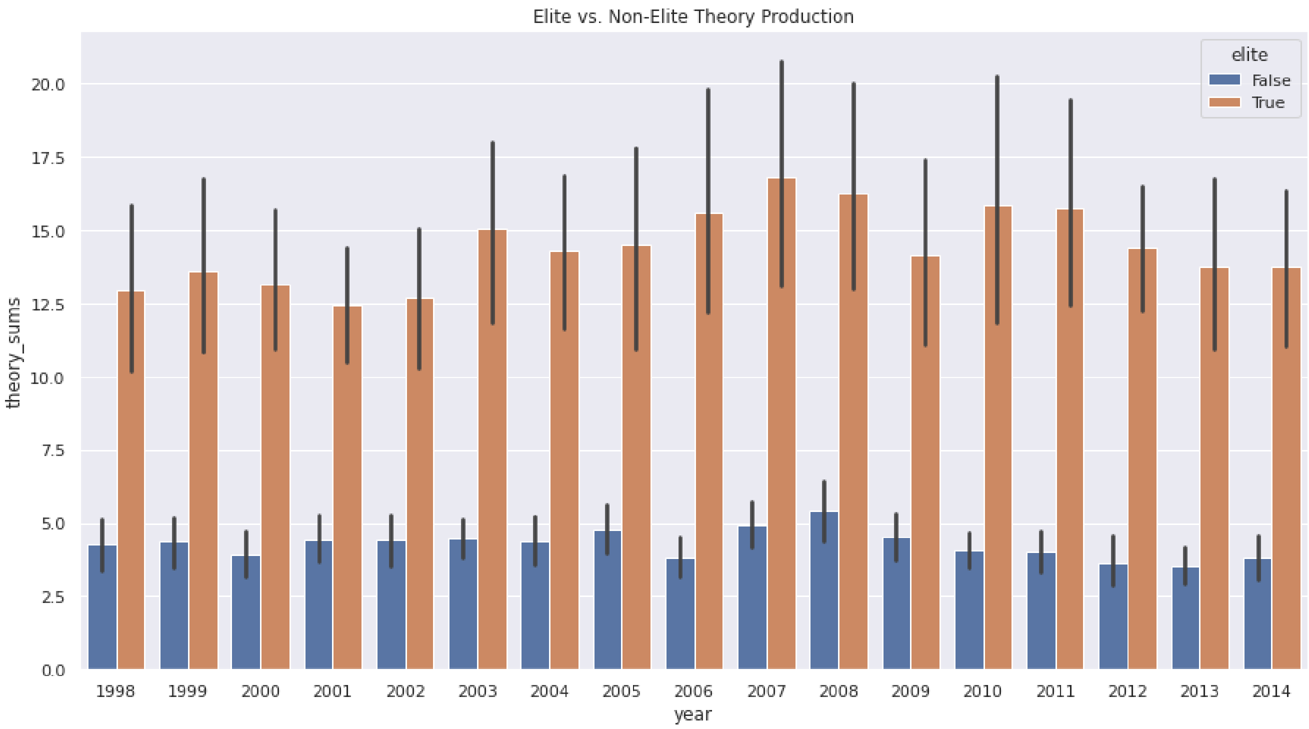
Vaswani, A., Shazeer, N., Palmer, N., Uszkoreit, J., Jones, L., Gomez, A. N., Kaiser, L. & Polosukhin, I. (2017), ‘Attention is all you need’.
URL: *https://arxiv.org/abs/1706.03762*

Whalley, A. & Hicks, J. (2014), ‘Spending wisely? how resources affect knowledge production in universities.’, *Economic Inquiry* **52**(1), 35–55.

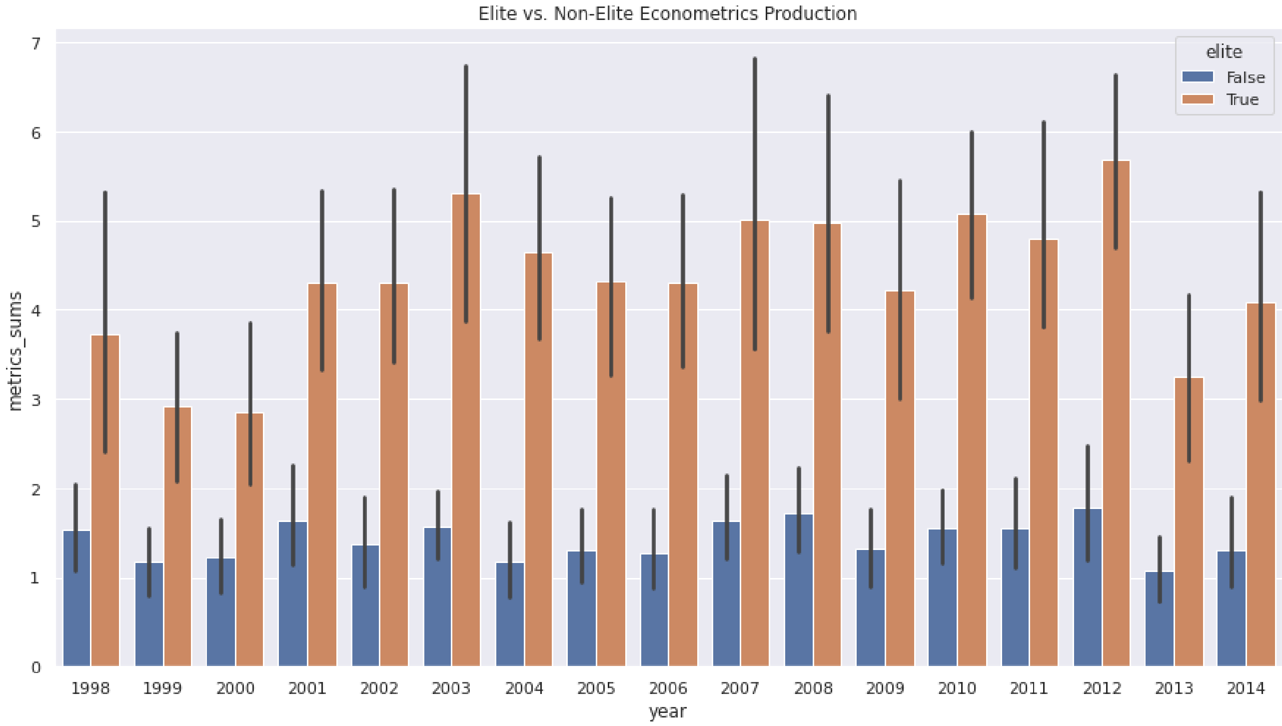
Appendix A

A.1 Chapter 1 Appendix

A.1.1 Elite v Non-Elite Productivity



Production of Theoretical Papers For Elite and Non-Elite Universities



Production of Econometrics Papers Between Elite and Non-Elite Universities

Production of Other Empirical Papers Between Elite and Non-Elite

A.1.2 Codes for Primary Fields

This section of the appendix contains the JEL codes that were used to train the deep learning model to label the primary field. These primary fields were later used to normalise the number of citations received by researchers and universities.

New JEL Codes:

- Microeconomics: C7, D
- Macroeconomics: E, O11, O4, O5
- Labor: J, I2
- Econometrics: C0-C5, C6, C8
- Industrial Organization: L
- International: F
- Finance: G
- Public Economics: H
- Health & Urban: I0, I1, R, K
- Agricultural & Environmental:
- Development: O
- History: N
- Lab Experiments: C9
- Other: All other codes not listed above

Old Fields Codes:

The JEL system underwent changes in the 90s, we also need to map the old numerical codes to the newer alphanumeric coding system. These are as follows:

Fields under old JEL system (1970-1990):

- Microeconomics: 022, 024, 025, 114, 224, 511-513, 522, 921, 021, 026
- Macroeconomics: 023, 112, 120-124, 131-134, 221, 223, 226, 311
- Labor: 811-813, 821, 822, 823, 824-826, 831-833, 841, 851, 912, 917, 918
- Econometrics: 211-214, 220, 222, 229
- Industrial organization: 514, 611-616, 619, 631-636
- International: 111, 400, 411, 421-423, 431-433, 441-443
- Finance: 310, 312-315, 521
- Public Economics: 320-325, 641, 915
- Health & Urban Econ.: 731, 913, 916, 931-933, 941
- Development: 621
- History: 041-048
- Lab-based experiments: 215
- Other: 011, 012, 027, 031, 036, 050-053, 113, 531, 541, 710, 711, 713-718, 721-723, 911, 914

A.1.3 Departments (Ranked by Position Left to Right):

Princeton	MIT
Chicago	Northwestern
Harvard	UC Berkley
UC San Diego	Boston U
Yale	Michigan
NYU	U Penn
Rochester	Carnegie-Mellon
Stanford	Maryland
Wisconsin-Madison	UT Austin
UCLA	Minnesota
Brown	Pittsburgh
Florida	Ohio State
Duke	U Seattle Washington
Cornell	Michigan State
Iowa	Indiana-Bloomington
Johns Hopkins	UC Davis
Houston	Texas A&M
UC Santa Barbara	Columbia
Colorado - Boulder	North Carolina
Virginia	Rice
Illinois-Urbana-Champaign	Suny-Stony Brook
Penn State	SMU
Boston College	Arizona
North Carolina State-Raleigh	Iowa State
Dartmouth	Emory
Florida State	George Washington
Georgetown	Syracuse
Tufts	UC Irvine
UC Santa Cruz	Missouri-Columbia
Oregon	Notre Dame
Vanderbilt	WUSTL
USC	Georgia
Kentucky	Purdue
Georgia State	

A.1.4 Elite Universities

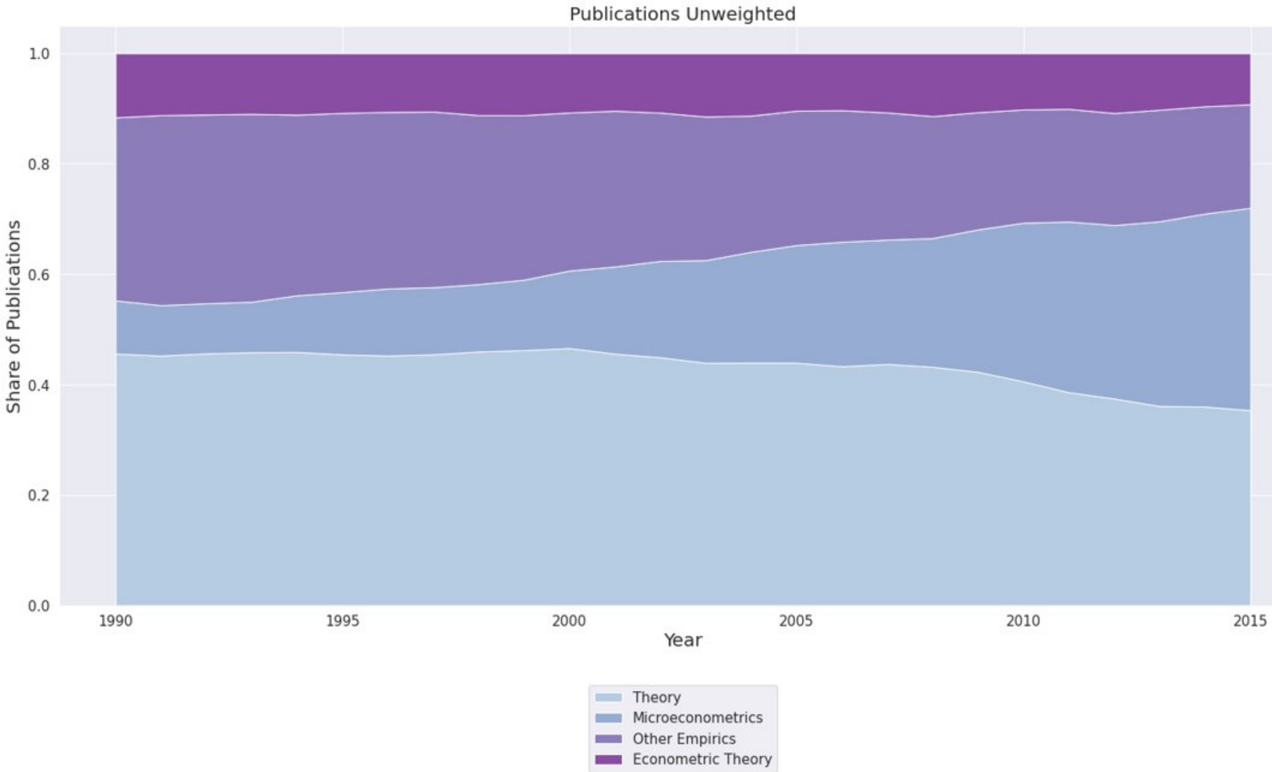
Chicago	U Penn
Harvard	NYU
MIT	Stanford
Northwestern	UCLA
Michigan	Columbia
Rochester	UC Berkeley
Yale	Princeton
Ohio State	Cornell
Wisconsin-Madison	Purdue
Duke	Washington-Seattle

A.1.5 Top 70 Journals - Angrist et al. (2020)

American Economic Review
Econometrica
Review of Economics Studies
Journal of Monetary Economics
Bell Journal of Economics
Journal of Economic Perspectives
Rand Journal of Economics
Journal of International Economics
Games and Economic Behavior
Economica
Journal of Human Resources
Economic Inquiry
Brookings Papers on Economic Activity
Economics Letters
Journal of Money Credit and Banking
American Economic Journal: Applied Economics
American Economic Journal: Macroeconomics
Review of Economic Dynamics
American Economic Journal: Economic Policy
Canadian Journal of Economics
National Tax Journal
Journal of Economic Education
Journal of Industrial Economics
Journal of Business & Economic Statistics
Journal of Risk and Uncertainty
Oxford Economic Papers-New Series
Scandinavian Journal of Economics
Experimental Economics
International Monetary Fund Staff Papers
Bell Journal of Economics and Management Science
Explorations in Economic History
Kyklos
Land Economics
World Development
Econometric Theory

Journal of Political Economy
Quarterly Journal of Economics
Review of Economics & Statistics
Journal of Economic Theory
Economic Journal
Journal of Public Economics
Journal of Economic Literature
Journal of Law & Economics
Journal of Labor Economics
International Economic Review
Journal of the European Economic Association
European Economic Review
Journal of Econometrics
Journal of Economic Behavior & organization
Annals of Economic and Social Measurement
Journal of Economic History
Southern Economic Journal
Journal of Development Economics
Industrial & Labor Relations Review
Carnegie-Rochester Conference Series on Public Policy
Journal of Law Economics & Organization
Journal of Economic Dynamics & Control
Journal of Urban Economics
Journal of Health Economics
Economic Theory
NBER macroeconomics Annual
Journal of Environmental Economics and Management
Public Interest
Monthly Labor Review
Journal of Economics and Management Strategy
American Journal of agricultural Economics
Economic Development and Cultural Change
Economic Record
Journal of Mathematical Economics

A.1.6 Production of Papers by Style Over Time Unweighted



Production of Styles of Papers Over Time Unweighted

A.1.7 Main Results With More Lags

This section of the appendix contains results for the main regression with further lags of 4 and 5 years.

2SLS Estimates of Economics R&D Expenditure on Publications & Citations With 4 Lags

	Total	Micrometrics	Theory	Other Empirics	Econometrics
Publications-No Controls					
R&D Expenditure	-2.801***	-1.233***	-0.844**	-0.316*	-0.407**
	(0.851)	(0.317)	(0.386)	(0.166)	(0.187)
	[-4.499, -1.102]	[-1.867, -0.600]	[-1.615, -0.073]	[-0.647, 0.014]	[-0.781, -0.034]
First-Stage F-Stat	58.56	58.56	58.56	58.56	58.56
Publications-Controls					
R&D Expenditure	-1.696***	-0.744***	-0.435	-0.244	-0.272*
	(0.624)	(0.231)	(0.327)	(0.161)	(0.150)
	[-2.941, -0.450]	[-1.205, -0.284]	[-1.089, 0.218]	[-0.567, 0.078]	[-0.570, 0.027]
# Microeconometricians	0.850***	0.515***	0.154**	0.123**	0.057
	(0.233)	(0.110)	(0.073)	(0.059)	(0.050)
	[0.385, 1.314]	[0.297, 0.734]	[0.009, 0.299]	[0.005, 0.242]	[-0.044, 0.158]
# Other Empiricists	0.082	0.020	0.066	0.004	-0.008
	(0.176)	(0.106)	(0.080)	(0.055)	(0.041)
	[-0.269, 0.434]	[-0.193, 0.232]	[-0.093, 0.225]	[-0.106, 0.115]	[-0.090, 0.075]
# Theorists	0.258*	0.059	0.166**	-0.011	0.043**
	(0.140)	(0.048)	(0.072)	(0.041)	(0.020)
	[-0.021, 0.538]	[-0.036, 0.154]	[0.023, 0.310]	[-0.093, 0.072]	[0.004, 0.083]
# Econometricians	0.016	-0.059	-0.107	-0.020	0.202***
	(0.246)	(0.087)	(0.111)	(0.083)	(0.067)
	[-0.475, 0.508]	[-0.232, 0.114]	[-0.329, 0.115]	[-0.185, 0.146]	[0.068, 0.336]
First-Stage F-Stat	51.62	51.62	51.62	51.62	51.62
Citations-No Controls					
R&D Expenditure	-15.466***	-7.751***	-3.327***	-2.367***	-2.021**
	(4.300)	(2.046)	(1.169)	(0.864)	(0.765)
	[-24.054, -6.878]	[-11.837, -3.665]	[-5.662, -0.992]	[-4.093, -0.642]	[-3.548, -0.494]
First-Stage F-Stat	58.56	58.56	58.56	58.56	58.56
Citations-Controls					
R&D Expenditure	-10.399***	-5.392***	-1.875**	-1.829**	-1.302**
	(3.174)	(1.570)	(0.904)	(0.790)	(0.593)
	[-16.737, -4.060]	[-8.527, -2.256]	[-3.680, -0.070]	[-3.408, -0.251]	[-2.486, -0.119]
# Microeconometricians	4.218***	2.651***	0.611**	0.551	0.405**
	(1.268)	(0.692)	(0.253)	(0.435)	(0.177)
	[1.686, 6.750]	[1.269, 4.034]	[0.106, 1.116]	[-0.317, 1.418]	[0.051, 0.759]
# Other Empiricists	-0.088	-0.028	-0.163	0.089	0.014
	(1.184)	(0.674)	(0.244)	(0.312)	(0.179)
	[-2.454, 2.277]	[-1.373, 1.318]	[-0.650, 0.324]	[-0.534, 0.712]	[-0.344, 0.371]
# Theorists	1.135*	0.241	0.571**	0.086	0.237***
	(0.590)	(0.271)	(0.262)	(0.143)	(0.088)
	[-0.043, 2.313]	[-0.300, 0.783]	[0.047, 1.095]	[-0.200, 0.373]	[0.062, 0.412]
# Econometricians	-1.297	-0.677	-0.073	-0.455	-0.092
	(1.438)	(0.721)	(0.409)	(0.429)	(0.305)
	[-4.168, 1.574]	[-2.118, 0.763]	[-0.890, 0.743]	[-1.311, 0.402]	[-0.702, 0.518]
N	1122	1122	1122	1122	1122
University Fixed-Effect	X	X	X	X	X
Year Fixed-Effect	X	X	X	X	X
First-Stage F-Stat	51.62	51.62	51.62	51.62	51.62

R&D expenditure in $US millions. Total refers to total of all styles, other columns refer to publications of each methodology respectively. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Economics R&D Expenditure on Publications & Citations With 5 Lags

	Total	Micrometrics	Theory	Other Empirics	Econometrics
Publications-No Controls					
R&D Expenditure	-2.538***	-1.303***	-0.690**	-0.174	-0.370**
	(0.700)	(0.365)	(0.267)	(0.146)	(0.161)
	[-3.937, -1.139]	[-2.032, -0.575]	[-1.223, -0.157]	[-0.465, 0.116]	[-0.692, -0.048]
First-Stage F-Stat	67.67	67.67	67.67	67.67	67.67
Publications-Controls					
R&D Expenditure	-1.511***	-0.868***	-0.309	-0.087	-0.246
	(0.530)	(0.291)	(0.229)	(0.144)	(0.150)
	[-2.569, -0.453]	[-1.450, -0.286]	[-0.767, 0.148]	[-0.376, 0.201]	[-0.546, 0.054]
# Microeconometricians	0.809***	0.511***	0.138**	0.109**	0.051
	(0.196)	(0.119)	(0.058)	(0.043)	(0.042)
	[0.418, 1.200]	[0.273, 0.749]	[0.023, 0.254]	[0.024, 0.194]	[-0.034, 0.136]
# Other Empiricists	0.049	0.002	0.059	0.001	-0.013
	(0.169)	(0.112)	(0.073)	(0.054)	(0.040)
	[-0.288, 0.387]	[-0.221, 0.226]	[-0.087, 0.205]	[-0.106, 0.109]	[-0.094, 0.068]
# Theorists	0.280**	0.048	0.179***	0.005	0.046**
	(0.125)	(0.049)	(0.063)	(0.038)	(0.021)
	[0.030, 0.529]	[-0.051, 0.147]	[0.053, 0.306]	[-0.070, 0.080]	[0.004, 0.088]
# Econometricians	-0.064	-0.135	-0.112	-0.005	0.188**
	(0.264)	(0.115)	(0.105)	(0.088)	(0.075)
	[-0.592, 0.464]	[-0.364, 0.095]	[-0.321, 0.097]	[-0.181, 0.170]	[0.039, 0.338]
First-Stage F-Stat	59.06	59.06	59.06	59.06	59.06
Citations-No Controls					
R&D Expenditure	-14.737***	-7.881***	-3.366***	-1.282**	-2.209**
	(3.762)	(2.335)	(1.007)	(0.526)	(0.836)
	[-22.250, -7.225]	[-12.544, -3.218]	[-5.376, -1.356]	[-2.333, -0.232]	[-3.879, -0.538]
First-Stage F-Stat	67.67	67.67	67.67	67.67	67.67
Citations-Controls					
R&D Expenditure	-10.193***	-5.793***	-2.128**	-0.659	-1.614**
	(2.881)	(1.943)	(0.836)	(0.510)	(0.733)
	[-15.948, -4.439]	[-9.674, -1.913]	[-3.797, -0.460]	[-1.676, 0.359]	[-3.078, -0.149]
# Microeconometricians	4.032***	2.589***	0.597**	0.443	0.404**
	(1.174)	(0.716)	(0.255)	(0.275)	(0.198)
	[1.687, 6.377]	[1.159, 4.018]	[0.087, 1.107]	[-0.106, 0.993]	[0.009, 0.799]
# Other Empiricists	-0.304	-0.147	-0.206	0.067	-0.018
	(1.236)	(0.729)	(0.267)	(0.300)	(0.186)
	[-2.772, 2.164]	[-1.602, 1.309]	[-0.738, 0.326]	[-0.533, 0.666]	[-0.389, 0.353]
# Theorists	1.173**	0.210	0.549**	0.205*	0.208*
	(0.547)	(0.261)	(0.258)	(0.114)	(0.115)
	[0.081, 2.265]	[-0.311, 0.732]	[0.033, 1.064]	[-0.023, 0.434]	[-0.021, 0.437]
# Econometricians	-1.976	-1.130	-0.253	-0.349	-0.244
	(1.614)	(0.906)	(0.438)	(0.424)	(0.355)
	[-5.199, 1.248]	[-2.940, 0.680]	[-1.128, 0.622]	[-1.195, 0.497]	[-0.952, 0.465]
N	1122	1122	1122	1122	1122
University Fixed-Effect	X	X	X	X	X
Year Fixed-Effect	X	X	X	X	X
First-Stage F-Stat	59.06	59.06	59.06	59.06	59.06

R&D expenditure in $US millions. Total refers to total of all styles, other columns refer to publications of each methodology respectively. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Economics R&D Expenditure on Publications & Citations With 6 Lags

	Total	Micrometrics	Theory	Other Empirics	Econometrics
Publications-No Controls					
R&D Expenditure	-2.599***	-1.096***	-0.825**	-0.294*	-0.384**
	(0.732)	(0.337)	(0.312)	(0.171)	(0.176)
	[-4.061, -1.137]	[-1.769, -0.424]	[-1.447, -0.202]	[-0.635, 0.047]	[-0.735, -0.033]
First-Stage F-Stat	73.69	73.69	73.69	73.69	73.69
Publications-Controls					
R&D Expenditure	-1.666***	-0.667**	-0.501*	-0.229	-0.269*
	(0.556)	(0.264)	(0.290)	(0.165)	(0.151)
	[-2.777, -0.556]	[-1.195, -0.139]	[-1.081, 0.079]	[-0.560, 0.101]	[-0.571, 0.032]
# Microeconometricians	0.842***	0.507***	0.158**	0.121**	0.056
	(0.201)	(0.098)	(0.069)	(0.051)	(0.046)
	[0.441, 1.243]	[0.312, 0.702]	[0.021, 0.295]	[0.020, 0.222]	[-0.036, 0.148]
# Other Empiricists	0.070	0.014	0.063	0.003	-0.010
	(0.175)	(0.103)	(0.086)	(0.055)	(0.041)
	[-0.279, 0.419]	[-0.192, 0.220]	[-0.108, 0.234]	[-0.107, 0.112]	[-0.091, 0.072]
# Theorists	0.242*	0.059	0.154**	-0.012	0.040**
	(0.132)	(0.046)	(0.074)	(0.037)	(0.020)
	[-0.021, 0.504]	[-0.033, 0.151]	[0.006, 0.302]	[-0.085, 0.061]	[0.001, 0.080]
# Econometricians	-0.106	-0.099	-0.154	-0.035	0.182**
	(0.263)	(0.098)	(0.109)	(0.094)	(0.072)
	[-0.632, 0.420]	[-0.296, 0.097]	[-0.372, 0.065]	[-0.223, 0.153]	[0.039, 0.325]
First-Stage F-Stat	63.92	63.92	63.92	63.92	63.92
Citations-No Controls					
R&D Expenditure	-13.092***	-7.080***	-3.314***	-0.785	-1.913***
	(3.781)	(2.315)	(0.985)	(0.938)	(0.719)
	[-20.643, -5.540]	[-11.703, -2.457]	[-5.281, -1.346]	[-2.658, 1.088]	[-3.350, -0.476]
First-Stage F-Stat	73.69	73.69	73.69	73.69	73.69
Citations-Controls					
R&D Expenditure	-8.795***	-5.084***	-2.216**	-0.150	-1.345**
	(2.905)	(1.861)	(0.944)	(0.977)	(0.622)
	[-14.597, -2.993]	[-8.801, -1.367]	[-4.101, -0.331]	[-2.102, 1.802]	[-2.587, -0.103]
# Microeconometricians	4.058***	2.610***	0.632**	0.412*	0.404**
	(0.962)	(0.643)	(0.249)	(0.238)	(0.177)
	[2.138, 5.979]	[1.327, 3.894]	[0.136, 1.129]	[-0.063, 0.887]	[0.051, 0.758]
# Other Empiricists	-0.164	-0.067	-0.177	0.076	0.004
	(1.140)	(0.670)	(0.280)	(0.302)	(0.175)
	[-2.441, 2.114]	[-1.405, 1.271]	[-0.736, 0.382]	[-0.527, 0.678]	[-0.346, 0.354]
# Theorists	1.193**	0.212	0.510*	0.254	0.217*
	(0.549)	(0.250)	(0.278)	(0.156)	(0.115)
	[0.097, 2.289]	[-0.286, 0.711]	[-0.045, 1.066]	[-0.057, 0.564]	[-0.014, 0.447]
# Econometricians	-1.757	-1.023	-0.285	-0.250	-0.199
	(1.489)	(0.831)	(0.401)	(0.442)	(0.344)
	[-4.731, 1.216]	[-2.682, 0.636]	[-1.086, 0.516]	[-1.132, 0.633]	[-0.885, 0.487]
N	1122	1122	1122	1122	1122
University Fixed-Effect	X	X	X	X	X
Year Fixed-Effect	X	X	X	X	X
First-Stage F-Stat	63.92	63.92	63.92	63.92	63.92

R&D expenditure in $US millions. Total refers to total of all styles, other columns refer to publications of each methodology respectively. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.1.8 Production of Other types of Papers - Private Vs. Public

This section contains results for production of total number of papers, other empiric papers, theoretical papers and econometric theory papers. The results are not terribly different and show little effect for private universities.

2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by Private & Public Universities - Total Papers

	Publications	Citations
Private-No Controls		
R&D Expenditure	-3.148*	-22.198*
	(1.604)	(11.081)
	[-6.433, 0.137]	[-44.896, 0.499]
First-Stage F-Stat	18.73	18.73
Private-Controls		
R&D Expenditure	-0.694	-11.211**
	(0.899)	(4.833)
	[-2.535, 1.147]	[-21.111, -1.310]
# Microeconometricians	0.524**	2.237
	(0.194)	(1.385)
	[0.126, 0.922]	[-0.599, 5.073]
# Other Empiricists	0.265	2.549*
	(0.244)	(1.483)
	[-0.235, 0.765]	[-0.489, 5.586]
# Theorists	0.503***	2.331***
	(0.119)	(0.690)
	[0.259, 0.746]	[0.918, 3.745]
# Econometricians	0.293	-0.066
	(0.221)	(1.613)
	[-0.159, 0.746]	[-3.371, 3.239]
N	493	493
First-Stage F-Stat	12.42	12.42
Public-No Controls		
R&D Expenditure	-0.480	-0.905
	(0.639)	(2.504)
	[-1.776, 0.817]	[-5.984, 4.174]
First-Stage F-Stat	25.73	25.73
Public-Controls		
R&D Expenditure	-0.420	-0.748
	(0.469)	(1.907)
	[-1.372, 0.532]	[-4.615, 3.119]
# Microeconometricians	0.771***	2.499**
	(0.259)	(1.144)
	[0.245, 1.297]	[0.178, 4.820]
# Other Empiricists	0.070	-0.445
	(0.191)	(0.915)
	[-0.317, 0.457]	[-2.301, 1.410]
# Theorists	0.101	0.523*
	(0.146)	(0.289)
	[-0.196, 0.397]	[-0.063, 1.110]
# Econometricians	0.168	-0.225
	(0.305)	(1.606)
	[-0.450, 0.786]	[-3.481, 3.031]
N	629	629
University Fixed-Effect	X	X
Year Fixed-Effect	X	X
First-Stage F-Stat	23.52	23.52

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by Private & Public Universities - Theory Papers

	Publications	Citations
Private-No Controls		
R&D Expenditure	-0.532	-4.735
	(0.566)	(3.295)
	[-1.691, 0.627]	[-11.485, 2.014]
First-Stage F-Stat	18.73	18.73
Private-Controls		
R&D Expenditure	0.736	-0.332
	(0.560)	(0.827)
	[-0.411, 1.884]	[-2.026, 1.362]
# Microeconometricians	0.214	0.623**
	(0.171)	(0.247)
	[-0.138, 0.565]	[0.118, 1.129]
# Other Empiricists	0.016	0.129
	(0.131)	(0.353)
	[-0.251, 0.284]	[-0.594, 0.852]
# Theorists	0.292***	1.036***
	(0.068)	(0.243)
	[0.153, 0.431]	[0.539, 1.534]
# Econometricians	0.095	0.523
	(0.136)	(0.582)
	[-0.183, 0.373]	[-0.670, 1.716]
N	493	493
First-Stage F-Stat	12.42	12.42
Public-No Controls		
R&D Expenditure	0.029	1.061
	(0.248)	(0.885)
	[-0.475, 0.533]	[-0.734, 2.855]
First-Stage F-Stat	25.73	25.73
Public-Controls		
R&D Expenditure	0.079	1.094
	(0.293)	(1.021)
	[-0.515, 0.673]	[-0.977, 3.165]
# Microeconometricians	0.032	-0.403
	(0.125)	(0.587)
	[-0.222, 0.285]	[-1.594, 0.788]
# Other Empiricists	0.050	-0.043
	(0.097)	(0.304)
	[-0.147, 0.247]	[-0.659, 0.574]
# Theorists	0.055	0.055
	(0.062)	(0.156)
	[-0.071, 0.181]	[-0.261, 0.371]
# Econometricians	-0.011	0.448
	(0.148)	(0.624)
	[-0.311, 0.289]	[-0.817, 1.713]
N	629	629
University Fixed-Effect	X	X
Year Fixed-Effect	X	X
First-Stage F-Stat	23.52	23.52

Values for R&D expenditure are in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by Private & Public Universities - Other Empirics Papers

	Publications	Citations
Private-No Controls		
R&D Expenditure	-0.021	-3.324
	(0.384)	(2.542)
	[-0.807, 0.765]	[-8.532, 1.884]
First-Stage F-Stat	18.73	18.73
Private-Controls		
R&D Expenditure	0.060	-2.793
	(0.445)	(1.843)
	[-0.851, 0.970]	[-6.568, 0.982]
# Microeconometricians	0.014	-0.423
	(0.079)	(0.788)
	[-0.147, 0.176]	[-2.038, 1.192]
# Other Empiricists	-0.008	0.801
	(0.110)	(0.667)
	[-0.234, 0.218]	[-0.566, 2.167]
# Theorists	0.015	0.322
	(0.057)	(0.230)
	[-0.102, 0.132]	[-0.150, 0.794]
# Econometricians	0.049	-0.651
	(0.099)	(0.511)
	[-0.153, 0.252]	[-1.699, 0.396]
N	493	493
First-Stage F-Stat	12.42	12.42
Public-No Controls		
R&D Expenditure	-0.068	-0.432
	(0.200)	(0.867)
	[-0.475, 0.338]	[-2.190, 1.326]
First-Stage F-Stat	25.73	25.73
Public-Controls		
R&D Expenditure	-0.067	-0.397
	(0.179)	(0.751)
	[-0.430, 0.297]	[-1.920, 1.125]
# Microeconometricians	0.184**	0.793
	(0.086)	(0.493)
	[0.010, 0.358]	[-0.207, 1.794]
# Other Empiricists	0.008	-0.084
	(0.077)	(0.295)
	[-0.148, 0.164]	[-0.683, 0.515]
# Theorists	0.008	0.118
	(0.044)	(0.113)
	[-0.081, 0.097]	[-0.112, 0.347]
# Econometricians	-0.007	-0.275
	(0.124)	(0.602)
	[-0.259, 0.244]	[-1.497, 0.946]
N	629	629
University Fixed-Effect	X	X
Year Fixed-Effect	X	X
First-Stage F-Stat	23.52	23.52

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by Private & Public Universities - Econometrics Papers

	Publications	Citations
Private-No Controls		
R&D Expenditure	-0.454	-3.436*
	(0.318)	(1.906)
	[-1.105, 0.196]	[-7.341, 0.469]
First-Stage F-Stat	18.73	18.73
Private-Controls		
R&D Expenditure	-0.138	-1.850
	(0.237)	(1.231)
	[-0.623, 0.347]	[-4.372, 0.671]
# Microeconometricians	-0.044	0.117
	(0.070)	(0.305)
	[-0.187, 0.100]	[-0.507, 0.742]
# Other Empiricists	-0.022	0.510**
	(0.081)	(0.235)
	[-0.187, 0.143]	[0.029, 0.991]
# Theorists	0.088***	0.363***
	(0.017)	(0.115)
	[0.054, 0.123]	[0.129, 0.598]
# Econometricians	0.250**	0.423
	(0.091)	(0.402)
	[0.064, 0.437]	[-0.400, 1.246]
N	493	493
First-Stage F-Stat	12.45	12.45
Public-No Controls		
R&D Expenditure	-0.147*	0.217
	(0.084)	(0.443)
	[-0.317, 0.023]	[-0.683, 1.116]
First-Stage F-Stat	25.73	25.73
Public-Controls		
R&D Expenditure	-0.134	0.340
	(0.093)	(0.462)
	[-0.324, 0.055]	[-0.598, 1.278]
# Microeconometricians	0.107**	0.037
	(0.050)	(0.287)
	[0.006, 0.208]	[-0.545, 0.619]
# Other Empiricists	0.043	-0.033
	(0.053)	(0.151)
	[-0.065, 0.150]	[-0.338, 0.272]
# Theorists	0.010	0.191
	(0.023)	(0.139)
	[-0.036, 0.056]	[-0.091, 0.473]
# Econometricians	0.178**	-0.177
	(0.080)	(0.313)
	[0.015, 0.340]	[-0.811, 0.458]
N	629	629
University Fixed-Effect	X	X
Year Fixed-Effect	X	X
First-Stage F-Stat	23.68	23.68

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.1.9 Productivity for Other Papers - Elite Vs. Non-Elite

2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by status - Total Papers

	Publications	Citations
Elite-No Controls		
R&D Expenditure	-1.720	-10.379*
	(1.029)	(5.083)
	[-3.873, 0.434]	[-21.017, 0.260]
First-Stage F-Stat	24.97	24.97
Elite-Controls		
R&D Expenditure	-0.649	-6.860*
	(0.547)	(3.437)
	[-1.794, 0.495]	[-14.054, 0.334]
# Microeconometricians	1.045***	4.599***
	(0.246)	(1.594)
	[0.530, 1.560]	[1.263, 7.934]
# other Empiricists	0.010	-2.365
	(0.331)	(2.290)
	[-0.683, 0.703]	[-7.157, 2.427]
# Theorists	0.345**	0.934
	(0.156)	(0.698)
	[0.018, 0.671]	[-0.527, 2.394]
# Econometricians	-0.039	-3.277
	(0.382)	(2.233)
	[-0.838, 0.761]	[-7.952, 1.398]
N	340	340
First-Stage F-Stat	19.09	19.09
Non-Elite-No Controls		
R&D Expenditure	-1.181	-1.032
	(0.960)	(1.940)
	[-3.114, 0.751]	[-4.939, 2.876]
First-Stage F-Stat	22.50	22.50
Non-Elite-Controls		
R&D Expenditure	-1.273	-1.144
	(0.988)	(1.876)
	[-3.263, 0.718]	[-4.923, 2.635]
# Microeconometricians	0.341**	1.011***
	(0.147)	(0.324)
	[0.046, 0.636]	[0.358, 1.665]
# other Empiricists	0.043	-0.011
	(0.145)	(0.368)
	[-0.249, 0.335]	[-0.752, 0.730]
# Theorists	-0.017	0.277
	(0.128)	(0.238)
	[-0.275, 0.242]	[-0.202, 0.756]
# Econometricians	0.428	1.792*
	(0.276)	(1.015)
	[-0.128, 0.984]	[-0.252, 3.836]
First-Stage F-Stat	20.43	20.43

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by status - Theory Papers

	Publications	Citations
Elite-No Controls		
R&D Expenditure	-0.675	-3.270*
	(0.446)	(1.657)
	[-1.610, 0.259]	[-6.739, 0.199]
First-Stage F-Stat	24.97	24.97
Elite-Controls		
R&D Expenditure	-0.111	-1.699
	(0.258)	(1.088)
	[-0.650, 0.429]	[-3.976, 0.578]
# Microeconometricians	0.319***	0.850*
	(0.108)	(0.483)
	[0.092, 0.545]	[-0.160, 1.861]
# other Empiricists	0.219	-0.335
	(0.178)	(0.671)
	[-0.154, 0.591]	[-1.740, 1.071]
# Theorists	0.261**	0.797*
	(0.094)	(0.420)
	[0.065, 0.458]	[-0.081, 1.675]
# Econometricians	0.005	-0.203
	(0.170)	(0.820)
	[-0.351, 0.360]	[-1.920, 1.514]
N	340	340
First-Stage F-Stat	19.09	19.09
Non-Elite-No Controls		
R&D Expenditure	-0.096	0.363
	(0.316)	(0.740)
	[-0.732, 0.539]	[-1.128, 1.854]
First-Stage F-Stat	22.50	22.50
Non-Elite-Controls		
R&D Expenditure	-0.055	0.476
	(0.350)	(0.831)
	[-0.760, 0.651]	[-1.198, 2.149]
# Microeconometricians	-0.077	-0.127
	(0.063)	(0.184)
	[-0.204, 0.050]	[-0.497, 0.244]
# other Empiricists	0.007	-0.246**
	(0.053)	(0.107)
	[-0.100, 0.113]	[-0.462, -0.030]
# Theorists	0.054	0.179
	(0.053)	(0.152)
	[-0.054, 0.161]	[-0.128, 0.486]
# Econometricians	-0.018	0.404
	(0.118)	(0.360)
	[-0.256, 0.220]	[-0.322, 1.130]
N	782	782
University Fixed-Effect	X	X
Year Fixed-Effect	X	X
First-Stage F-Stat	20.43	20.43

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by status - Other Empirics Papers

	Publications	Citations
Elite-No Controls		
R&D Expenditure	-0.069	-1.463
	(0.228)	(1.155)
	[-0.547, 0.409]	[-3.880, 0.953]
First-Stage F-Stat	24.97	24.97
Elite-Controls		
R&D Expenditure	-0.002	-1.525
	(0.236)	(1.124)
	[-0.496, 0.492]	[-3.879, 0.828]
# Microeconometricians	0.102	0.321
	(0.065)	(0.780)
	[-0.034, 0.238]	[-1.311, 1.953]
# other Empiricists	-0.029	-0.350
	(0.137)	(0.885)
	[-0.316, 0.259]	[-2.203, 1.503]
# Theorists	0.010	-0.083
	(0.073)	(0.252)
	[-0.143, 0.163]	[-0.610, 0.444]
# Econometricians	-0.033	-1.589**
	(0.121)	(0.718)
	[-0.286, 0.220]	[-3.093, -0.086]
N	340	340
First-Stage F-Stat	19.09	19.09
Non-Elite-No Controls		
R&D Expenditure	-0.522	-0.502
	(0.402)	(0.597)
	[-1.331, 0.288]	[-1.705, 0.701]
First-Stage F-Stat	22.50	22.50
Non-Elite-Controls		
R&D Expenditure	-0.575	-0.568
	(0.418)	(0.630)
	[-1.417, 0.267]	[-1.836, 0.700]
# Microeconometricians	0.127*	0.374**
	(0.064)	(0.143)
	[-0.002, 0.256]	[0.085, 0.662]
# other Empiricists	0.020	0.124
	(0.062)	(0.123)
	[-0.104, 0.144]	[-0.123, 0.371]
# Theorists	-0.054	0.022
	(0.050)	(0.098)
	[-0.155, 0.047]	[-0.175, 0.219]
# Econometricians	0.051	0.191
	(0.109)	(0.366)
	[-0.168, 0.270]	[-0.547, 0.928]
N	782	782
University Fixed-Effect	X	X
Year Fixed-Effect	X	X
First-Stage F-Stat	20.43	20.43

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence Intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of R&D Expenditure on Publications and Citations, by status - Econometrics Papers

	Publications	Citations
Elite-No Controls		
R&D Expenditure	-0.260	-1.568*
	(0.157)	(0.853)
	[-0.589, 0.069]	[-3.354, 0.218]
First-Stage F-Stat	24.97	24.97
Elite-Controls		
R&D Expenditure	-0.159	-1.063
	(0.134)	(0.626)
	[-0.440, 0.121]	[-2.373, 0.247]
# Microeconometricians	0.019	0.553
	(0.066)	(0.323)
	[-0.120, 0.158]	[-0.122, 1.228]
# other Empiricists	-0.090	-0.161
	(0.112)	(0.545)
	[-0.325, 0.145]	[-1.302, 0.981]
# Theorists	0.060*	0.149
	(0.030)	(0.159)
	[-0.003, 0.123]	[-0.184, 0.481]
# Econometricians	0.179	-0.048
	(0.151)	(0.556)
	[-0.138, 0.496]	[-1.212, 1.117]
N	340	340
First-Stage F-Stat	19.09	19.09
Non-Elite-No Controls		
R&D Expenditure	-0.343*	-0.492
	(0.190)	(0.512)
	[-0.725, 0.039]	[-1.523, 0.539]
First-Stage F-Stat	22.50	22.50
Non-Elite-Controls		
R&D Expenditure	-0.364*	-0.394
	(0.200)	(0.517)
	[-0.767, 0.038]	[-1.435, 0.647]
# Microeconometricians	0.079	0.032
	(0.052)	(0.165)
	[-0.027, 0.185]	[-0.299, 0.364]
# other Empiricists	0.014	0.023
	(0.041)	(0.075)
	[-0.068, 0.097]	[-0.128, 0.174]
# Theorists	0.009	0.194
	(0.029)	(0.123)
	[-0.048, 0.067]	[-0.053, 0.441]
# Econometricians	0.212***	0.038
	(0.067)	(0.261)
	[0.077, 0.346]	[-0.488, 0.564]
N	782	782
University Fixed-Effect	X	X
Year Fixed-Effect	X	X
First-Stage F-Stat	20.43	20.43

R&D expenditure in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.2 Chapter 2 Appendix

A.2.1 Field Codes

Different fields in economics receive different numbers of citations. This makes it difficult to compare say papers in macroeconomics to papers in agricultural, or environmental economics. To account for differences in citation rates, we look at citations normalized by the papers primary fields. These primary fields are taken from Card & Dellavigna (2013), and then used to train a transformer model using the first code prior to 2004 as prior to 2004, the first JEL code listed was the one representing the primary field that papers belonged to. After the predictions are made for papers after 2004, we then take the average citations for each field by year and divide the 5-year citations by them. This method is the same normalization used in Perry & Reny (2016). The breakdown of each primary code is shown below:

New JEL Codes:

- Microeconomics: C7, D
- Macroeconomics: E, O11, O4, O5
- Labor: J, I2
- Econometrics: C0-C5, C6, C8
- Industrial Organization: L
- International: F
- Finance: G

- Public Economics: H
- Health & Urban: I0, I1, I3, R, K
- Agricultural & Environmental: Q
- Development: O
- History: N
- Other: All other codes not listed above

Old Fields Codes:

The JEL system underwent changes in the 90s, I also need to map the old numerical codes to the newer alphanumeric coding system. These are as follows:

Fields under old JEL system (1970-1990):

- Microeconomics: 022, 024, 025, 114, 224, 511-513, 522, 921, 021, 026
- Macroeconomics: 023, 112, 120-124, 131-134, 221, 223, 226, 311
- Labor: 811-813, 821, 822, 823, 824-826, 831-833, 841, 851, 912, 917, 918
- Econometrics: 211-214, 220, 222, 229
- Industrial organization: 514, 611-616, 619, 631-636
- International: 111, 400, 411, 421-423, 431-433, 441-443
- Finance: 310, 312-315, 521
- Public Economics: 320-325, 641, 915
- Health & Urban Econ.: 731, 913, 916, 931-933, 941

- Agricultural & Environmental: 710-718, 721-723
- Development: 621
- History: 041-048
- Other: 011, 012, 027, 031, 036, 050-053, 113, 215, 531, 541, 710, 711, 713-718, 721-723, 911, 914

A.2.2 List of Top 50 Schools in Conroy et al. (1995):

Princeton	MIT
Chicago	Northwestern
Harvard	UC Berkley
UC San Diego	Boston U
Yale	Michigan
NYU	U Penn
Rochester	Carnegie-Mellon
Stanford	Maryland
Wisconsin-Madison	UT Austin
UCLA	Minnesota
Brown	Pittsburgh
Florida	Ohio State
Duke	U Seattle Washington
Cornell	Michigan State
Iowa	Indiana-Bloomington
Johns Hopkins	UC Davis
Houston	Texas A&M
UC Santa Barbara	Columbia
Colorado - Boulder	North Carolina
Virginia	Rice
Illinois-Urbana-Champaign	Suny-Stony Brook
Penn State	SMU
Boston College	Arizona
North Carolina State-Raleigh	Iowa State

A.2.3 Top 70 journals according to Angrist et al. (2020)

American Economic Review
Econometrica
Review of Economics Studies
Journal of Monetary Economics
Bell Journal of Economics
Journal of Economic Perspectives
Rand Journal of Economics
Journal of International Economics
Games and Economic Behavior
Economica
Journal of Human Resources
Economic Inquiry
Brookings Papers on Economic Activity
Economics Letters
Journal of Money Credit and Banking
American Economic Journal: Applied Economics
American Economic Journal: Macroeconomics
Review of Economic Dynamics
American Economic Journal: Economic Policy
Canadian Journal of Economics
National Tax Journal
Journal of Economic Education
Journal of Industrial Economics
Journal of Business & Economic Statistics
Journal of Risk and Uncertainty
Oxford Economic Papers-New Series
Scandinavian Journal of Economics
Experimental Economics
International Monetary Fund Staff Papers
Bell Journal of Economics and Management Science
Explorations in Economic History
Kyklos
Land Economics
World Development
Econometric Theory

Journal of Political Economy
Quarterly Journal of Economics
Review of Economics & Statistics
Journal of Economic Theory
Economic Journal
Journal of Public Economics
Journal of Economic Literature
Journal of Law & Economics
Journal of Labor Economics
International Economic Review
Journal of the European Economic Association
European Economic Review
Journal of Econometrics
Journal of Economic Behavior & organization
Annals of Economic and Social Measurement
Journal of Economic History
Southern Economic Journal
Journal of Development Economics
Industrial & Labor Relations Review
Carnegie-Rochester Conference Series on Public Policy
Journal of Law Economics & Organization
Journal of Economic Dynamics & Control
Journal of Urban Economics
Journal of Health Economics
Economic Theory
NBER macroeconomics Annual
Journal of Environmental Economics and Management
Public Interest
Monthly Labor Review
Journal of Economics and Management Strategy
American Journal of agricultural Economics
Economic Development and Cultural Change
Economic Record
Journal of Mathematical Economics

A.2.4 OLS Results

This section of the appendix contains the OLS (Ordinary Least Squares) results for chapter 2.

OLS Estimates of Effect of First NSF Grant on Publications & Citations

	Publications	Citations
First Grant-No Controls		
Has Received First Grant	0.140***	0.735***
	(0.028)	(0.129)
	[0.086, 0.195]	[0.482, 0.987]
First Grant-Controls		
Tenured	-0.031	0.305**
	(0.027)	(0.141)
	[-0.085, 0.023]	[0.029, 0.581]
Years Employed	0.013***	0.021
	(0.004)	(0.017)
	[0.005, 0.021]	[-0.011, 0.054]
Has Received First Grant	0.145***	0.731***
	(0.028)	(0.128)
	[0.090, 0.200]	[0.480, 0.983]
N	12335	12335
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X

Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

OLS Estimates of Effect of a Subsequent NSF Grant on Publications & Citations

	Publications	Citations
Subsequent Grant- No Controls		
Second Grant	-0.015	0.763**
	(0.047)	(0.358)
	[-0.107, 0.078]	[0.057, 1.469]
Subsequent Grant-Controls		
Tenured	0.012	0.609**
	(0.050)	(0.291)
	[-0.087, 0.111]	[0.037, 1.182]
Years Employed	0.016**	0.064
	(0.008)	(0.041)
	[0.001, 0.031]	[-0.018, 0.145]
Subsequent Grant	-0.012	0.741**
	(0.047)	(0.355)
	[-0.104, 0.081]	[0.042, 1.440]
N	3596	3596
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X

Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

OLS Estimates of Effect of Having an NSF Grant on Publications & Citations

	Publications	Citations
Has Grant-No Controls		
Has Grant	0.013	0.242**
	(0.023)	(0.096)
	[-0.031, 0.057]	[0.053, 0.431]
Has Grant-Controls		
Has Grant	0.025	0.225**
	(0.022)	(0.096)
	[-0.020, 0.069]	[0.036, 0.414]
Tenured	-0.101***	0.153*
	(0.020)	(0.088)
	[-0.139, -0.063]	[-0.021, 0.326]
Years Employed	0.001	-0.001
	(0.001)	(0.006)
	[-0.002, 0.003]	[-0.012, 0.010]
N	24707	24707
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X

Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

OLS Estimates of Effect of NSF Grant Money Awarded on Publications & Citations

	Publications	Citations
Grant Money-No Controls		
Grant $	0.001	0.027*
	(0.003)	(0.016)
	[-0.004, 0.007]	[-0.004, 0.058]
Grant Money-controls		
Grant $	0.002	0.025
	(0.003)	(0.016)
	[-0.003, 0.008]	[-0.006, 0.056]
Tenured	-0.100***	0.164*
	(0.019)	(0.089)
	[-0.138, -0.062]	[-0.011, 0.338]
Years Employed	0.001	-0.001
	(0.001)	(0.006)
	[-0.002, 0.003]	[-0.012, 0.010]
N	24707	24707
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X

Grant Amounts are in $US millions, and refer to 3-year lags of grants. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

OLS Estimates of Effect of First NSF Grant on Publications & Citations - Empiricists & Theorists

	Pubs-Empiricists	Cites-Empiricists	Pubs-Theorists	Cites-Theorists
Speicalties-No Controls				
First grant Received	0.185***	1.206***	0.108**	0.485***
	(0.046)	(0.250)	(0.042)	(0.176)
	[0.095, 0.274]	[0.715, 1.697]	[0.026, 0.190]	[0.138, 0.831]
Specialties-Controls				
First Grant received	0.184***	1.185***	0.115***	0.489***
	(0.046)	(0.245)	(0.043)	(0.177)
	[0.094, 0.274]	[0.703, 1.668]	[0.031, 0.200]	[0.140, 0.837]
Tenured	-0.001	0.618***	-0.059	0.004
	(0.042)	(0.235)	(0.044)	(0.205)
	[-0.084, 0.083]	[0.157, 1.079]	[-0.147, 0.028]	[-0.400, 0.408]
Years Employed	0.017***	0.053*	0.010	0.007
	(0.006)	(0.030)	(0.007)	(0.022)
	[0.005, 0.028]	[-0.006, 0.112]	[-0.003, 0.023]	[-0.037, 0.051]
N	5504	5504	5175	5175
Year Fixed-Effect	X	X	X	X
Researcher Fixed-Effects	X	X	X	X
University Fixed-Effects	X	X	X	X

Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

OLS Estimates of Having an NSF Grant on Publications & Citations - Empiricists & Theorists

	Papers-Empiricist	Citations-Empiricist	Paper-Theorists	Citations-Theorist
Has Grant- No Controls				
Has Grant	0.011	0.671***	0.051*	0.171*
	(0.043)	(0.219)	(0.030)	(0.103)
	[-0.073, 0.094]	[0.241, 1.101]	[-0.007, 0.109]	[-0.032, 0.374]
Has Grant-Controls				
Has Grant	0.023	0.648***	0.065**	0.181*
	(0.042)	(0.219)	(0.029)	(0.101)
	[-0.060, 0.106]	[0.219, 1.078]	[0.008, 0.123]	[-0.017, 0.379]
Tenured	-0.113***	0.161	-0.096***	-0.034
	(0.029)	(0.134)	(0.030)	(0.137)
	[-0.171, -0.056]	[-0.102, 0.423]	[-0.155, -0.037]	[-0.302, 0.235]
Years Employed	-0.002	-0.003	0.003	0.007
	(0.002)	(0.009)	(0.002)	(0.009)
	[-0.006, 0.002]	[-0.020, 0.014]	[-0.001, 0.008]	[-0.012, 0.025]
N	10069	10069	11678	11678
Year Fixed-Effect	X	X	X	X
Researcher Fixed-Effects	X	X	X	X
University Fixed-Effects	X	X	X	X

Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

OLS Estimates of Effect of NSF Grant Money Awarded on Publications & Citations - Empiricists & Theorists

	Theorists Pubs	Empiricists Pubs	Theorists Cites	Empiricist Cites
Grant Money Theorists v Empirics-No Controls				
Grant $	0.002	0.005	-0.002	0.119***
	(0.003)	(0.005)	(0.015)	(0.043)
	[-0.005, 0.008]	[-0.005, 0.016]	[-0.032, 0.027]	[0.035, 0.202]
Grant Money-Theorists v Empirics-Controls				
Grant $	0.003	0.007	-0.001	0.116***
	(0.003)	(0.006)	(0.016)	(0.042)
	[-0.003, 0.010]	[-0.004, 0.018]	[-0.032, 0.029]	[0.033, 0.198]
Tenured	-0.091***	-0.113***	-0.018	0.177
	(0.030)	(0.029)	(0.140)	(0.134)
	[-0.150, -0.033]	[-0.171, -0.056]	[-0.292, 0.256]	[-0.086, 0.440]
Years Employed	0.003	-0.002	0.006	-0.002
	(0.002)	(0.002)	(0.010)	(0.009)
	[-0.001, 0.008]	[-0.006, 0.002]	[-0.012, 0.025]	[-0.019, 0.014]
N	11678	10069	11678	10069
Year Fixed-Effect	X	X	X	X
Researcher Fixed-Effects	X	X	X	X
University Fixed-Effects	X	X	X	X

Grant Amounts are in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.2.5 Extended Lags for Having a Grant and Grant Money

This section contains results for the effect of having a grant four years, five years and six years back.

2SLS Estimates of Effect of Having an NSF Grant on Publications & Citations - 4 Lags

	Publications	Citations
Has Grant-No Controls		
Has Grant	-0.257	-2.538
	(0.320)	(1.699)
	[-0.885, 0.371]	[-5.871, 0.795]
N	21285	21285
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X
First-Stage F-Stat	70.41	70.41
Has Grant-Controls		
Has Grant	-0.247	-2.548
	(0.321)	(1.710)
	[-0.877, 0.383]	[-5.902, 0.805]
Tenured	-0.131***	0.127
	(0.030)	(0.161)
	[-0.190, -0.071]	[-0.189, 0.443]
Years Employed	0.001	-0.002
	(0.002)	(0.007)
	[-0.002, 0.004]	[-0.015, 0.012]
N	21285	21285
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X
First-Stage F-Stat	70.03	70.03

Results for first stage F test for excluded instruments are in the row First-Stage F-Stat. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of Having an NSF Grant on Publications & Citations - 5 Lags

	Publications	Citations
Has Grant-No Controls		
Has Grant	-0.207	-1.474
	(0.374)	(1.694)
	[-0.941, 0.527]	[-4.797, 1.849]
First-Stage F-Stat	58.94	58.94
Has Grant-Controls		
Has Grant	-0.222	-1.470
	(0.371)	(1.679)
	[-0.950, 0.506]	[-4.764, 1.823]
Tenured	-0.110***	0.024
	(0.035)	(0.168)
	[-0.178, -0.042]	[-0.304, 0.353]
Years Employed	0.001	-0.001
	(0.002)	(0.007)
	[-0.002, 0.004]	[-0.015, 0.013]
N	19661	19661
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X
First-Stage F-Stat	60.25	60.25

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments are in the row First-Stage F-Stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of Having an NSF Grant on Publications & Citations - 6 Lags

	Publications	Citations
Has Grant-No Controls		
Has Grant	0.131	-0.612
	(0.370)	(1.913)
	[-0.594, 0.857]	[-4.364, 3.139]
N	18112	18112
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X
First-Stage F-Stat	71.37	71.37
Has Grant-Controls		
Has Grant	0.118	-0.602
	(0.368)	(1.900)
	[-0.604, 0.839]	[-4.329, 3.126]
Tenured	-0.099***	0.078
	(0.035)	(0.151)
	[-0.167, -0.031]	[-0.217, 0.373]
Years Employed	0.002	0.000
	(0.002)	(0.008)
	[-0.002, 0.005]	[-0.015, 0.015]
N	18112	18112
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X
First-Stage F-Stat	72.31	72.31

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments are in the row First-Stage F-Stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of NSF Grant Money Awarded on Publications & Citations - 4 Lags

	Publications	Citations
Grant Money-No Controls		
Grant $	-0.043	-0.428
	(0.057)	(0.328)
	[-0.155, 0.068]	[-1.072, 0.216]
N	21285	21285
First-Stage F-Stat	73.13	73.13
Grant Money-controls		
Grant $	-0.042	-0.429
	(0.057)	(0.330)
	[-0.153, 0.070]	[-1.075, 0.217]
Tenured	-0.141***	0.025
	(0.024)	(0.129)
	[-0.188, -0.093]	[-0.229, 0.279]
Years Employed	0.000	-0.005
	(0.002)	(0.009)
	[-0.003, 0.004]	[-0.022, 0.012]
N	21285	21285
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X
First-Stage F-Stat	72.87	72.87

Grant Amounts are in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets. The results of the first stage F-statistic are presented in the row First-Stage F-Stat

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of NSF Grant Money Awarded on Publications & Citations - 5 Lags

	Publications	Citations
Grant Money-No Controls		
Grant $	-0.038	-0.268
	(0.069)	(0.321)
	[-0.174, 0.098]	[-0.898, 0.362]
First-Stage F-Stat	58.24	58.24
Grant Money-controls		
Grant $	-0.041	-0.269
	(0.069)	(0.321)
	[-0.177, 0.095]	[-0.898, 0.360]
Tenured	-0.122***	-0.052
	(0.026)	(0.134)
	[-0.173, -0.070]	[-0.315, 0.210]
Years Employed	0.001	-0.003
	(0.002)	(0.008)
	[-0.003, 0.004]	[-0.019, 0.013]
N	19661	19661
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X
First-Stage F-Stat	58.57	58.57

Grant Amounts are in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets. The results of the first stage F-statistic are presented in the row First-Stage F-Stat

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of Effect of NSF Grant Money Awarded on Publications & Citations - 6 Lags

	Publications	Citations
Grant Money-No Controls		
Grant $	0.028	-0.130
	(0.079)	(0.406)
	[-0.126, 0.182]	[-0.927, 0.668]
First-Stage F-Stat	55.90	55.90
Grant Money-controls		
Grant $	0.025	-0.128
	(0.078)	(0.406)
	[-0.129, 0.179]	[-0.924, 0.669]
Tenured	-0.094***	0.053
	(0.031)	(0.127)
	[-0.155, -0.033]	[-0.195, 0.301]
Years Employed	0.002	-0.001
	(0.002)	(0.008)
	[-0.002, 0.005]	[-0.017, 0.016]
N	18112	18112
Year Fixed-Effect	X	X
Researcher Fixed-Effects	X	X
University Fixed-Effects	X	X
First-Stage F-Stat	55.93	55.93

Grant Amounts are in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets. The results of the first stage F-statistic are presented in the row First-Stage F-Stat

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.2.6 More Granular Empirics Results

This section contains the results for the effects of grants when the empirical economists are divided into microeconometricians and other types of empiricists. As can be seen the effect of a first grant is largest for microeconometricians although the effect is less precisely measured. There is no statistically significant effect measured for having a grant three years prior or grant money available three years prior.

2SLS Estimates of Effect of First NSF Grant on Publications & Citations - Split Between Microeconometricians and Other Empiricists

	Micrometrics-Pubs	Micrometrics-Cites	Other-Pubs	Other-Cites
First Grant-No Controls				
First Grant	1.313	13.694	0.095	6.446
	(0.905)	(8.441)	(1.255)	(6.172)
	[-0.467, 3.094]	[-2.910, 30.298]	[-2.392, 2.581]	[-5.778, 18.671]
N	3507	3507	1526	1526
First-Stage F-Stat	12.76	12.76	7.04	7.04
First Grant-Controls				
First Grant	1.427	13.724*	0.207	6.900
	(0.899)	(8.282)	(1.201)	(5.994)
	[-0.341, 3.195]	[-2.567, 30.015]	[-2.172, 2.585]	[-4.972, 18.772]
Tenured	-0.135**	0.248	0.119	0.362
	(0.065)	(0.478)	(0.087)	(0.695)
	[-0.264, -0.007]	[-0.693, 1.188]	[-0.052, 0.291]	[-1.013, 1.738]
Years Employed	0.009	0.012	0.002	-0.008
	(0.010)	(0.066)	(0.010)	(0.067)
	[-0.010, 0.029]	[-0.117, 0.142]	[-0.019, 0.023]	[-0.142, 0.125]
N	3507	3507	1526	1526
Year Fixed-Effect	X	X	X	X
Researcher Fixed-Effects	X	X	X	X
University Fixed-Effects	X	X	X	X
First-Stage F-Stat	13.43	13.43	7.71	7.71

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-Stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of the Effect of Having a Grant - Split Between Microeconometricians and Other Empiricists

	Micrometrics-Pubs	Micrometrics-Cites	Other-Pubs	Other-Cites
Has Grant-No Controls				
Has Grant	-2.371	-0.454	-1.049	-9.864
	(1.637)	(6.492)	(1.817)	(10.993)
	[-5.591, 0.848]	[-13.222, 12.313]	[-4.623, 2.525]	[-31.488, 11.759]
First-Stage F-Stat	8.39	8.39	4.22	4.22
Has Grant-Controls				
Has Grant	-2.159	-0.405	-1.045	-9.777
	(1.624)	(6.989)	(1.805)	(10.958)
	[-5.353, 1.035]	[-14.149, 13.339]	[-4.595, 2.504]	[-31.331, 11.778]
Tenured	-0.151**	-0.018	0.044	0.974
	(0.069)	(0.238)	(0.180)	(1.145)
	[-0.288, -0.015]	[-0.486, 0.450]	[-0.309, 0.398]	[-1.278, 3.226]
Years Employed	-0.001	0.001	-0.003	-0.009
	(0.007)	(0.028)	(0.003)	(0.014)
	[-0.016, 0.013]	[-0.053, 0.056]	[-0.009, 0.002]	[-0.036, 0.019]
First-Stage F-Stat	7.31	7.31	4.33	4.33

Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-Stat.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2SLS Estimates of the Effects NSF Grant Money Awarded on Publications & Citations - Split Between Microeconometricians and Other Empiricists

	Micrometrics-Pubs	Micrometrics-Cites	Other-Pubs	Other-Cites
Grant Money-No Controls				
Grant $	-0.156	-0.030	-0.263	-2.470
	(0.129)	(0.428)	(0.461)	(2.777)
	[-0.409, 0.096]	[-0.872, 0.812]	[-1.170, 0.645]	[-7.932, 2.992]
First-Stage F-Stat	41.43	41.43	5.83	5.83
Grant Money-Controls				
Grant $	-0.136	-0.026	-0.262	-2.451
	(0.116)	(0.440)	(0.459)	(2.769)
	[-0.364, 0.092]	[-0.891, 0.840]	[-1.164, 0.640]	[-7.899, 2.996]
Tenured	-0.185***	-0.024	0.029	0.829
	(0.044)	(0.214)	(0.162)	(1.074)
	[-0.271, -0.100]	[-0.444, 0.396]	[-0.289, 0.347]	[-1.284, 2.942]
Years Employed	0.001	0.002	-0.003	-0.005
	(0.005)	(0.023)	(0.003)	(0.015)
	[-0.009, 0.010]	[-0.043, 0.046]	[-0.008, 0.003]	[-0.035, 0.025]
N	3824	3824	5511	5511
Year Fixed-Effect	X	X	X	X
Researcher Fixed-Effects	X	X	X	X
University Fixed-Effects	X	X	X	X
First-Stage F-Stat	39.55	39.55	5.96	5.96

Grant amounts are in $US millions. Robust standard errors in parentheses. Confidence intervals in square brackets. Results for first stage F test for excluded instruments can be found in the row First-Stage F-Stat.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.3 Chapter 3 Appendix

A.3.1 Linear Probability & Probit Model Results

This section contains results for both linear probability and probit models. The results both show that there does seem to be a statistically significant effect of being an empiricists on tenure probabilities, and this effect is concentrated in the middle ranked schools.

LPM Estimates of the Average Marginal Effect of Being an Empiricist on the Probability of Receiving Tenure

	Total	T15	T16-30	T31+
Is an Empiricist	0.089**	0.040	0.164**	0.004
	(0.036)	(0.051)	(0.066)	(0.114)
	[0.019, 0.159]	[-0.060, 0.141]	[0.034, 0.294]	[-0.222, 0.230]
# Top 5 Publications	0.075***	0.075***	0.137***	-0.004
	(0.012)	(0.013)	(0.036)	(0.073)
	[0.053, 0.098]	[0.050, 0.099]	[0.066, 0.208]	[-0.150, 0.141]
# Top Field Publications	0.018*	-0.002	0.047**	0.055*
	(0.010)	(0.014)	(0.023)	(0.032)
	[-0.002, 0.039]	[-0.031, 0.026]	[0.001, 0.093]	[-0.008, 0.119]
# Secondary General Interest Publications	0.012	0.002	0.009	0.075
	(0.021)	(0.022)	(0.044)	(0.065)
	[-0.029, 0.053]	[-0.042, 0.047]	[-0.078, 0.096]	[-0.053, 0.203]
# B Class Field Publications	0.004	0.026	0.026	-0.066*
	(0.017)	(0.026)	(0.029)	(0.036)
	[-0.029, 0.037]	[-0.025, 0.077]	[-0.031, 0.083]	[-0.138, 0.006]
Citations	-0.008**	-0.008*	-0.005	0.001
	(0.004)	(0.004)	(0.010)	(0.022)
	[-0.016, 0.000]	[-0.017, 0.001]	[-0.025, 0.015]	[-0.042, 0.045]
Male	0.073*	0.074	0.080	-0.012
	(0.042)	(0.061)	(0.074)	(0.116)
	[-0.009, 0.155]	[-0.045, 0.194]	[-0.066, 0.227]	[-0.242, 0.218]
NSF Grants	0.061	0.048	0.048	0.171
	(0.042)	(0.054)	(0.088)	(0.152)
	[-0.021, 0.143]	[-0.057, 0.154]	[-0.126, 0.222]	[-0.130, 0.473]
N	863	430	274	159

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Probit Estimates of the Average Marginal Effect of Being an Empiricist on the Probability of Receiving Tenure

	Total	T15	T16-30	T31+
Is an Empiricist	0.102***	0.060	0.201***	-0.003
	(0.036)	(0.055)	(0.057)	(0.054)
	[0.032, 0.173]	[-0.048, 0.167]	[0.089, 0.312]	[-0.108, 0.103]
# Top 5 Publications	0.095***	0.099***	0.171***	-0.004
	(0.016)	(0.018)	(0.039)	(0.038)
	[0.065, 0.126]	[0.063, 0.135]	[0.095, 0.247]	[-0.078, 0.070]
# Top Field Publications	0.022*	0.000	0.056**	0.029*
	(0.012)	(0.016)	(0.025)	(0.016)
	[-0.001, 0.045]	[-0.031, 0.030]	[0.007, 0.104]	[-0.002, 0.060]
# Secondary General Interest Publications	0.027	0.014	0.009	0.050
	(0.024)	(0.032)	(0.060)	(0.031)
	[-0.020, 0.074]	[-0.049, 0.076]	[-0.109, 0.127]	[-0.011, 0.111]
# B Class Field Publications	0.006	0.029	0.037	-0.043*
	(0.019)	(0.028)	(0.034)	(0.023)
	[-0.030, 0.043]	[-0.027, 0.084]	[-0.029, 0.104]	[-0.088, 0.002]
Citations	-0.010**	-0.011**	-0.006	0.003
	(0.004)	(0.005)	(0.010)	(0.009)
	[-0.019, -0.002]	[-0.020, -0.001]	[-0.024, 0.013]	[-0.015, 0.021]
Male	0.083*	0.095	0.078	0.015
	(0.044)	(0.066)	(0.078)	(0.061)
	[-0.004, 0.170]	[-0.034, 0.224]	[-0.075, 0.232]	[-0.104, 0.134]
NSF Grants	0.069	0.049	0.067	0.122
	(0.050)	(0.062)	(0.113)	(0.109)
	[-0.028, 0.167]	[-0.072, 0.171]	[-0.154, 0.287]	[-0.093, 0.336]
N	863	430	274	159

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.3.2 Results With Credit for Papers Published

Some universities may consider the number of co-authors on a given paper to count publications. This section contains results for top 5s, A fields, B Fields and secondary general interest publications divided by the number of authors. For instance, if a paper has 3 other co-authors, the economist up for tenure would only receive 0.25 of a publication at the time of tenure. as can be seen, the coefficients are not terribly changed by the inclusion of these measures.

Average Marginal Effect of Being an Empiricist on the Probability of Receiving Tenure, Proportional Publications

	Total	T15	16-30	31+
Is an Empiricist	0.086**	0.045	0.192***	-0.003
	(0.034)	(0.055)	(0.059)	(0.015)
	[0.020, 0.153]	[-0.063, 0.152]	[0.077, 0.308]	[-0.033, 0.027]
Prop. Top 5s	0.130***	0.143***	0.255***	-0.007
	(0.023)	(0.027)	(0.073)	(0.013)
	[0.085, 0.174]	[0.090, 0.196]	[0.112, 0.398]	[-0.033, 0.019]
prop. Top field	0.020	-0.006	0.051	0.012*
	(0.016)	(0.023)	(0.039)	(0.007)
	[-0.012, 0.051]	[-0.050, 0.039]	[-0.024, 0.127]	[-0.002, 0.026]
Prop. Secondary	0.032	0.014	0.009	0.021
	(0.035)	(0.052)	(0.089)	(0.012)
	[-0.037, 0.101]	[-0.087, 0.115]	[-0.165, 0.184]	[-0.004, 0.045]
Prop B Fields	-0.006	0.013	0.048	-0.014
	(0.025)	(0.042)	(0.045)	(0.009)
	[-0.054, 0.043]	[-0.068, 0.095]	[-0.040, 0.136]	[-0.032, 0.003]
Citations	-0.006	-0.007	0.001	0.001
	(0.004)	(0.005)	(0.010)	(0.002)
	[-0.014, 0.002]	[-0.017, 0.002]	[-0.019, 0.022]	[-0.003, 0.005]
Male	0.096**	0.111	0.114	0.004
	(0.044)	(0.069)	(0.081)	(0.017)
	[0.010, 0.183]	[-0.023, 0.246]	[-0.045, 0.272]	[-0.030, 0.037]
NSF Grants	0.080*	0.069	0.089	0.040
	(0.047)	(0.060)	(0.119)	(0.032)
	[-0.012, 0.171]	[-0.049, 0.188]	[-0.144, 0.322]	[-0.022, 0.102]
N	863	430	274	159

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.3.3 Tenured Theorists Interacted With Empiricists

This section contains results for tenured theorists in the department being compared with whether or note the assistant professor in question is an empiricist. The interacted results are still statistically insignificant..

Average Marginal Effect of Being an Empiricist on the Probability of Receiving Tenure Interacted with Above or Below Average Tenured Theorists in Department

	Total	T15	T16-30	T31+
Is an Empiricist	0.094**	0.008	0.227***	-0.007
	(0.046)	(0.088)	(0.067)	(0.023)
	[0.003, 0.184]	[-0.165, 0.180]	[0.096, 0.357]	[-0.053, 0.038]
Empiricist x Above avg.	0.001	0.070	-0.131	0.011
	(0.070)	(0.102)	(0.176)	(0.018)
	[-0.137, 0.138]	[-0.130, 0.270]	[-0.475, 0.213]	[-0.024, 0.046]
Above Avg.	-0.069	-0.155	-0.046	-0.006
	(0.065)	(0.110)	(0.134)	(0.022)
	[-0.196, 0.058]	[-0.371, 0.060]	[-0.309, 0.217]	[-0.050, 0.037]
# Top 5 Publications	0.093***	0.102***	0.159***	-0.001
	(0.015)	(0.018)	(0.040)	(0.011)
	[0.064, 0.122]	[0.067, 0.137]	[0.081, 0.237]	[-0.022, 0.020]
# Top Field Publications	0.021*	-0.002	0.060**	0.008*
	(0.011)	(0.016)	(0.025)	(0.004)
	[-0.001, 0.043]	[-0.033, 0.029]	[0.010, 0.109]	[-0.001, 0.017]
# Secondary General Interest Publications	0.027	0.013	0.022	0.014*
	(0.023)	(0.032)	(0.062)	(0.008)
	[-0.018, 0.071]	[-0.051, 0.076]	[-0.098, 0.143]	[-0.003, 0.031]
# B Class Field Publications	0.004	0.033	0.040	-0.011*
	(0.018)	(0.029)	(0.034)	(0.006)
	[-0.031, 0.039]	[-0.023, 0.089]	[-0.028, 0.107]	[-0.023, 0.001]
Citations	-0.010**	-0.011**	-0.005	0.001
	(0.004)	(0.005)	(0.010)	(0.002)
	[-0.018, -0.002]	[-0.021, 0.000]	[-0.025, 0.014]	[-0.004, 0.006]
Male	0.081*	0.096	0.082	0.004
	(0.043)	(0.067)	(0.080)	(0.017)
	[-0.004, 0.165]	[-0.036, 0.227]	[-0.075, 0.240]	[-0.029, 0.037]
NSF Grants	0.061	0.042	0.046	0.035
	(0.047)	(0.059)	(0.116)	(0.034)
	[-0.031, 0.153]	[-0.074, 0.159]	[-0.182, 0.274]	[-0.030, 0.101]
N	863	430	274	159

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Average Marginal Effect of Being an Empiricists on Tenure Probability Interacted With Proportion of Tenured Theorists in Department

	Total	T15	T16-30	T31+
Is an Empiricist	0.065	-0.124	0.142	-0.034
	(0.133)	(0.298)	(0.220)	(0.075)
	[-0.197, 0.326]	[-0.708, 0.461]	[-0.289, 0.573]	[-0.182, 0.114]
%Theorists	-0.002	0.006	-0.003	-0.001
	(0.003)	(0.007)	(0.006)	(0.001)
	[-0.007, 0.004]	[-0.008, 0.021]	[-0.014, 0.009]	[-0.002, 0.001]
Empiricists x %Theorist	0.001	0.003	0.001	0.000
	(0.003)	(0.005)	(0.005)	(0.001)
	[-0.005, 0.006]	[-0.007, 0.013]	[-0.009, 0.012]	[-0.001, 0.002]
# Top 5 Publications	0.094***	0.104***	0.163***	0.000
	(0.015)	(0.018)	(0.039)	(0.011)
	[0.065, 0.123]	[0.069, 0.139]	[0.086, 0.240]	[-0.021, 0.022]
# Top Field Publications	0.021*	0.000	0.058**	0.008*
	(0.011)	(0.016)	(0.025)	(0.004)
	[-0.001, 0.043]	[-0.031, 0.031]	[0.009, 0.106]	[-0.001, 0.017]
# Secondary General Interest Publications	0.027	0.017	0.026	0.014*
	(0.023)	(0.032)	(0.063)	(0.009)
	[-0.018, 0.072]	[-0.046, 0.080]	[-0.097, 0.149]	[-0.003, 0.032]
# B Class Field Publications	0.004	0.029	0.036	-0.011*
	(0.018)	(0.029)	(0.034)	(0.006)
	[-0.030, 0.039]	[-0.028, 0.087]	[-0.030, 0.102]	[-0.023, 0.001]
Citations	-0.010**	-0.012**	-0.006	0.001
	(0.004)	(0.005)	(0.010)	(0.002)
	[-0.019, -0.002]	[-0.022, -0.002]	[-0.026, 0.014]	[-0.004, 0.006]
Male	0.080*	0.093	0.085	0.005
	(0.043)	(0.068)	(0.080)	(0.017)
	[-0.005, 0.165]	[-0.041, 0.227]	[-0.071, 0.241]	[-0.028, 0.038]
NSF Grants	0.062	0.052	0.055	0.035
	(0.047)	(0.060)	(0.117)	(0.032)
	[-0.030, 0.153]	[-0.065, 0.169]	[-0.175, 0.285]	[-0.028, 0.099]
N	863	430	274	159

Other controls are university and year effect. Robust standard errors in parentheses. Confidence intervals in square brackets.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Average Marginal Effect of being an Empiricists on Tenure Probability Interacted with Number of Tenured Theorists in Department

	Total	T15	T16-30	T31+
Is an Empiricist	0.120*	-0.049	0.209	-0.006
	(0.070)	(0.182)	(0.149)	(0.026)
	[-0.017, 0.256]	[-0.405, 0.307]	[-0.083, 0.500]	[-0.058, 0.046]
# Top 5 Publications	0.094***	0.103***	0.164***	-0.002
	(0.015)	(0.018)	(0.040)	(0.010)
	[0.065, 0.123]	[0.068, 0.138]	[0.086, 0.243]	[-0.022, 0.019]
# Top Field Publications	0.021*	0.000	0.057**	0.007
	(0.011)	(0.016)	(0.025)	(0.005)
	[-0.001, 0.043]	[-0.031, 0.031]	[0.008, 0.105]	[-0.002, 0.016]
# Secondary General Interest Publications	0.027	0.015	0.023	0.014
	(0.023)	(0.033)	(0.061)	(0.009)
	[-0.018, 0.072]	[-0.049, 0.079]	[-0.097, 0.143]	[-0.003, 0.031]
# B Class Field Publications	0.005	0.031	0.039	-0.011*
	(0.018)	(0.029)	(0.036)	(0.006)
	[-0.030, 0.040]	[-0.026, 0.088]	[-0.031, 0.109]	[-0.023, 0.001]
Citations	-0.011**	-0.011**	-0.005	0.000
	(0.004)	(0.005)	(0.010)	(0.002)
	[-0.019, -0.002]	[-0.021, -0.002]	[-0.025, 0.014]	[-0.004, 0.005]
Male	0.080*	0.088	0.081	0.004
	(0.043)	(0.068)	(0.080)	(0.017)
	[-0.005, 0.165]	[-0.046, 0.222]	[-0.075, 0.237]	[-0.029, 0.037]
NSF Grants	0.061	0.053	0.054	0.036
	(0.046)	(0.060)	(0.117)	(0.035)
	[-0.030, 0.152]	[-0.065, 0.170]	[-0.176, 0.284]	[-0.033, 0.104]
Empiricist x #Theorists	-0.002	0.004	-0.002	0.001
	(0.004)	(0.007)	(0.015)	(0.002)
	[-0.009, 0.006]	[-0.010, 0.019]	[-0.032, 0.028]	[-0.003, 0.005]
Tenured Theorists	0.006	0.009	-0.004	0.003
	(0.006)	(0.011)	(0.019)	(0.004)
	[-0.006, 0.019]	[-0.011, 0.030]	[-0.042, 0.034]	[-0.004, 0.011]
N	863	430	274	159

Other controls are university and year effects. Robust standard errors in parentheses. Confidence intervals in square brackets.
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

A.3.4 Universities

These are the 50 university departments the junior faculty in my cross-section are drawn from. This is the same list of universities that can be found in Conroy et al. (1995). The dataset on the faculty and their appointments comes from the dataset available fro Brogaard et al. (2018) which is freely available.

Princeton	MIT
Chicago	Northwestern
Harvard	UC Berkley
UC San Diego	Boston U
Yale	Michigan
NYU	U Penn
Rochester	Carnegie-Mellon
Stanford	Maryland
Wisconsin-Madison	UT Austin
UCLA	Minnesota
Brown	Pittsburgh
Florida	Ohio State
Duke	U Seattle Washington
Cornell	Michigan State
Iowa	Indiana-Bloomington
Johns Hopkins	UC Davis
Houston	Texas A&M
UC Santa Barbara	Columbia
Colorado - Boulder	North Carolina
Virginia	Rice
Illinois-Urbana-Champaign	Suny-Stony Brook
Penn State	SMU
Boston College	Arizona
North Carolina State-Raleigh	Iowa State
Dartmouth	Emory
Florida State	George Washington
Georgetown	Syracuse
Tufts	UC Irvine
UC Santa Cruz	Missouri-Columbia
Oregon	Notre Dame
Vanderbilt	WUSTL
USC	Georgia
Kentucky	Purdue
Georgia State	

A.3.5 Journals and Rankings

This section contains the journals used and their rankings. These are the same journals and rankings mentioned in the Appendix of Heckman & Moktan (2020).

Journals Used in Analysis

Top 5:	**Secondary General Interest:**
American Economic Review	*Review of Economics & Statistics*
Journal of Political Economy	*Economic Journal*
Econometrica	*Journal of the European Economic Association*
Quarterly Journal of Economics	*European Economic Review*
Review of Economic Studies	*International Economic Review*
Top Field:	**B Field:**
Journal of Development Economics	*World Development*
Journal of Economic Growth	*Economic Development and Cultural Change*
Journal of Econometrics	*World Bank Economic Review*
Journal of Business and Economic Statistics	*Journal of Applied Econometrics*
Journal of Financial Economics	*Econometric Theory*
Journal of Finance	*Journal of the American Statistical Association*
Journal of Economic Theory	*Review of Financial Studies*
Games and Economic Behavior	*Journal of Financial and Quantitative Analysis*
Journal of Health Economics	*Mathematical Finance*
Health Economics	*Journal of Economic Behavior and Organization*
RAND Journal of Economics	*Economic Theory*
Journal of Industrial Economics	*Journal of Risk and Uncertainty*
Journal of Labor Economics	*Health Services Research*
Journal of Human Resources	*Int. Journal of Health Care Finance and Economics*
Journal of Monetary Economics	*Economics and Human Biology*
Journal of Money, Credit and Banking	*International Journal of Industrial Organization*
Journal of Public Economics	*Journal of Economics and Management Strategy*
Public Choice	*Industrial and Corporate Change*
	Labour Economics
	Industrial and Labor Relations Review
	Industrial Relations
	Journal of Economic Dynamics and Control
	Review of Economic Dynamics
	Macroeconomic Dynamics
	National Tax Journal
	Review of Income and Wealth
	Int. Tax and Public Finance