

# The Binding Force of Economics

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## Abstract

A discipline is bound by some combination of a shared subject matter, shared theory, and shared techniques. Yet modern economics is seemingly without limitation to its domain. As a discipline without a shared subject matter, what is the binding force of economics today? We use a topic modeling approach to analyze the prevalence of different approaches to inquiry within economics. We find that economics has become increasingly defined by its common empirical techniques rather than its common theory. We question whether this trajectory is stable as the main binding force of economics as a discipline.

# 1 Introduction

What defines a discipline? What distinguishes economics from sociology, political science, or any other social science? Early economists defined economics by its primary subject matter, wealth and economic growth (Backhouse and Medema 2009: 223). Jean-Baptiste Say (1803 [1834]: 15), for example, considered economics to be the science that “unfolds the manner in which wealth is produced, distributed, and consumed.” A similar subject-centric framing can be found in Alfred Marshall’s definition but with an important addition. Marshall (1890 [2013]: 1) defined economics as the “study of mankind in the ordinary business of life; it examines that part of individual and social action which is most closely connected with the attainment and with the use of the material requisites of well being. Thus it is on the one side a study of wealth; and on the other, and more important side, a part of the study of man.”

Modern economists and more modern definitions of economics have embraced Marshall’s “more important side” to economic inquiry, centering the definition on the problem that ails us all, scarcity. Lionel Robbins’ definition is perhaps the most famous in this regard. According to Robbins (1932: 15), economics is “the science which studies human behavior as a relationship between ends and scarce means which have alternative uses.” Yet identifying the problem to be studied says little about *how* it is to be studied (Becker 1976). Economists then set to distinguish their approach from other disciplines by identifying and embracing a distinct methodology. Consider, for example, George Stigler’s definition which is almost identical to Robbins’ yet adds an important clause about the aim of those facing scarcity, maximization. Economics according to Stigler (1942: 12) is “the study of the principles governing the allocation of scarce resources among competing ends when the objective of the allocation is to maximize the attainment of the ends.”

Ronald Coase provides a different, more positivist approach to distinguishing a discipline. Rather than being bound by a rigid definition, a discipline is bound together by some combination of “common techniques of analysis, a common theory or approach to the subject, or a common subject matter”, the boundaries of which are determined by competition (Coase 1978: 204). An established discipline may increase their market share and expand their domain in the short run by applying better attuned techniques and theories, but in the long run the practitioners in these other fields will simply adopt the more successful approaches and with their deeper knowledge of the subject matter displace the encroaching scholars. The long run equilibrium of these competitive forces results in a discipline defined by “the normal binding force of a scholarly profession, its

subject matter.” For economists, this would mean studying “the working of the social institutions which bind together the economic system: firms, markets for goods and services, labour markets, capital markets, the banking system, international trade, and so on” as “It is the common interest in these social institutions which distinguishes the economics profession” (Coase 1978: 206-207).

If Coase is correct about the long run dynamics of the discipline, then we are well within the short run. The domain of economic inquiry has further expanded since the time Coase was writing, not contracted. A cursory reading of the table of contents of a modern economics journal can bear little resemblance to the more traditional economic topics. And articles on pirates [both Caribbean (Leeson 2007) and digital (Harris 2018)], magical beliefs (Nunn and de la Sierra 2017), forest loss (Berazneva and Byker 2017), drunk driving (Hansen 2015), and MTV shows (Aubrey et al., 2014) can be found in leading economics journals. Some of the more popular economics books, such as Stephen Dubner and Steven Levitt’s *Freakonomics* or Peter Leeson’s *WTF?!: An Economic Tour of the Weird*—a book Levitt calls “Freakonomics on steroids”, also suggest that there is seemingly no limitation to the domain of modern economic inquiry.

The expansion of economics’ domain has largely been attributed to the work of Gary Becker and the Chicago school. Becker even won the Nobel Prize in 1992 for “extend[ing] the domain of economic theory to aspects of human behavior which had previously been dealt with by other social science disciplines”.<sup>1</sup> Becker (1976: 5) rejected the earlier definitions of economics favoring to define it by what was unique about the economic approach: “The combined assumptions of maximizing behavior, market equilibrium, and stable preferences, used relentlessly and unflinchingly, form the heart of the economic approach as I see it.” Becker’s (1976: 14, 8) rational choice framework provided “a valuable unified framework for understanding *all* human behavior” fitting for the “broad and unqualified definition” provided earlier by Robbins. The profession seemed to think so too as Becker is attributed with ushering in and accelerating an era of “economic imperialism” where economists utilized a rational choice approach to expand their inquiry into other disciplines’ domains (Lazear 2000).

As economics became a discipline without a shared subject, it emerged as one bound by a shared theory and techniques. The success of Chicago price theory can be attributed to their use of a simple theory with testable predictions and a commitment to empirical falsification (Weyl 2019;

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<sup>1</sup> See <https://www.nobelprize.org/prizes/economic-sciences/1992/becker/facts/>

for particular reference to Becker’s approach see Heckman 2015). Economics became synonymous with explanations of human behavior based on changes in relative prices and constraints (price theory), modeled mathematically to generate formal predictions which were tested using empirical data and statistical techniques (econometrics). This approach was, of course, not without its critics. Behavioralists attacked the core assumptions as unrealistic while experimentalist econometricians attacked it for holding “hard core” propositions which were protected from falsification, such as utility maximization or demand curves sloping downward—any evidence to the contrary was suggestive of misspecification rather than falsehood (Leamer 1983). As the discipline without a shared subject, to what extent is economics today still bound by a shared theory and technique?

We utilize a topic modeling approach to analyze the prevalence of different approaches to inquiry within the discipline of economics. Chicago’s combined emphasis on theory and empirics may have helped drive the expansion of the domain, but our results suggest a noticeable decline in price theory following shortly after the credibility revolution and where the basic econometrics approach reached its peak. Economics as a discipline has become increasingly defined by its common techniques of analysis, rather than its common theory or approach. To the extent Coase is right about the long run competitive features that govern the domain of disciplines, economists may be forced back to their original discipline’s domain—what Coase (1978: 206) believed to be “the normal binding force of a scholarly profession, its subject matter”—or become subsumed as a sub-discipline of statistics.

## 2 Data and Methods

In order to trace the different approaches and techniques utilized in economics, we first must be able to identify and distinguish between them. We employ a machine learning topic model to identify the key words—called topic words—to define each approach. The prevalence of these topic words is then traced through the top five economic journals as representative of the mainstream of the discipline. We are primarily interested in identifying and comparing the main approach to economics, price theory, and the main technique, econometrics. However, we identify and analyze three additional approaches for robustness purposes. The additional approaches include graduate microeconomics, mathematical economics, and Austrian economics. Price

theory, Austrian, and microeconomic approaches constitute a “common theory or approach” while econometrics and mathematical economics capture “common techniques of analysis.”

Our topic model approach features a variety of benefits over manual analysis methods (e.g. Hamermesh 2013) and comparative keyword analysis methods (e.g. Seale et al. 2006, Seale et al. 2010). First, we generate our topic words using textbooks representative of each approach as our training data. This allows us to identify words associated with the methods of applying an approach rather than what is common across applied examples and yields not only important substantive words, but also significant methodological terms. This is a notable improvement from other attempts to apply text analysis to the economics discipline. Kosnik (2015), for example, employs text analysis using the key words found in JEL-codes. The JEL-code key words identify and group like-topics, but they do not identify the common approach to these topics. They can tell us that “Labor” is a more popular research topic than “Economic History” but cannot tell us what constitutes a standard labor or economic history article.

Second, whereas manual classification methods are extremely resource-intensive and cannot cover an entire literature, our automated method allows us to analyze a broader perspective of the discipline. Hamermesh (2013), for example, finds a similar decline in theory and rise in empirical analysis from the 1960s to 2010s, yet because he had to manually identify the approaches in each paper, he was only able to look at the articles published in one year per decade for a total of 748 articles. In contrast, our approach allows us to analyze the content of 28,462 individual articles.

Finally, researcher bias is minimized in our design because topic words are automatically generated by the machine learning topic modeling approach. Our topic words for each approach align well with our prior beliefs of what constitutes and is distinct about the various approaches, but they are not generated by our priors.

## 2.1 Topic Modeling

Topic modeling is a form of unsupervised machine learning in which an algorithm generates groupings of words that have a high probability of occurring together within a given set of documents. If texts are structured so that like-words appear together frequently and such coincidences define a text’s meaning, then the model’s word groupings reflect the inner structure of a set of documents (Blei 2012). Topic modeling is considered a form of unsupervised machine

learning because the only inputs required are a set of documents and an integer corresponding to the number of groups desired to be identified.

Originating in computer science about 15 years ago, topic modeling is only a recent addition to the social scientist's toolbox (Meeks and Weingart, 2012; see Gentzkow et al. 2019 for an introduction to text as data for economists). Wehrheim (2019) is the first to employ topic modeling techniques in the economic literature. By identifying the key topics in the *Journal of Economic History*, Wehrheim dually illustrates the relevance and technical foundations of the approach. Wehrheim concludes that “topic models are the right tool for research on publication trends” (2019: 85).

There are a variety of topic modeling algorithms built upon different assumptions about the set of input documents (Steyvers and Griffiths 2007). We use the literature standard Latent Dirichlet Allocation (LDA), which has been called the “state of the art in topic modeling” (Steyvers and Griffiths 2007). To estimate the posterior distribution we use Gibbs sampling, again the literature standard (Griffiths and Steyvers, 2004).

Multiple applications for topic modeling are publicly available. We use the Machine Learning for Language Toolkit (MALLET) developed by Andrew McCallum (2002).<sup>2</sup> MALLET is a versatile tool that allows for numerous topic modeling configurations. We run individual LDA topic models for each of our five approaches with group sizes of 1, 3, 5, 10, 15, and 20, generating 30 distinct topic word groupings. Each topic model is run using 2000 iterations and contains 20 words per topic grouping. Following Wehrheim (2019), we allow for hyperparameter optimization (allowing for dynamic topic and group weights) after every iteration.

In most topic modeling applications, it is necessary to manually classify each topic group based upon the model-generated words. However, because we aim to capture the topic words of each approach as a whole (rather specific approaches' topics) we use the output when group size is one as our primary group for analysis. Despite our preference for the singular group output, our results remain substantively the same when using a variety of different group sizes.<sup>3</sup>

In our research design the topic model's topic word outputs are themselves a final product. Thus, we seek to maximize the value of each word. Schofield et al. (2017) demonstrate that

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<sup>2</sup> For more information on MALLET, see <http://mallet.cs.umass.edu/>.

<sup>3</sup> As an example, Figure A.5 shows Price Theory follows almost-identical trends whether we use group sizes of 1 or 20.

stemming training sets before topic modeling yields less consistent topic word assignments. Instead, we singularize our training set (e.g. transforming “goods” into “good”) so that each topic word is substantively unique. Finally, the MALLET-produced topic words are stemmed in order to facilitate comparison with our journal data.

Our method of analysis requires two types of textual input: a training set and longitudinal text corpus. The training set constitutes the input for our topic model while the text corpus is used to trace the over-time variation in topic words.

The ideal training set for our analysis encapsulates the entirety of each approach and its methods of analysis while remaining insulated from spurious application-specific content material. Textbooks, as the foundation of each approach’s knowledge, encapsulate the essence of each approach in this manner. Thus, we construct our training set by selecting the seminal textbooks of each approach. In total, this training set incorporates 24 digitized textbooks. For a complete breakdown of the training set, see Table A.1. We construct five groupings (called approaches) of twenty topic words each. While it is impossible to capture the entirety of an economic approach in twenty topic words, we believe that our topic words trace the overall method of each approach.

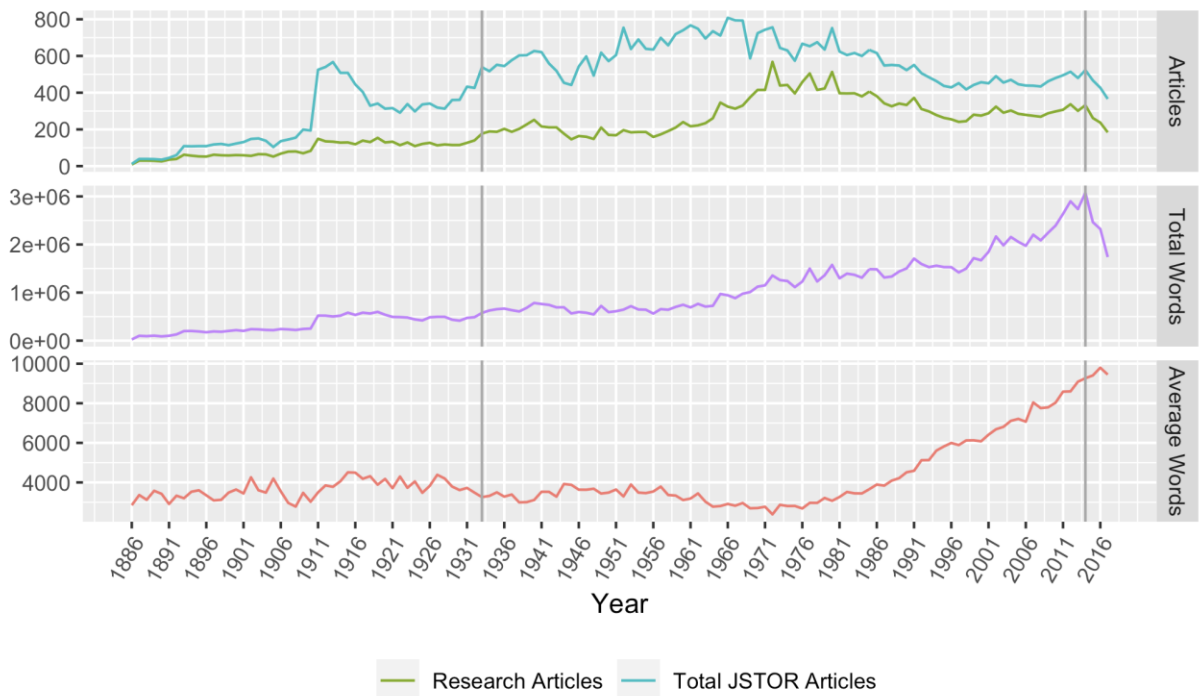
## 2.2 The Top Five

We use the articles published in the so-called top five economics journals as our text corpus to be representative of the mainstream of the profession. Scholars have recently formed a consensus on the makeup of the top five. Based on ranking processes, Pieters and Baumgartner (2002), Card and DellaVinga (2013), Hamermesh (2013), Heckman and Moktan (2017) and Bornmann et al. (2017) conclude that the top five journals are: *American Economic Review* (AER), *Econometrica* (ECMA), *Journal of Political Economy* (JPE), *Quarterly Journal of Economics* (QJE), and *Review of Economic Studies* (RESTUD). Wei (2018) and Hamermesh (2013) use this conception of the top five in their bibliometrics analyses. Other studies of publication trends will limit their selection of journals based on different criteria. For example, Sutter and Pjesky (2007) attempt to identify the level of economics publications that do not utilize math and as such exclude journals with explicit math focus. Since our goal is to identify the trend in the mainstream of the profession, we include all top 5 journals even though there is likely to be a heavier econometrics focus in *Econometrica* than say JPE.

Our text corpus data was gathered from JSTOR’s Data for Research (DFR).<sup>4</sup> The data is provided at the article level and includes a count of each word in an article (i.e. an n-gram format). We include only “research articles” as classified by JSTOR and eliminate book reviews, front matter, and other unrelated materials. Figure 1 illustrates the number of research articles in our dataset per year. Our data begins with the first edition of each journal and runs through at least 2014 (see Table A.2 for complete coverage information). In total, our data constitutes 28,462 individual articles containing 124,403,287 words. This is approximately 212 times the quantity of text in Tolstoy’s *War and Peace*.

**Figure 1:**

### Journal Article Data Descriptive Statistics



Note: Grey lines indicate beginning (1933) and end (2014) of our complete data set.

We pre-process this data in two steps. First, we remove any n-gram that does not contain standard English characters from A to Z. Second, we stem the n-grams using the standard Porter stemming algorithm. Stemming allows us to capture a wider variety of the uses of each topic word.

<sup>4</sup> <https://www.jstor.org/dfir/>



Copies of the resulting data are aggregated and stored at the article and yearly levels for each individual journal.

Finally, as a means interpreting our analysis, we compare our main results to the works of notable scholars within our identified approaches to economics, including Gary Becker, Steven Levitt, Peter Leeson, Raj Chetty, and Josh Angrist. We collect the top 20 article publications by number of Google Scholar citations for each author.<sup>5</sup> See Table A.5 for a complete listing of each author’s top 20 articles. These texts are pre-processed in a similar fashion to our JSTOR data with the addition that we remove JSTOR’s list of stop words.<sup>6</sup>

With the topic words and journal text corpus complete, we analyze the frequencies of topic word groupings across journals and time. Our primary measure analyzes topic word trends at the article level. To construct this measure, we first calculate the percentage of each article’s total word count that falls into a distinct topic word approach. We then average these percentages within each year. Another potential approach would be to simply calculate a topic word fraction within each year. We prefer the article-level approach to a year-level approach because it minimizes the impact of outlier articles with very high or low counts of topic words and outliers related to article length. However, in Figure A.3 we demonstrate that the article and year-level analyses follow almost-identical trends.

### 3 The Decline of Price Theory

The training set for our Price Theory approach incorporates key price theory textbooks from Chicago-affiliated scholars. The topic word results highlight what one might first think defines “price theory”, including terms such as “price”, “cost”, “marginal”, “demand”, “supply”, “quantity”, and “utility”. The full list of the 20 price theory topic words analyzed are listed below Figure 2 in their un-stemmed form.

Price theoretic language rises from an average of 3% of all words in our dataset in 1886 to approximately 5.5% in 1940 where it remains nearly constant for five decades. The average percentage of price theory words declined steadily after 1980, ending around 3.5%. Not surprisingly, *Econometrica* sees a steeper and earlier decline in price theoretic language than its

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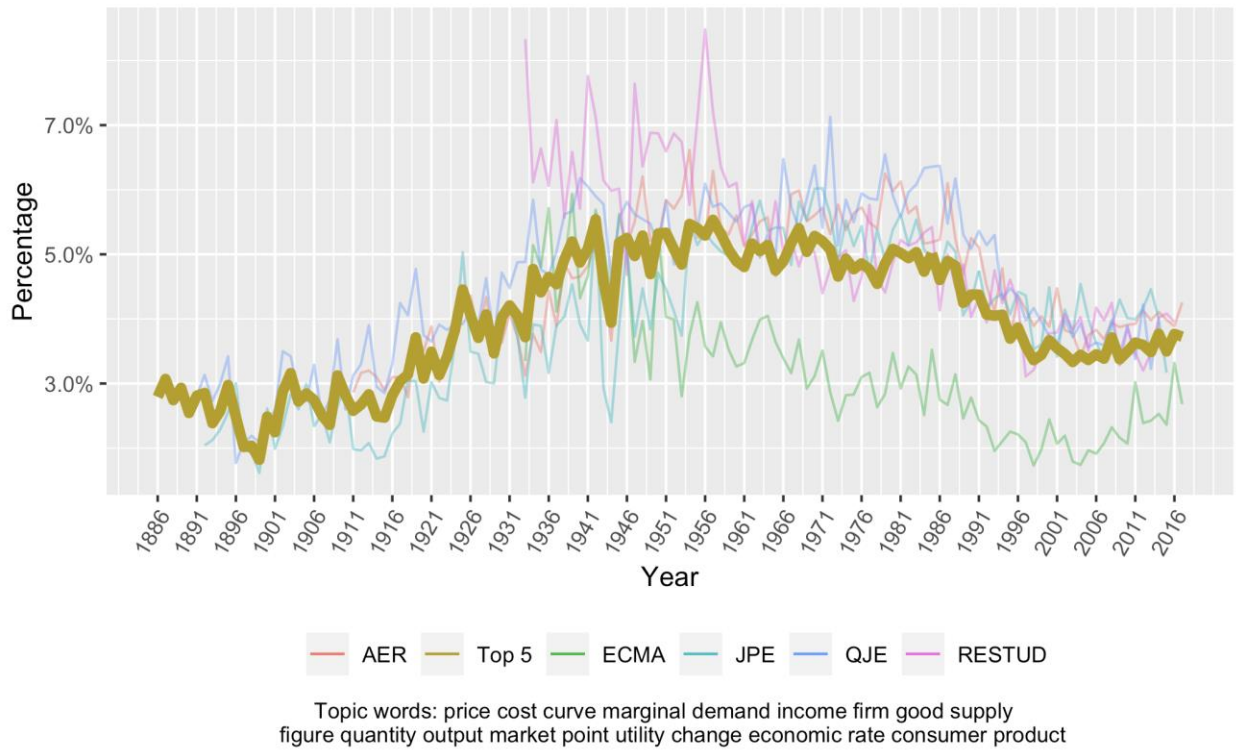
<sup>5</sup> Of the five, Leeson is the only author without a Google Scholar page. To identify his topic 20 cited articles, we individually identify the citation count of each of Leeson’s publications.

<sup>6</sup> Refer to <https://www.jstor.org/df/about/technical-specifications> for a complete listing on stop words removed.

peers. Interestingly, by the time Becker was awarded the Nobel Prize in 1992 for his wide-ranging application of price theory, price theory in the profession was nearing its lowest point in sixty years.

**Figure 2:**

Price Theory: Average Topic Word Percentage per Article



### 3.1 The Decline of Formal Theory

One possibility is that the above decline is not actually a decline in price theoretic methods but simply a result of the transition to more formal and less verbal language. Price and constraint-centric explanations of human behavior may be equally as prominent today as ever before but are now discussed in their equivalent mathematical language. To account for this possibility, we utilize the prominence of topic words associated with mathematical economics textbooks and graduate microeconomic textbooks. The topic words for microeconomics are similar to price theory but with greater emphasis on what likely comes from game theory, with microeconomic topic words including “game”, “player”, and “strategy”. It also includes more math related words, such as “function”, “set”, “condition”, and “equilibrium”. The microeconomics topic words also include

the core price theory terms “price”, “cost”, “demand”, “firm”, “consumer”, “good”, and “utility”. Our mathematical economics topic words feature technical terms used often in formal neoclassical models, such as “function”, “theorem”, “equation”, “vector”, “linear”, and “derivative,” but does not contain any price theory content terms.

**Figure 3:**

Average Topic Word Percentage per Article

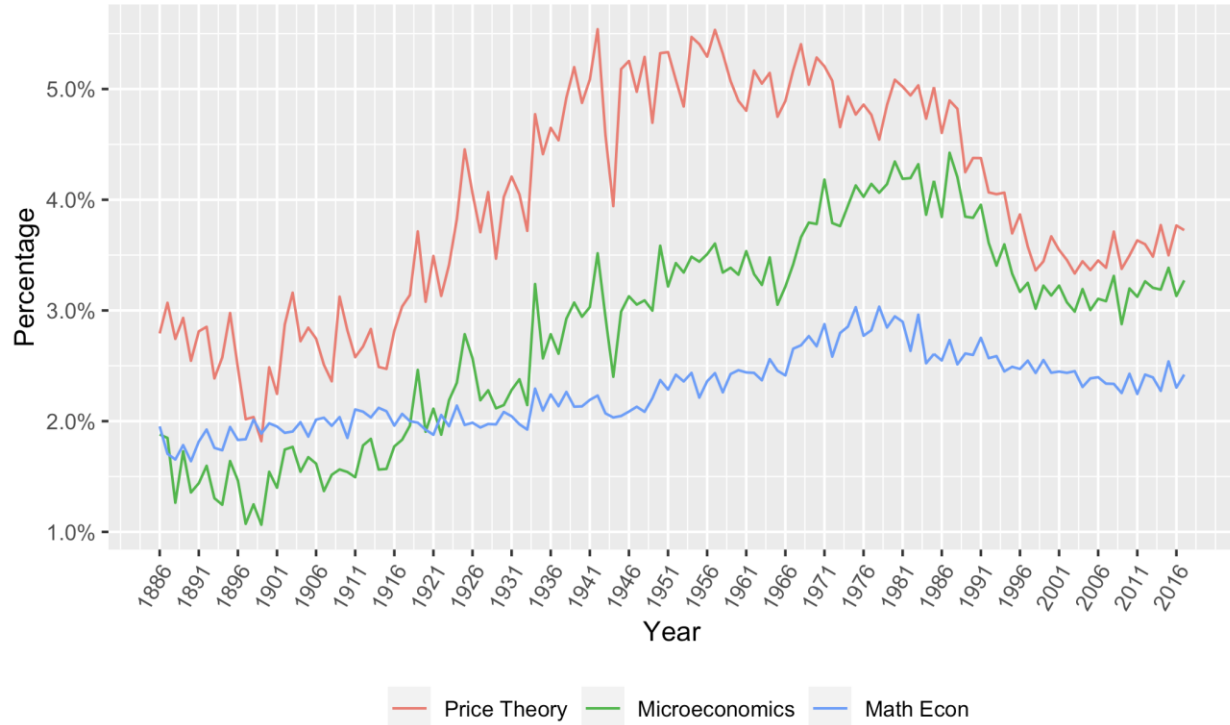


Figure 3 traces the trend in price theory, mathematical economics, and microeconomics topic words. Microeconomics follows the general trend of price theory but has a steeper growth rate post-1966. Mathematical economics grows minimally over time and peaks in the 1970s. These simultaneous positive growth rates indicate that mathematical economics and microeconomics were likely complements to price theoretic analysis rather than substitutes. All three, however, decline simultaneously beginning in the 1980s, making it unlikely that the decline in price theory evidenced in Figure 2 can be attributed to being displaced by the more formalized version.

### 3.2 Rational Choice and the Austrians

In order to further illustrate the decline in price theory, we consider the case of the Austrians.

Becker was not the first to argue that economics is defined by its theoretical approach and that this approach can be applied to understand any human behavior. Austrian economists also defined economics in terms of rational choice theory, believing that economics could be applied to all human action. Ludwig von Mises’ magnum opus *Human Action* is titled as such because he believed that economics applied to the full domain of human behavior, rather than just actions dealing with money, exchange, or business. In Mises’ (1949: 491) words, “Economics is not about goods and services; it is about human choice and action”. And this “Action is, by definition, always rational” (Mises 1960: 35). As Peter Leeson (2012: 189), a scholar with affiliation and affinity for both approaches, notes “The Austrian approach to economic science is, in my view, the same one Becker (1976, 1993) articulates. It views economics as a method rather than a subject matter.”

Given Leeson’s equivalence of the Austrian and Chicago approach to economics, it is not surprising that our Austrian and Price Theory topic words share many of the same terms. This can be seen visibly in Figure 4 which illustrates the near parallel trends of Chicago Price Theory and Austrian topic words across the top five journals.

**Figure 4:**

**Price Theory and Austrian Approaches:  
Average Topic Word Percentage per Article**



Yet, despite their similarities, there are important differences between the two approaches. One noticeable difference arises from the importance and emphasis on formal mathematical theory and empirical verification. Chicago Price Theory emphasizes the role of formal mathematical theory and empirical analysis. In contrast, Mises (1949: 348) writes that “Statistics is a method for the presentation of historical facts concerning prices and other relevant data of human action. It is not economics and cannot produce economic theorems and theories.” (1949: 348). Austrians distinguish between theory and history. The importance of theory is to be able to interpret history, but historical facts (presented as statistics) can never negate theory (economics). As Mises (1996: 155) notes, “There is economics and there is economic history. The two must never be confused.”

The different perspectives on the importance of empirical work is perhaps a noticeable difference between the two approaches, but it’s not a fundamental one—there’s nothing wrong with doing history, it’s just not economics. After all, none of our Chicago price theory topic words include ones which would signify empirics as a central theme of the approach. The more fundamental difference between the Chicago and Austrian approaches are their focus on comparative statics vs. process orientated analysis, respectively (Boettke 1996; see Boettke and Candela 2017). As Mises (1978: 30) puts it, “What distinguishes the Austrian School and will lend it everlasting fame is its doctrine of economic action, in contrast to one of economic equilibrium or nonaction.” In contrast to the equilibrium emphasis in Chicago’s price theory, the Austrian approach highlights the ever-evolving nature of an economy, preferring to highlight entrepreneurs and individual actions rather than aggregate movements.

This difference between the two approaches can be identified when we look to our broader topic words groups (e.g. n=3, 5, 10, 20). At the broader level, the terms "entrepreneur(ship)", "order", "process", and "system" can be found in 7 distinct Austrian topics. These words do not appear in the topics generated for Chicago other than "system" appearing once at the broadest (n=20) level. "Exchange" appears in 11 Austrian topics but only once in Price Theory topics.

Thus, to further suggest a real decline in price theory, we examine a broader grouping of Austrian and Price Theory topic words. The Austrian’s market process approach still constitutes a rational choice perspective, but it is one that is significantly more challenging to formalize. A rise in price theory relative to Austrian may indicate that part of the success of price theory stems from the accompanied acceptance of formalism in the profession instead of the acceptance of the rational choice (maximization) assumption. In Figure 5, Austrian and price theory (Chicago) are almost

identical in prominence until the 1930's. In the late 1930's, the Austrian approach saw a steep and consistent decline while Chicago maintained its steady rate until its decline in the 1980s. To the extent that the more nuanced Austrian topic words represent verbal rational choice price theory whereas Chicago represents more formal price theory, the unique aspect of price theory may be declining even faster than our initial results suggest.

**Figure 5:**

Price Theory and Austrian: Average Topic Word Percentage per Article



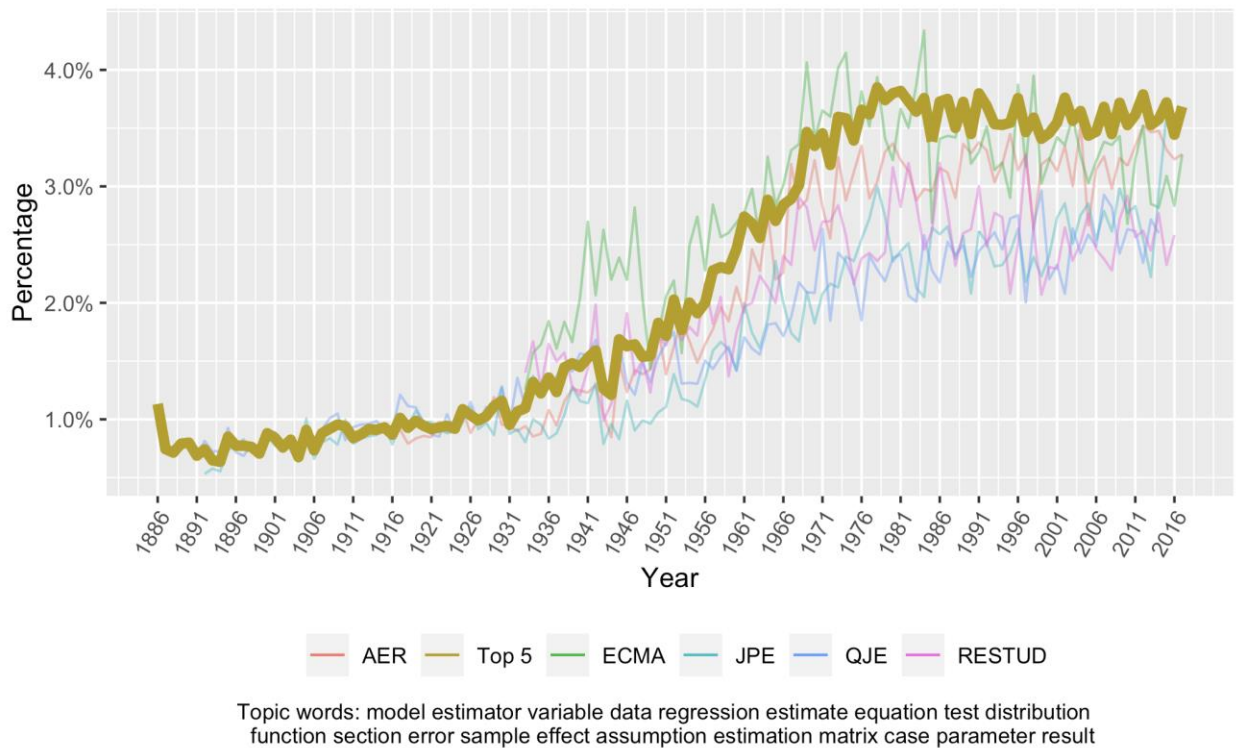
The timing of this divergence also aligns with our historical expectations. The initial parallel trend mimics Mises (1981: 214) belief that by 1933 there were little substantive differences between the Austrian and neoclassical perspectives. As Boettke (1997: 14) notes, “[Mises] viewed Austrian economics as squarely within the mainstream of neoclassical thought”. Yet following the Great Depression, Keynesian interventionism, and WWII, the “Austrian School of Economics ... has increasingly claimed a unique position within the scientific community of economists” only really noticeable with the following generations (Boettke 2002: 263-264)

### 3.3 The Rise of Econometrics

The primary shared technique of economics has been the application of econometrics. Figure 6 depicts the average percentage of each article’s total word count that are econometric topic words. As a whole, econometric language increases from about 1% of all words in 1886 to approximately 3.5% in 1980. Econometric language remains stable from the 1980s onward. The Top 5 journals vary considerably in their level of econometric language. ECMA and AER average greater than 1% more econometric language than QJE and RESTUD while RESTUD remains in the middle. These results evince the considerable rise econometric analysis.

**Figure 6:**

**Econometrics: Average Topic Word Percentage per Article**

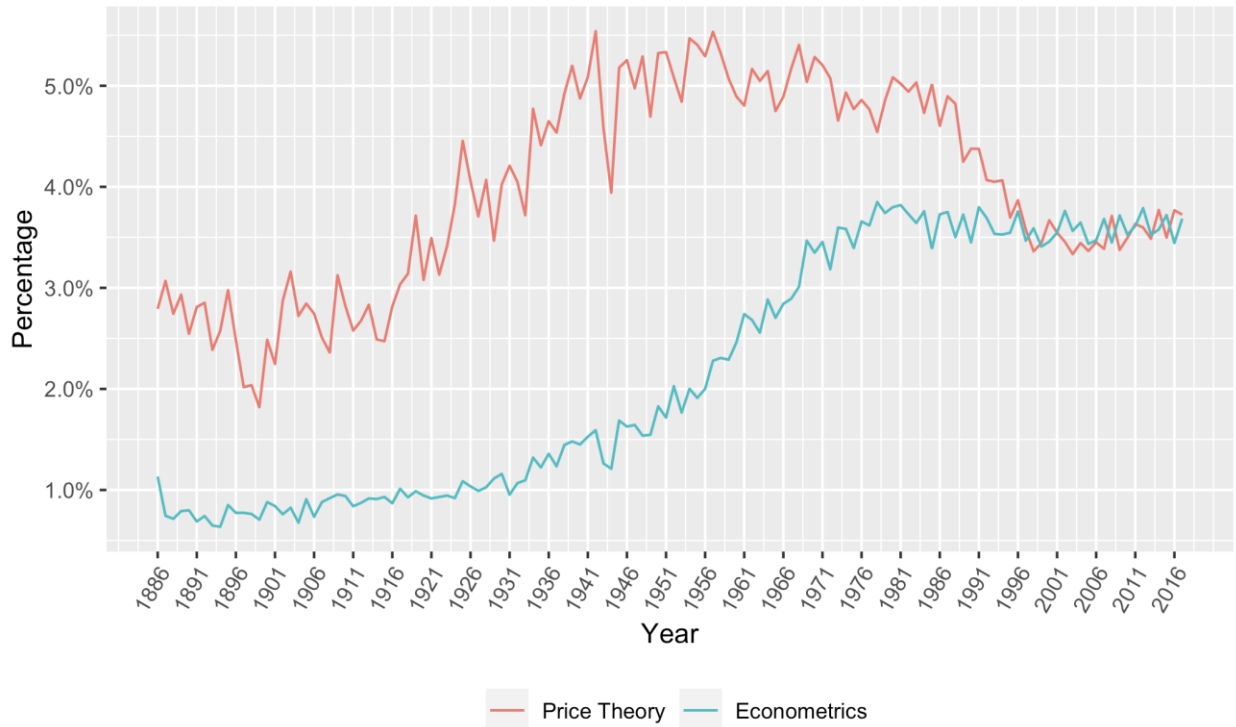


In order to evaluate the extent to which the economics profession has substituted econometric analysis for price theoretic analysis, Figure 7 compares both approaches. In Figure 7, price theoretic and econometric language rise in equal measure, indicating that statistics was initially employed to evaluate economic theory, allowing for the expansion of the economic discipline. However, price theoretic language declines post-1980 without a change in econometric

language. By 2017, Top 5 articles feature approximately equal proportions of price theoretic and econometric language.

**Figure 7:**

Price Theory and Econometrics: Average Topic Word Percentage per Article

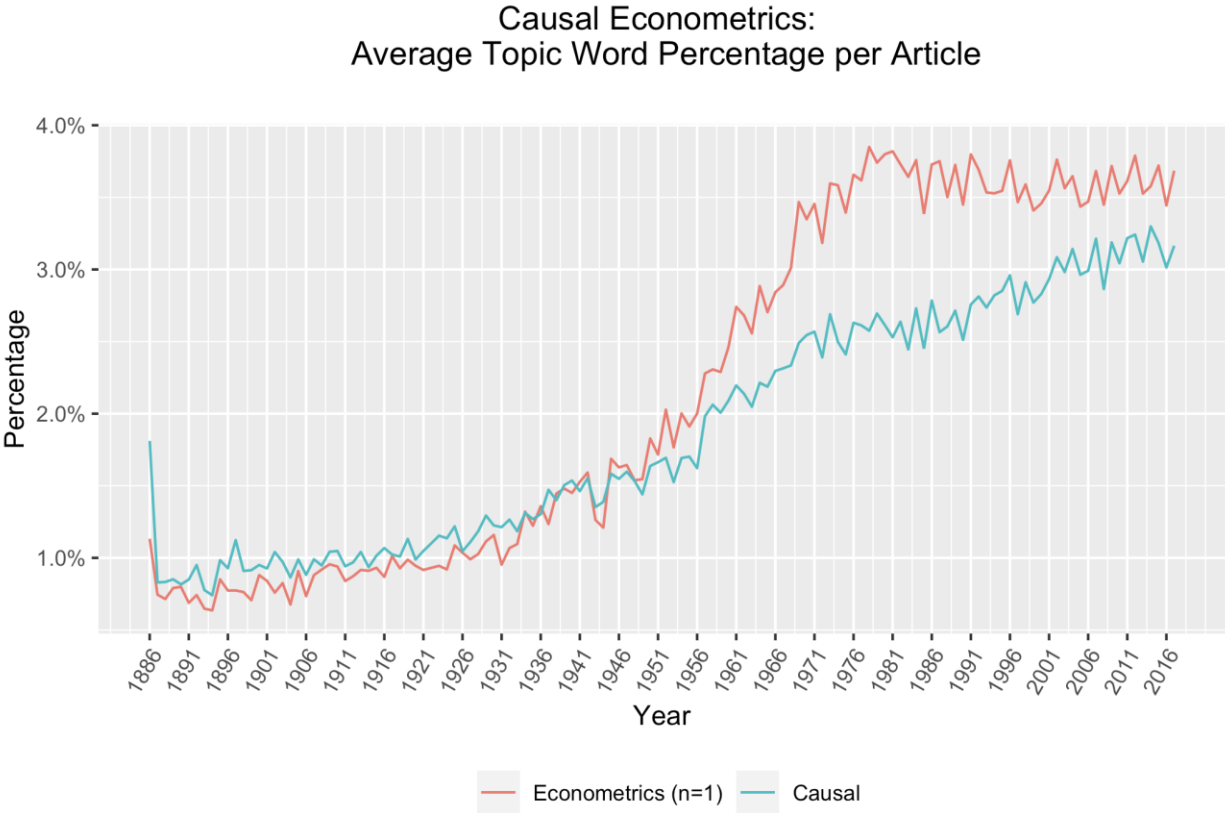


The steady econometrics level at 3.5% post 1980 may surprise the reader, given anecdotal evidence of the continued rise of econometrics or Hamermesh’s (2013) evidence mentioned earlier. We contextualize these findings in relation to what scholars have called the “credibility revolution” stemming from Edward Leamer’s famous call to take the ‘con’ out of econometrics (Angrist and Pischke 2010). Before the credibility revolution, use of basic statistical methods—such as OLS models—was widely accepted. However, around the 1980s, basic OLS models became much less acceptable as a primary means of defending a theory. Our econometric topic words largely capture the pre-credibility revolution universe of econometric methods, as indicated by the basic words like “regression”, “variable”, “error” and “model.” Modern econometric methods focus instead on causal identification and use new tools and methods that our initial topic word group does not capture.



In order to capture this post-credibility revolution in addition to econometrics, we manually identify a causal identification topic word grouping from our topic model output. This causal identification grouping contains words such as: effect treatment estimate estimator matching control covariate sample average causal error difference instrument and case. Many of these topic words relate to various causal strategies, such as instrumental variable, difference in difference, matching models, and treatment effects. Figure 8 compares these causal econometric key words to our standard econometric key words. Figure 8 demonstrates that, rather than leveling off like the broader econometrics approach, causal econometric topic words continue to increase post-1980. These results indicate that econometrics has maintained a positive growth rate after the 1980s, albeit using different tools.

**Figure 8:**



### 3.4 Is 3.5% A Lot?

To provide context to the previous sections, we analyze scholars associated with these various approaches. Gary Becker is chosen as the representative of price theory. Angrist is selected as representative of more econometric—rather than theoretically driven—approach.

In Figures 9 and 10 we contextualize the decline in price theoretic and rise in econometric language with reference to Becker and Angrist’s publications. With the authors’ top 20 most cited journal publications as data, we calculate the fraction of each authors’ language that falls into our price theory and econometric language categories. Approximately 4% of the non-stop word diction in Becker’s top 20 journal publications are price theoretic compared to 1.7% of econometric language. Nearly the reverse holds for Angrist: about 1.5% of Angrist’s language is price theoretic while about 5% of the same language is econometric. We call these values “thresholds”.

**Figure 9:**

**Top 5 Articles with at least Becker's Level of Price Theory and Econometric Language**

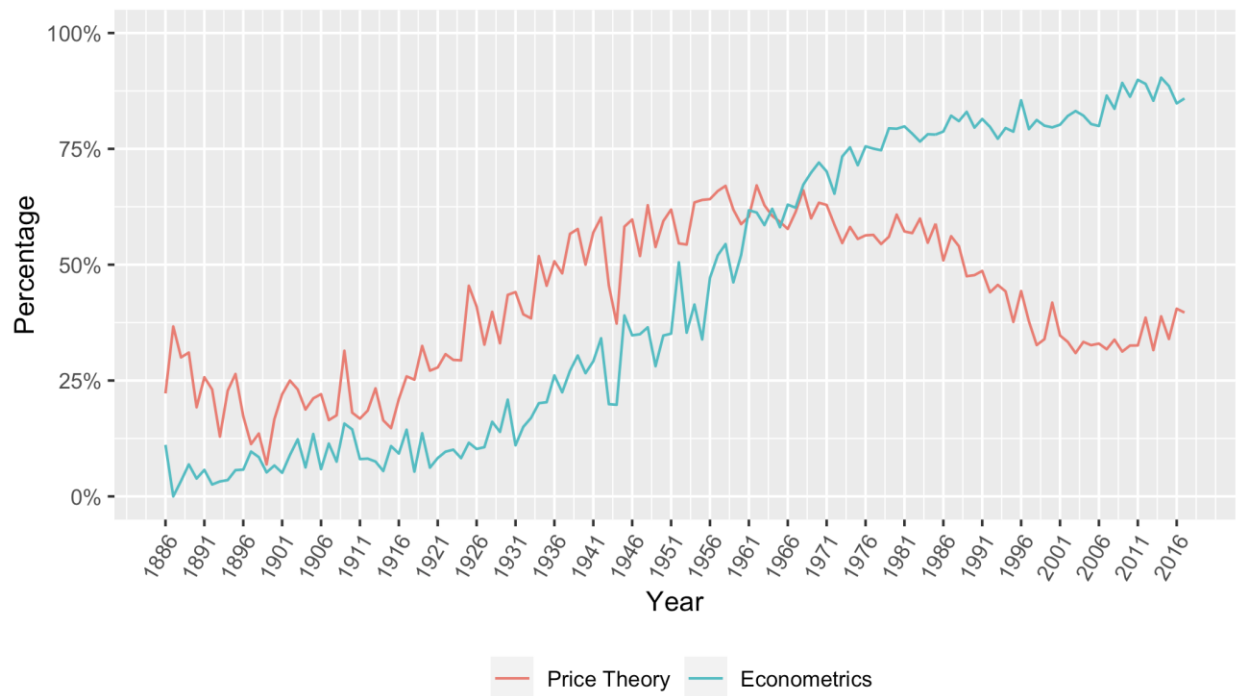
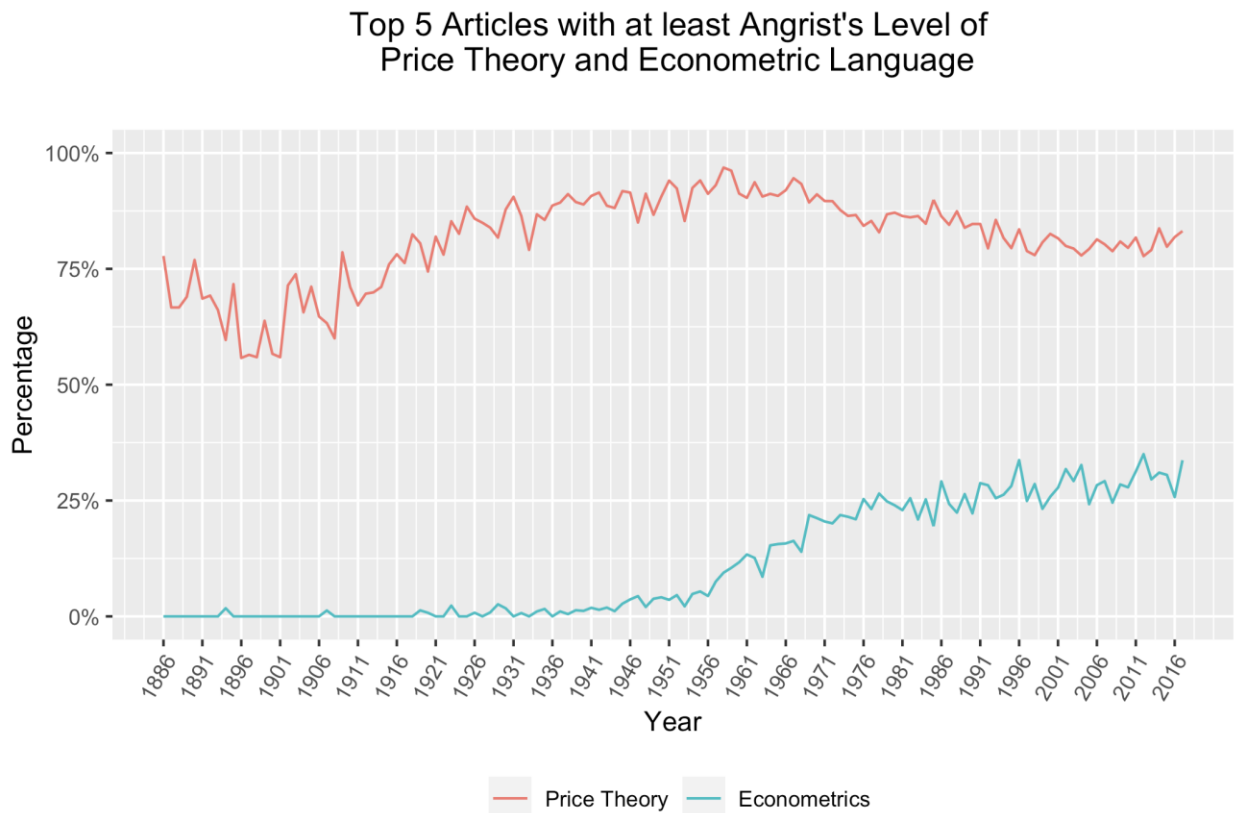


Figure 9 analyses the publication trends in reference to Becker’s work. We find that, between 1886 and 1920, only about 25% of Top 5 articles had as much or more price theoretic

content than Becker. By the mid twentieth century, about 2/3 of all articles contained at least Becker’s level of price theoretic language, hinting at the widespread adoption of price theory during this time. However, the fraction of articles containing at least Becker’s level of price theoretic language declined starting in the 1950’s, ending at around 35%. Conversely, throughout our dataset the fraction of articles with at least Becker’s level of econometric language rises to approximately 85% of all articles. Today, Top 5 articles are significantly more likely to exceed Becker’s level of econometric language than his price theoretic language. Before the decline of price theory, more articles were price theoretic than econometric using Becker’s threshold.

**Figure 10:**

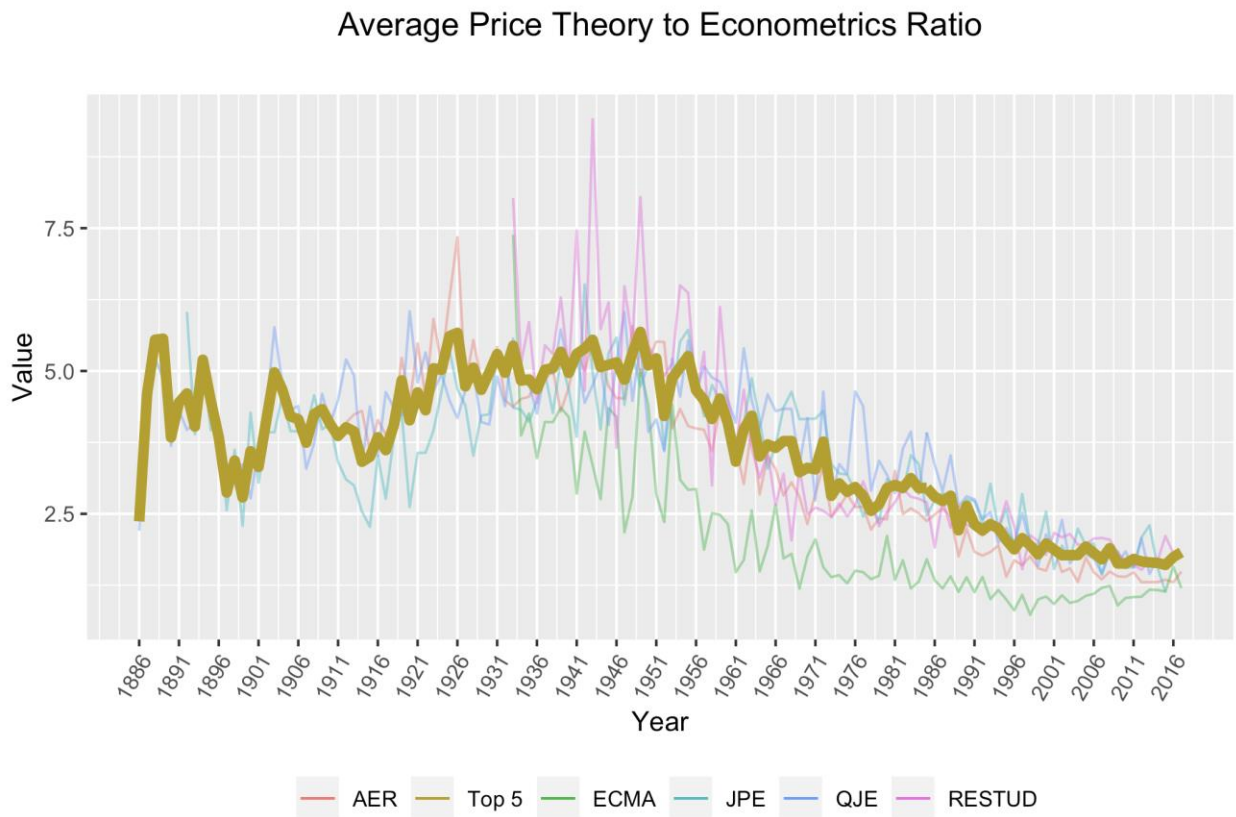


In Figure 10 we contextualize the decline in price theoretic and rise in econometric language with reference to Joshua Angrist’s publications. With Angrist’s top 20 most cited journal publications as data, we calculate the fraction of Angrist’s language that falls into our price theory and econometric language categories. Figure 10 highlights the rise of econometric analysis. At the

start of our data zero articles had more econometric language than Angrist, while today approximately 40% exceed Angrist’s econometrics language. Angrist’s Price Theory language is low throughout our comparison; during the peak of Price Theory, almost 100% of top 5 articles had more econometric language than Angrist.

Another way to provide context is to compare price theory to econometrics. Chicago Price Theory emphasized empirically testing the predictions that stemmed from their price theory, so it’s not surprising that an article should contain both types of language. Figure 11 depicts the ratio of the average percentage of each article’s total word count that are price theoretic topic words to the average percentage of each article’s total word count that are econometric. Setting aside early outlier years driven by the small initial sample size, our ratio increases and remains stable through 1950; price theory is increasingly used to contextualize statistical tests. However, the ratio declines after 1950 by over 100% to about 2 in 2017, indicating that there is less theory per empirical language in the average article and possibly some empirics that are not guided by theory.

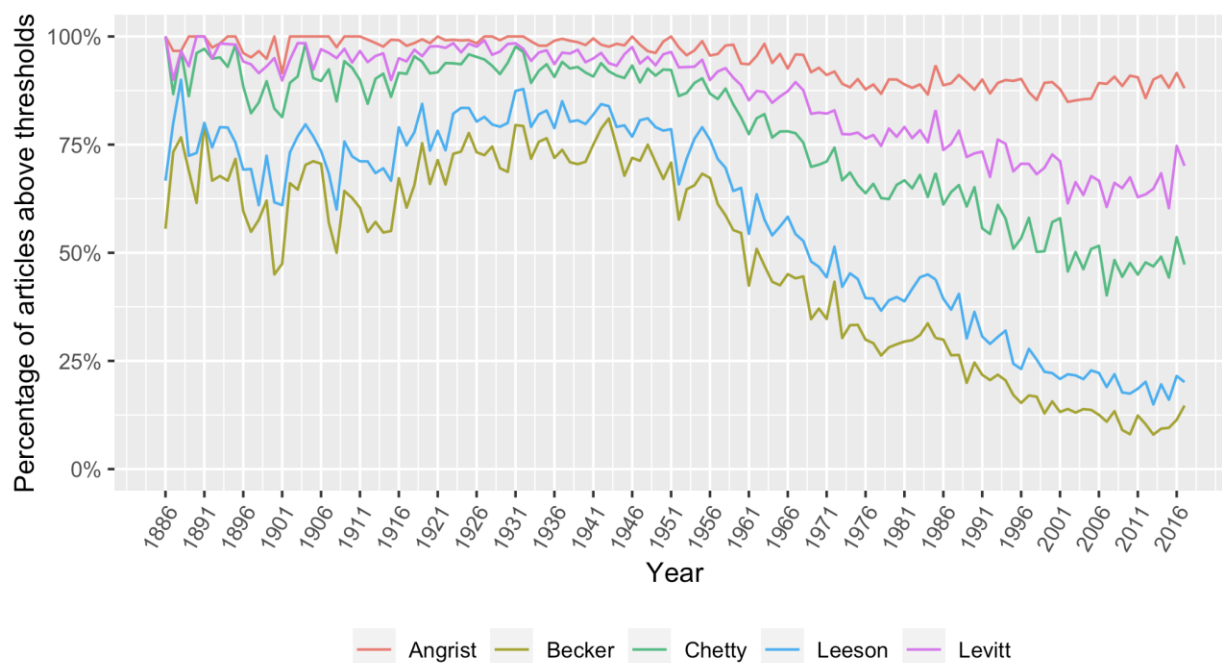
**Figure 11:**



What does the decline in price theory to econometric language ratio mean? Figure 12 contextualizes our findings in relation to easily identifiable scholars affiliated with the different approaches. We calculate the fraction of Top 5 articles whose price theory to econometrics ratios are greater than Gary Becker, Peter Leeson, Steven Levitt, Joshua Angrist, and Raj Chetty's top 20 journal article publications. Levitt's work is similar to Becker's but utilizes econometric tools more frequently. Leeson is a scholar with connections to both Chicago and Austrian perspective and is notable for pushing Becker's (and Mises') perspective to the limit (see Leeson 2017). Chetty has, rightly or wrongly, been associated with the data over theory approach.<sup>7</sup>

**Figure 12:**

**Number of Articles Above Becker, Leeson, and Levitt's Price Theory to Econometrics Ratio**



Thresholds: Becker: 2.3202 Leeson: 1.8162 Levitt: 0.6436 Angrist: 0.2799 Chetty: 0.9778

<sup>7</sup> Our results suggest perhaps wrongly. Despite the VOX piece on Harvard doing away with principles to replace it by big data and being the director of an institute focused on using “big data”, Chetty actually utilizes a similar amount of price theoretic topic words as Becker, he just additionally uses more econometric words. See <https://www.vox.com/the-highlight/2019/5/14/18520783/harvard-economics-chetty>

In parallel with our findings in Figure 11, the price theory to econometrics ratio compared to all five scholars declines. Almost 100% of articles published before 1950 contain more price theoretic to empirical language than Angrist, Levitt, and Chetty's works. Today, almost 90% of articles contain more price theoretic to empirical language than Angrist. Thus, the prominence of price theory has declined in even the most econometric-focused literature.

At the other extreme, econometric language also overtakes price theoretic language by the metric of price theory-heavy authors such as Becker and Leeson. The price theory to econometrics ratios for Becker and Leeson follow similar paths. The number of articles with at least Becker or Leeson's price theory per econometric word ratio declines by approximately 80% from its peak.

## 4 The Short Run and the Long Run

Stigler (1984: 312) suggests that the "imperialistic age" of economics and the "extended application of economic theory" was brought about by its "growing abstractness and generality." According to Stigler, such abstraction was facilitated by an increased use of "mathematical language" which turned economics into a "general analytical machine, the machine of maximizing behavior" and "made the extensions to other bodies of phenomena easy and natural." Stigler concludes that if he's correct, "there will be no reversal of the imperialism."

However, our results indicate that at the same time the economic "analytical machine" expanded to other disciplines, economists began to substitute their reliance on price theory explanations for econometric techniques. In the short run, the economist's comparative advantage in formal modeling techniques and statistics has allowed them to maintain their edge even as the more general theory of rational choice was adapted by other disciplines (e.g. rational choice sociology). Yet, as Coase believes, such an advantage and expansion cannot persist in the long run. Other scholars, in Coase's view, will learn how to use the econometric toolbox and out-compete economists with their discipline specific knowledge. In the long run, only a common subject can unite a discipline. There are, of course, opponents to Coase's competition view. Stigler (1984), for example, argues that, in order to preserve their rents, scholars will erect barriers to entry. But, suppose that Coase is right, that a shared theory or technique as the primary binding force of a discipline is an unstable equilibrium. What does Coase's perspective suggest for the future of the discipline?

There are three plausible long run outcomes if economics were to become defined by a shared subject, technique, or theory, respectively. The first outcome aligns with Coase's traditional long run argument and outlines what may happen if economics comes to be defined by a common a shared technique or shared theory alone. Compared to techniques and theory (which can be easily learned and adopted), Coase believes that deep subject matter is difficult to obtain. Thus, as practitioners in other disciplines adopt advanced econometric techniques, economists would lose their competitive edge. Economics as a discipline, then, may have to revert back to one that studies the social institutions of markets. In the long run, an economist would be someone who studies social institutions that allow for markets to function, regardless of any particular method or technique of inquiry.

The second possible outcome is that economics becomes defined by its techniques of analysis. Economics might morph into a field of applied statistics or data science. In this scenario, an economist would be someone who utilizes advanced statistical techniques and causal identification strategies to inquire about causal relations, regardless of the subject matter or underlying theory. The third option is that economics fully embraces the rational choice perspective as the distinguishing approach to studying human behavior. An economist would then be someone who utilizes price theory to explain behavior through changes in relative prices and constraints, regardless of the subject matter or techniques of empirical testing.

Scenario one is not currently relevant. For decades economic analysis has expanded beyond traditional market analysis and there is seemingly no stopping it now. While it's possible that the profession is still in the short run, a limitation to the domain of economic inquiry hasn't been relevant for decades.<sup>8</sup> What about scenario two? Perhaps more than at any point in the discipline's history, economics has indeed become defined by its techniques of analysis. But if Coase is right about the competitive forces in the academic market, then economists will lose market share as sociologists or historians or epistemologists learn statistics. As Coase suggests, technique alone is "a fragile basis for predicting long-run movement by economists into other social sciences" (Coase 1978: 206). Contemporary economists may hold the competitive edge, but this advantage may not

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<sup>8</sup> The irrelevancy of subject-centric definitions and perspectives in the mainstream of the profession does not equate to it being wrong or that it is not what economists *should* do. Buchanan (1964: 222), for example, suggests that economists "should be 'market economists'" who should "concentrate on market or exchange institutions".

be sustained for long. Under scenarios one and two economics as a discipline would either be forced to limit its domain to market institutions or become a field of applied statistics.

What about scenario three? Coase argues that theory is equally as accessible as techniques; therefore, other disciplines could simply adopt economic theory. Yet, for Beckerians or Misesians, such an outcome isn't a problem. In fact, it is a success. As scholars of other disciplines adopt price theory, they become practitioners of economics, rather than economists becoming practitioners of statistics or other social disciplines. Economists' rents may dissipate, but the economic science as a whole would be applied and practiced as broadly as possible. Simply, the adoption of the economic approach by other disciplines would mean that economics as a science "won." And as Mises (1949: 875, 879) suggests, this is nothing to lament: "Whether we like it or not, it is a fact that economics cannot remain an esoteric branch of knowledge accessible only to small groups of scholars and specialists. Economics deals with society's fundamental problems; it concerns everyone and belongs to all. It is the main and proper study of every citizen."

## 5 Conclusion

If Coase is right about the long run, then perhaps the current trajectory is unsustainable and the boundaries of economics as a discipline remain in question. There is, however, another perspective one could take from our results. The decline in price theory is not something to cause concern, it's simply a return to normal following a meteoric rise and dominance of price theory for nearly five decades. Perhaps the mainstream of the profession has reached a new equilibrium with theory and techniques each accounting for their equal share of the profession's attention—each with a near share of 3.5% (see Figure 13). And yet, for the modern Beckerian or Misesian, the decline in price theory is not simply a reshuffling of the importance of techniques and methods. A decline in price theory *is* a decline in economics. As Leeson (2020: 423) states, "Economic analysis is a *theoretical* approach, not an empirical one. It is a way of thinking, not a way of testing." Or, as he puts it succinctly in the title, "Economics is not statistics (and vice versa)."



**Figure 13:**

**Average Topic Word Percentage per Article**



## Appendix

**Table A.1** – Training Set Data

<b>Approach</b>	<b>Text</b>	<b>Author(s)</b>
Austrian	<i>Human Action</i>	Ludwig von Mises
Austrian	<i>Market Theory and the Price System</i>	Israel Kirzner
Austrian	<i>Man, Economy, and State with Power and Market</i>	Murray Rothbard
Austrian	<i>Principles of Economics</i>	Carl Menger
Price Theory	<i>The Applied Theory of Price</i>	Deirdre McCloskey
Price Theory	<i>Economic Theory</i>	Gary Becker
Price Theory	<i>Theory of Price</i>	George Stigler
Price Theory	<i>Price Theory</i>	Milton Friedman
Price Theory	<i>Price Theory: An Intermediate Text</i>	David Friedman
Microeconomics	<i>A Course in Microeconomic Theory</i>	David Kreps
Microeconomics	<i>Foundations of Economic Analysis</i>	Paul Samuelson
Microeconomics	<i>Advanced Microeconomic Theory</i>	Geoffrey Jehle and Philip Reny
Microeconomics	<i>Microeconomic Analysis</i>	Hal Varian
Microeconomics	<i>Microeconomic Theory</i>	Andreu Mas-Colell, Michael Whinston, and Jerry Green
Econometrics	<i>Microeconomics: Methods and Applications</i>	A. Cameron and Pravin Trivedi
Econometrics	<i>Econometric Analysis of Cross Section and Panel Data</i>	Jeffrey Wooldridge
Econometrics	<i>Mostly Harmless Econometrics: An Empiricist's Companion</i>	Joshua Angrist and Jörn Pischke
Econometrics	<i>Matching, Regression Discontinuity, Difference in Differences, and Beyond</i>	Myoung-Jae Lee
Econometrics	<i>Econometric Analysis</i>	William Greene
Mathematical Economics	<i>A First Course in Optimization Theory</i>	Rangarajan Sundaram
Mathematical Economics	<i>Mathematical Methods and Models for Economists</i>	Angel de la Fuente
Mathematical Economics	<i>Mathematical Optimization and Economic Theory</i>	Michael Intriligator
Mathematical Economics	<i>Fundamental Methods of Mathematical Economics</i>	Kevin Wainwright and Alpha Chiang
Mathematical Economics	<i>Mathematics for Economists</i>	Michael Hoy, John Livernois, Chris McKenna, Ray Rees, and Thanasis Stengos

**Table A.2 – Journal Abbreviations and Data Coverage**

Journal	Abbreviation	Coverage in Data
<i>American Economic Review</i>	AER	1911-2017
<i>Econometrica</i>	ECMA	1933-2017
<i>Journal of Political Economy</i>	JPE	1892-2015
<i>Quarterly Journal of Economics</i>	QJE	1886-2014
<i>Review of Economic Studies</i>	RESTUD	1933-2016

**Table A.3 – Topic Words (n = 1)**

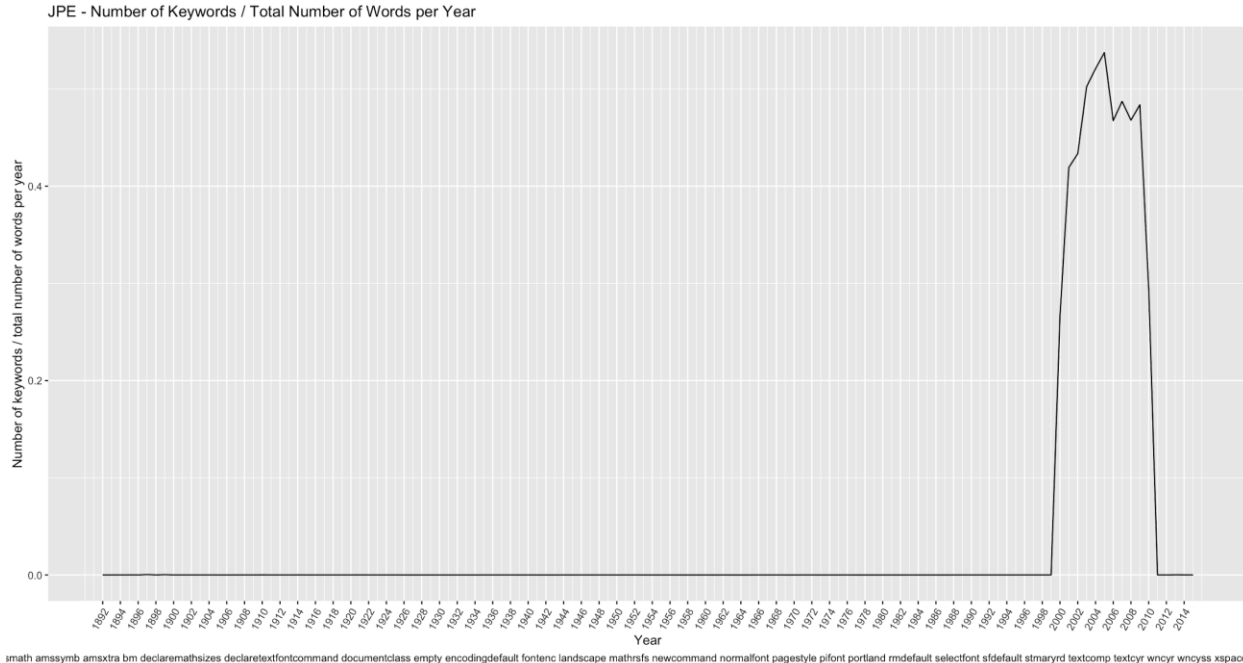
Approach	Topic Words (unstemmed)
Price Theory	price cost curve marginal demand income firm good supply figure quantity output market point utility change economic rate consumer product
Econometrics	model estimator variable data regression estimate equation test distribution function section error sample effect assumption estimation matrix case parameter result
Mathematical Economics	function set point theorem problem solution matrix equation condition system vector case linear show number functions equilibrium sequence time derivative
Microeconomics	function equilibrium price consumer firm set utility good demand player game cost problem condition case strategy choice suppose preference level
Austrian	price good market money production economic man factor action economy consumer exchange capital state product labor rate demand time individual

**Section A.1 – Data Cleaning Details**

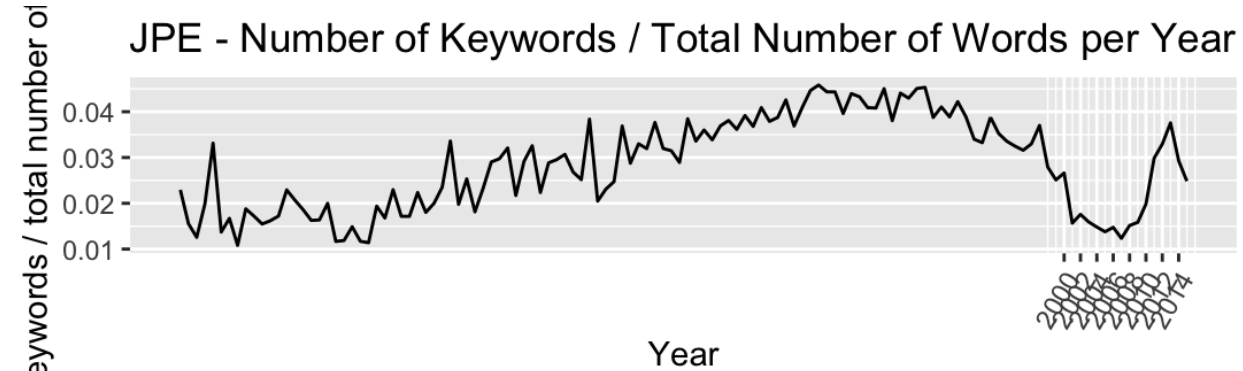
In this section we outline data cleaning details not included in Section 3.

Cleaning JPE JSTOR data:

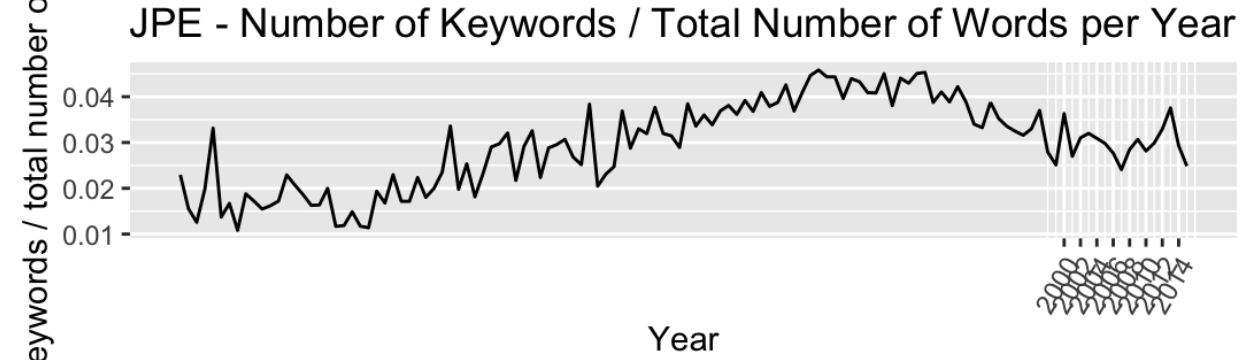
Due to an OCR error in the n-gram data provided by JSTOR, our JPE data between 2000 and 2010 contains erroneous document-related filler terms. Since these terms are not related to the publications themselves, we remove all such instances from our analysis dataset. The words removed are (separated by one space): "usepackage renewcommand cyr document aastex amsbsy amsfonts amsmath amssymb amsxtra bm declaremathsizes declaretextfontcommand documentclass empty encodingdefault fontenc landscape mathrsfs newcommand normalfont pagestyle pifont portland rmdefault selectfont sfdefault stmaryrd textcomp textcyr wncyr wncyss xspace"



This could also be identified in the base level results. Below is an example of before and after the removal of these words for price theory.



production goods utility prices good cost money firm marginal consumer theory set income case economic  
 AFTER



production goods utility prices good cost money firm marginal consumer theory set income case economic

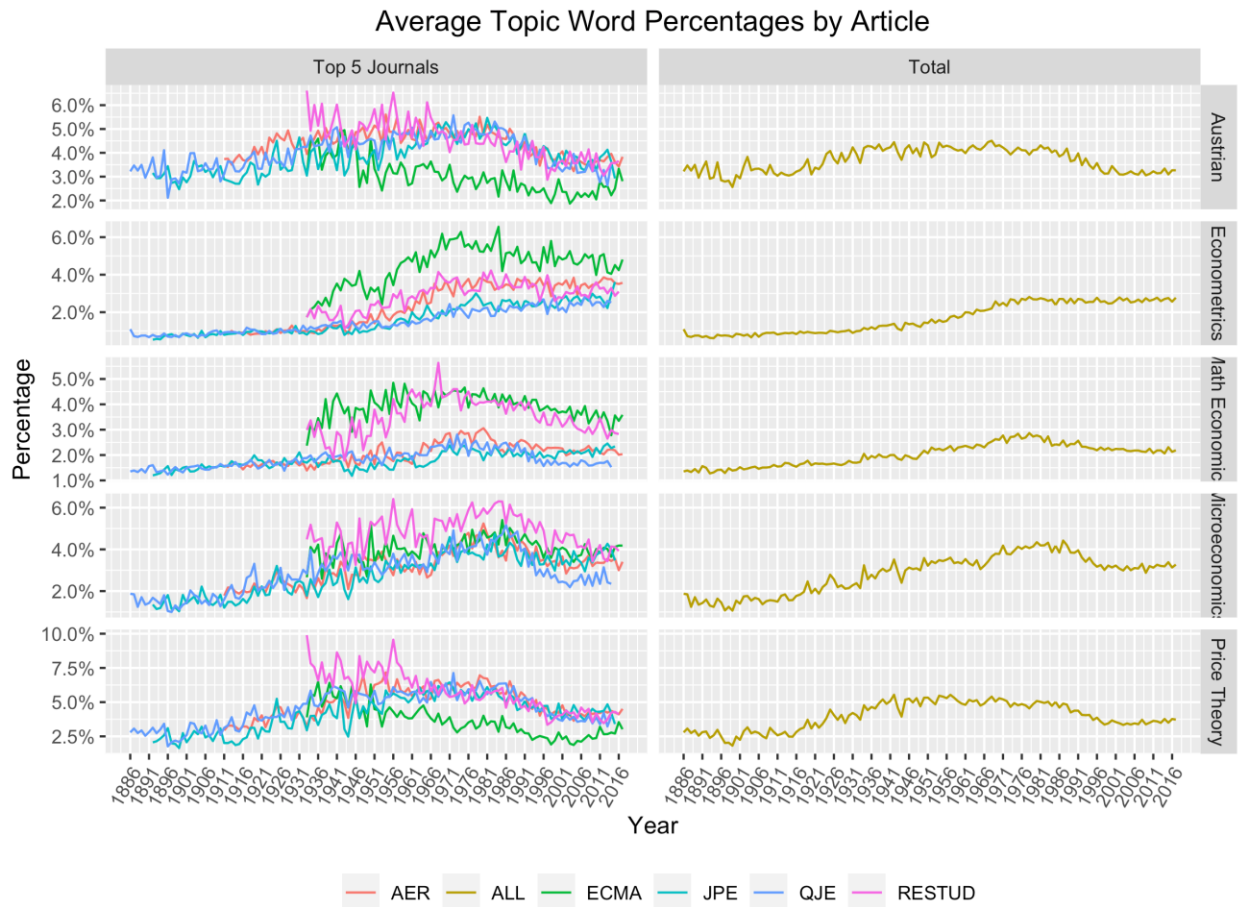
Correcting Singularization Error:

In general, the singularization of our training text does not alter our stemming function’s output. This allows us to stem our singularized topic model outputs for direct comparison with our stemmed Top 5 data. However, the stemming function cannot stem singularized Latin terms. Thus, we manually change our topic model’s output “datum” to “data” in the econometrics approach’s topic word list.

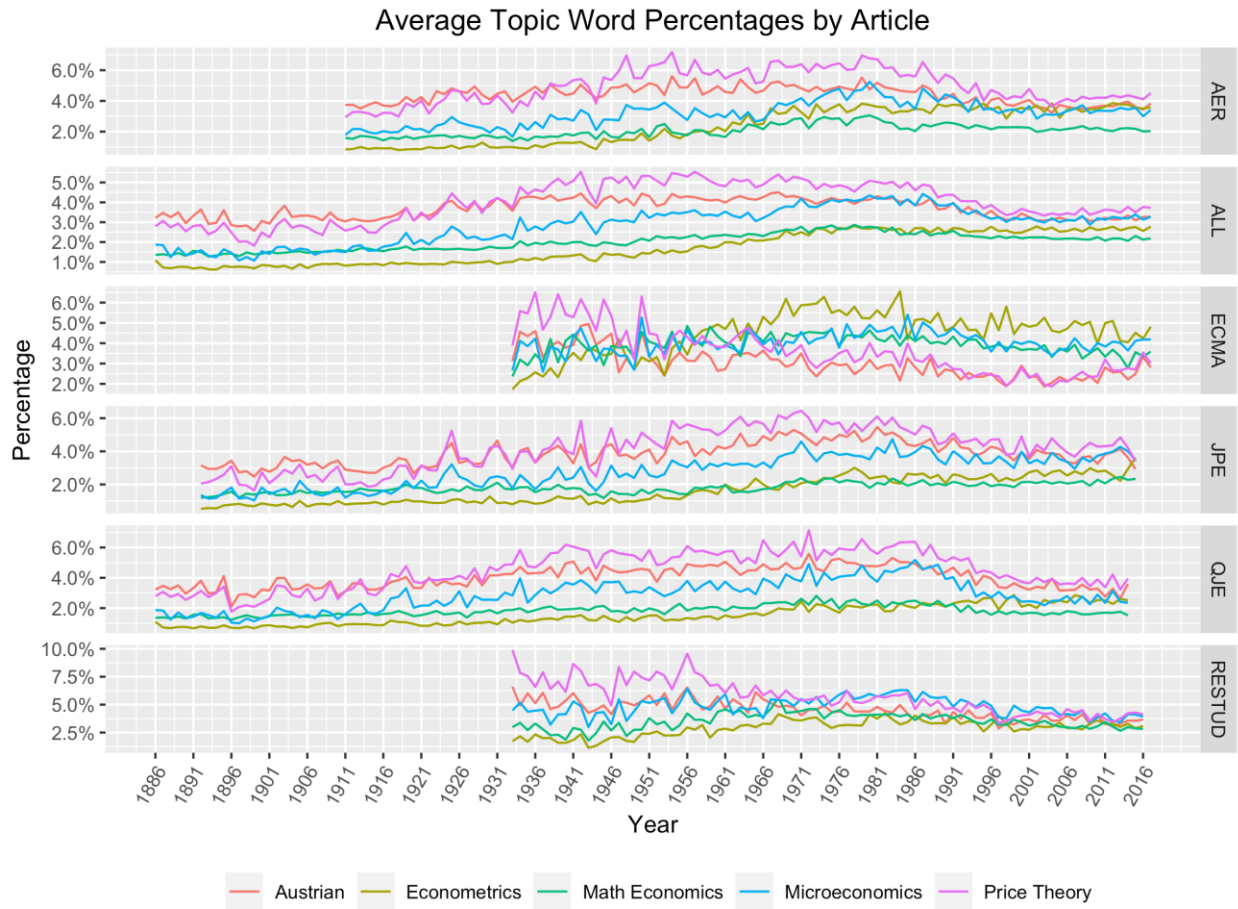
Removing May AER Publications:

In parallel with other bibliometric studies, we exclude AER publications in the month of May. Publications in the AER’s May edition are invited instead of peer reviewed.

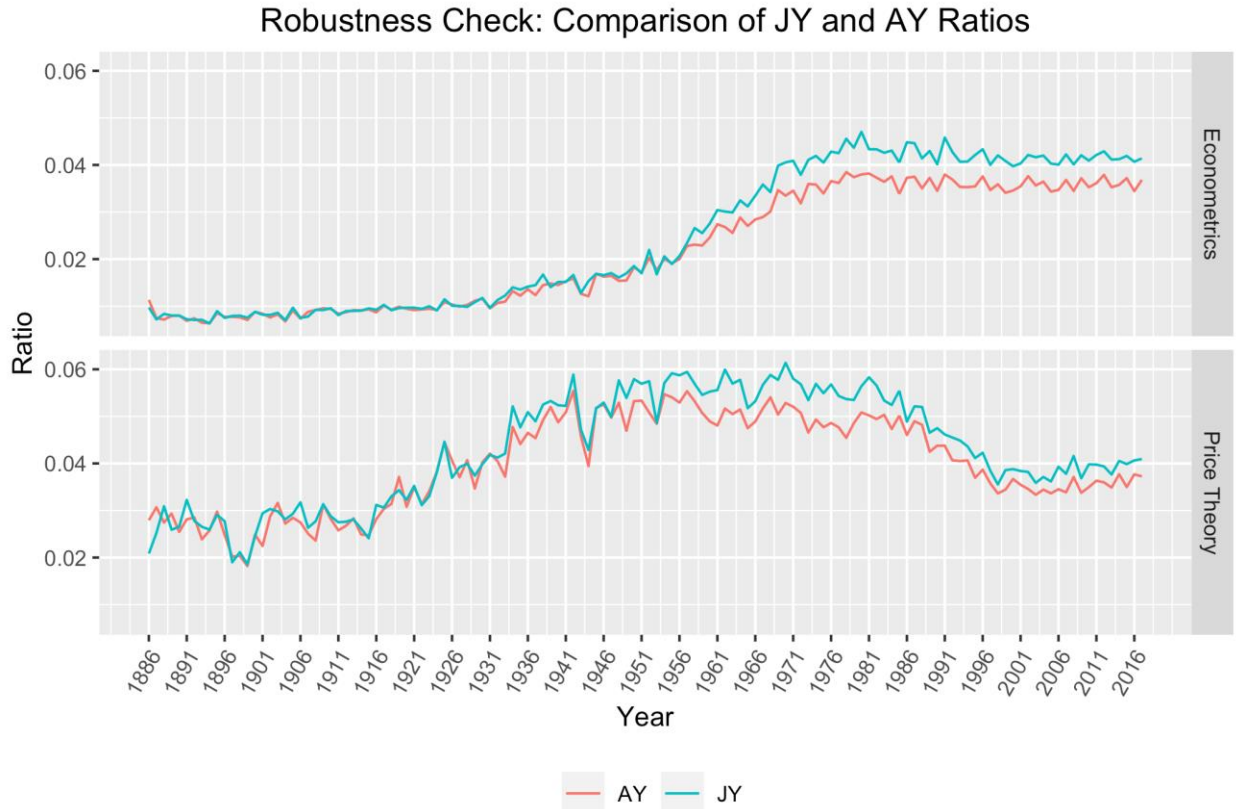
**Figure A.1** – Complete Article-Level Results (Grouped by Approach)



**Figure A.2 – Complete Article-Level Results (Grouped by Journal)**



**Figure A.3** – Article vs. Year-Level Robustness Check



**Table A.4** – Leeson, Becker, Angrist, Chetty, and Levitt’s Top 20 Papers

(Listed in Alphabetical Order)

<b>Author</b>	<b>Title</b>
Gary Becker	<i>A Reformulation of the Economic Theory of Fertility</i>
Gary Becker	<i>A Theory of Competition Among Pressure Groups for Political Influence</i>
Gary Becker	<i>A Theory of Marriage: Part I</i>
Gary Becker	<i>A Theory of Rational Addiction</i>
Gary Becker	<i>A Theory of Social Interactions</i>
Gary Becker	<i>A Theory of the Allocation of Time</i>
Gary Becker	<i>An Economic Analysis of Marital Instability</i>
Gary Becker	<i>An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility</i>
Gary Becker	<i>Child Endowments and the Quantity and Quality of Children</i>
Gary Becker	<i>Crime and Punishment: An Economic Approach</i>
Gary Becker	<i>De Gustibus Non Est Disputandum</i>
Gary Becker	<i>Human Capital and the Rise and Fall of Families</i>

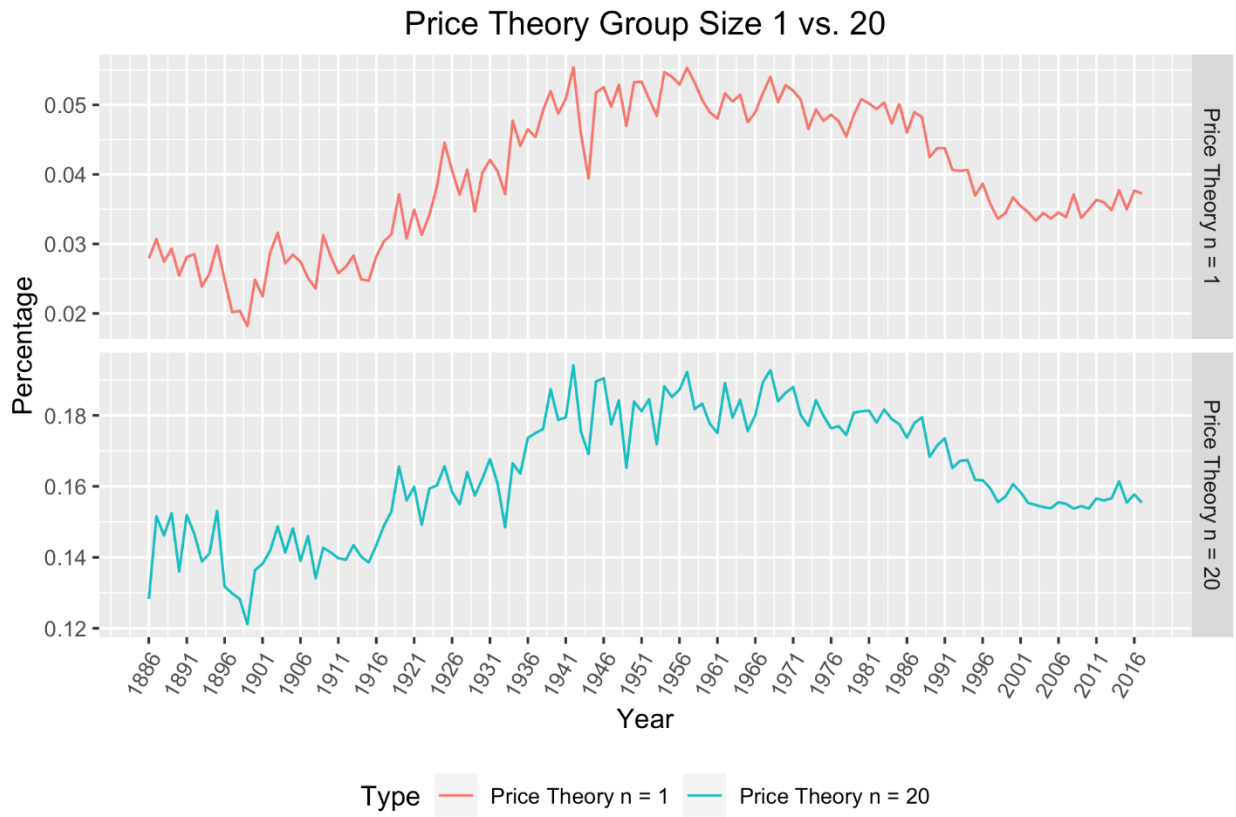
Gary Becker	<i>Human Capital, Fertility, and Economic Growth</i>
Gary Becker	<i>Human Capital, Effort, and the Sexual Division of Labor</i>
Gary Becker	<i>Investment in Human Capital: A Theoretical Analysis</i>
Gary Becker	<i>Irrational Behavior and Economic Theory</i>
Gary Becker	<i>Law Enforcement, Malfeasance, and Compensation of Enforcers</i>
Gary Becker	<i>Market Insurance, Self-Insurance, and Self-Protection</i>
Gary Becker	<i>Nobel Lecture: The Economic Way of Looking at Behavior</i>
Gary Becker	<i>On the Interaction between the Quantity and Quality of Children</i>
Joshua Angrist	<i>Accountability and Flexibility in Public Schools: Evidence from Boston's Charters and Pilots</i>
Joshua Angrist	<i>Children and Their Parents' Labor Supply: Evidence from Exogenous Variation in Family Size</i>
Joshua Angrist	<i>Consequences of Employment Protection? The Case of the Americans with Disabilities Act</i>
Joshua Angrist	<i>Does Compulsory School Attendance Affect Schooling and Earnings?</i>
Joshua Angrist	<i>Does School Integration Generate Peer Effects? Evidence from Boston's Metco Program</i>
Joshua Angrist	<i>Estimating the Labor Market Impact of Voluntary Military Service Using Social Security Data on Military Applicants</i>
Joshua Angrist	<i>Estimation of Limited Dependent Variable Models With Dummy Endogenous Regressors</i>
Joshua Angrist	<i>How Do Sex Ratios Affect Marriage and Labor Markets? Evidence from America's Second Generation</i>
Joshua Angrist	<i>How Large Are Human-Capital Externalities? Evidence from Compulsory Schooling Laws</i>
Joshua Angrist	<i>Identification and Estimation of Local Average Treatment Effects</i>
Joshua Angrist	<i>Identification of Causal Effects Using Instrumental Variables</i>
Joshua Angrist	<i>Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments</i>
Joshua Angrist	<i>Instrumental Variables Estimates of the Effect of Subsidized Training on the Quantiles of Trainee Earnings</i>
Joshua Angrist	<i>Lifetime Earnings and the Vietnam Era Draft Lottery: Evidence from Social Security</i>
Joshua Angrist	<i>New Evidence on Classroom Computers and Pupil Learning</i>
Joshua Angrist	<i>The Credibility Revolution in Empirical Economics: How Better Research Design is Taking the Con out of Econometrics</i>
Joshua Angrist	<i>The Effect of Age at School Entry on Educational Attainment: An Application of Instrumental Variables with Moments from Two Samples</i>
Joshua Angrist	<i>Two-Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity</i>
Joshua Angrist	<i>Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement</i>
Joshua Angrist	<i>Vouchers for Private Schooling in Colombia: Evidence from a Randomized Natural Experiment</i>
Peter Leeson	<i>An-arrgh-chy: The Law and Economics of Pirate Organization</i>



Peter Leeson	<i>Better Off Stateless: Somalia Before and After Government Collapse</i>
Peter Leeson	<i>Efficient Anarchy</i>
Peter Leeson	<i>Endogenizing Fractionalization</i>
Peter Leeson	<i>Government's Response to Hurricane Katrina: A Public Choice Analysis</i>
Peter Leeson	<i>Institutional Stickiness and the New Development Economics</i>
Peter Leeson	<i>Liberalism, Socialism, and Robust Political Economy</i>
Peter Leeson	<i>Media Freedom, Political Knowledge, and Participation</i>
Peter Leeson	<i>Read All About It! Understanding the Role of Media in Economic Development</i>
Peter Leeson	<i>Robust Political Economy</i>
Peter Leeson	<i>Social Distance and Self-Enforcing Exchange</i>
Peter Leeson	<i>The Democratic Domino Theory: An Empirical Investigation</i>
Peter Leeson	<i>The Laws of Lawlessness</i>
Peter Leeson	<i>The New Comparative Political Economy</i>
Peter Leeson	<i>The Plight of Underdeveloped Countries</i>
Peter Leeson	<i>The Political, Economic, and Social Aspects of Katrina</i>
Peter Leeson	<i>The Use of Knowledge in Natural Disaster Relief Management</i>
Peter Leeson	<i>Trading with Bandits</i>
Peter Leeson	<i>Two-Tiered Entrepreneurship and Economic Development</i>
Peter Leeson	<i>Weathering Corruption</i>
Raj Chetty	<i>A New Method of Estimating Risk Aversion</i>
Raj Chetty	<i>Active vs. Passive Decisions and Crowd-Out in Retirement Savings Accounts: Evidence from Denmark</i>
Raj Chetty	<i>Adjustment Costs, Firm Responses, and Micro vs. Macro Labor Supply Elasticities: Evidence from Danish Tax Records</i>
Raj Chetty	<i>Are Micro and Macro Labor Supply Elasticities Consistent? A Review of Evidence on the Intensive and Extensive Margins</i>
Raj Chetty	<i>Bounds on Elasticities with Optimization Frictions: A Synthesis of Micro and Macro Evidence on Labor Supply</i>
Raj Chetty	<i>Cash-on-Hand and Competing Models of Intertemporal Behavior: New Evidence from the Labor Market</i>
Raj Chetty	<i>Dividend Taxes and Corporate Behavior: Evidence from the 2003 Dividend Tax Cut</i>
Raj Chetty	<i>How Does Your Kindergarten Classroom Affect Your Earnings? Evidence From Project Star</i>
Raj Chetty	<i>Is the United States Still a Land of Opportunity? Recent Trends in Intergenerational Mobility†</i>
Raj Chetty	<i>Measuring the Impacts of Teachers I: Evaluating Bias in Teacher Value-Added Estimates</i>
Raj Chetty	<i>Measuring the Impacts of Teachers II: Teacher Value-Added and Student Outcomes in Adulthood</i>
Raj Chetty	<i>Moral Hazard vs. Liquidity and Optimal Unemployment Insurance</i>
Raj Chetty	<i>Saliency and Taxation: Theory and Evidence</i>
Raj Chetty	<i>Sufficient Statistics for Welfare Analysis: A Bridge Between Structural and Reduced-Form Methods</i>

Raj Chetty	<i>The Association Between Income and Life Expectancy in the United States, 2001-2014</i>
Raj Chetty	<i>The Effects of Exposure to Better Neighborhoods on Children: New Evidence from the Moving to Opportunity Experiment to Opportunity Experiment</i>
Raj Chetty	<i>The fading American dream: Trends in absolute income mobility since 1940</i>
Raj Chetty	<i>The Long-Term Impacts of Teachers: Teacher Value-Added and Student Outcomes in Adulthood</i>
Raj Chetty	<i>Using Differences in Knowledge Across Neighborhoods to Uncover the Impacts of the EITC on Earnings</i>
Raj Chetty	<i>Where is the Land of Opportunity? The Geography of Intergenerational Mobility in the United States</i>
Steven Levitt	<i>An economic analysis of a drug-selling gang's finances</i>
Steven Levitt	<i>An empirical analysis of the gender gap in mathematics</i>
Steven Levitt	<i>Crime, urban flight, and the consequences for cities</i>
Steven Levitt	<i>Field experiments in economics: the past, the present, and the future</i>
Steven Levitt	<i>How do senators vote? Disentangling the role of voter preferences, party affiliation, and senator ideology</i>
Steven Levitt	<i>Juvenile crime and punishment</i>
Steven Levitt	<i>Market distortions when agents are better informed: The value of information in real estate transactions</i>
Steven Levitt	<i>Political parties and the distribution of federal outlays</i>
Steven Levitt	<i>Rotten apples: An investigation of the prevalence and predictors of teacher cheating</i>
Steven Levitt	<i>The black-white test score gap through third grade</i>
Steven Levitt	<i>The causes and consequences of distinctively black names</i>
Steven Levitt	<i>The effect of prison population size on crime rates: Evidence from prison overcrowding litigation</i>
Steven Levitt	<i>The effect of school choice on participants: Evidence from randomized lotteries</i>
Steven Levitt	<i>The impact of federal spending on House election outcomes</i>
Steven Levitt	<i>The impact of legalized abortion on crime</i>
Steven Levitt	<i>The impact of school choice on student outcomes: an analysis of the Chicago Public Schools</i>
Steven Levitt	<i>Understanding the black-white test score gap in the first two years of school</i>
Steven Levitt	<i>Understanding why crime fell in the 1990s: Four factors that explain the decline and six that do not</i>
Steven Levitt	<i>Using electoral cycles in police hiring to estimate the effect of police on crime</i>
Steven Levitt	<i>What do laboratory experiments measuring social preferences reveal about the real world?</i>

Figure A.5



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