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What Students Learn in Economics 101: Time for a Change†

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We make the case for a shift in what students learn in a first economics course, taking as our exemplar Paul Samuelson's paradigm-setting 1948 text. In the shadow of the Great Depression, Samuelson made Keynesian economics an essential component of what every economics student should know. By contrast, leading textbooks today were written in the glow of the Great Moderation and the tamed cyclical fluctuations in the two decades prior to 2007. Here, using topic modeling, we document Samuelson's novelty and the evolution of the content of introductory textbooks since, and we put forward three propositions. First, as was the case in the aftermath of the Great Depression, new problems now challenge the content of our introductory courses; these include mounting inequalities, climate change, concerns about the future of work, and financial instability. Second, the tools required to address these problems, including strategic interaction, limited information, principal–agent models, new behavioral foundations, and dynamic processes including instability and path dependence, are available (indeed widely taught in PhD programs). And third, as we will illustrate by reference to a new open access introductory text, a course integrating these tools into a new benchmark model can be accessible, engaging, coherent and, as a result, successfully taught to first-year students. Deployed to address the new problems, following Samuelson's example, the new benchmark provides the basis for integrating not only micro- and macroeconomics but also the analysis of both market failures and the limits of government interventions. (*JEL* A22, D00, E00).

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1. *Introduction*

Paul Samuelson explained the motivation for his pathbreaking 1948 introductory economics textbook with these words: "Today the non-specialist in physics deserves and expects to learn about atomic energy and nuclear structure in his first year of study, rather than remain bogged down in elementary experiments on falling bodies and heat calorimetry. Why then should teachers of economics withhold from the first-year course the really interesting and vital problems of over-all economic policy?" (Samuelson 1948, p. vi).

At the time, physics students were indeed learning a lot about inclined planes. It wasn't until 1961 that Richard Feynman took his first-year students at the California Institute of Technology to the frontier of modern physics using plain language, and a minimum of mathematics, to teach them quantum physics and relativity.

Feynman's students would "study the ammonia maser, whose basic units were states of the world that defied the classical imagination—and which contained, in miniature, the story of the laser." (DeDeo 2016). Feynman was convinced that first-year students could be given a language for modern physics—one that they could learn without years of technical training. Feynman brought modern physics to the forefront, and his lectures became the blockbuster *Feynman Lectures on Physics.* What Samuelson brought toward the front of his *Economics*—literally—was the problem of unemployment and, to address the problem, a teachable version of Keynes.

Because it became the industry standard in its many editions, and because the book itself changed over time, it is easy today to miss how radical and ambitious Samuelson (1948) was. Its first lines were "This book is … for those who will never take more than one or two semesters of economics. … It aims at an understanding of the economic institutions and problems of American civilization in the middle of the twentieth century" (p. v).

Samuelson was aware even then that a substantial fraction of all students in higher education would take an introduction to the subject; those who would go on in economics were a minority. At the time Samuelson wrote his text, Massachusetts Institute of Technology's (MIT) Ec11 was a required course for all engineering students. Today, approximately forty percent of the twenty million undergraduates in the United States take at least one economics course (Siegfried and Walstad 2014). This means that very roughly two million students annually take some kind of introductory course, well over 600 times the number of students annually entering doctoral programs in economics.

Samuelson concluded two decades ago: "I don't care who writes a nation's laws if I can write its economics textbooks" (Samuelson 1990, pp. xi–x). Recently, Gregory Mankiw —author of the leading introductory textbook today—echoed Samuelson (though less colorfully): "I am guided by the fact that, in introductory economics, the typical student is not a future economist but is a future voter" (Mankiw 2016, p. 170).

Following Samuelson's example, we ask: what are today's "really interesting and vital problems of overall economic policy" and what are the teachable economic models that will help students better understand them?

Curious about what students would say to this, we asked economics teachers around the world to pose the following question to students on the first day of their introductory classes: "what is the most pressing problem economists should be addressing?" The results from a total of 4,442 students from twenty-five universities in twelve countries over the years 2016–18 are summarized in a word cloud in figure 1.

The themes were remarkably consistent across universities and countries. Unemployment was still on the minds of students, but inequality was now the dominant issue, with the four terms expressing concern

Figure 1. Student Replies to the Question "What Is the Most Pressing Problem Economists Should be Addressing?"

Notes: The size of the font is proportional to the frequency with which subjects mentioned the word or term. Individual word clouds from each of the twenty-five samples of students are at https://tinyco.re/6235473.

with the environment rivaling "unemployment." The future of work (robots, digitalization); globalization and migration; innovation; financial instability; and political problems (corruption, war) were major concerns. In the most recent word clouds (from 2019), "climate change" is on par in importance with "inequality."

Our reading and the topic modeling analysis of some of the leading textbooks (below) suggest that our introductory students may be disappointed at what they are getting. A casualty, we fear, is Samuelson's aspiration of a citizenry literate in the economics it needs to shape the relevant public policies to address these issues.[1] And, an opportunity to engage the hearts and minds of our students —of all ability levels—is being squandered.

If we are right, it is well worth returning to Samuelson's vision and his accomplishment.

2. *What an Introductory Text Should Accomplish: Samuelson's Vision*

Writing in 1947 and responding to criticism of the draft manuscript as "left wing," Samuelson downplayed how radical his text would be: "The methods of analysis used are those that have been employed by 90 percent of the active academic economists under the

[1] A generation ago, the American Economic Association's Commission on Graduate Education in Economics voiced similar concerns about the doctoral study of economics and noted the "considerable scope for improvement in ensuring that students' knowledge of economic problems and institutions enables them to use their tools and techniques on important problems" (Krueger et al. 1991, p. 1040).

age of 50 over the last decade" (Giraud 2014, p. 141).

But while Keynesian economics may have been common by then in the doctoral seminar rooms, its entry into the introductory lecture halls was definitely new, especially the way Samuelson chose to do this. He sought to address the shortcomings of "present day economics texts built on foundations laid down at about the time of World War I with chapters on monopolistic competition and national income appended" at the end of the book. Like Feynman's *Lectures*, Samuelson's *Economics* would invert the order of things.

The first part of the book—"Basic economic concepts and national income"—comprising well over two hundred pages, introduces three analytical building blocks: "economic organization," "technological choices," and "demography." He also made use of "the rich array of quantitative material about economic institutions" to present a descriptive account of the main economic actors: families, trade unions, firms, and the government, as well as problems of economic stratification and opportunity (including the Lorenz curve for measurement of income inequality). Early on he raises the question of distributive justice, as had Alfred Marshall on the very first pages of his *Principles of Economics* a half-century earlier.[2]

Space is made for the new material, he explained, by "ruthlessly omitting completely many of the usual textbook topics and in reducing to more appropriate emphasis the conventional 'marginal' analysis of 'value and distribution' theory … [which] has also made possible an increased emphasis on governmental and sociological influences."

Part Two, dedicated to "National Income and its Fluctuations," presents the Keynesian model, the business cycle, and the institutions involved in monetary and fiscal policy. Standard fare in introductory textbooks ever since, this was Samuelson's most radical innovation. A year before the publication of his text, Stanford economist Lorie Tarshis had introduced Keynesian concepts in his *Elements of Economics* (Tarshis 1947). Along with Samuelson's text, this innovation was widely attacked, including by William Buckley in his *God and Man at Yale* (Buckley 1951). A member of the MIT Corporation, concerned about the draft of Samuelson's text, wrote to MIT's President: "It is perfectly obvious that the young man is socially-minded if not strictly communistic"(Backhouse 2017, pp. 560–61).

Samuelson put off the previously conventional starting point "Determination of price by supply and demand" until part three, which begins on p. 447. Exactly ten pages later, we read: "This is all there is to the doctrine of supply and demand. All that is left to do is to point out some of the cases to which it can be applied and some to which it cannot."

Even within part three, Samuelson adopts an unconventional ordering of topics both by previous and by today's standards. The firm's output and pricing decisions are presented first for the monopolistically competitive firm ("includes most firms and industries" p. 492) and then finally a section on the perfectly competitive firm ("includes a few agricultural industries") in which he introduces right at the start "decreasing costs and the breakdown of competition" (p. 505).

Economics closes with a chapter on "Social movements and economic welfare" in which general competitive equilibrium is introduced for the first time (in just four pages) and contrasted with central economic planning as ideal-type economic systems.

[2] Marshall (1890). According to Mark Blaug: "All through the second half of the nineteenth century … Mill's *Principles* was the undisputed bible of economists. In the 1890s Marshall's treatise began to displace Mill." (Blaug 1962). Neither Marshall's nor Mill's works were introductory textbooks in the modern sense; rather they were syntheses of what the author considered to be the current state of the field.

The problem of employment and aggregate output—"the first problem of modern economics"—frames the entire book: the titles of all three parts of the work include the term "national income" or "national output."

Samuelson did not object to the substance of standard Marshallian/Walrasian value and distribution theory and its associated marginal analysis. He reordered the topics in his text for pedagogical and normative reasons. The pedagogical reason was based on the "tentative evidence from more than two dozen instructors at MIT" that students were more interested in learning about the contemporary economy and its problems (income determination and price-setting, rather than price-taking, firms) than about neoclassical price theory.

The normative reason is what we think drove Samuelson to write the book:

> The political health of a democracy is tied up in a crucial way with the successful maintenance of stable high employment and living opportunities. It is not too much to say that the widespread creation of dictatorships and the resulting World War II stemmed in no small measure from the world's failure to meet this basic economic problem adequately (p. 3).

The first of the "Questions for Discussion" in the book is: "How do you expect to fare in the next depression?"

In the third edition in 1955, Samuelson coined what Kerry Pearce and Kevin Hoover called "one of the most famous phrases in the history of macroeconomics and underscored his harmonist aim in salvationist terms" (Pearce and Hoover 1995, p. 202). Samuelson wrote:

> … I have set forth what I call a "grand neoclassical synthesis." This is a synthesis of (1) the valid core of modem income determination with (2) the classical economic principles. Its basic tenet is this: Solving the vital problems of monetary and fiscal policy by the tools of income analysis will validate and bring back into relevance the classical verities (p. 202).

He claimed not only to have found the policy framework to achieve full employment but also to have brought the Keynesian theory of national income determination into harmony with "classical" microeconomics:

> This neoclassical synthesis … heals the breach between aggregative macro-economics and traditional micro-economics and brings them into complementing unity (p. vi).

Samuelson's vision was that Keynesian economics and the policies that it supported would sustain a full employment economy, for which Marshallian economics would be appropriate.

3. *The Success and Limitations of Samuelson's Neoclassical Synthesis*

But there was no synthesis.

What Samuelson provided was a concatenation of what later came to be called Keynesian macroeconomics with Marshallian microeconomics. Aware of the limited sense in which he had provided a unified treatment of how an economy operates at full employment and away from it, he warns the reader that the price-taking model of supply and demand is unsuited for the analysis of the labor market: "the demand for labor in the United States cannot be analyzed by the methods of this chapter." But he provides no alternative model of the labor market.[3]

In spite of the development since the 1980s of microeconomic models of equilibrium unemployment, teachers and writers of modern textbooks to this day have not heeded Samuelson's warning that the supply

[3] Samuelson (1948, p. 454). The first principal–agent model of employment with incomplete contracts, an approach that would later provide the basis for such an alternative to the neoclassical model consistent with Keynesian ideas, was published just three years after Samuelson's text. (Simon 1951).

and demand graph should not be used to represent the aggregate labor market. They have continued to resort to ad hoc assumptions about "downward rigidity" of wages or "stickiness" of prices (e.g., Acemoglu, Laibson, and List 2015, pp. 237–8; Mankiw 2009, p. 589; Krugman and Wells 2015, pp. 665–6).

Like persistent unemployment, a second key component of Samuelson's national income and employment analysis—the Keynesian multiplier—could not be rationalized in a coherent model. This is because income shocks do not entail demand shocks as long as far-sighted households can borrow substantial sums at the going interest rate.

What is needed for the Keynesian multiplier—credit-constrained borrowers who are forced to respond to income shocks by cutting expenditures—are not part of the Marshallian microeconomics. Notwithstanding the development of models of quantity-constrained and credit market excluded borrowers, it remains the case that to get the multiplier in play, textbook writers and macroeconomics teachers still introduce the ad hoc "hand-to-mouth" household.

Another indication that Samuelson was aware of the limited nature of the neoclassical "synthesis" is the second discussion question he put to readers of his first edition: "Give an example of an economic principle which is valid when there is full employment but misleading when there is unemployment." The hint Samuelson provided was diagnostic: "What is true in one kind of world may be false in another" (Samuelson 1948, p. 10).

As productivity growth ebbed and inflationary pressures grew in response to the stable and high employment of the late 1960s and early 1970s, Samuelson's program for sustained full employment by means of aggregate demand management came under attack. A casualty was the foundational idea of his neoclassical synthesis, namely, that Keynesian macroeconomics could be used to get the economy to full employment, which, when achieved, would provide a setting in which Marshallian microeconomics could once again reign.

One pathway to a genuine synthesis, called the micro-foundations revolution in macroeconomics (or New Classical macroeconomics), was based on Walrasian micro-foundations (Hoover 1988). The model was of an intertemporal optimizing representative agent with rational expectations. This setup would allow private actors to "solve the model" and thereby form new beliefs in response to the actions of the policy maker, thus avoiding the so-called Lucas critique (Lucas 1976, Sargent and Wallace 1976). Sargent and Wallace explain:

> In this system, there is no sense in which the authority has the option to conduct countercyclical policy. To exploit the Phillips Curves it must somehow trick the public. But by virtue of the assumption that expectations are rational, there is no feedback rule that the authority can employ and expect to be able systematically to fool the public. This means that the authority cannot expect to exploit the Phillips Curve equation even for one period. Thus combining the natural rate hypothesis with the assumption that expectations are rational transforms the former from a curiosity with perhaps remote policy implications into an hypothesis with immediate and drastic implications about the feasibility of pursuing countercyclical policy (Sargent and Wallace 1976, pp. 177–8).

The New Classical synthesis of micro and macro provided a unified framework, but one that was of no use as a guide to public policy in pursuit of the objectives that Samuelson had initially laid out: sustaining high employment and moderating the business cycle.[4]

[4]When subject to productivity shocks, the model produced the laws of motion of an aggregate economy with equilibrium business cycles around the Ramsey growth path and evolved into the Real Business Cycle research program (Kydland and Prescott 1977, Lucas 1972, Sargent and Wallace 1975; see Carlin and Soskice 2015, chapter 16). In sharp contrast to Samuelson, real business

Moreover, while Walrasian microeconomic foundations were being introduced to macroeconomics, they were beginning to be displaced as the dominant theoretical framework in microeconomics, where the information economics revolution was underway (e.g., Akerlof 1970, Stiglitz and Weiss 1981) and game theory was replacing models of price-taking agents and nonstrategic interaction (Fudenberg and Tirole 1991, Grossman and Hart 1983, Holmstrom and Tirole 1989, Milgrom and Roberts 1990).

Meanwhile, textbooks for beginning students of economics were almost entirely untouched by the contradictory research programs that came to dominate the journals and graduate economics training. In introductory micro, game theory and information economics, and in macro, the New Classical economics and real business cycle theory remained peripheral or entirely absent. Recognition by many that Samuelson's grand neoclassical synthesis had failed led to the increasing separation of "micro" from "macro" economics.

Samuelson's original part three on microeconomics ("The Composition and Pricing of National Output") had long since made its way to the front of his book. As is now standard, the still-predominantly Keynesian macroeconomics became the latter part of the text, along with the introduction of the treatment of economic growth.

Textbooks were split in two—sometimes with different authors—usually taught by different faculty with little knowledge of, or interest in, the content of the other course. A distinguished economist writing the micro text for a publisher told us he did not recall the name of the economist producing the companion macro book. Students came to see micro and macro as entirely different locations in the economic universe, clearly demarcated by using special and often inconsistent assumptions (flexible versus "sticky" prices and wages, for example), and using lowercase and Greek letters in one, and uppercase letters in the other.

Samuelson's vision of a genuine integration of the principal ideas in economics capable of mitigating society's ills and defending democracy had run its course. Nevertheless, Samuelson's *Economics*, along with the textbooks that followed, would equip generations of students in the analytical tools developed there to address problems of unemployment and the business cycle. Decades later, in the wake of the global financial crisis, the broad diffusion of this knowledge would galvanize policy makers in the high-income countries to coordinate the levers of monetary and fiscal policy in support of aggregate demand. The world has much to thank Samuelson (1948) for.

4. *A Topic Model Measure of the Novel Content in Samuelson's* Economics

Our assessment of Samuelson's novelty and contribution is based in part on a quantitative text analysis. The novelty of a textbook can be gauged from a perusal of its table of contents or by an evaluation based on a deep reading of the text or by an assessment of what students exposed to the text learn. All these methods can contribute important insights. Here, we adopt an approach that substantially removes the researcher from making judgments about content in favor of a more data-centered approach.

4.1 *Topic Modeling*

We use a Bayesian machine-learning technique known as topic modeling to ask: what themes best characterize the distribution of words found in introductory economics

cycles are *equilibrium* phenomena since cyclical behavior of the aggregate economy is the result of agents optimally adjusting their labor–leisure choice in response to exogenous and persistent technology shocks.

textbooks? The themes, called topics, are vectors of words (each weighted by its importance in that particular topic). These vectors are generated from a fixed corpus, in our case, comprising research papers published in top economics journals since 1900. By applying topic modeling to this research corpus, we are able to produce a lens in the form of a set of economically meaningful topics that can be used for measuring themes and their relative importance in any work in economics. We illustrate, below, a topic that we term "adverse selection; 'lemons'." This lens can be focused on the object of interest, which in our case is the content of introductory textbooks. Texts are deemed similar if the topics that best account for the distribution of words in them are similar.

Topic modeling is a form of probabilistic modeling that treats a corpus of observed data (the documents) as arising from a hidden data-generating process, the structure of which is to be estimated (Ash, Chen, and Naidu 2019; Blei 2012; Blei, Jordan, and Ng 2003: Blei, Ng, and Jordan 2003; Gentzkow, Kelly, and Taddy 2019). Neither the meaning, the order in a document, nor the temporal order of documents is used in generating the topics or the weights associated with each document.[5] Thus, each document is treated as a "bag of words"; the only observed structure is the presence of words in documents.

The model then asks: what thematic structure is most likely to have—hypothetically—generated the observed data (distribution of words making up each document in the corpus)? The data-generating process by which words are supposed to have been deposited into the bag of words making up the document occurs in two steps. First, a topic is selected to contribute a word to the bag, with a probability equal to the importance of this particular topic for the document in question. Second, a word is drawn from that topic's vector of words with the probability weight for that particular word in the topic. The two-step process is then repeated until the document has its complement of words.

Supposing that each document in the corpus had been produced by this hypothetical process, topic modeling generates the topic weights and word weights within topics that would be most likely to have produced the observed distribution of words across documents.

The simplest and most widely used topic model is called the latent Dirichlet allocation, or LDA model, based on the discrete distribution due to the nineteenth century German mathematician Gustav Lejeune Dirichlet. The support of the distribution is the set of K vectors—the topics—whose elements are probabilities of some categorical event (e.g., the probability that a particular word is drawn to be in a document conditional on the topic having contributed to the document). The LDA model may be considered to be a type of principal components analysis.

The observed data is a set of N unique words or bigrams (two-word couplets that frequently appear together such as "minimum wage") located in a set of D documents. Words and bigrams are jointly referred to as tokens. The estimated topic model delivers two matrices. The first comprises the K topic vectors whose elements—the N token weights in each topic vector—are the probability that the token will be among the document's "bag of words" conditional on the topic contributing. The second matrix is the allocation of topics across documents, the elements of which are the probability that each topic will be drawn to contribute tokens to the document in question.

To compare the content of economics textbooks using topic modeling, we proceed in

[5] An alternative approach would recognize that the word occurrences have a structure, so that the observations would be words conditional on the previous word or words. Other departures from the "bag of words" method of topic modeling are worth exploring.

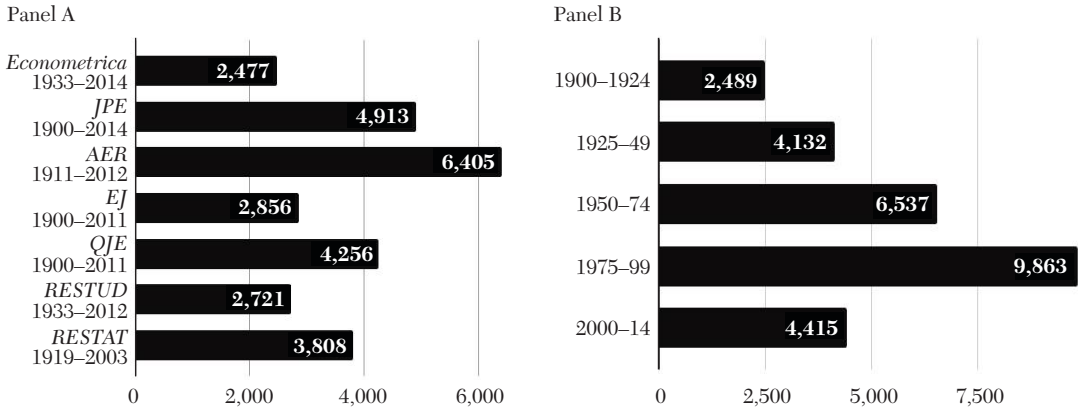

Figure 2. The Corpus of Documents: 27,436 Research Articles since 1900 by Journal and Time Slice

three steps. First, we select a corpus of documents from which to generate topics. This corpus is economics research comprising articles published in the major economics journals in the United Kingdom and United States between 1900 and 2014, a total of 27,436 articles, as shown in figure 2.

The corpus is processed by "stemming" to collect as a single token the set of words that are present in different forms such as a noun, a verb, or an adjective ("competition"; "compete"; "competitive") and by using standard dictionaries to remove so-called stop words that are without informative content for our purposes (conjunctions, pronouns, prepositions). This processing results in a vocabulary of 10,849 unique tokens.

Second, we set the number of topics $K = 100$ and then topic-modeled this corpus to generate the set of topics and their allocations over each of the D documents, that is, the two matrices (topics × token probabilities; documents × topic probabilities) mentioned above.[6]

Third, we can then use these two matrices as our lens to compare the content of—that is, similarities or differences in the topics highly likely to have contributed to—any set of documents. (In subsequent sections we use these techniques to study the content of some contemporary textbooks.)

To make sense of these comparisons, we need to find a shorthand description of each topic, which is an N=10,849-dimensional vector of token weights. In this, an undeniably subjective element is involved.[7] Figure 3 presents one of these word clouds—for topic 4—where the size of the font is proportional to the probabilities that the word or bigram would contribute to a document's bag of words, conditional on topic 4 being drawn to contribute to that document. The most heavily weighted tokens, are "quality" with a word weight of 0.296 and "car" with a weight of 0.069, meaning that if topic 4 is selected to contribute to a document, these two tokens

[6]Our initial choice of $K = 100$ topics generated easily interpretable topics; coincidentally, it roughly corresponds to the number of JEL codes at the two-digit level (of which there are 111, excluding "general" and other non-substantive codes).

[7]We present word clouds of the top hundred tokens in each of our one hundred topics in the online appendix along with the labels we have assigned to each topic.

Figure 3. Word Cloud of the Top 100 Words in Topic 4, Labeled "Adverse Selection; 'Lemons'"

will be contributed to the document's bag of words with probabilities 29.6 percent and 6.9 percent, respectively.

We named this topic "adverse selection; 'lemons'." The five articles with the greatest estimated probability that topic 4 would contribute words to the article in question are shown in table 1. The left-hand column entry means that for any particular draw in the generation of the bag of words represented by Hendel and Lizzeri (1999), topic 4 would be selected to contribute with probability 0.36, and similarly for the other papers.

We are now ready to put to work the lens honed using the topic modeling machinery in comparing introductory textbooks, beginning by exploring the extent to which, and in what sense, Samuelson 1948 was novel.

4.2 *Samuelson's Novelty*

At first glance the most obvious comparison by which to gauge Samuelson's novelty would be the distance of his text from Alfred Marshall's *Principles*, written in the late 1880s and published first in 1890. But with a few exceptions, Marshall was not used as an introductory economics text, at least not in the United States. The US market was dominated by a work by Richard T. Ely (and a series of coauthors), *Outlines of Economics*, written at the same time as Marshall's work and published first in 1893. Between the two world wars Ely et al. sold about 14,500 copies a year in the United States, and Marshall about 800 (Backhouse, Bateman, and Medema 2011).

Today, Ely is known to many economists for the annual lecture in his name at the meetings of the American Economic Association. Reflecting concerns about the political and economic power of Standard Oil and other trusts at the time he was writing, Ely advocated an active governmental role in the economy to assure a more just distribution of income and to sustain competition and regulate noncompetitive

TABLE 1.
Documents for Which a Contribution from Topic 4 (Adverse Selection; "Lemons") Is Most Likely and Topic Weights

Weight	Document in the corpus of research papers
0.361933	Hendel, Igal, and Alessandro Lizzeri. 1999. "Adverse Selection in Durable Goods Markets." *The American Economic Review* 89 (5): 1097–1115.
0.336411	Gavazza, Alessandro, Alessandro Lizzeri, and Nikita Roketskiy. 2014. "A Quantitative Analysis of the Used-Car Market." *The American Economic Review* 104 (11): 3668–700.
0.336104	Kim, Jae-Cheol. 1985. "The Market for 'Lemons' Reconsidered: A Model of the Used Car Market with Asymmetric Information." *The American Economic Review* 75, (4): 836–43.
0.33552	House, Christopher L., and John V. Leahy. 2004. "An sS Model with Adverse Selection." *Journal of Political Economy* 112 (3): 581–614.
0.319636	Hendel, Igal, Alessandro Lizzeri, and Marciano Siniscalchi. 2005. "Efficient Sorting in a Dynamic Adverse-Selection Model." *The Review of Economic Studies* 72 (2): 467–97.

firms. The coauthors of the edition of his *Outlines* that we use for comparison, completed in March 1930 (too early to have been influenced by the stock market crash a few months before), included Max Lorenz (there is an entire chapter on inequality) and Allyn Young. Young (Ely's student) was Edward Hastings Chamberlin's teacher and his lectures anticipated much of the subsequent development of the theory of monopolistic competition.

Figure 4 shows the topic weights for the two textbooks. The length of each outline bar measures the importance of that topic (the weight in the document's vector of one hundred topic weights) for Ely (in the bars to the right of the vertical axis) and for Samuelson 1948 (in the bars to the left.) Each solid bar shows the between-textbook difference in weight on the topic in question. Solid bars to the right show a heavier weight on those topics in Ely than in Samuelson and vice versa. Topics are ordered by the between-textbook difference in weights; in the middle are the topics where weights are most similar.

Ely's textbook places more weight on the topics of business entrepreneurship and organization (77), economic history; history of economic thought (61), public regulation (15), transportation; early twentieth century (75), agricultural economics (46), gold standard (30), and income tax; institutional (82) than does Samuelson. Samuelson's innovations are revealed in the topics fluctuations in aggregate demand (89) and aggregate demand; consumption (33). The importance of these topics illustrates Samuelson's primary novelty: the introduction of the determination of national income using a Keynesian framework.

The other main conceptual novelty in Samuelson is his emphasis on competition and market structure (44), along with elasticity of demand and supply (80), reflecting the contributions of Edward Chamberlin and Joan Robinson fifteen years earlier (Chamberlin 1933, Robinson 1933). Samuelson brought in a more formal treatment of price setting and market structure than was the case in Ely, along with down-weighting the institutional coverage captured by the business entrepre-

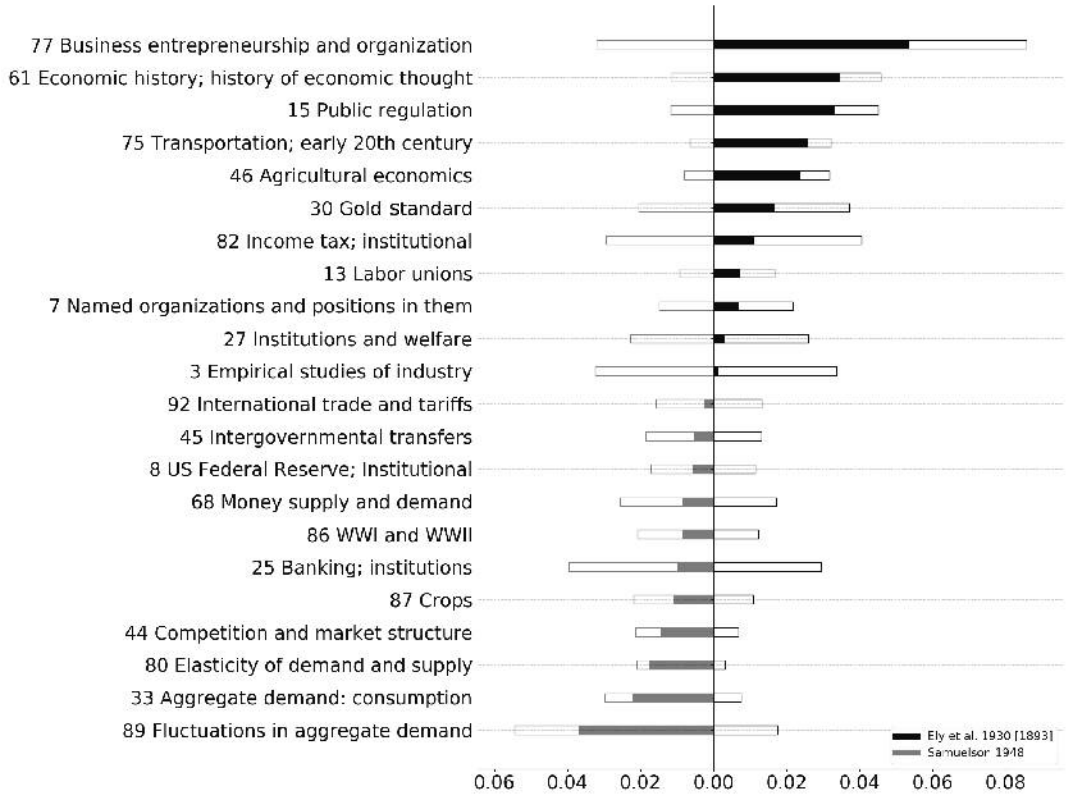

Figure 4. Comparison of Content in Samuelson (1948) and Ely et al. (1930)

Notes: A topic is excluded if it has a weight less than 0.015 in both textbooks or the token with the greatest weight is less than 0.01. The topic numbers are simply identifiers, which convey no relevant information.

neurship and organization topic. The outline bars for Samuelson show that like Ely, his textbook paid considerable attention to banking institutions, empirical studies of industry, and institutional aspects of income tax.[8]

[8]Agricultural economics (46) has less importance in Samuelson but crops (87) does not, evidence of inertial pedagogy and dynamic economic history: crops such as wheat are used to teach models of production both in Ely and Samuelson, whereas the falling importance of agriculture in the economy accounts for its reduced significance in Samuelson. But, reflecting its popularity among teachers (if not relevance to students' daily lives), "crops" appears as an important topic in all the modern textbooks we have analyzed.

Ely's three chapters on "Production and Consumption" and four chapters on "Value and Price" (drafted by Allyn Young) are substantially the same as Marshall's treatment, including careful attention to externalities and the "reality of the tendency to decreasing expense" (that is, downward sloping average cost curves). Young sent Marshall a copy of *Outlines,* and in the accompanying letter endorsed Marshall's "careful analysis of the forces of demand and supply" and his limited use of marginal utility analysis (Backhouse, Bateman, and Medema 2011). Samuelson's 1948 text was very much in this Marshallian

tradition, but with content from Keynes's work added. This is sometimes called the "Marshall plus Keynes synthesis," which we put in quotation marks to underscore the fact that much that was in Marshall and Keynes did not make an appearance in Samuelson.

5. *Economics 101 Today: Thinking Like an Economist*

The market response to Samuelson's innovations was phenomenal: over four million copies of the text were sold prior to the text becoming Samuelson–Nordhaus in 1985, and this at a time when the number of bachelor's degrees being granted in the United States averaged no more than half a million a year. The newer textbooks that came to challenge the market share of Samuelson–Nordhaus around the turn of the current century adopted Samuelson's "Marshall plus Keynes" neoclassical synthesis and the commitment to teach the non-specialist future citizen.

Our look at introductory economics courses today will focus on two textbooks, authored by distinguished economists: Mankiw's *Principles of Economics,* first published in 1997, and Krugman and Wells's *Economics* first published in 2005—which, like Samuelson in its heyday, are widely used in the United States and are also prevalent in introductory courses worldwide[9].

5.1 *Samuelson 1948 and the Modern Textbooks: A Quantitative Comparison*

Just as we used our topic modeling lens to compare the content of Ely and Samuelson, we do the same for Samuelson and the modern textbooks. Figures 5 and 6 show the topic weight comparisons. The greater weight on either or both the Keynesian topics of aggregate demand (33, 89) in Samuelson is apparent from their presence toward the top of the two charts. Two micro topics that gain in importance in the modern textbooks are elasticity of demand and supply (80) and competition and market structure (44), though this appears to reflect the greater attention to micro in general in the modern textbooks, not an increase in the relative importance of the topics within micro.

The innovations in the modern textbooks show up in the asymmetric bars at the bottom of the charts: most marked are the introduction of monetary policy and inflation (31), welfare effects of taxes (41), and behavioral economics and game theory (20).

The similarity of the content of the Mankiw and Krugman–Wells textbooks is highlighted visually in figure 7 by the symmetry of the bars, and therefore the small size of the solid bars to either side of the vertical axis measuring the absolute difference in the weight of the topic in the respective texts. The essential content that they share is indicated by the fact that competition and market structure (44) and elasticity of demand and supply (80) are the largest topics for both by a considerable measure, with little difference in their weights for these staples of curve-shifting analysis.

The black bars show that Mankiw devotes more attention than Krugman–Wells to monetary policy and inflation (31), and Krugman–Wells devotes more attention to fluctuations in aggregate demand (89) and comparative international development (60). This difference of emphasis in macroeconomic policy appears in their initial overview for students of the top principles of economics: for Mankiw, number nine is "Prices rise when the government prints too much money," and for Krugman–Wells, number ten is "One person's spending is another person's income;" number eleven is "Overall spending sometimes gets out of

[9] In this respect, these books differ from McConnell, Brue, and Flynn (2018), now in its twenty-first edition, which has a major presence in the United States but not elsewhere.

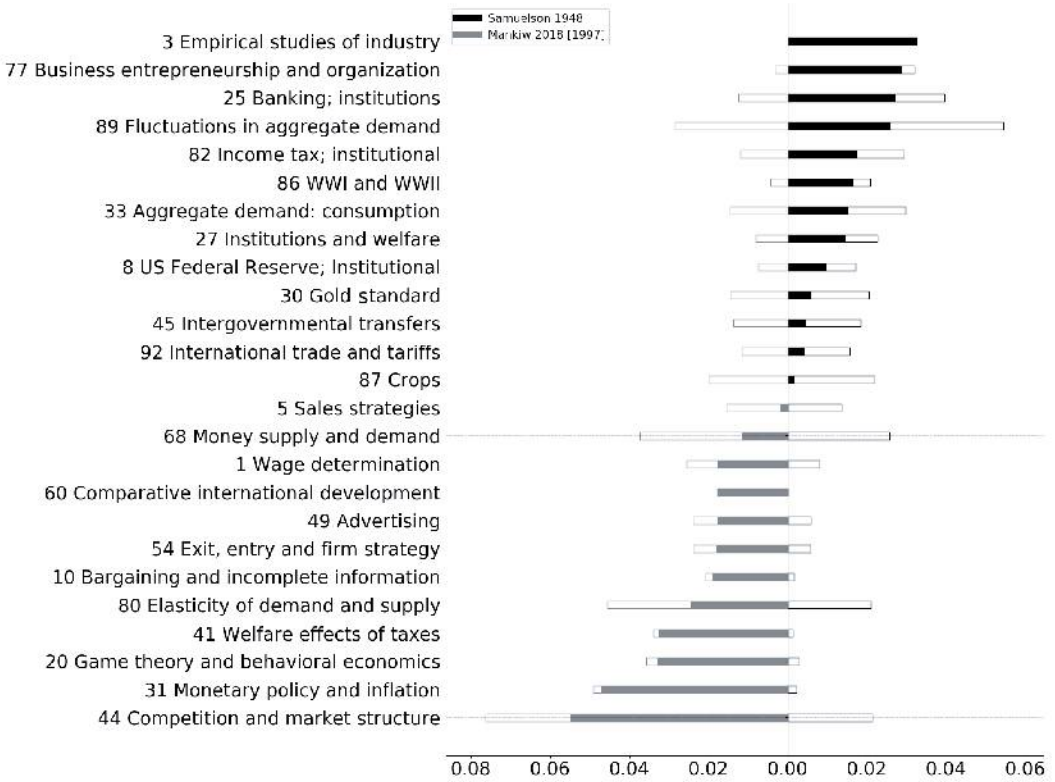

Figure 5. A Topic Comparison of Samuelson (1948) and Mankiw (2018)

Notes: As in the earlier figure, the length of each outline bar measures the importance of that topic for the two textbooks. The solid bars show the difference in the weight on the topic between the two texts.

line with the economy's productive capacity;" and number twelve, "Government policies can change spending."

5.2 *From Samuelson 1948 to Mankiw and Krugman–Wells*

What the topic modeling does not capture is the shift away from Samuelson's early engagement with the most pressing economic problems of the day to a focus on economics as individual decision making, "thinking like an economist," and the application of market-clearing supply and demand models to a larger domain of economic problems.

The departure from Samuelson's vision in his 1948 text is notable in three respects.

First, as the Great Moderation wore on, it no longer made sense to ask the student, as Samuelson had: "How do you expect to fare in the next depression?" There was little reason to doubt Robert Lucas in his Presidential Address to the American Economic Association in 2003 when he summed up the prevailing view: "The central problem of

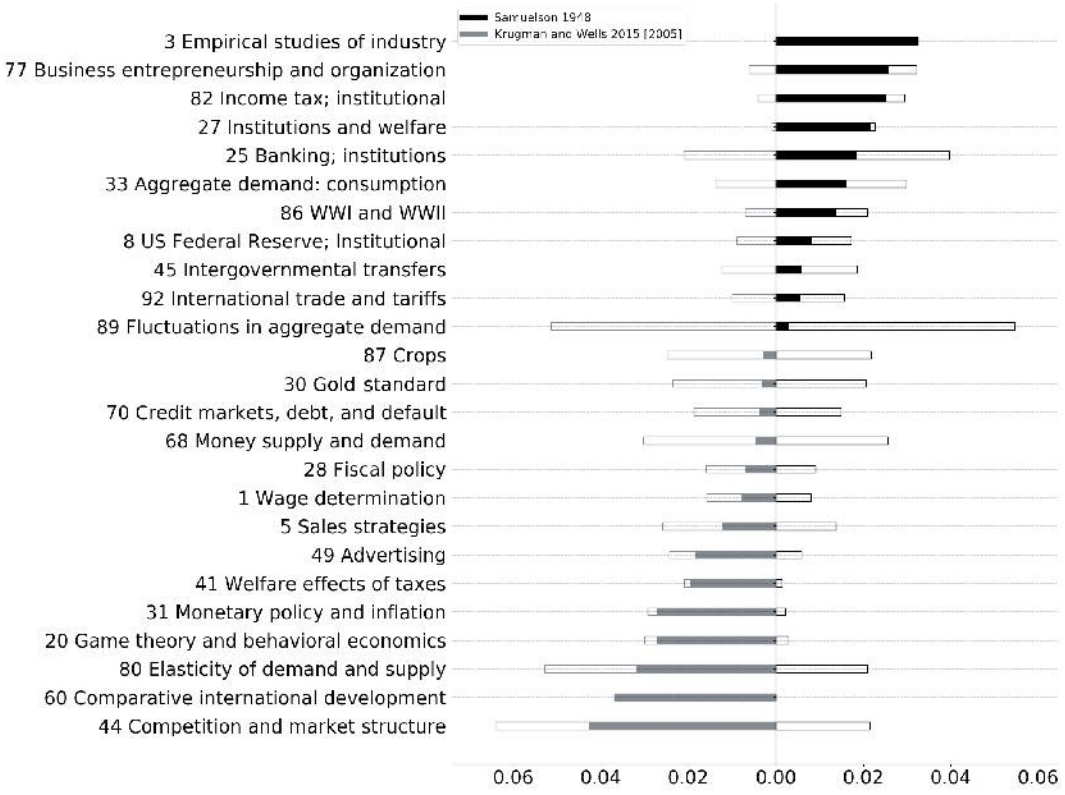

Figure 6. A Topic Comparison of Samuelson (1948) and Krugman and Wells (2015)

depression-prevention [has] been solved, for all practical purposes, and has been in fact solved for many decades" (Lucas 2003).

This is what Samuelson had hoped would happen—at least partly because of the better education of citizens and policy makers who had taken an economics class using his textbook. He said "… if ever the business cycle is brought under control by intelligent social action, these [economic forces governing the use of economic resources at high employment] will again become the main concern of economics" (Samuelson 1948, p. 591). Under these conditions, the macroeconomics of persistent underemployment could safely be placed toward the back of the book and given less weight. Whilst Samuelson 1948 spends less than half the number of pages on micro than macro, Mankiw and Krugman–Wells spend over a quarter more space on micro.

Second, in place of the institutional and empirical detail of Samuelson's 249-page part one, Mankiw and Krugman–Wells begin with a brief lesson on "thinking like an economist" along with an introduction to supply and demand in a competitive market, both of which take the student away from their own world to an abstract one where they are asked to learn a set of truths known to

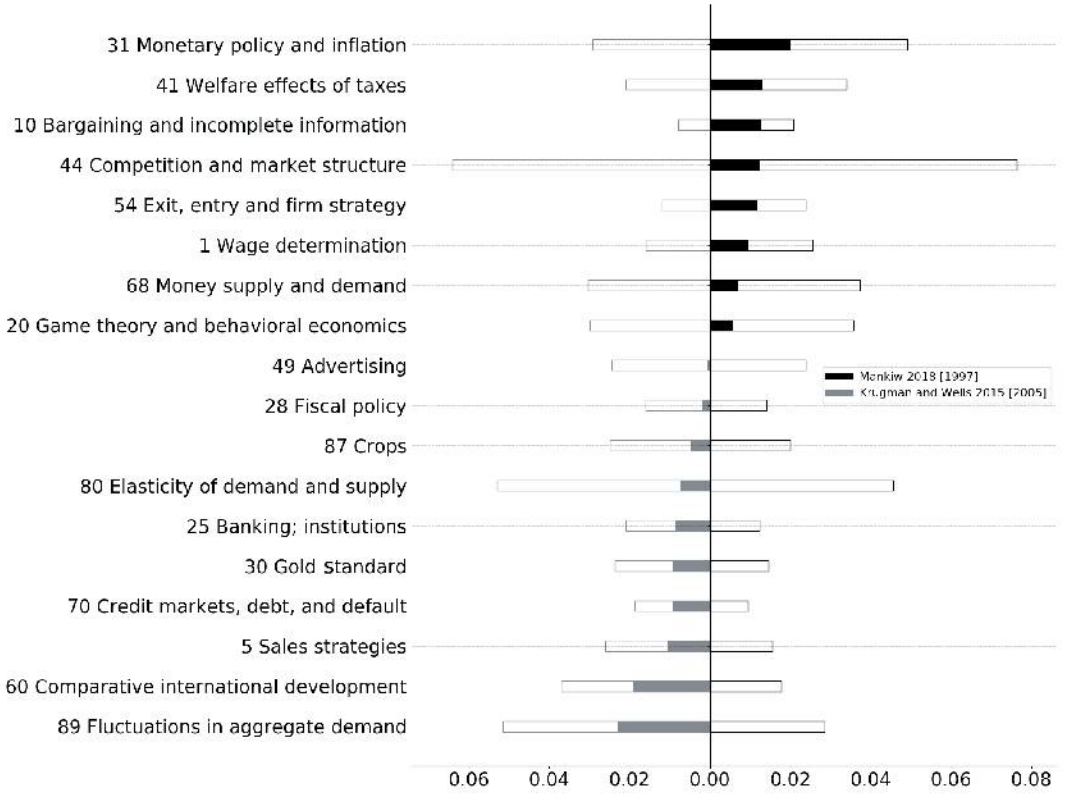

Figure 7. A Topic Comparison of Mankiw (2018) and Krugman and Wells (2015)

the economist.[10] These statements convey the message that economics is about *Homo economicus* interacting with his own kind at the equilibrium of competitive markets with a beneficent social planner sometimes stepping in to improve efficiency when markets (atypically) fail.

Samuelson had a rather different perspective. Immediately following his introduction of Adam Smith's description of the workings of the invisible hand, he cautioned the student: "This un-guarded conclusion has done almost as much harm as good in the past century and a half, especially since too often it is all that some of our leading citizens remember, 30 years later, of their college course in economics. Actually, much of the praise of perfect competition is beside the mark" (Samuelson 1948, p. 36).

Third, a good many of today's "really interesting and vital problems of overall economic policy" receive little attention in the modern textbooks, and are certainly not, in contrast with Samuelson's treatment of unemployment, a major focus of the theoretical content of the book. The latest edition of Samuelson–Nordhaus does engage the student with a significant treatment of environmental problems and recent conceptual developments in this field. But other than this, the problems

[10]This is a criticism frequently leveled by those promoting so-called heterodox or pluralist approaches to the principles course (e.g., Chang 2014, ch. 1).

that draw students to economics (figure 1) and that preoccupy policymakers today—climate change, inequality, wealth creation, and innovation together with its effect on the future of jobs, and financial instability—are now introduced not, as Samuelson did, as a challenge to theory building but as illustrations of the models already taught or conversely as special topics addressed without reference to the benchmark model taught.

6. *Reclaiming Samuelson's Vision: New Problems Require New Models*

When, at the start of his 1948 book, Samuelson posed unemployment as the central challenge facing economics, he knew that the rest of the book would have to change, too.

The problems facing economies today are different, but they raise the same Samuelsonian question: is it sufficient to append the treatment of new material addressed to new problems in chapters at the back of the book without substantially altering the benchmark model in the earlier ones? An affirmative answer is the presumption memorialized in the rule of thumb laid down by publishers of economics textbooks that a maximum of 15 percent of the content can deviate from the "standard" principles textbook.[11]

Are we again at a "Samuelsonian moment?"

In many countries, the financial crisis of 2008 and its aftermath triggered a debate that was taken up in the media and among students, faculty, economists in the private sector, and policy makers. The question: is the economics curriculum and in particular, the introductory course, fit for purpose? Prominent examples are the high-profile conference at the Bank of England in 2012 (Coyle 2012) and sessions held on curriculum reform at the Institute for New Economic Thinking (INET) international conferences 2011 to 2014. A vibrant global student movement began campaigning in 2012 for an overhaul of the economics curriculum under the banners of Rethinking Economics and the International Student Initiative for Pluralism in Economics.

Responses among economists varied. All of the major textbooks were revised, many including new special topics chapters on the financial crisis and inequality, presented as applications of a substantially unchanged conceptual benchmark taught in the earlier chapters. A new textbook by Daron Acemoglu, David Laibson, and John List introduced the contemporary empirical practice of economists, but like the leading textbooks and apparently adhering to the 15 percent rule, it continues to teach the standard benchmark model.[12]

Others advanced the view that the financial crisis and dissatisfaction with our introductory courses signaled fundamental shortcomings in contemporary economic knowledge. These authors threw the 15 percent rule to the winds and advocated the development and teaching of entirely new conceptual frameworks inspired by the Austrian, Marxian, Keynesian, feminist, ecological, and other traditions.[13]

[11] Colander provides a detailed explanation of the manner in which the 15 percent rule influenced the content and pedagogy of his principles textbook (Colander 2003).

[12] In the online appendix, we present a topic modeling comparison of this textbook with the others considered here, along with a similar treatment of another textbook (Goodwin et al. 2014). To summarize, both the Acemoglu and Goodwin books have somewhat higher weights than Mankiw on comparative international development and less on both competition and market structure, and monetary policy and inflation. The former's distinguishing feature is a higher weight than other textbooks on experimental design; the latter's, like the pre-Samuelson Ely text, is higher weight on descriptive topics.

[13] A list of "alternative" textbooks arising from the World Economics Association's textbook commentaries project can be found here https://www.worldeconomicsassociation.org/textbook-commentaries/alternative-texts/.

The first set of responses—staying within the 15 percent rule—was based on the idea that there is nothing fundamentally wrong with the benchmark model that is being taught in the introductory courses. The second set of responses was based on a conviction that there is something fundamentally wrong with economics as a whole. There was obviously a third set of possible responses: there is nothing fundamentally wrong with the economics that research economists regularly use and that would be familiar to many graduate students; but there is indeed something fundamentally wrong with what we are teaching our first-year students.

In January 2013, a small group of economists met at the NBER in Cambridge, Massachusetts, to discuss a possible new introduction to economics course. Some were of the view that the main changes needed were well within the 15 percent rule: incorporating the new methods of experimental research and recent empirical evidence, and behavioral economics.

But a group diverse in field specialization and global in scope emerged from the meeting committed to the third possibility: new problems facing our economies required a more ambitious overhaul of the entire introductory course, and the best of contemporary economics provided the conceptual tools to do the job. The group also sought to introduce an open access interactive and problem-centered pedagogy.

The project adopted the name Curriculum Open-access Resources in Economics (CORE) and in November 2013, CORE was launched at Her Majesty's Treasury in London. The objective was to provide a new benchmark for teaching introductory economics. Out of this project, in which both of the current authors have been involved, came a free online text, *The Economy*, the 1.0 version of which was launched in 2017 (CORE Team 2017). Beta versions published online from 2014 were adopted as the standard introductory course at University College London (UCL), Sciences Po (Paris), Humboldt University (Berlin), the Toulouse School of Economics, and elsewhere.[14] As of December 2019, the text had been adopted in 310 universities from 63 countries with translations in French and Italian complete and in Spanish, Portuguese, Vietnamese, Finnish, and Georgian among those underway.

As Samuelson had done half a century earlier, the group identified two components of a new course. First was a set of problems facing citizens and economic policy makers; and second was a set of concepts and data, the mastery of which would equip students—even those who would take just a single year of economics—to engage in reasoned discussion of public policy.

Table 2 illustrates a set of problems, along with some of the concepts that the CORE group believes are needed to analyze them. Many of the concepts in the middle column are either missing from standard introductory courses (Schumpeterian rents, power, dynamics, incomplete contracts) or are addressed superficially and little used (institutions, other-regarding preferences). As the research papers in column 3 show, however, the new models and concepts are already quite commonplace among research economists and are routinely taught to doctoral students. Or, repeating Samuelson, these methods are those that have been employed by 90 percent of the active academic economists under the age of fifty over the last few decades.

[14]The text can be viewed online at www.core-econ.org/the-economy/. The primary authors are: Yann Algan, Timothy Besley, Samuel Bowles, Antonio Cabrales, Juan Camilo Cardenas, Wendy Carlin, Diane Coyle, Marion Dumas, Georg von Graevenitz, Cameron Hepburn, Daniel Hojman, David Hope, Arjun Jayadev, Suresh Naidu, Robin Naylor, Kevin O'Rourke, Begüm Özkaynak, Malcolm Pemberton, Paul Segal, Nicholas Rau, Rajiv Sethi, Margaret Stevens, and Alexander Teytelboym.

TABLE 2
Problems and Key Concepts for a New Introductory Course

Problems	Key concepts for a new introductory course	Illustrative sources for the concepts
Wealth creation and innovation	Schumpeterian rents, increasing returns, disequilibrium, dynamics, "creativity of the market"	Aghion and Howitt 1992, Hayek 1945, Krugman 1979, Makowski and Ostroy 2001, Matsuyama 1991, Romer 1990, Schumpeter 1934 [1911]
Environmental sustainability	Nonmarket social interactions, other-regarding preferences, positive feedbacks and tipping points	Bénabou and Tirole 2006, Camerer 2003, Jackson 2008, Ostrom 1990, Schelling 1978
Inequality	Economic rents, power, games, institutions, inequality aversion	Coase 1937, Fehr and Schmidt 1999, Hart 1995, Holmstrom and Milgrom 1994, Milgrom and Roberts 1990, Nash 1950, von Neumann and Morgenstern 1944
Unemployment/ fluctuations	Incomplete labor and credit contracts	Akerlof 1982, Shapiro and Stiglitz 1984, Simon 1951, Stiglitz and Weiss 1981
Financial instability	Prices as information, dynamics of price setting, positive feedbacks and tipping points	Geanakoplos 2010, Hayek 1945, Minsky 1986, Morris and Shin 2001

Inspired by Samuelson in economics and Feynman in physics, the challenge taken up by the CORE group was to make these concepts accessible to introductory students in a way that would shed light on the "pressing problems."

Instead of beginning the text with "economics" and "thinking like an economist," CORE begins with "the economy" and "how the world came to look the way it does today." Students are motivated by historical evidence about a complex, dynamic process and the promise of gaining insight using economic models and data.

The first chapter, titled "The Capitalist Revolution," starts with a set of recently estimated thousand-year time series data on GDP per capita. The first figure students see and manipulate shows seven centuries of "flat world economies" followed by a pronounced upward kink of "history's hockey stick" as the series takes off, first in Great Britain, then in Japan and Italy, and more recently in China and India. Next is an interactive figure illustrating global inequality within and between countries and how it changed since 1980.

This provides a "need to know" motivation for students to work with the first tools of economics: measurement of output (with data exercises) and models of innovation. The first model that the students learn (in the second chapter) is Schumpeterian, providing a framework for understanding the importance of economic rents in explaining the dynamism of capitalism; and specifically, the ways that innovation rents contributed to the industrial revolution and to the kink in history's hockey stick.

The analytical treatment of inequality illustrates the same problem-based and "need to

know" structure and motivation. It begins with an account of the (written) constitutions of eighteenth century pirate ships stipulating how the division of the spoils would be determined (Leeson 2007), how the result can be represented by a Lorenz curve and a Gini coefficient, and comparing these with inequality on the Royal Navy ships that were giving chase.

Here the major challenge was to render the sometimes vague but nonetheless essential concepts of "power" and "institutions" in analytical terms. This is done by introducing elementary game theory at the outset (chapter 4) and representing institutions as the "rules of the game." A simple bargaining model represents a farmer and landlord interacting under evolving institutional settings including coercion, rule of law, democratic rule making, and Coase-style bargaining.

This analytical treatment of the exercise of power in conflicts over economic rents is then used to study principal–agent relationships in the credit and labor markets and between a central bank and commercial banks. In each of these three cases, the incomplete nature of the relevant contracts means that economic rents and the exercise of power (by principals) are characteristics of the relevant Nash equilibria. Thus, the details of the institutional environment of an economic interaction have a central and analytically tractable place in the account, and political-social aspects of exchange become integral to the modeling, not something that may be appended electively and descriptively, as a gesture toward interdisciplinarity.

The remaining key concepts in figure 9 present similar opportunities for integrating modern theoretical developments and empirical findings as essential ingredients to model today's economic challenges. By building them into the student's toolkit from the outset, addressing these issues does not have to wait until the new concepts can be added as "frontier topics" at the end of the book.

7. *Relevance and Coherence: Challenges for a New Benchmark*

Writing an introductory text commits an author to take a position on a set of benchmark questions concerning what the economy is, what people are like, how we interact in the economy, the economic outcomes of these interactions, and how these are to be evaluated and might be improved by public policy.

A schematic representation of the resulting new benchmark appears in the right column of table 3 alongside a summary of the conventional one. The conventional one is well worked out and established, and the other is nascent but we think coherent and (we will suggest below) teachable. The entries are highly abbreviated and oversimplified and, of course, cannot convey the richness and nuance of the relevant textbooks. Instead, they represent markers of what we think a student would take away from a course based on the conventional benchmark or one based on the new benchmark.

While each of us would compile a slightly different list, few economists would claim that the elements in the right-hand column —perhaps with modest modifications—are untrue or unimportant. Equally, few would insist that the conventional benchmark is entirely without merit. Where economists differ is over the sequencing. One position is that the modern view of contracts as incomplete is better taught in advanced courses after the student has learned the conventional complete contracts benchmark. The other is that both beginning majors and one-course-only students would be better off learning a new benchmark, one in which these subjects did not appear as special cases, exceptions, or criticisms of the benchmark but rather as the foundations and implications of a new way of doing economics.

To oversimplify a bit: disagreements boil down to whether the benchmark taught in the introductory course should still be the

TABLE 3.
BENCHMARK REPRESENTATION OF THE ECONOMY IN INTRODUCTORY TEXTBOOKS: CONVENTIONAL AND NEW

Subject	Conventional benchmark	A new benchmark for introductory textbooks
People	*Homo economicus* is far-sighted and self-interested.	People are also cognitively limited and have motives other than self-interest, including social norms of fairness and reciprocity and "us" versus "them" thinking.
Nature	External to the economy	Economy is part of the biosphere; the sustainability of which is in question.
Social interactions	Market exchange by individual price takers.	…also non market and strategic interactions, including collective action
Information	is complete and verifiable.	is often incomplete, asymmetric, and non-verifiable.
Contracts	are complete and enforceable at zero cost.	are incomplete in labor and credit markets, missing markets (traffic congestion, knowledge).
Institutions	Markets, private property, and government as exogenous	Modeled generically as "rules of the game" including informal rules (norms), endogenous
Technology	Exogenous, decreasing returns	Endogenous; constant or increasing returns
Competition	"Perfect" among price-taking agents	Monopolistic, monopsonistic, among price-making firms, winner-take-all
History	Largely ignored except to illustrate models	Provides modeling challenges to understand alternative rules of the game and the process of change
Agent heterogeneity	Preference and budget constraint differences among buyers and sellers	Also includes asymmetric positions, for example as employers or employees, lenders or borrowers
Power	Market power and government, exogenous	Includes also a principal's power over an agent in labor, credit, and other markets; endogenous
Economic rents	are inefficient and originate in mistaken public policy or limited competition.	are also essential in a well-functioning private economy, creating the incentive to innovate, to work hard and use borrowed funds prudently, and to equilibrate markets.
Stability and instability	The economy is self-stabilizing.	Stability and instability are both characteristics of the economy.
Policy	Directed by a Pigou–Marshall-style beneficent impartial social planner	also, state failures due to information limitations on policy design and implementation, rent seeking states (modern political economy)
Evaluation	is confined to the presence of unexploited mutual gains (Pareto-inefficiency).	also includes procedural and substantive fairness, and environmental sustainability.
20th-century provenance	Marshall, Walras, Keynes	also, Hayek, Nash, von Neumann, Schumpeter, Coase, Ostrom

middle column, with the right-hand column reserved for advanced topics courses for the much smaller number of students going on in economics.

The CORE team's alternative in *The Economy* is to bring the new benchmark (right column of table 3) to the front of the book. The outcome is that the equilibrium of a perfectly competitive market with price-taking agents becomes an illuminating special case to be taken up in more detail in later courses. Unlike the conventional benchmark, the economy is not represented by a static equilibrium of a self-contained system, but rather as an always-changing process embedded in society and the biosphere, which it both impacts and reflects.

By shifting the benchmark, in *The Economy*, people are capable of both calculative self-interest and generosity; they interact not only in markets, but also in situations where differences in power and the rules of the game (institutions) matter to the nature of the relationship, whether it be as managers and employees, as citizens and government, as members of unions and of families. In the new benchmark model, the economic outcomes arising from these interactions are seldom either efficient or fair, leaving governments, which have their own characteristic failures, with a potential role in addressing inefficiencies, injustice, and problems of environmental sustainability.

By contrast, in standard principles teaching, market failures are brought in as deviations from the conventional benchmark. For instance, the twelve "principles" with which Krugman and Wells introduce students to the field mentioned above include the reassurance that "markets move toward equilibrium" and "usually lead to efficiency" and "when markets don't achieve efficiency government intervention can improve society's welfare." For Mankiw, "markets are usually a good way to organize economic activity."

Considering the starting point and balance of topics in standard textbooks, the student may reasonably conclude that the economy is about interactions in competitive markets (a positive statement) that function pretty well (a normative one) and in which governments ought not to "meddle," to use Krugman–Wells's term. Externalities and the asymmetric information and incomplete contracts that give rise to market failures are a special case, not a characteristic of most transactions.

Government failures, too—the textbook examples presented are rent control and the minimum wage—appear as special cases. There is no analytical treatment of rent seeking by public bodies or of the information limits under which governments operate, which might help explain the intrinsic shortcomings of intervention by states, even democratically elected ones.

Moreover, without the aid of a model of why, for some goods or services, the command economy of a firm or the cooperative economy of a family or a community of neighbors might be superior to market transactions, the student might wonder at the substantial extent of economic interactions that do not occur in markets, but instead take place within firms, families, and communities.

The modern theories of nonmarket interactions, asymmetric and non-verifiable information, public economics, and political economy offer a new benchmark that provides a more balanced and possibly less favorable view of both markets and governments, supporting a more empirically relevant and less idealized view of policy alternatives.

8. *New Micro-Foundations of Macroeconomics for the Introductory Course*

A new benchmark of the kind sketched in table 3 can integrate micro and macroeconomics by exploiting advances in our understanding of the workings of labor and

credit markets. A critical flaw in Samuelson's synthesis and the modern textbooks that have carried it on is that Marshallian microeconomics is simply inconsistent with key elements of a macroeconomic model with Keynesian-type demand-driven fluctuations and persistent unemployment at labor market equilibrium. But these gaps in Marshallian economics have been filled by research over the last four decades.[15]

Principal–agent models of the credit market (e.g., Stiglitz and Weiss 1981) explain why, for a population in which there are many families with limited wealth, there will be excluded borrowers. These are the credit-constrained households with a high marginal propensity to consume that place a limit on the extent of consumption smoothing at the level of the aggregate economy and thereby animate the multiplier process.

Similarly, recognizing that it is impossible to write enforceable contracts for worker effort in an information-scarce environment means firms will set wages so that there is always a cost of job loss for workers (e.g., Bowles 1985, Salop 1979, Shapiro and Stiglitz 1984). As a result, there is involuntary unemployment at the equilibrium of the labor market. This is not (as is standard in the leading textbooks) a deviation from market clearing caused by arbitrary wage rigidities, minimum wages, monopsony, or unions. Unemployment results from profit seeking with flexible prices and wages and no impediments to competition. This is a different benchmark model of the economy, one in which the intersection of demand and supply functions for labor or credit does not exist and is analytically displaced by the Nash equilibrium of strategically interacting principals (employers and lenders) and agents (employees and borrowers).

The fundamental relationships in the new benchmark for introductory macroeconomics are thus derived from tractable models of constrained optimization behavior by the major actors: workers, firms, banks, and the government. Contracts are incomplete in credit and labor markets so families and individuals are quantity constrained, a setting that accords with the world as students experience it. The transition between the micro and macro classroom does not require a new and jarring set of ad hoc assumptions because the students' understanding of the multiplier conforms with the modeling of the credit market, and the presence of unemployment in equilibrium lines up with how profit-maximizing firms set wages.

By contrast, in the conventional textbooks, even when the idea of an efficiency wage is introduced, it is typically simply appended to the standard labor market apparatus of intersecting labor supply and demand curves, as an ad hoc deviation from the model in which the labor market clears (e.g., Mankiw 2009, p. 594; Acemoglu, Laibson, and List 2015, pp. 237–8). The efficiency wage—like a government-imposed minimum wage—is represented as a surcharge on the market-clearing wage, which cannot be based on any coherent model at all, because in the efficiency wage model there is no finite market-clearing wage.

9. *The Forces of Supply and Demand or the Intersection of the Two Curves?*

The question thus arises: how do we want students to use the supply and demand apparatus when there may be excess demand or supply in equilibrium—as in the labor or credit markets when lending and hiring is analyzed using a principal–agent model? A

[15] Credit constraints and equilibrium unemployment have become staples of research frontier macroeconomics, grouped under the label of heterogeneous agent New Keynesian models (HANK), for example, Challe and Ragot (2016); Kaplan, Moll, and Violante (2016); Ravn and Sterk (2016, 2017); and search and matching models (SAM), Blanchard and Galí (2010); Christiano, Eichenbaum, and Trabandt (2016); and Gertler and Trigari (2009).

related question arises in other markets if the out-of-equilibrium rent-seeking behavior of firms and individuals generates significant excursions away from the intersection of the supply and demand curves determined by economic fundamentals.

Our response is that in many settings "where the supply and demand curves cross" is not the correct answer. Importantly, this does not amount to an abrogation of the "laws of supply and demand" or a reduction in their force. It requires instead that we break away from the benchmark of the intersection of the two curves, either because that intersection may not exist, or may not be where the market is heading as occurs, for example, during a bubble.

The modern theory of the labor market and the wage-setting firm discussed above provides an illustration of the enduring importance of the forces of supply and demand even in a setting in which excess supply is a characteristic of equilibrium. In this model the wage is set by the employer (the principal), conferring a rent on the employee (the agent) set to minimize the cost of a unit of effort (which the firm cannot secure by contract) that is supplied by the worker. The forces of supply and demand affect the profit-maximizing wage because they alter the worker's fallback option, which depends on the expected duration of a spell of unemployment should the employee be fired for supplying insufficient effort.

The combination of this model of the labor market with one of the product market in which firms face downward sloping demand curves provides a compact way of studying the effects on equilibrium wages and employment of immigration, productivity change, increases in skill, unemployment insurance, unions, legal restrictions on firing, no-compete clauses, labor market monopsony, and the degree of product market competition. In this set-up, supply and demand effects are the mechanisms by which wages and employment change, but no use is made at all of the "intersection of labor supply and labor demand curves."

The fact that "where supply and demand curves cross" is no longer an adequate answer is a feature, not a bug, in the new benchmark. The reason is that understanding the mechanisms by which supply and demand work—including effects on bargaining power—gives the student a causal understanding of the process rather than a simple algorithmic way to generate "the right answer." A similar analysis allows the student to understand the causal mechanisms affecting the behavior of interest rate setting banks and quantity constrained borrowers.

In the CORE introduction, the forces of supply and demand work in a range of institutional environments not limited to the equilibrium of the perfectly competitive price-taking model. The rudiments of game theory and its application to economic institutions and monopolistic competition, including the effect of shifts in costs and product demand, are introduced prior to the perfectly competitive markets in chapter 8. In this the text follows not only Samuelson 1948, but also the leading microeconomics text for doctoral students (Mas-Colell, Whinston, and Green 1995) in which the analysis of the competitive market begins in chapter 10, like *The Economy*, over three hundred pages into the book.

By contrast, in standard modern introductory textbooks, the supply and demand apparatus is introduced right at the start and presented as a general model in which to discuss the forces of supply and demand. The special character of the equilibrium of a price-taking market equilibrium is discussed much later, by which time a student could be excused for thinking that the clearing market represented in the diagram is much more widely applicable. As we have seen, Samuelson (1948) deliberately chose not to

do this. He introduced the model very late and with many caveats.

Rod Hill and Anthony Myatt explain:

> Krugman–Wells are quite explicit about the rationale for using the model of supply and demand in a much wider range of settings than for perfect competition. After noting, for example, that oligopoly is by far the most common market structure, they ask "Given the prevalence of oligopoly, then, is the analysis … based on perfect competition still useful?" They argue that it is because "[i]t is also true that predictions from supply and demand analysis are often valid for oligopolies." Given the complexity of oligopoly models, "in situations where they do not expect the complications associated with oligopoly to be crucial, economists prefer to adopt the working assumption of perfectly competitive markets" (Krugman and Wells 2005, 383; [2015, 438]; Hill and Myatt 2010, p. 58).

Figure 8 illustrates the count of analytical figures, including of the iconic supply and demand diagram, in five textbooks, normalized by the number of words. From Samuelson 1948 to the modern textbooks there has been an increase in the use of analytical figures in the teaching of economics. In Mankiw and Krugman–Wells a substantial fraction of those figures are supply and demand diagrams—for price-taking markets for goods and services, for oligopolistic markets, for the labor market whether local or aggregate, and, using the same vernacular and imagery, for the analysis of the macroeconomy using the aggregate demand and aggregate supply (AD/AS) apparatus.

There was a total of fifty-two distinct analytical figures in Samuelson 48. There are nearly four times as many figures in Mankiw and Samuelson–Nordhaus, and nearly five times as many in Krugman–Wells and in CORE's *The Economy*. Only a fifth of the figures in Samuelson were of supply and demand (none of AD/AS), whereas 41 percent in Mankiw and 34 percent in Krugman and Samuelson–Nordhaus were of supply and demand. Just one-tenth of the analytical figures in CORE are of supply and demand (none of AD/AS).

The AD/AS apparatus is replaced in the new benchmark represented by the CORE text, by a model of the aggregate economy in which the same actors introduced in the "micro" chapters (firms, banks, and the central bank) set wages, prices, and interest rates.

Take as an example how the economy responds to a change in aggregate demand. CORE's new benchmark model and the "AD/AS plus Phillips curve" model in the conventional textbooks share qualitative predictions for output, employment, and inflation.

However, familiarity with supply and demand curves could lead students of the conventional textbooks to forget that the AD is a complicated general equilibrium condition involving the goods and money markets with a real balance effect, and to reason in terms of the logic of a partial equilibrium market supply and demand interaction. Given the association of the supply–demand intersection in "micro" with Pareto efficiency, students might even be led to conclude that as long as the economy is competitive, a "long-run" AD/AS intersection is one without deadweight loss.

In its own terms, the logic of AD/AS is unappealing, as Blanchard explains using the example of a negative shock to aggregate demand: "Its main point is to show how output naturally returns to potential with no change in policy, through a mechanism that appears marginally relevant in practice: Lower output leads to a lower price level, which leads, for a given money stock, to a higher real money stock, which leads to a lower interest rate, which leads to higher demand and higher output. This is a long, convoluted chain of events with doubtful realism" (Blanchard 2016).

This contrasts with the reasoning in the actor-centered CORE text. Illustrating

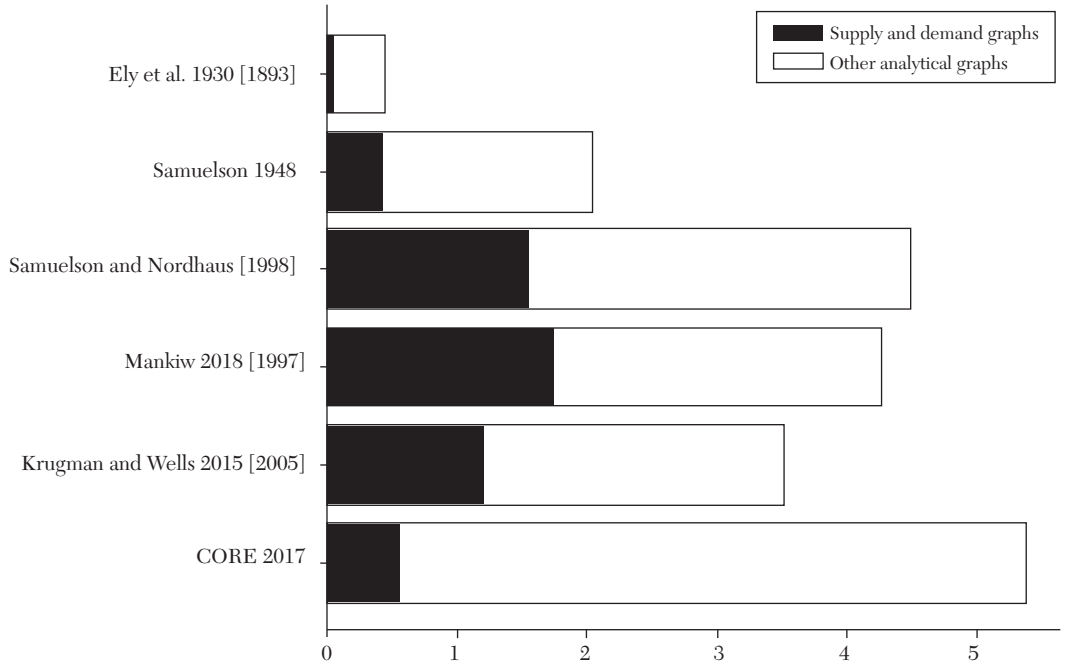

Figure 8. Supply and Demand Figures and All Analytical Figures per 10,000 Words

Notes: A figure is counted as "supply and demand" if there is both a supply and a demand curve or if the AD/AS model is shown. If several graphs are simply about building up the final figure, this counts as one and if, for example, there are two panels—one with the market for apples and the other for apple pickers, this counts as two. The number of AD/AS figures in the textbooks (in the above order) is: 0, 0, 16, 9, 16, and 0.

this by taking the opposite case to Blanchard of a positive shock to aggregate demand, it explains first that firms (facing downward-sloping demand curves) respond to a rise in aggregate demand by increasing production because this is profitable even at the existing price. Next, quantity constraints based on the principal–agent model of the credit market motivate the working of the multiplier mechanism, which reinforces the rise in demand because some households are unable to smooth their consumption. And the principal–agent model of the labor market explains that when aggregate unemployment falls, the fallback position of workers improves, so firms choose to set higher wages. Firms mark up their increased costs and inflation goes up. The policy maker is an actor with objectives (such as inflation targeting) and intervenes to steer the economy toward its inflation target at minimum cost.

The policy maker's inflation target (not the growth rate of the money supply) pins down the inflation rate in the constant inflation equilibrium. Of course, money plays a part in any model of inflation, but under inflation targeting, the growth of the money supply does not determine the inflation rate. For example, if inflation is above target because of high aggregate demand, then the central bank will aim to reduce aggregate demand by raising the policy interest rate. The central bank achieves its inflation objective by inducing the banks to raise their lending rates and

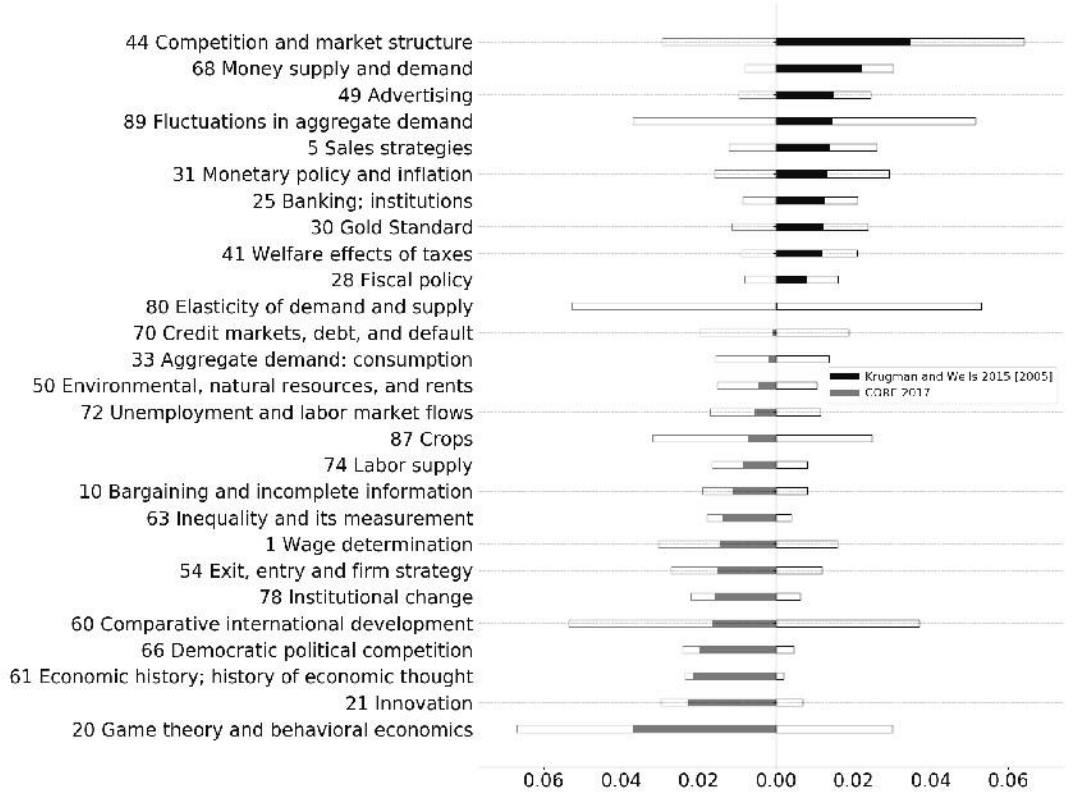

Figure 9. A Topic Comparison of CORE (2017) and Krugman and Wells (2015)

thereby to bring about lower growth in the demand for loans by households and firms. A fall in money supply growth is the outcome (as banks make fewer loans), not the cause of the fall in inflation. Money supply is endogenous in the new benchmark model.

10. *A Quantitative Comparison of Textbooks*

Although topic modeling alone cannot adequately capture contrasting benchmarks, it can reveal the differences in coverage of topics and in the distribution of topics over the chapters of the text.

The bars in the figures comparing CORE's *The Economy* in turn with Krugman–Wells (figure 9), and Mankiw (figure 10) are noticeably less symmetric around the vertical axis than are those in figure 7, which compares Mankiw with Krugman–Wells. This reflects the dissimilarity of topic coverage in CORE and the two leading modern textbooks.

However, the large symmetric outline bars show that all three modern textbooks share substantial coverage of standard topics in the economics of competition and market structure, elasticity of demand and supply, and fluctuations in aggregate demand.

All three textbooks introduce game theory and behavioral economics (20), and comparative international development (60) (in contrast to Samuelson 1948), but as the

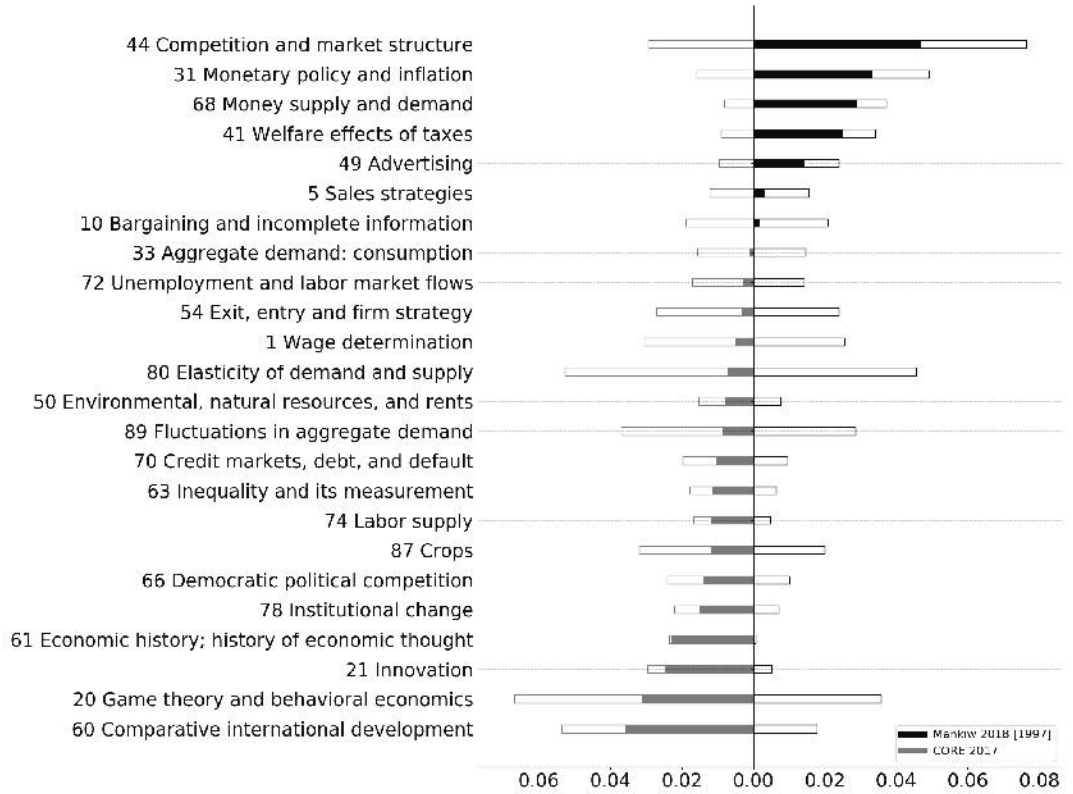

Figure 10. A Topic Comparison of CORE (2017) and Mankiw (2018)

solid bars at the bottom of figures 9 and 10 indicate, CORE devotes considerably more attention to both. The topic weights indicate that both Krugman and Wells and Mankiw devote more attention to competition and market structure (the top row in both figures). CORE's topic novelty also lies in the introduction of innovation (21) and economic history, history of economic thought (61) and greater coverage of institutional change (78), and democratic political competition (66).

Students are likely to pay attention to which topics are introduced first and returned to frequently, in contrast to the ones that once introduced are abandoned. The former, they will understand, is what economics is about.

The quantitative textual analysis can be used to trace the distribution of topics across the chapters in the text. The standard modern textbooks follow a very similar chapter sequence, which as we have seen is quite different both from the sequence in Samuelson's text and from CORE's. Topic modeling can be used to trace particular themes through the sequence of chapters. The results are shown for two topics of interest.

10.1 *Innovation (Topic 21)*

The early introduction of the innovation topic and its frequent recurrence in the CORE textbook is evident in the final

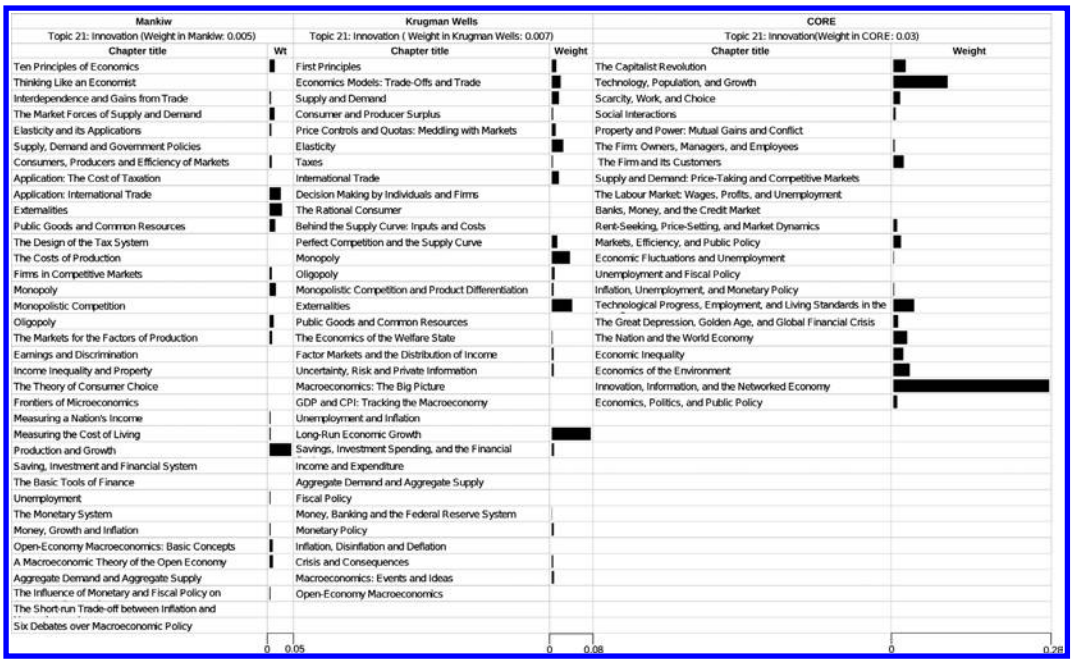

Figure 11. The Chapter Distribution of the Topic Innovation (21) in Three Textbooks

Notes: The length of the bars is the topic weight of topic (21) in the indicated chapter of the three textbooks. The chapters are listed in sequential order.

column of figure 11. Following the data on the phase transition from a world without growth in living standards to the "hockey stick," a model of innovation is introduced in *The Economy* in chapter 2 in the analysis of Schumpeterian rents in the industrial revolution. Innovation is not a one-off "topic," but instead is an abiding theme with significant appearances in subsequent chapters on the organization of the firm, market failures, technological change and the future of work, the global economy, and the environment. A "capstone" unit on innovation addresses problems of intellectual property, the diffusion of innovations, and matching markets with platform technologies.

By contrast, the treatment of innovation in standard textbooks, as exemplified by both Krugman–Wells and Mankiw, is concentrated on patents in a chapter on externalities and on exogenous technological change in a chapter on long-run economic growth. Its relative sparseness is clear from the left-hand columns of figure 11.

10.2 *Game Theory and Behavioral Economics (Topic 20)*

The vector of words and their weights given the topic name "game theory and behavioral economics" (20) is present in many chapters in all three books, showing up where economic interactions and the motivation and behavior of economic actors are discussed. But its distribution through the textbooks differs in important ways as

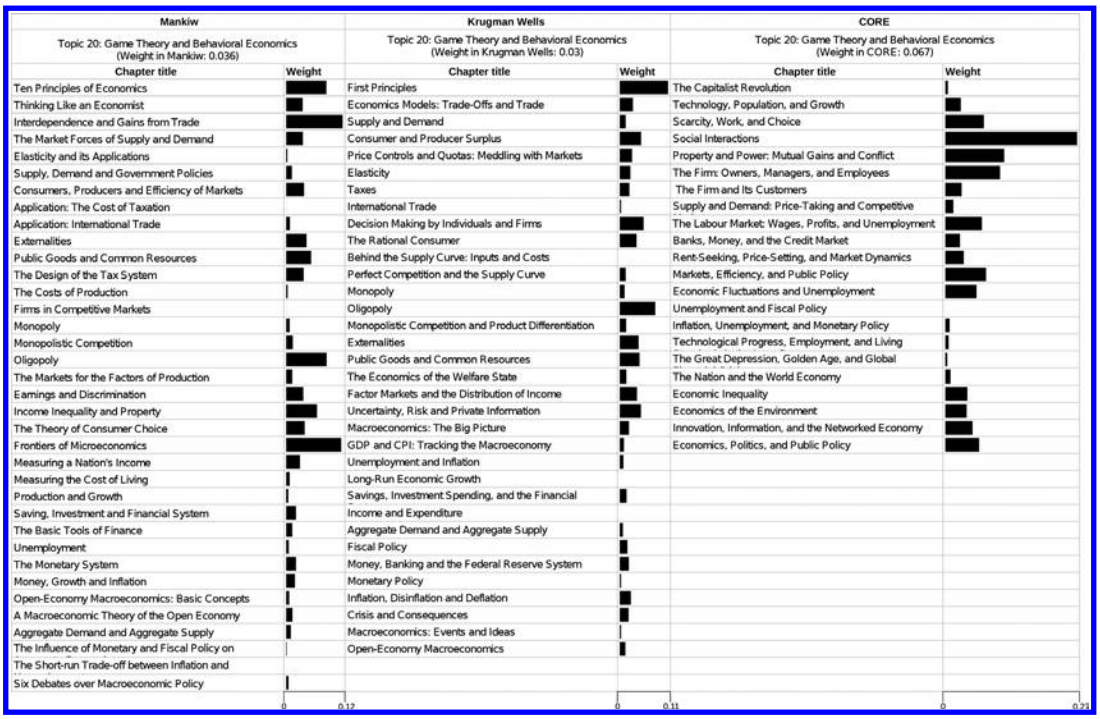

Figure 12. The Chapter Distribution of the Topic Game Theory and Behavioral Economics (20) in Three Textbooks

Note: The length of the bars is the topic weight of topic (20) in the indicated chapter of the three textbooks.

is evident visually from figure 12. In *The Economy*, there is a build-up to a peak in the fourth chapter and the topic remains salient through most of the text.

The book progresses from modeling the individual actor making decisions against "nature" in chapters 2 and 3 to the study of social interactions using game theory in chapter 4, where the distribution peaks. The tools developed there are applied first in chapter 5 to show how differences in the rules of the game under which actors operate (institutions) affect outcomes, and then in the principal–agent setting for the micro-foundations of the labor and credit markets.

The game theory and behavioral economics topic has weight in the "macro" chapter 13, "Economic fluctuations and unemployment" for two reasons. First, the effect of cognitive biases—weakness of will—in inhibiting consumption smoothing (along with credit constraints) is part of the discussion of economic fluctuations. And second, the volatility of investment is illustrated using a two-player coordination game where the investment of one firm depends on its beliefs about the growth of its market, which in turn depends on the investment of the other firm.

By contrast, for example, this topic occurs in Mankiw in three quite separate places—in the analysis of the gains from trade in chapter 3, oligopoly in chapter 17, and at the end of the micro part in chapter 22 on frontiers in microeconomics.

11. *Can the New Benchmark Model be Taught to First-Year Students?*

The fact that the new benchmark concepts are frequently introduced only in later courses for students majoring in economics or in graduate programs could be explained by inertia or pedagogical logic. A plausible explanation is that such concepts are introduced by younger faculty in elective courses at the end of a student's degree program, minimizing the need for any more general updating of the curriculum. But it is often said that the topics in CORE's new benchmark are simply too difficult for the introductory course.

A reason for thinking that the concepts themselves are not more difficult to teach and learn is that CORE's *The Economy* has been successfully taught as the standard introduction to economics both at elite universities (UCL, Sciences Po, Columbia University) and also to first-generation university students (Colorado State University, Birkbeck University of London, La Trobe University) and in large lecture-based courses (Toulouse School of Economics, Humboldt University of Berlin, Trinity College Dublin). The accessibility of the material is also suggested by the fact that a CORE adaptation is now being taught in French secondary schools.

It is too early to draw conclusions about the relative success of this new course, but the take-up of such a radically different—and superficially more demanding—approach deserves some explanation.

The team of CORE authors began from the principle—adopted by Samuelson for economics and Feynman for physics—that teaching economics to provide insight about a world recognizable to students was likely to be motivating. Most students have had a job and understand the concept of an incomplete labor contract immediately. They or their families have experienced the credit market and know about credit exclusion and credit rationing. They know that the world they live in is not one in which it is irrelevant whether workers hire capital or capital hires workers, which Samuelson had pointed out was a characteristic of the standard textbook perfectly competitive model (Samuelson 1957).

As shown in figure 8, CORE makes extensive use of analytical figures. Feasible sets and indifference curves along with the Nash equilibrium concept (introduced with game theory in chapter 4, see figure 12) are used repeatedly across a much wider range of applications than is usual in a first course. By standardizing the visual presentation and terminology, students are helped to appreciate the power and multiple applications of an economic model. For example, in CORE, the central bank is depicted with preferences represented by indifference curves and facing the constraint of the short-run Phillips curve.

A second example is the repurposing of the monopoly model to explore political monopoly and competition. The model of the price-setting firm where the firm sets the price to maximize profits at the tangency of the iso-profit curve and the demand curve is used to show a dictator maximizing political rents setting the tax rate subject to a "duration in office" constraint, which is a downward-sloping line just like the demand curve (where the expected future duration in power of the dictator is on the horizontal axis).

For students who choose to major in economics, the habit of thinking in terms of constrained optimization and Nash equilibria is established early, providing them with some intrinsic motivation to develop facility in calculus. Although the choice of modeling tools was made based on the "need to know" driven by the sequence of topics, it has the side effect of preparing and motivating students for intermediate courses, some of which now begin with game theory rather

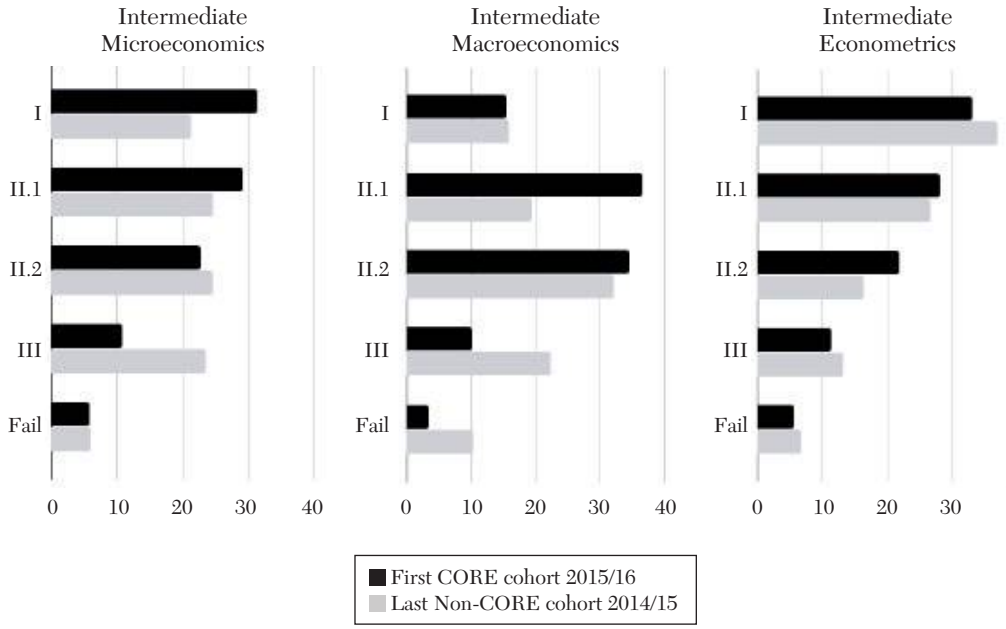

Figure 13. Comparison of the First UCL Cohort That Took the CORE-based Principles Course with the Last Cohort That Did Not: Results for Examinations in Unchanged Intermediate Microeconomics, Macroeconomics, and Econometrics Courses

Note: Grading: I: 70–100; II.1: 60–69; II.2: 50–59; III: 40–49; Fail: 0–39.

than with the "consumer," "producer," "general equilibrium" sequence.

Some combination of preparation and motivation may account for the fact CORE-exposed students have done well in subsequent courses. In unchanged intermediate micro- and macroeconomics courses at UCL, the first cohort of students who took the CORE introductory course (all first year students take the same course) did markedly better than the previous cohort (results in econometrics were unchanged). See figure 13. While the data in figure 13 by no means constitutes an adequate test of how well an introductory course that uses *The Economy* prepares students for subsequent economics courses, it is an encouraging sign.

Students who take CORE do not learn the traditional IS/LM or AD/AS models. This places them well to go on to modern intermediate macro courses, where textbooks are increasingly dropping these models (e.g., Blanchard 2017). The elements of updated intermediate courses include two interest rates (the lending rate set by banks and the policy rate set by the central bank), an inflation-targeting central bank subject to the zero lower bound, and a supply side based on wage- and price-setting curves that yields equilibrium involuntary unemployment and is used to derive the Phillips curve. These are all to be found in chapters 9, 10, and 13–15 of *The Economy*.

Not only is the content and sequencing of material in CORE very different from the

traditional introductory course, so too is the voice. The text is written for a person of any age whether attending a formal course or not, who is interested in understanding the economy and acquiring a toolkit of economics concepts and methods. The reader also gets a glimpse of what economists do in their scientific work and in policy analysis, and of the central importance of data and facts.

The final seven chapters are denoted as "capstones" and provide sustained treatments of important problems facing economies today. An introductory course would rarely have space for more than a couple of these and they are designed for use in other courses as well as for independent readers. When writing *The Economy* and publishing it digital-first free online, the authors had in mind not only undergraduate students but also any audience that reads economics blogs, newspapers, and magazines.[16]

12. *The Necessity of Pluralism*

A lack of "pluralism" in economics has been a recurrent critique, including of the CORE text: insufficient attention, the critics say, is given to contrasting schools of thought—Keynes versus the monetarists, Marx versus the neoclassicals, for example—and to the lessons of history and the other social sciences.

The critics are right. Undergraduate economics instruction tends to be narrow in both respects and our students are the worse-off for it. Problems arise, however, when it comes to remedies: some critics have a limited conception of pluralism, and a tendency to overlook recent developments in economics.

Let's distinguish between two variants of pluralism. One variant could be called *pluralism by juxtaposition*: differing approaches—schools of thought or disciplines—can be contrasted to highlight their differing ways of creating and using knowledge. Although at its best, this approach presents rich opportunities for students to learn to contrast and criticize ideas from differing points of view, what we call pluralism-by-juxtaposition can also reduce the study of economics to a kind of paradigm tournament, conveying little or no common analytical core concepts.

As well as being able to critically evaluate arguments and talk about competing approaches, the citizen or policy maker needs to be able to make economic arguments themselves. Samuelson's realization that what he called the "classical verities" are a poor guide to policy in an economy of underutilized resources did not drive him to write an introductory textbook titled *Keynesian versus Classical Economics.*

Pluralism can also be pursued, as Samuelson aspired to do, by integrating the insights of differing schools of thought and knowledge from other disciplines into a coherent paradigm. This can give students analytical tools borrowed from many schools or disciplines and help them to do economics rather than simply to talk about it. We call this *pluralism by integration*.

Here is an example of integrative pluralism, illustrating how the benchmark makes a difference. CORE's treatment of the firm and the labor market starts with the fact that

[16] Standard tools originally developed to compare the complexity of the language in training manuals in the US Navy are used to compare the readability of the textbooks. The result of the Flesch test is that the CORE text is somewhat more complex than Mankiw's, but less so than Krugman–Wells and Samuelson 1948. The tests are based on syllables per word/proportion of multisyllable words, and sentence length. The use of multisyllable words is virtually the same across the four textbooks, but Krugman–Wells and Samuelson use longer sentences. The Flesch–Kincaid (F–K) measure's output is the US grade level needed to comprehend the text, according to which, Samuelson 48 and Krugman–Wells are comprehensible to a twelfth grade student, Mankiw to a tenth-grader, and CORE to an eleventh-grader. An open-source tool called Flesh (sic) (https://sourceforge.net/projects/flesh/) was used for the full-sample analyses shown above. Syllables per word were calculated using online-utility.org. (Kincaid et al. 1975).

employer and employee have conflicting interests about effort exerted at work. The idea that the labor contract cannot ensure that the employee works hard and well is a common illustration of the modern microeconomics of incomplete contracts. But its provenance is Karl Marx, not Walras or Marshall.

The reason why the contract is incomplete is that information is both local and scarce, the cornerstone of the economics of Friedrich Hayek, although subsequently developed in very different ways by contributions to principal–agent modeling over the past three decades. The employer cannot possibly have the information needed to enforce the many dimensions of work effort by court order.

In CORE's *The Economy,* a student can then learn from Ronald Coase that "the distinguishing mark of the firm is the suppression of the price mechanism" in favor of a system of authority. This, too, sounds more Marx than Chicago. Wages and the amount of work done thus are determined in part by the exercise of power by the employer and the work ethic or other social norms among employees, not simply by market competition, invoking the writings of the late political scientist Robert Dahl. Sociology, psychology, political science, and law are all integral to understanding how this model works.

Students learn that Herbert Simon—an economist whose degree was in political science—provided a mathematical model of this process over half a century ago. Enriched by Coase, Hayek, Marx, and Simon and by recent research, this theory of the firm and of the labor market provides a model that students then use to analyze the gig economy, effects of minimum wages, or the macroeconomic performance of nations with different labor market institutions.

Pluralism is a necessity, not an option, in the new benchmark for an introductory course. Imagine that instead, the labor market and the firm were represented as in the standard supply and demand market-clearing model. The firm is supposed to purchase labor (that is, work) from the worker in a transaction with a complete contract no different from kilowatt hours of electricity or any other input. The implications are profound. There is no unemployment in the equilibrium of the labor market, no conflicts of interest over work, no exercise of power by the employer, and social norms play no role.

If the benchmark model is based on a selfish economic man in a world of complete information, complete contracts, and clearing markets, then pluralism by integration is pointless. The conventional benchmark depicts a world in which Coase, Hayek, Marx, Simon, not to mention Joseph Schumpeter, Hyman Minsky, and others are irrelevant and for which juxtaposition is about all that one could hope for.

In the new benchmark, pluralism—specifically, pluralism by integration—is demanded by the questions asked and models taught, and it shows students that useful insights come from many schools of thought and disciplines.

Consistent with the intrinsic pluralism of the new benchmark, the CORE introduction to economics draws upon and explicitly recognizes contributions from other disciplines and schools of thought. These contributions are not segregated in chapters dedicated to the history of economics, or to topics stressed particularly by advocates of greater pluralism in economics instruction, such as the role of institutions.

Figure 14 presents evidence from our topic modeling that the topics of institutional change (78) and economic history; history of economic thought (61) are introduced early in the course and taken up frequently as the course progresses.

13. *Conclusion*

Textbook writers may sometimes imagine that the publication of their work is a kind of

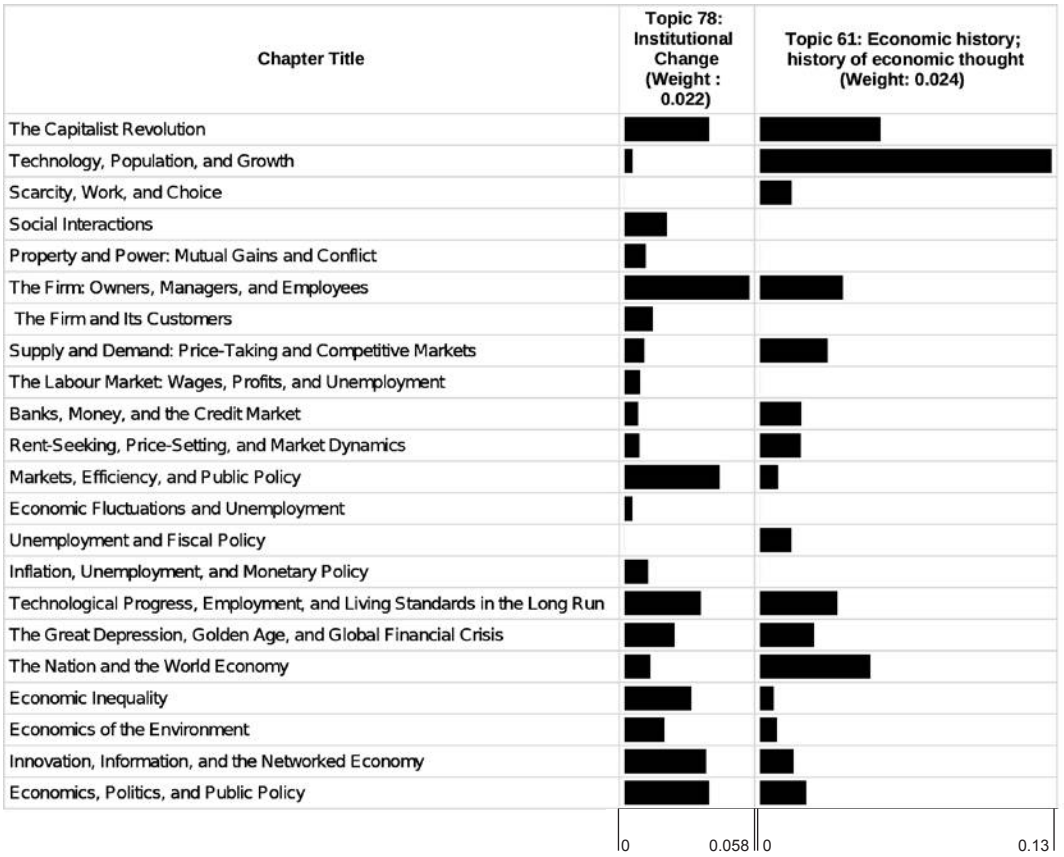

Figure 14. Topic Weights by Chapter in *The Economy* for the Topics, Institutional Change (78) (left panel) and Economic History; History of Economic Thought (61) (right panel)

Note: The overall topic weights in the column headings show the importance of the topic in generating CORE's *The Economy*, the bars in the figure are the importance of the topic in generating the content of the particular chapter given.

intellectual "end of history." Exactly a century before Samuelson published his book, readers of John Stuart Mill's *Principles of Political Economy* were no doubt cheered by the assurance: "Happily, there is nothing in the laws of value which remains for the present writer or any future writer to clear up; the theory of the subject is complete" (Mill 1867 [1848], p. 420).

Samuelson did not share Mill's hubris. And the accomplishment, limitations, and eventual collapse of Samuelson's grand neoclassical synthesis recommends a more modest assessment of what "the present writer or any future writer" can hope to accomplish, and a more historically contingent perspective on what "every economics student should know" and where the future critical insights for this knowledge might come from.

The intellectual environment of the post–World War II world—driven by the horrors of war, massive unemployment, and author-

itarian rule—signaled fundamental change in what students of economics should learn. Samuelson responded by boldly grafting a Keynesian branch onto the Marshallian tree.

But Keynes was far from the only intellectual offspring of these troubled times upon whom Samuelson might have drawn. For John von Neumann, the disturbing course of politics of Hungary and the rest of Europe was a major impetus for his contributions to game theory, which he hoped would illuminate political and economic relationships between social groups and how they might be better organized (Leonard 2010). For Hayek, authoritarian political systems and centralized economies under Hitler and Stalin were the threat that moved him to launch the economics of scarce and local information (Hayek 1937, 1945, 1948).

Samuelson (to von Neumann's chagrin) had little interest in game theory, perhaps because, at least by comparison to Keynesian economics, its policy applications at the time were less fully developed and less urgent than achieving a stable high-employment economy. Moreover, Hayek's economics of limited information had modest impact at the time because it came bundled with an opposition to the very government interventions in the economy that Samuelson and many others thought were essential if democratic capitalism was to survive (Bowles, Kirman, and Sethi 2017).

The Great Depression, fascism, and the advent of the Cold War was the real-world shock that—along with advances in economics—propelled the last sea-change in what students learn in Economics 101. Today the specter of global climate change with its unfolding calamities and a resurgence of challenges to democracy may motivate a fundamental rethinking about what we are teaching.

We have put forward the view that modern information economics and game theory—the distant but nonetheless recognizable descendants of von Neumann's and Hayek's and others' contributions in the 1940s—along with more recent developments in economics provide the conceptual building blocks for a new benchmark capable of addressing the primary economic problems of today.

Not surprisingly, the globally dominant economics textbooks since Mill were written in English and reflected the leading role of first the British and then the American economy in the capitalist world system. *Homo economicus* was a native English speaker. As economic dynamism shifts and as Asia restores its once preeminent share of world output, we conjecture that the new problems and advances in economics are likely to be less Anglo-centered in scope and origin than has been the case in economics to date. It may be that a new benchmark for teaching introductory economics—like the CORE project itself—will have a more global provenance.

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