

The future of economics and economics education – Insights from machine learning

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Australian Government

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THE EVOLUTION OF ECONOMICS AND THE FUTURE OF ECONOMICS EDUCATION: INSIGHTS FROM MACHINE LEARNING

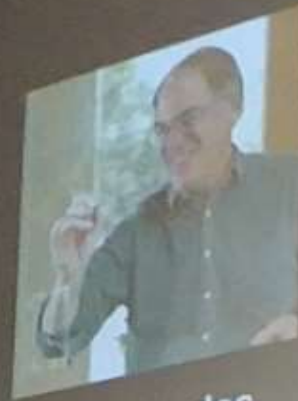
Wendy Carlin, UCL, CEPR, and CORE

Based on work forthcoming, with Samuel Bowles *J. Econ Literature* with a companion paper
by Greg Mankiw
ACE Melbourne July 2019

Thanks ...



Simon DeDeo



Sam Bowles



Suresh Naidu



Wendy Carlin

Sahana
Subramanyam
presenting
preliminary
results at the
Santa Fe
Institute



Economics

Harvard's Econ 101 Class Will Never Be the Same

It's time to retire Harvard professor Gregory Mankiw's conventional wisdom.

By Noah Smith

12 March 2019, 12:00 GMT



A sign of the times. Photograph by Scott Eisen/Bloomberg



One set of teaching materials that emphasizes empirical research is the CORE Project, an open-source effort developed by an international collective of economists. In addition to presenting a more syncretic vision of the economy than the Olympian wisdom dispensed by Mankiw's texts, and focusing more on hands-on data analysis, CORE's textbooks have the advantage of being free.

The classic theories of the 19th century, the focus on logic and philosophy over data and evidence, and the libertarian conventional wisdom of the 1970s are all looking out of date. As the profession changes, so must the face that it presents to students. The result will be an economics education that professes far fewer reassuring certainties. But in uncertainty itself, there is wisdom.

June 24, 2019

Democracy Dies in Darkness

Opinions

It's time we tear up our economics textbooks and start over

By Robert J. Samuelson

The modern era in economics textbooks began in 1948 with the [publication](#) of Samuelson's first introductory edition. We now are at a similar moment. We need to tear up the existing texts and start over, adding what is relevant and discarding what is outdated or

[Links to CORE's *The Economy*](#)

unimportant. Mankiw's textbook needs more than a touch-up; it needs a major overhaul. It has very little history: for example, the industrialization of the 19th century. Nor is there much about the expansion of the global economy. China gets a few mentions.

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Who is the CORE team?



Yann Algan
Sciences Po, Paris



Tim Besley
LSE



Samuel Bowles
Santa Fe Institute



Antonio Cabrales
UCL



Juan Camilo Cárdenas
Universidad de los Andes



Wendy Carlin
UCL



Diane Coyle
University of Cambridge



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David Hope
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Who is the CORE team?



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UCL



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King's College London



Nicholas Rau
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Rajiv Sethi
Columbia University



Margaret Stevens
University of Oxford



Alex Teytelboym
University of Oxford

- **Researchers** and **teachers** from **around the world** – from Colombia to Bangalore, from Sciences Po to Columbia University volunteering their time
- United by the **goal** of creating a high quality open access way of **bringing to students** the **best of economics**

What is CORE's reach to date?

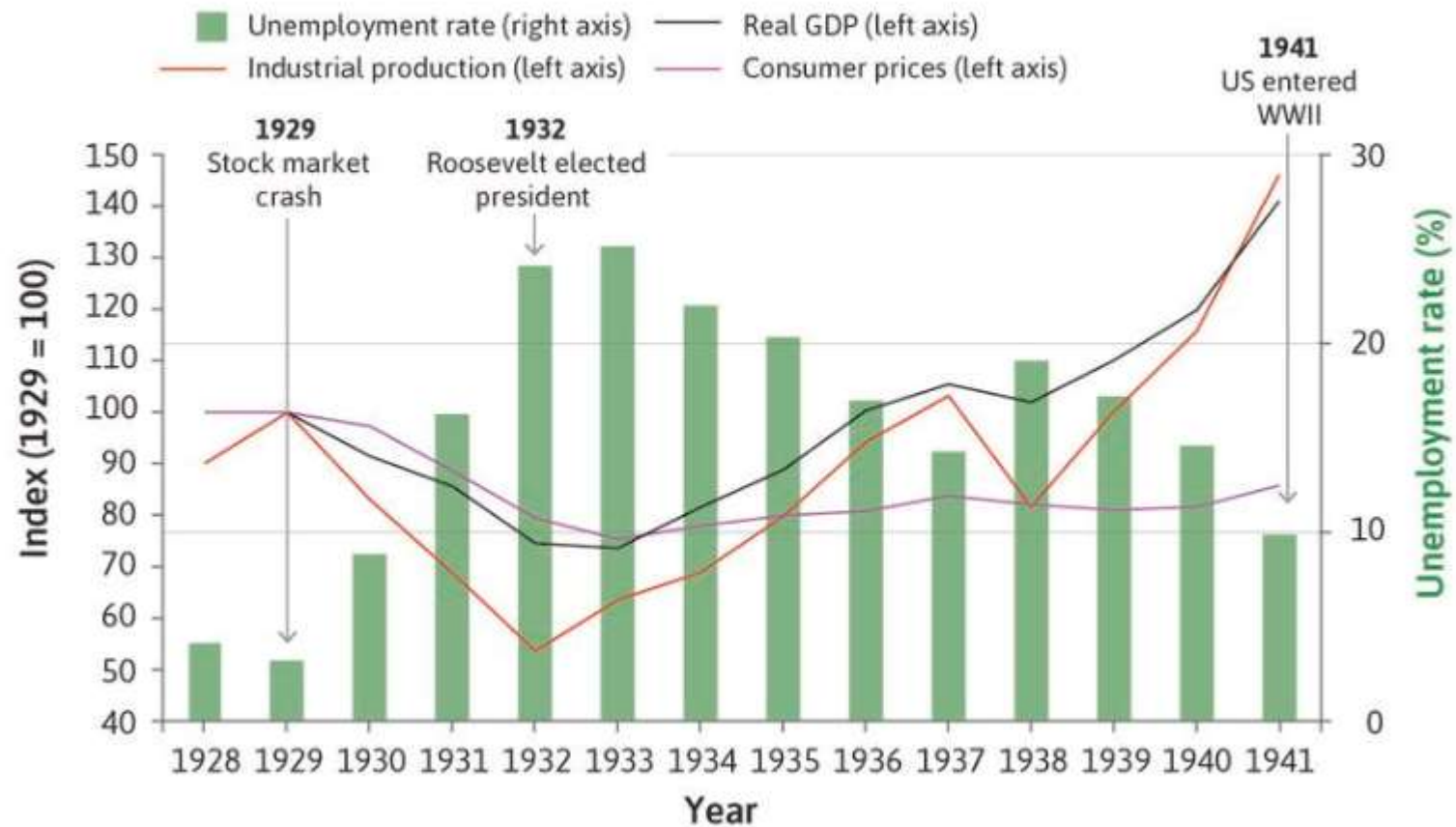
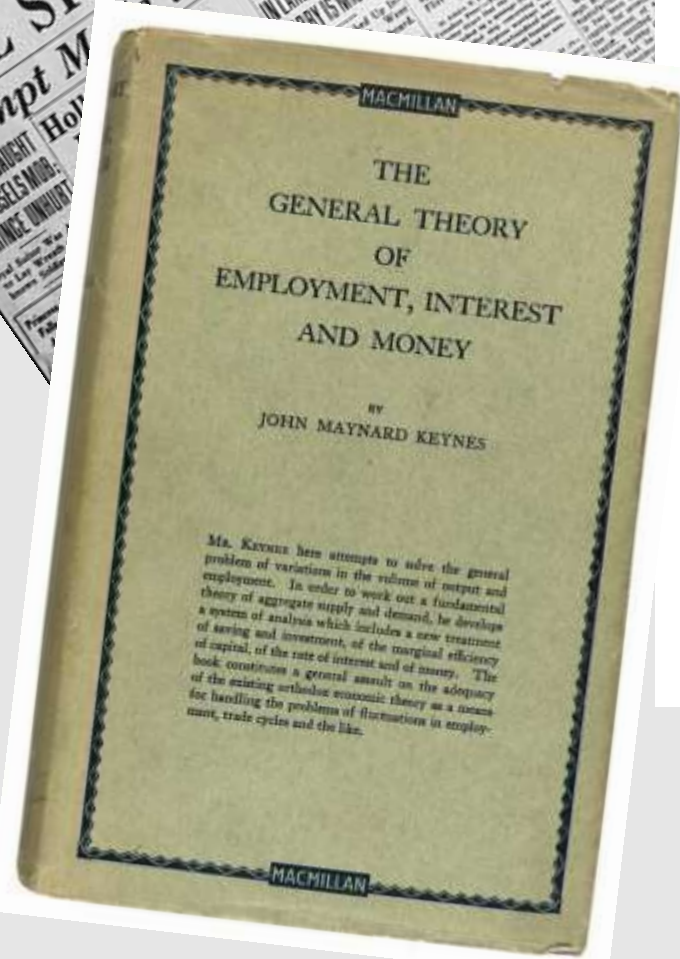
Engagement

240 universities teaching with CORE from 34 countries; 7,300 registered teachers

Replaced the principles course at:

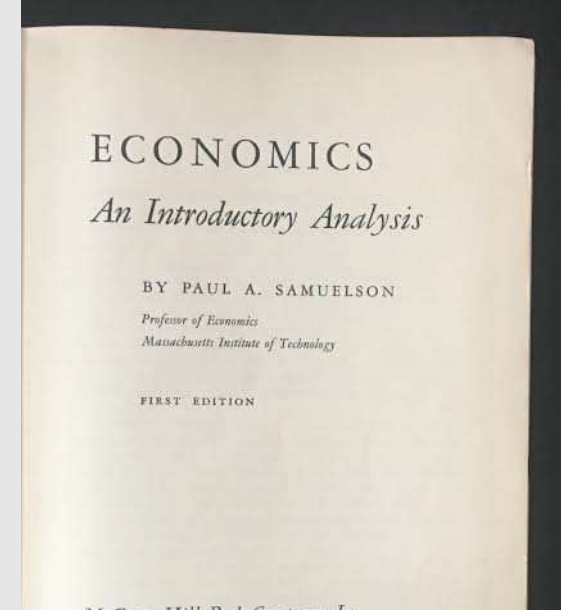
UCL, Bristol, Toulouse School of Economics, Sciences Po, Humboldt University, Birkbeck College, Kings College, University of Siena, UCLA, Colorado State University, Oxford University, Warwick University, and more

In use in Australia: UNSW, La Trobe, Macquarie, Melbourne, Monash, Sydney, UWA, Curtin, Adelaide, UTS, ANU (at PNG)

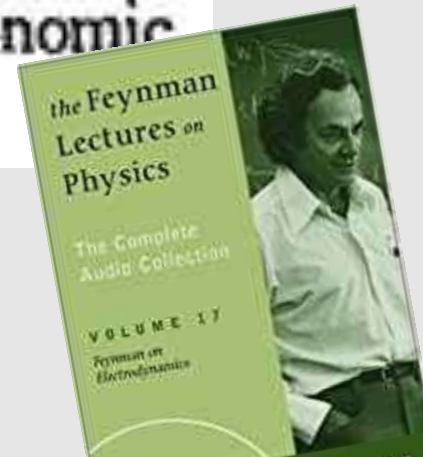




Samuelson, 1948, first page.



Today the nonspecialist in physics deserves and expects to learn about atomic energy and nuclear structure in his first year of study, rather than to 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?



Preface

QUESTIONS FOR DISCUSSION

1. How do you expect to fare in the next depression?

THIS book is written primarily as a textbook for those who will never take more than one or two semesters of economics but are interested in the subject as part of a general education. It aims at an understanding of the economic institutions and problems of American civilization in the middle of the twentieth century. National income provides the central unifying theme of the book.

Samuelson: “The methods of analysis used are those that have been employed by 90 per cent of the active academic economists under the age of 50 over the last decade.”

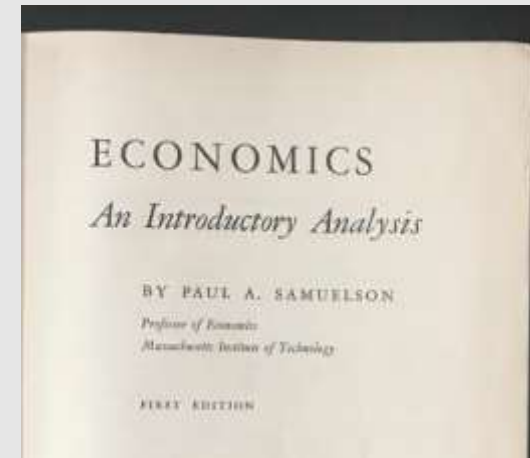
Part One: Basic Economic Concepts and **National Income**

1. Introduction
2. Central Problems of every Economic Society
3. Functioning of a “Mixed” Capitalistic Enterprise System
4. Individual and Family Income
5. Individual and Family Income: Earnings in Different Occupations
6. Business Organization and Income
7. The Economic Role of Government: Expenditure, Regulation, and Finance
8. The Economic Role of Government: Federal Taxation and Local Finance
9. Labor Organization and Problems
10. Personal Finance and Social Security
11. National Income

Part Two: Determination of **National Income** and its Fluctuations

1. Saving and Investment
2. Prices, Money and Interest Rates
3. Fundamentals of the Banking System and Deposit Creation
4. Federal Reserve and Central Bank Monetary Policy
5. International Finance and Domestic Employment
6. The Business Cycle
7. Fiscal Policy and Full Employment without Inflation

A revolutionary table of contents



Part Three: The Composition and Pricing of **National Output**

19. Determination of Price by Supply and Demand
20. The Theory of Consumption and Demand
21. Cost and the Equilibrium of the Firm under Perfect and Imperfect Competition
22. Production Equilibrium of the Firm and the Problem of Distribution
23. International Trade and the Theory of Comparative Advantage
24. The Economics of Tariff Protection and Free Trade
25. The Dynamics of Speculation and Risk
26. Social Movements and Economic Welfare

Chapter 19: DETERMINATION OF PRICE BY SUPPLY AND DEMAND

Page 457

← Page 447

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.

if marginal cost is falling, the firm has every reason to expand its output further, since each new step brings it the same extra revenue but lower extra cost.

This second part of our rule is not just a theoretical refinement. It shows us how and why competition tends to break down! Technology of a given industry

Pure or Perfect Competition

1. Includes a few agricultural industries

Monopolistic or

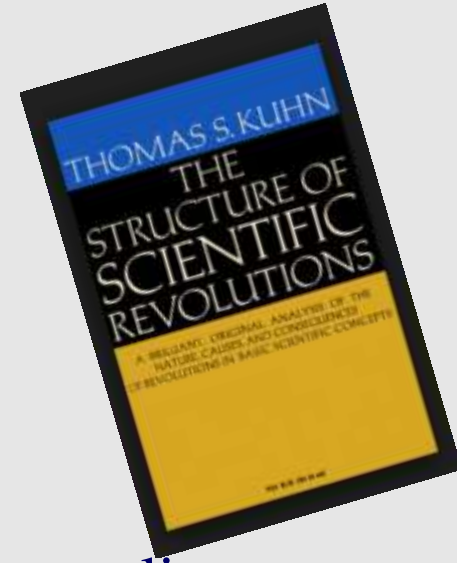
Imperfect Competition

1. Includes most firms and industries

Complete Monopoly

1. Rare

The idea: We combine a Bayesian statistical machine learning technique – topic modeling – with Thomas Kuhn’s concept of paradigm shift to explore the changing content of economics textbooks and how it reflects changes in both economics research and the economy.



- Kuhn’s scientific revolutions and paradigm shifts:
“*The [scientific] community’s paradigms [are] revealed in its textbooks..*”
- Topic modeling
- Was Samuelson 1948 a paradigm shift and if so, why did it happen and what earlier content did it preserve and what did it innovate.
- Do the current market-leading texts (Mankiw and Krugman & Wells (KW)) represent the current paradigm in economics, do they address the dominant economic problems ?
- How does the CORE open access introduction to economics differ from Mankiw and KW?

For those unfamiliar with topic modeling (TM): The idea

- A topic model is a Bayesian machine-learning answer to the question: What is the hidden structure of themes the authors most probably had in mind when they generated the documents?
- There are many ways that the above questions might be answered: e.g. reading the documents, interviewing the authors.
- TM: **by observing only the words** used can we reverse engineer what themes could have generated the observed collection of words in a set of documents?
- Topic modeling provides an answer by inverting the data-generating process and asking **what thematic structure is most likely to have produced some observed properties of the documents making up the corpus**

Bayesian probabilistic topic modeling

- Observed: a set of N unique words (including bigrams, etc, tokens) in a set of D documents (the corpus is D distinct “bags of words”)
- Hidden: the thematic content of the documents making up the corpus (the fixed number of K topics allocated across the D documents in ways that might have generated the observed word use)

Assumptions and researcher choices for the simplest applications (used here).

- *Bag of Words*. The only observed structure is the presence of words in documents. The order of words in a document is not observed (just a “bag of words”).
- Exogenous (selected by the researcher)
 - The number of topics that “generated” the corpus (K=100)
 - The set of D documents.
 - “Naming” the topics
 - Stemming and stop words

topic 4

```
(4, '0.296*"qualiti" + 0.069*"car" + 0.031*"merger" + 0.024*"attribut" + 0.024*"vehicl" +  
0.021*"high_qualiti" + 0.019*"vintag" + 0.015*"characterist" + 0.014*"automobil" + 0.010*"hedon")
```

Corpus

- 27,436 journal articles ...
- ...distributed over journals and time periods as shown
- ...after stemming and eliminating stop words gives
- 10,849 unique tokens (words, bigrams)

15.5%



10.4%



9 %



13.9%

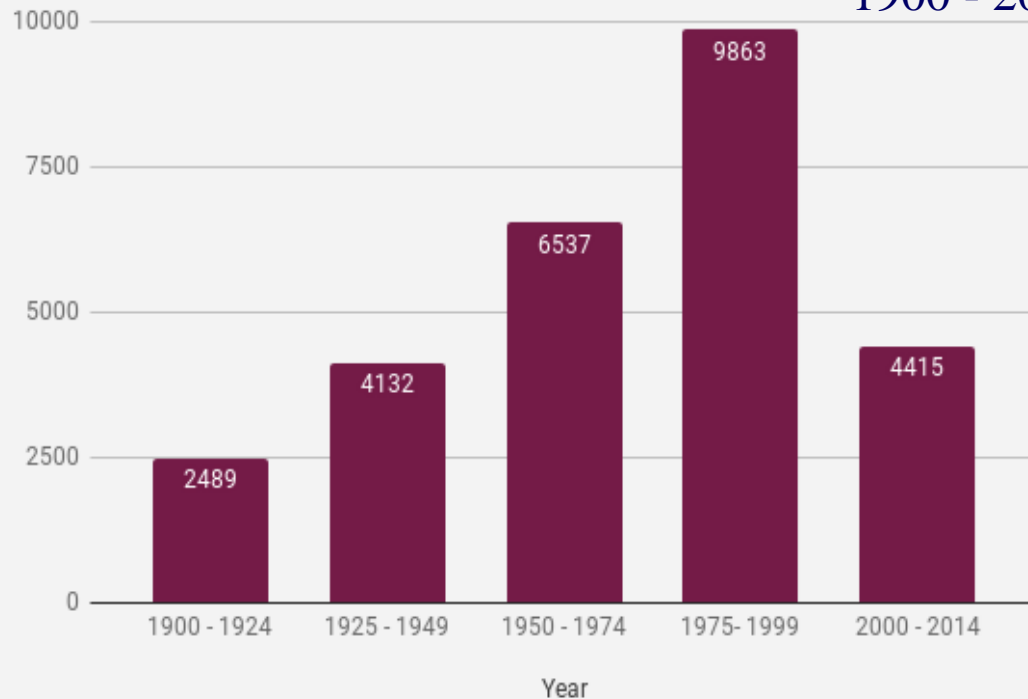


1900 - 2011

1900 - 2011

1933 - 2014

1919 - 2003



17.9%



1900 - 2014

23.3%



1911 - 2012

9.9%



1933 - 2012

Corpus

- 27,436 (=D) journal articles ...
- ...distributed over journals and time periods as shown
- ...after stemming and eliminating stop words gives
- 10,849 (=N) unique tokens (words, bigrams)

To be explained: w_{nd} the occurrence of token n in document d

$$W = \begin{bmatrix} w_{11}, w_{12}, \dots, w_{1D} \\ w_{21}, w_{22} \\ \vdots \\ w_{N1}, \dots, w_{ND} \end{bmatrix}$$

15.5%



1900 - 2011

10.4%



1900 - 2011

9 %



1933 - 2014

13.9%



1919 - 2003

17.9%



1900 - 2014

23.3%



1911 - 2012

9.9%



1933 - 2012

Question 1: How do words get to be in a document's bag, given that a particular topic (like Topic 4) is contributing to the document? "Word weights in topics"

topic 4

(4, '0.296*qualiti" + 0.069*"car" + 0.031*"merger" + 0.024*"attribut" + 0.024*"vehicl" +
0.021*"high_qualiti" + 0.019*"vintag" + 0.015*"characterist" + 0.014*"automobil" + 0.010*"hedon")

→ β_k ($k \in [1, K]$)

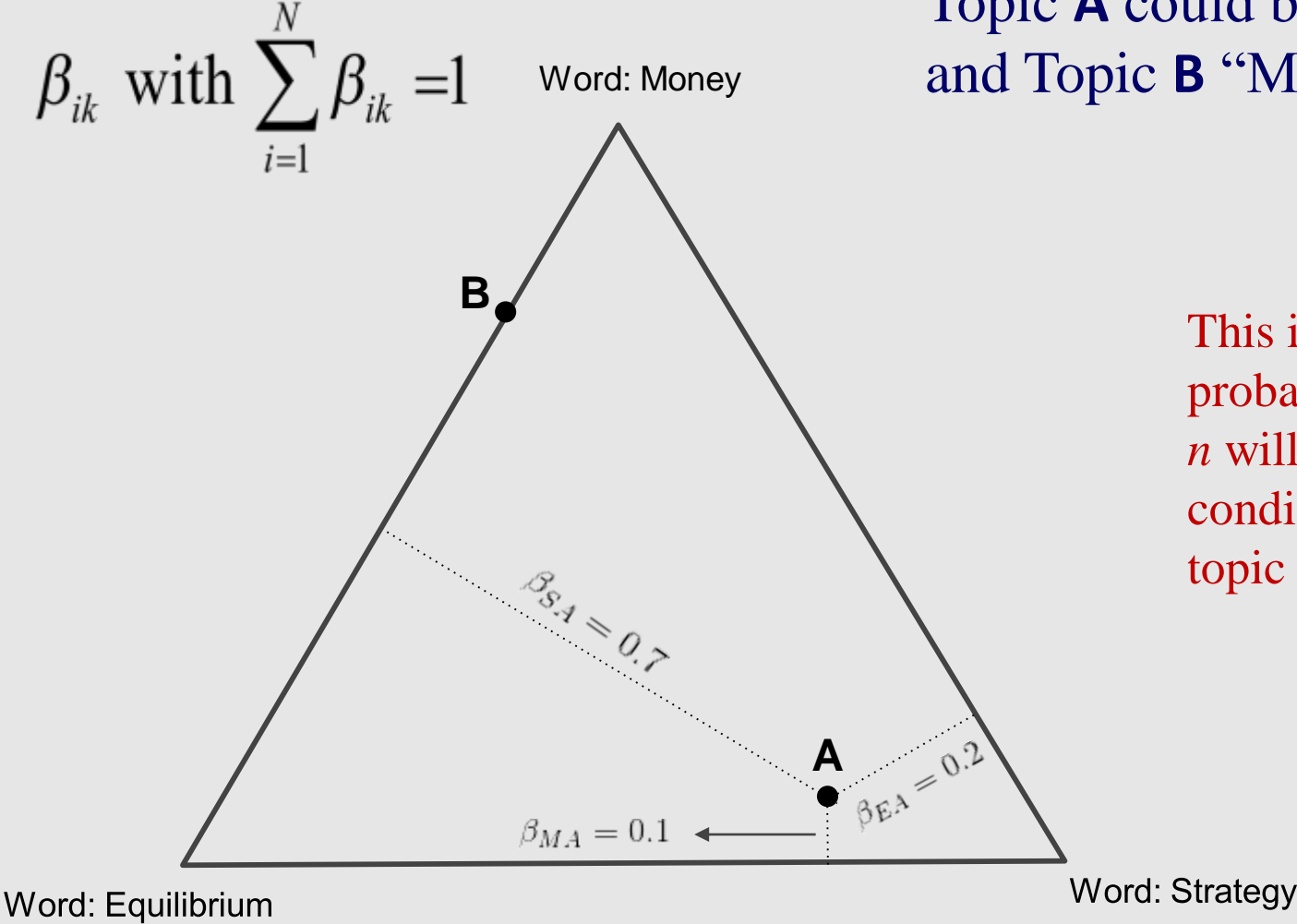
- A *topic* is one of the K vectors (or themes or subjects) represented as a distribution over the N words with word-weights summing to one, which represent the probability that word occurs, conditional on the topic having been drawn to contribute to the document.
- We arbitrarily set K topics and then have K vectors of dimension $1 \times N$, the elements of which are the weight of the i th word in the k th topic.

→ β_{ik} with $\sum_{i=1}^N \beta_{ik} = 1$



Example: Two topics **A** and **B** from a 3-word vocabulary: “Equilibrium” “Strategy” and “Money”. Shown are the word weights (the simplex coordinates) for topic **A**.

Topic **A** could be labeled “Game Theory”
and Topic **B** “Monetary Economics”



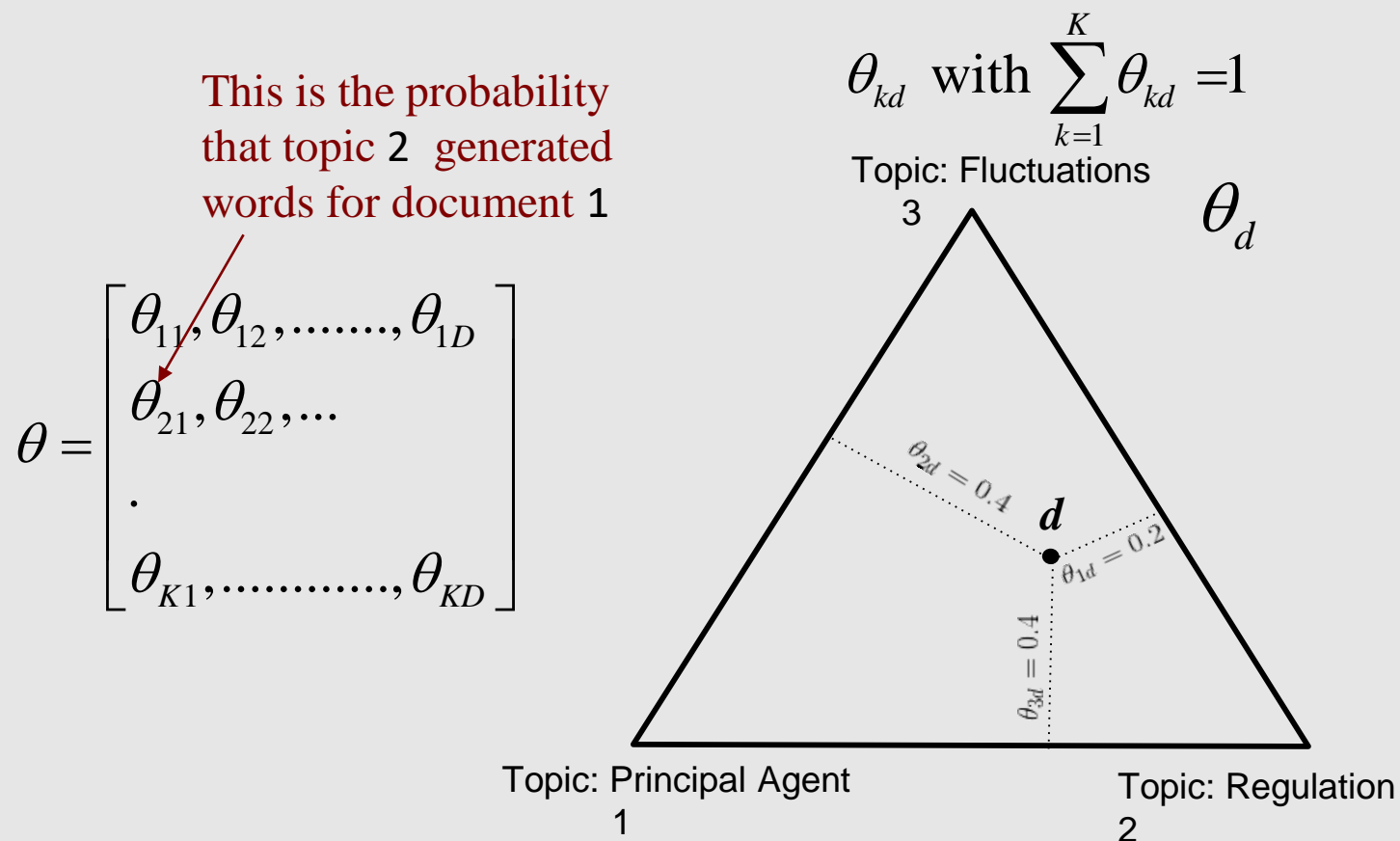
This is the probability that word n will be drawn, conditional on the topic being k

$\beta = \begin{bmatrix} \beta_{11}, \beta_{12}, \dots, \beta_{1K} \\ \beta_{21}, \beta_{22}, \dots \\ \vdots \\ \beta_{N1}, \dots, \beta_{NK} \end{bmatrix}$

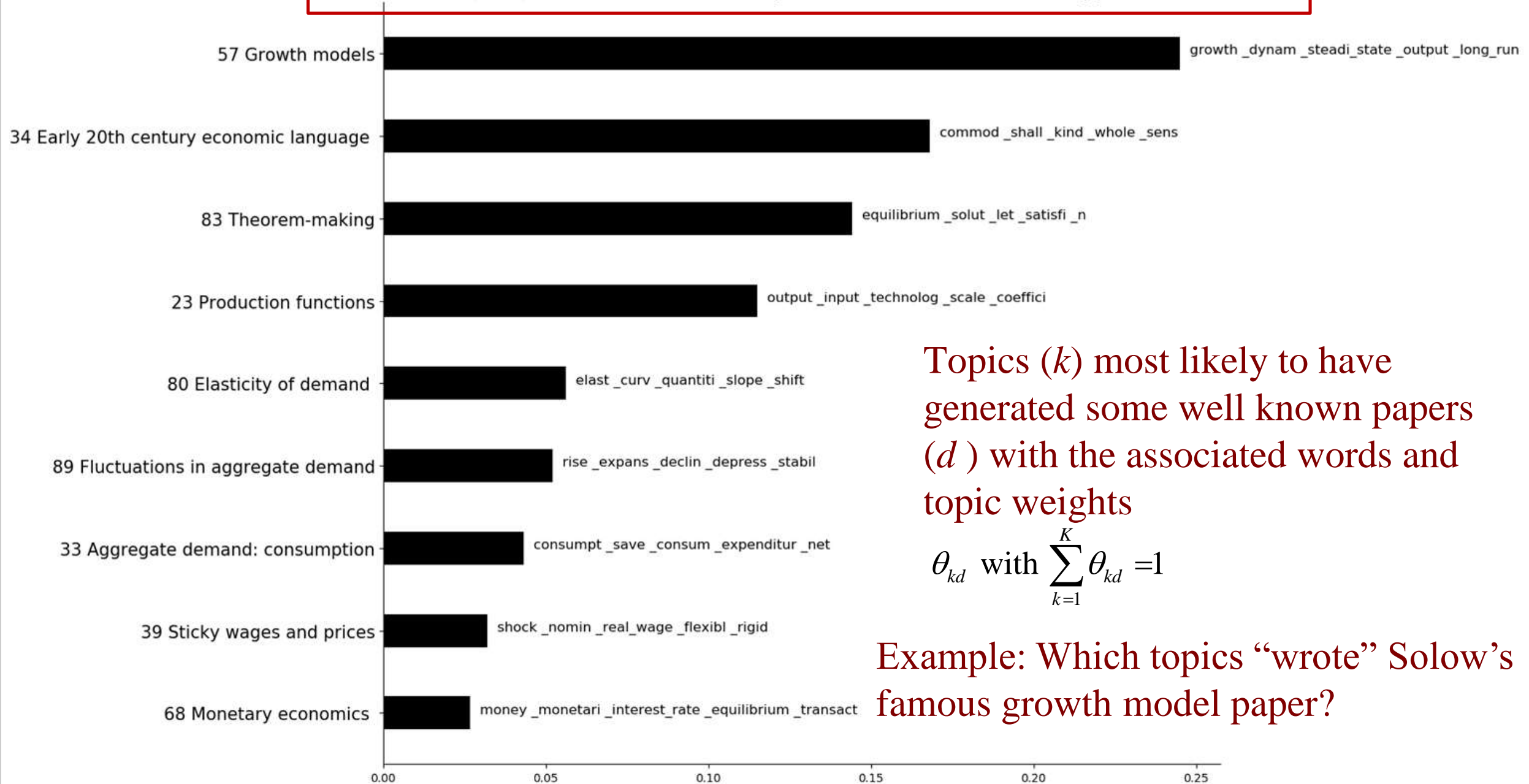
Question 2: How do topics get to put words in a document's bag of words? "Topic weights in documents"

- The *thematic content* of document d is represented as a distribution over topics given by a $1 \times K$ vector θ_d , the elements of which (called topic proportions, or weights) are the relative importance of that topic in generating the document or
- equivalently, ...for a given document, the probability that the topic is selected to draw words to place in the document's bag

Illustration from a corpus from which just 3 topics have been extracted: Shown are the topic weights for some document "How a central bank stabilizes aggregate demand", which could have been 'generated' by the topics "fluctuations" and "regulation" with a bit of input from "principal agent"



Robert M. Solow (1956). A Contribution to the Theory of Economic Growth. The Quarterly Journal of Economics




Topic modeling methods: Summing up

Observed documents

$$W = \begin{bmatrix} w_{11}, w_{12}, \dots, w_{1D} \\ w_{21}, w_{22} \\ \vdots \\ w_{N1}, \dots, w_{ND} \end{bmatrix}$$

Words over documents

probability that word n
will be drawn conditional
on the topic being k



$$\beta = \begin{bmatrix} \beta_{11}, \beta_{12}, \dots, \beta_{1K} \\ \beta_{21}, \beta_{22}, \dots \\ \vdots \\ \beta_{N1}, \dots, \beta_{NK} \end{bmatrix}$$

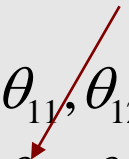
Words over topics

Imputed 'authors'

$$\theta = \begin{bmatrix} \theta_{11}, \theta_{12}, \dots, \theta_{1D} \\ \theta_{21}, \theta_{22}, \dots \\ \vdots \\ \theta_{K1}, \dots, \theta_{KD} \end{bmatrix}$$

Topics over documents

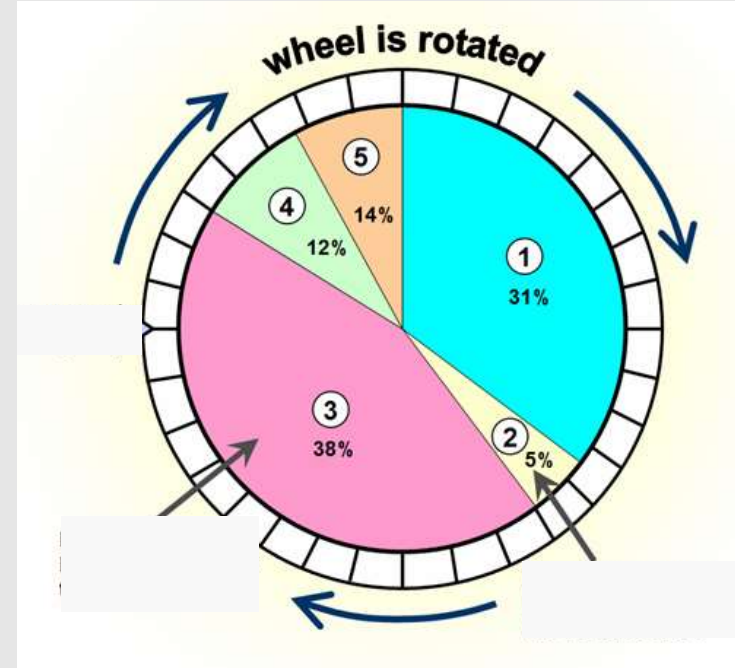
probability that topic 2
generated words for
document 1



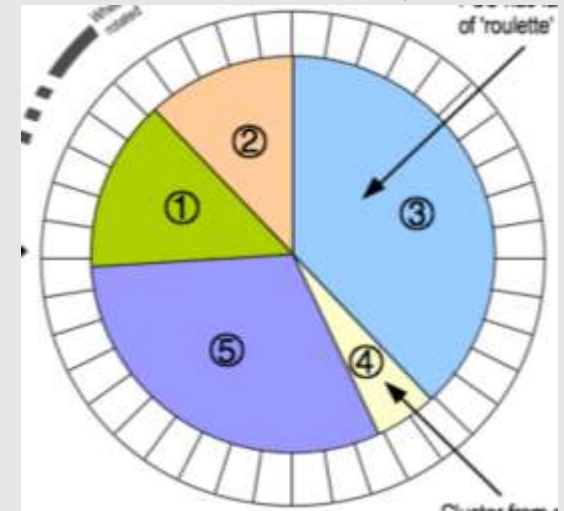
- Intuition: words are drawn from, and each document is associated with, a set of topics, both with probabilities that are estimated by the model.
- The method jointly estimates the weights of each word in the K topics and the topic proportions in each document.
- So, the topic model jointly estimates the θ and β most likely to have produced W .

Do it yourself kit: How to win the Nobel Prize (probably)

- This can be done at home.
- Select some article you think is likely to get you the prize had you written it, like, say, Solow 1956.
- Find the $1 \times K$ “topics in documents” vector θ_{Solow56}
- Locate a large empty bag (not plastic, if possible); label it “My Solow 1956”
- Spin the wheel on the top right, calibrated to the probabilities in θ_{Solow56} in order to select a topic (e.g. “production functions” which you are very likely to get in θ_{Solow56} , it’s the green sector in the unbalanced wheel i.e. Prob = 0.12).
- Find the vector $1 \times N$ “words in topics” vector, $\beta_{\text{production functions}}$
- Recalibrate the wheel to the probabilities in $\beta_{\text{production functions}}$ (below), give the wheel a spin, you’ll get a word like “input” (it’s the yellow sector, Prob = 0.07).
- Put the word “input” in the “My Solow, 1956” bag.
- Repeat until you have enough words in the bag (after restoring stop words) for your usual QJE paper.
- Submit paper (if possible from an address within 10 km of Harvard Square).
- Write some code to repeat this a few thousand times (including the paper submission step) for other papers you admire.
- Chill, order the champagne and your tickets to Stockholm



Unbalanced roulette wheel for randomizing topics in document Solow 1956 (comes with kit)



Unbalanced roulette wheel for randomizing words in topic “production functions”



Let's look at

- a) Some empirically estimated topics, the words that make them up, and the papers in the corpus for which these topics were most likely to have contributed and
- b) Some well-known papers, and the topics most likely to have generated them

$$\beta_{n1} \text{ with } \sum_{n=1}^N \beta_{nk} = 1$$

With probability 0.398 the word 'wage' will be used if Topic 1 is contributing to a document

topic 1 Modern theories of wage determination

(1, '0.398*"wage" + 0.191*"worker" + 0.015*"job" + 0.011*"pay" + 0.008*"labour supply" + 0.007*"offer" + 0.007*"paid" + 0.007*"differenti" + 0.007*"minimum wage" + 0.007*"hire"')

$$\theta_{1d} \text{ with } \sum_{k=1}^K \theta_{kd} = 1$$

With probability 0.386, Topic 1 contributed to the generation of Falk et al.

- 0.386093 Armin Falk, Ernst Fehr, Christian Zehnder (2006). Fairness Perceptions and Reservation Wages: The Behavioral E
- 0.382095 Paul Chen, Per-Anders Edin (2002). Efficiency Wages and Industry Wage Differentials: A Comparison across Met
- 0.37476 Dipak Mazumdar (1959). The Marginal Productivity Theory of Wages and Disguised Unemployment. The Review
- 0.364279 Andrew Weiss (1980). Job Queues and Layoffs in Labor Markets with Flexible Wages. Journal of Political Econon
- 0.358017 Alan Manning (1995). How Do We Know that Real Wages Are too High?. The Quarterly Journal of Economics

topic 4

(4, '0.296*"qualiti" + 0.069*"car" + 0.031*"merger" + 0.024*"attribut" + 0.024*"vehicl" + 0.021*"high_qualiti" + 0.019*"vintag" + 0.015*"characterist" + 0.014*"automobil" + 0.010*"hedon"')

- 0.361933 Igal Hendel, Alessandro Lizzeri (1999). Adverse Selection in Durable Goods Markets. The American Economic Review
- 0.336411 Alessandro Gavazza, Alessandro Lizzeri, Nikita Roketskiy (2014). A Quantitative Analysis of the Used-Car Market. The American Economic Review
- 0.336104 Jae-Cheol Kim (1985). The Market for "Lemons" Reconsidered: A Model of the Used Car Market with Asymmetric Information. The American Economic Review
- 0.33552 Christopher L. House, John V. Leahy (2004). AnsModel with Adverse Selection. Journal of Political Economy
- 0.319636 Igal Hendel, Alessandro Lizzeri, Marciano Siniscalchi (2005). Efficient Sorting in a Dynamic Adverse-Selection Model. The Review of Economic Studies

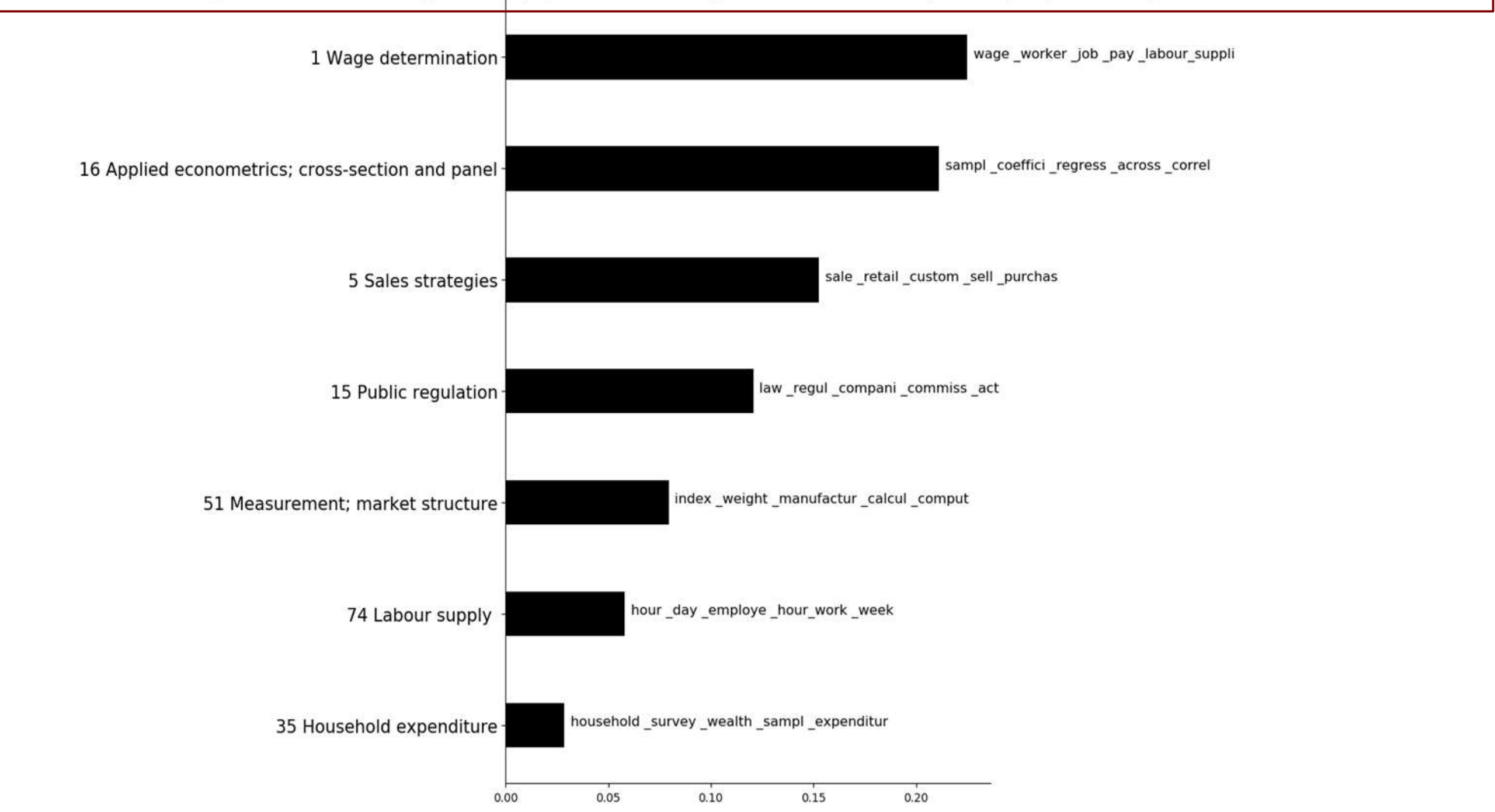
5 documents in the corpus with highest probability for the topic in question

A word cloud visualization of terms related to the Nash Bargaining Solution. The words are arranged in a circular pattern, with 'seller' and 'buyer' being the largest and most central. Other prominent words include 'offer', 'bargain', 'negotiate', 'surplus', 'reject', 'offer', 'bargain', 'negotiate', 'surplus', 'reject'. The background is a light blue gradient.

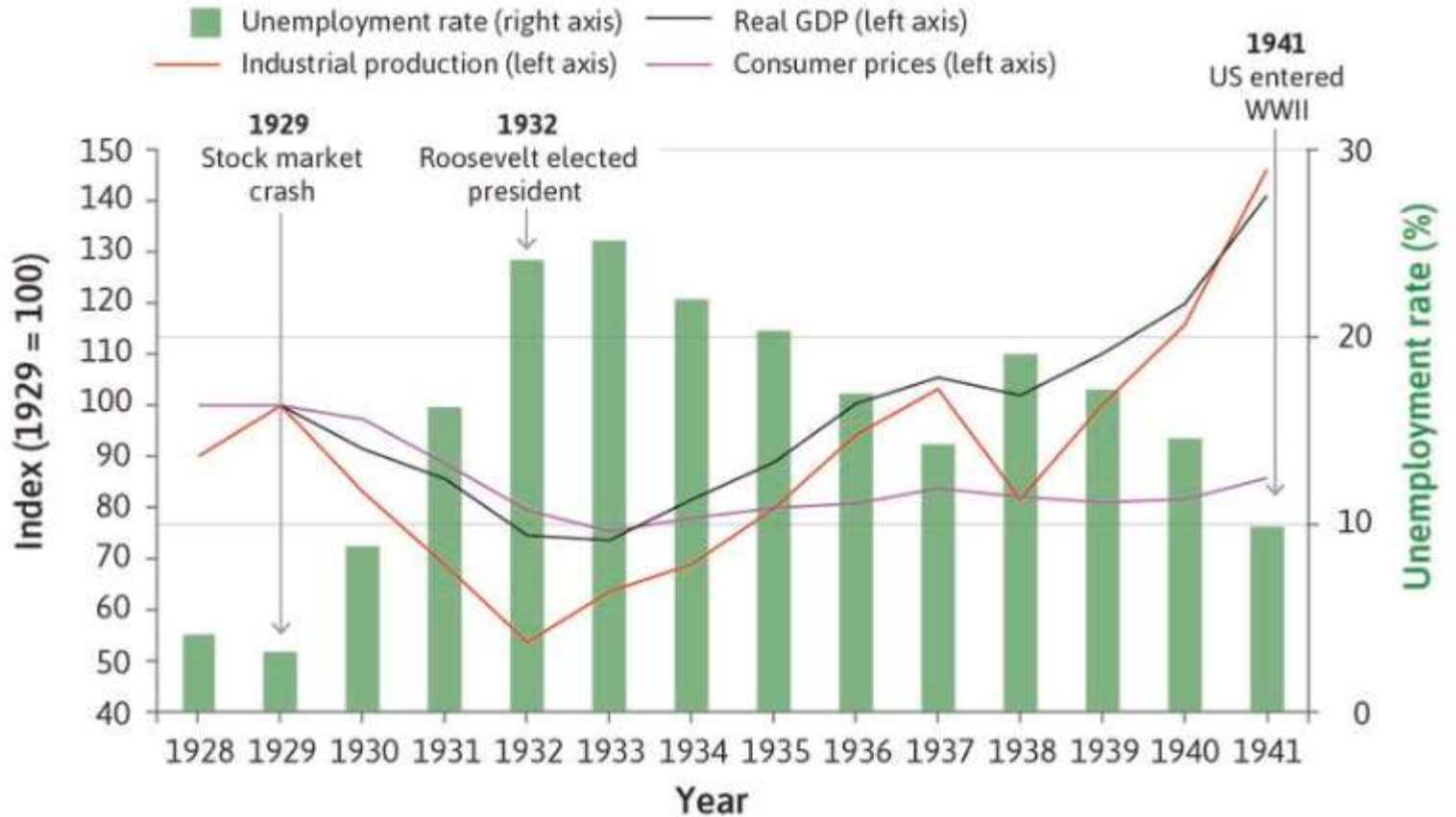
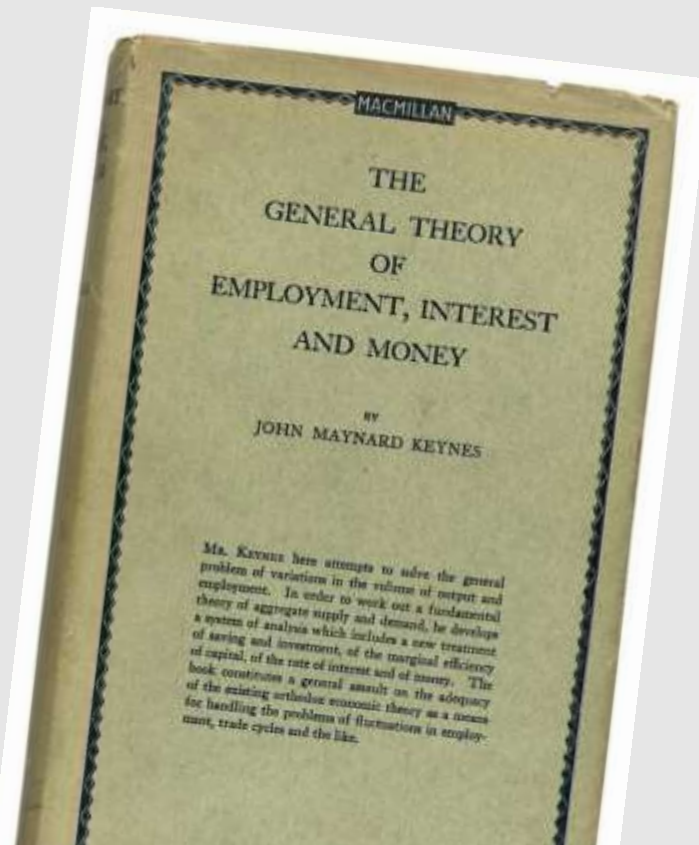
0.589248	Drew Fudenberg, David K. Levine, Jean Tirole (1987). Incomplete Information Bargaining with Outside Opportunities. The Quarterly Journal of Economics
0.5677344	Thomas H. Noe, Jun Wang (2004). Fooling All of the People Some of the Time: A Theory of Endogenous Sequencing in Confidential Negotiations. The Review of Economic Studies
0.536915	Peter C. Cramton (1984). Bargaining with Incomplete Information: An Infinite-Horizon Model with Two- Sided Uncertainty. The Review of Economic Studies
0.5325977	Janet Neelin, Hugo Sonnenschein, Matthew Spiegel (1988). A Further Test of Noncooperative Bargaining Theory: Comment. The American Economic Review
0.4976428	Peter C. Cramton (1992). Strategic Delay in Bargaining with Two-Sided Uncertainty. The Review of Economic Studies

[illegible]

0.5752078	Robert H. Frank (1989). If Homo Economicus Could Choose His Own Utility Function, Would He Want One with a Conscience? Reply. The American Economic Review
0.5336535	Florian Herold (2012). Carrot or Stick? The Evolution of Reciprocal Preferences in a Haystack Model. The American Economic Review
0.4913484	Elizabeth Hoffman, Kevin McCabe, Vernon L. Smith (1999). Social Distance and other-regarding Behavior in Dictator Games: Reply. The American Economic Review
0.4821517	Joseph E. Harrington, Jr. (1989). If Homo Economicus Could Choose His Own Utility Function, Would He Want One with a Conscience? Comment. The American Economic Review
0.4604293	Robert H. Frank (1987). If Homo Economicus Could Choose His Own Utility Function, Would He Want One with a Conscience?. The American Economic Review

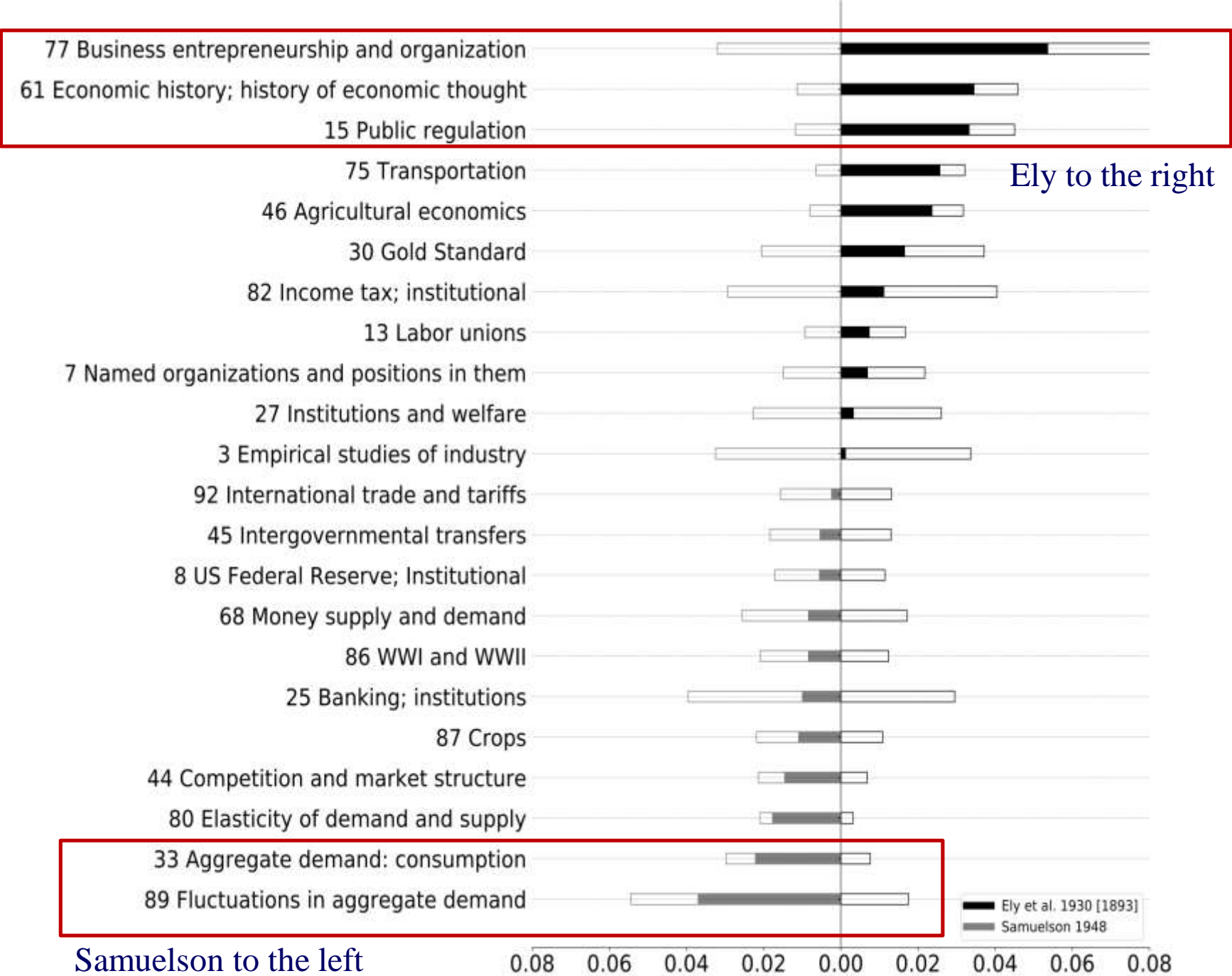


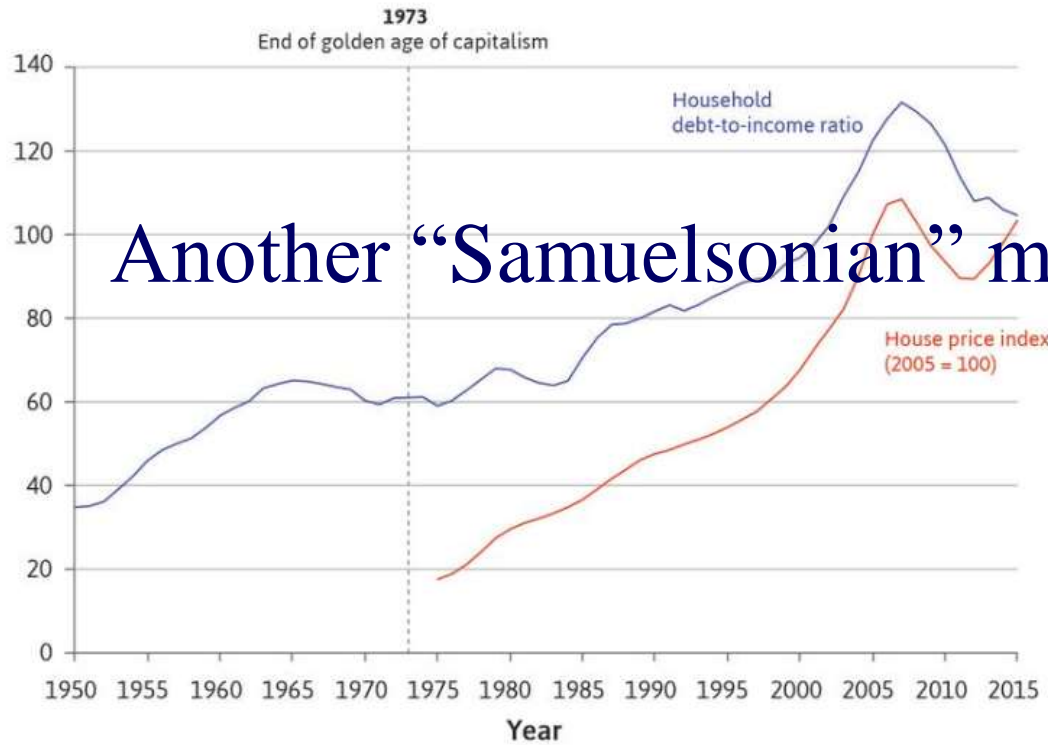
Does topic modeling capture the novelty of Samuelson 1948



Comparison of
content in
Samuelson 1948
and Richard T. Ely
et. al.1930 using
topic weights

White bar is the topic
weight to the right for
Ely et al, to the left for
Samuelson 1948. The
dark bar is the
absolute difference
between the two
authors for the topic in
question





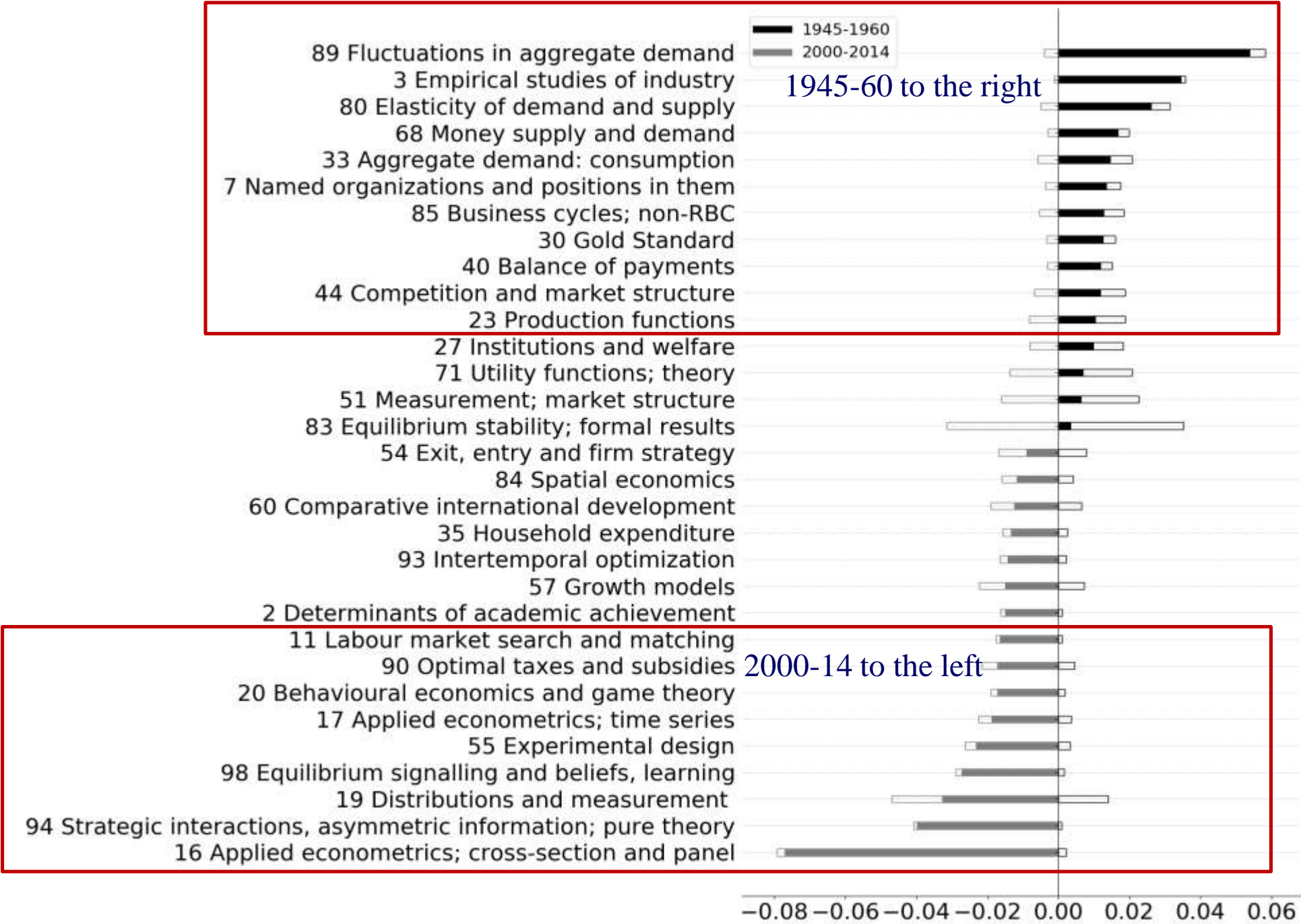
inequality

Student replies to the question “What is the most pressing problem economists should be addressing?” (4,442 students in 25 universities around the world).

How the research corpus changed since Samuelson 1948?

White bar is the topic weight to the right for the research corpus 1945-1960 to the left for 2000-2014.

The black bar is the absolute difference between the two periods for the topic in question



But if you put at the front of the book ...

- what Samuelson called “the really interesting and vital problems of public policy” and
- what economists are doing now in their research

like Samuelson, you end up rewriting the rest of the book!

Problems

Wealth creation and innovation

Key concepts for a new introductory course

Schumpeterian rents, disequilibrium, dynamics, “creativity of the market”

Illustrative sources for the concepts

(Aghion and Howitt 1992, Hayek 1945, Makowski and Ostroy 2001, Romer 1990, Schumpeter 1934 [1911])

Problems

Key concepts for a new introductory course

Illustrative sources for the concepts

Wealth creation and innovation

Schumpeterian rents, disequilibrium, dynamics, “creativity of the market”

(Aghion and Howitt 1992, Hayek 1945, Makowski and Ostroy 2001, Romer 1990, Schumpeter 1934 [1911])

Environmental sustainability

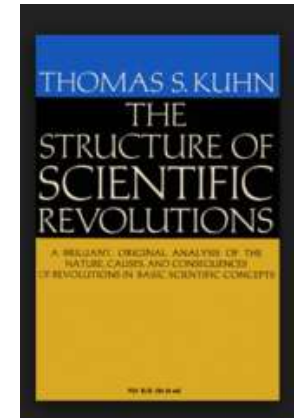
Non-market social interactions, other-regarding preferences, positive feedbacks and tipping points

(Benabou and Tirole 2006, Camerer 2003, Jackson 2008, Ostrom 1990, Schelling 1978)

Problems	Key concepts for a new introductory course	Illustrative sources for the concepts
<i>Wealth creation and innovation</i>	Schumpeterian rents, disequilibrium, dynamics, “creativity of the market”	(Aghion and Howitt 1992, Hayek 1945, Makowski and Ostroy 2001, Romer 1990, Schumpeter 1934 [1911])
<i>Environmental sustainability</i>	Non-market social interactions, other-regarding preferences, positive feedbacks and tipping points	(Benabou and Tirole 2006, Camerer 2003, Jackson 2008, Ostrom 1990, Schelling 1978)
<i>Inequality</i>	Economic rents, power, games, institutions, inequality aversion	(Coase 1937, Hart 1995, Holmstrom and Milgrom 1994, Milgrom and Roberts 1990, Nash 1950, von Neumann and Morgenstern 1944)

Problems	Key concepts for a new introductory course	Illustrative sources for the concepts
<i>Wealth creation and innovation</i>	Schumpeterian rents, disequilibrium, dynamics, “creativity of the market”	(Aghion and Howitt 1992, Hayek 1945, Makowski and Ostroy 2001, Romer 1990, Schumpeter 1934 [1911])
<i>Environmental sustainability</i>	Non-market social interactions, other-regarding preferences, positive feedbacks and tipping points	(Benabou and Tirole 2006, Camerer 2003, Jackson 2008, Ostrom 1990, Schelling 1978)
<i>Inequality</i>	Economic rents, power, games, institutions, inequality aversion	(Coase 1937, Hart 1995, Holmstrom and Milgrom 1994, Milgrom and Roberts 1990, Nash 1950, von Neumann and Morgenstern 1944)
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<i>Financial instability</i>	Prices as information, dynamics of price setting, positive feedbacks and tipping points	(Hayek 1945, Minsky 1986)



*Kuhn: What are the fundamental entities [under study]?
How do these interact with each other...? What questions
may legitimately be asked about such entities and what
techniques employed in seeking solutions?*

*Answers to questions like these are ...the educational
initiation that prepares and licenses the student for
professional practice.*

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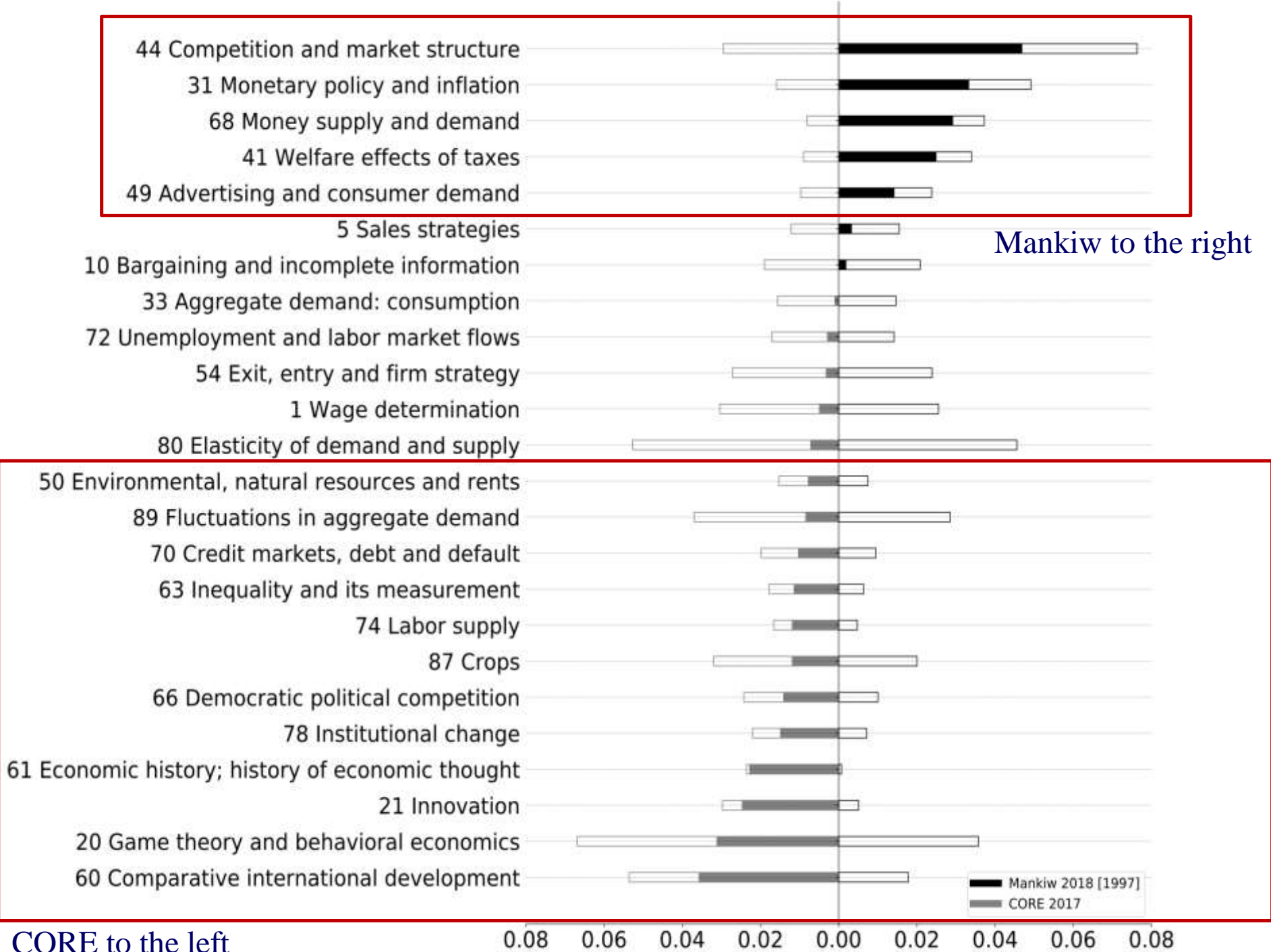
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20th c provenance	Marshall, Walras, Keynes	Also, Hayek, Nash, von Neumann, Schumpeter, Coase, Ostrom

Comparison of content
in CORE's *The
Economy* 2017 and
Mankiw 2018

White bar is the topic
weight to the right for
Mankiw to the left for
CORE. The black bar
is the absolute
difference between the
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What are the top three things that set *The Economy* apart from other principles of economics texts?

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HOW CAPITALISM REVOLUTIONISED THE WAY WE LIVE AND HOW ECONOMICS ATTEMPTS TO UNDERSTAND THIS AND OTHER ECONOMIC SYSTEMS

- Since the 1700s, increases in average living standards became a permanent feature of economic life in many countries.
- This was associated with the emergence of a new economic system called capitalism, in which private property, markets and firms play a major role.
- Under this new way of organizing the economy, advances in technology and specialization in products and tasks raised the amount that could be

Where to begin a course?

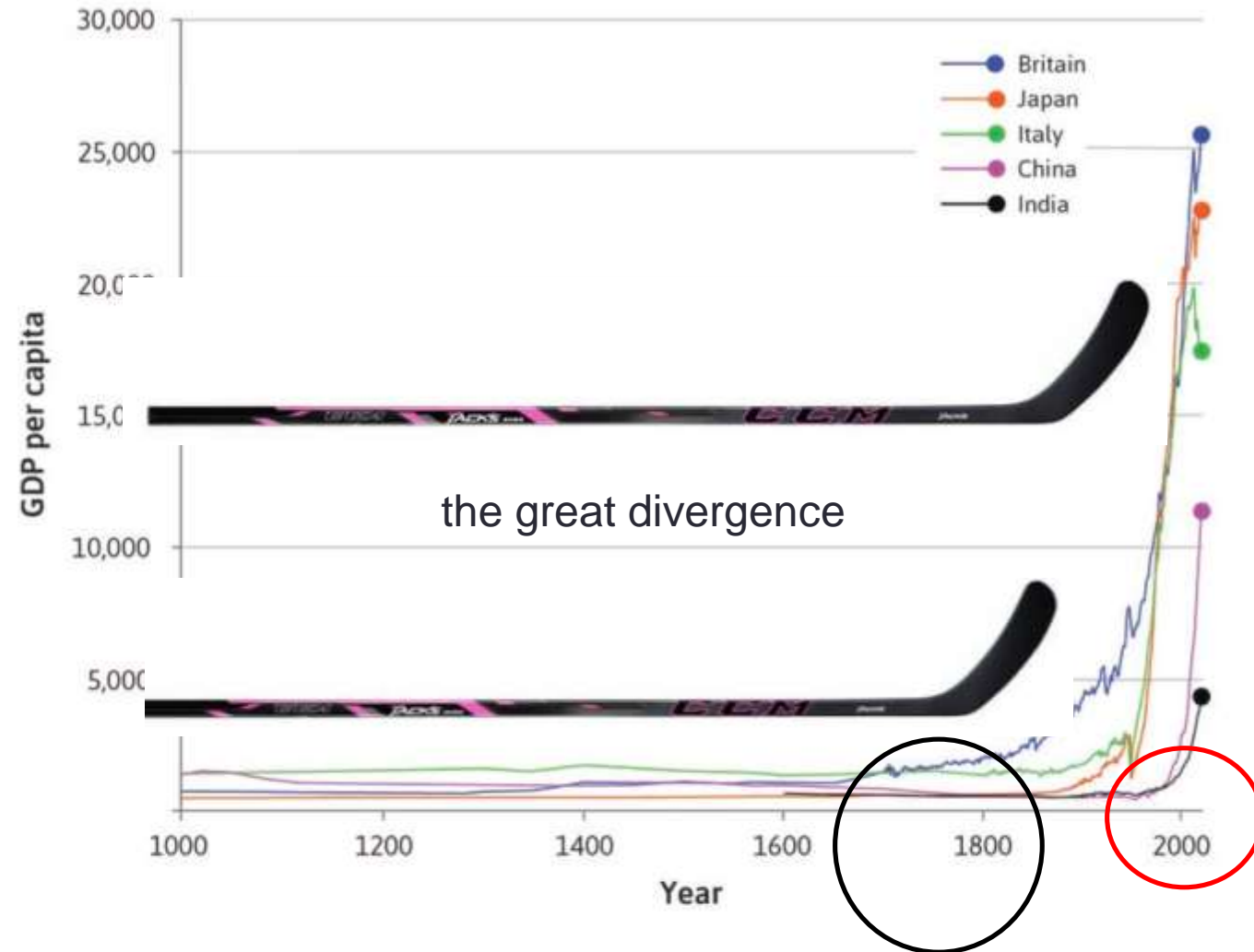
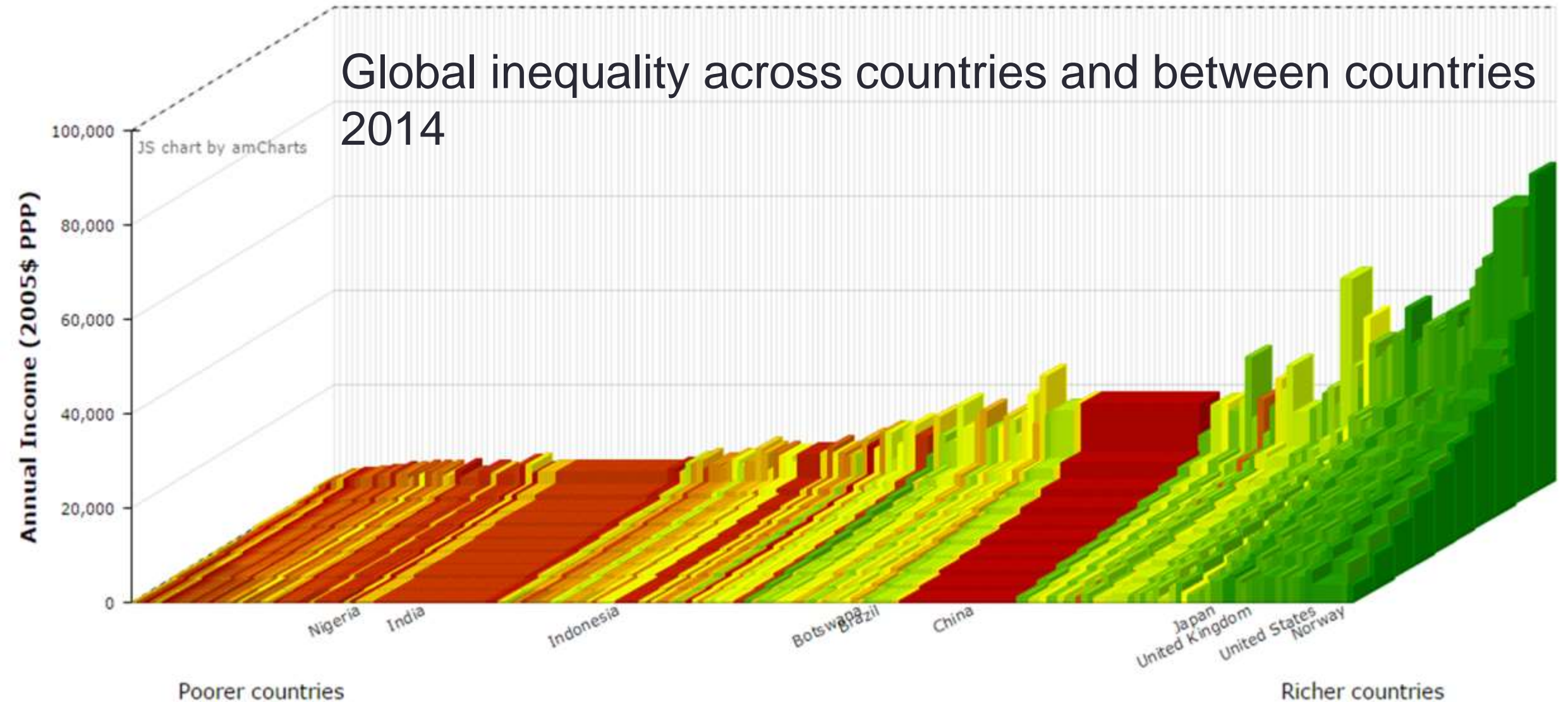


Figure 1.1a History's hockey stick: Gross domestic product per capita in five countries (1000–2015).

Where to begin a course?



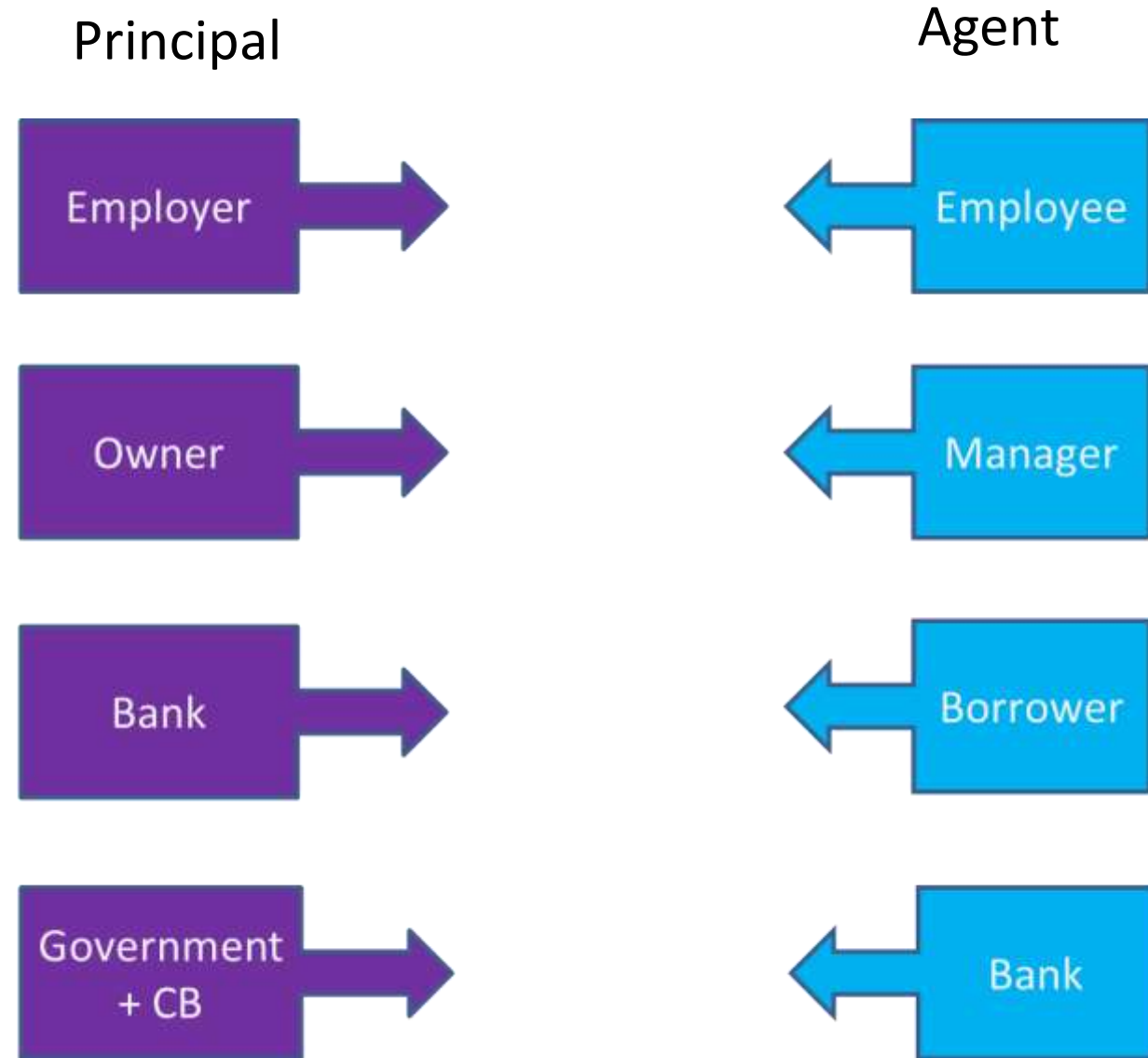
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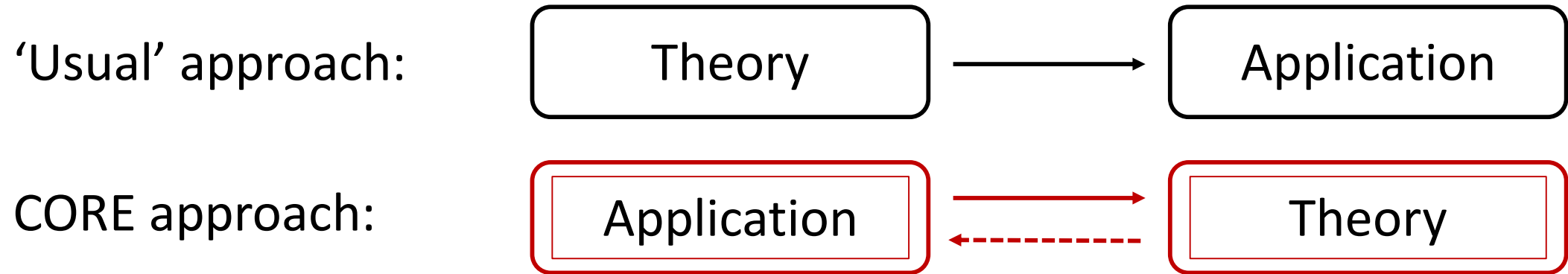


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Evidence-based learning



- Start with a question, and look at the evidence.

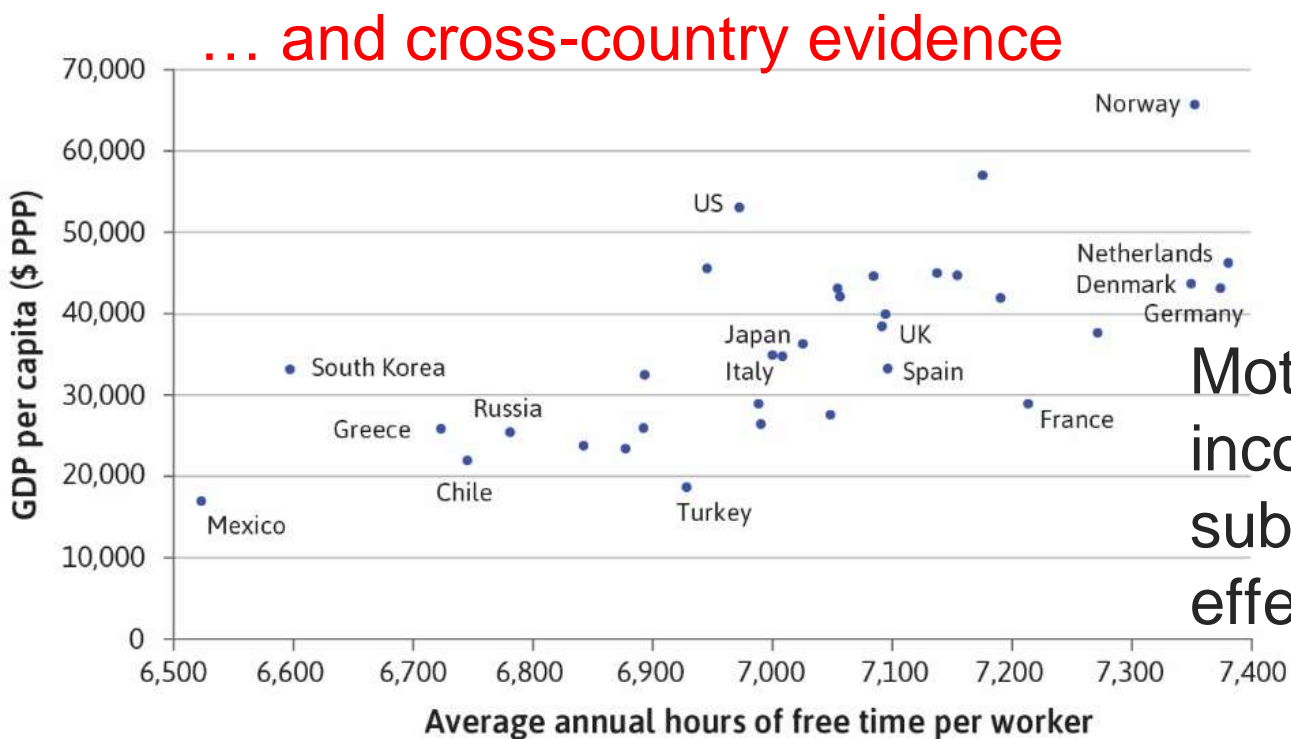
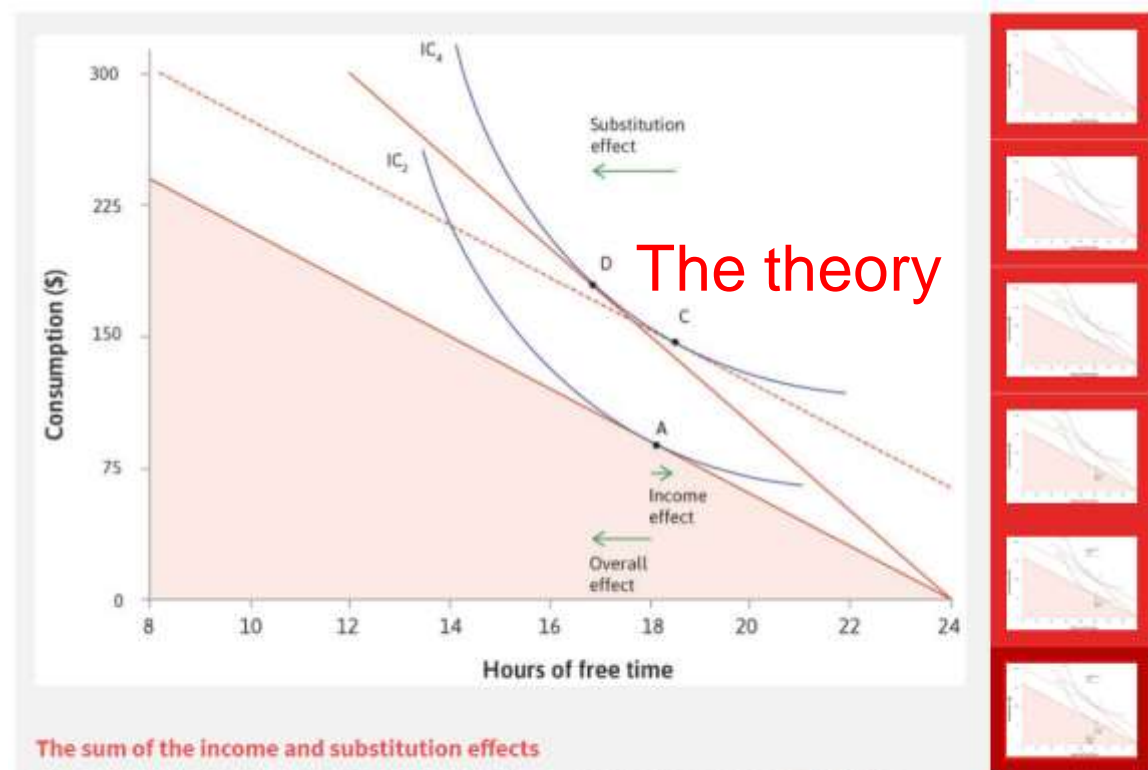
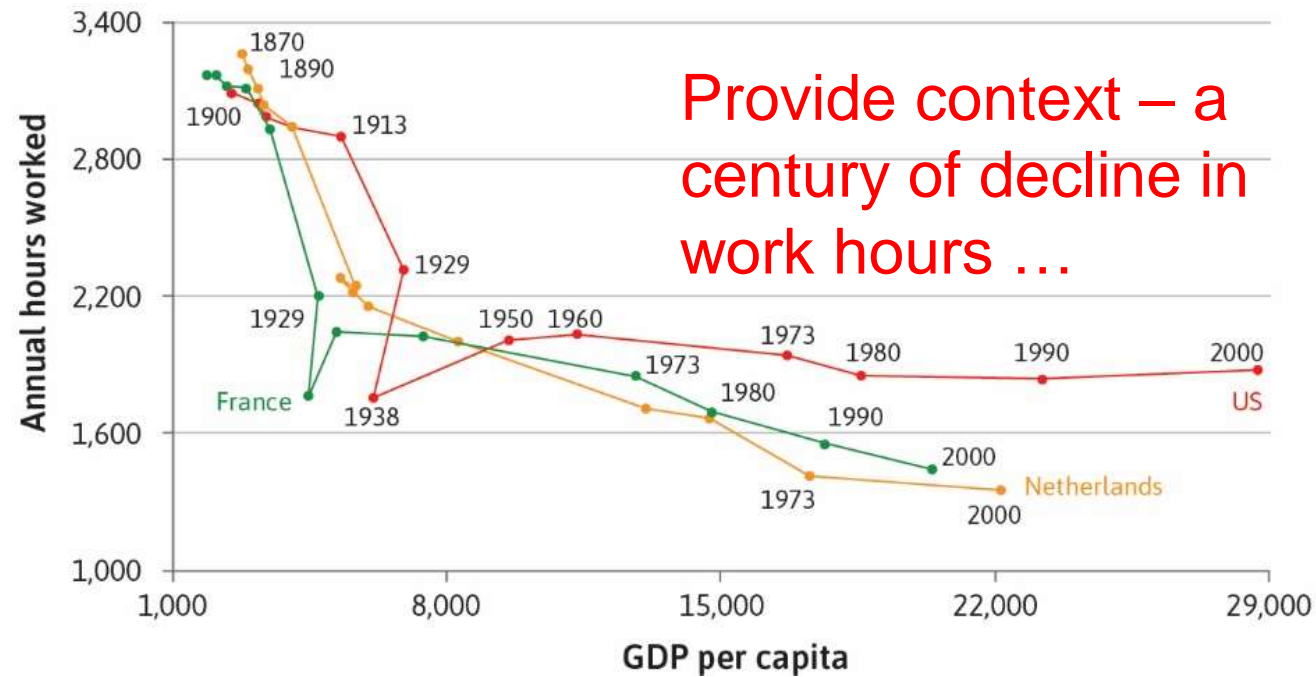
‘Why do working hours differ across countries and time?’

- Build a model that helps us understand what we see.

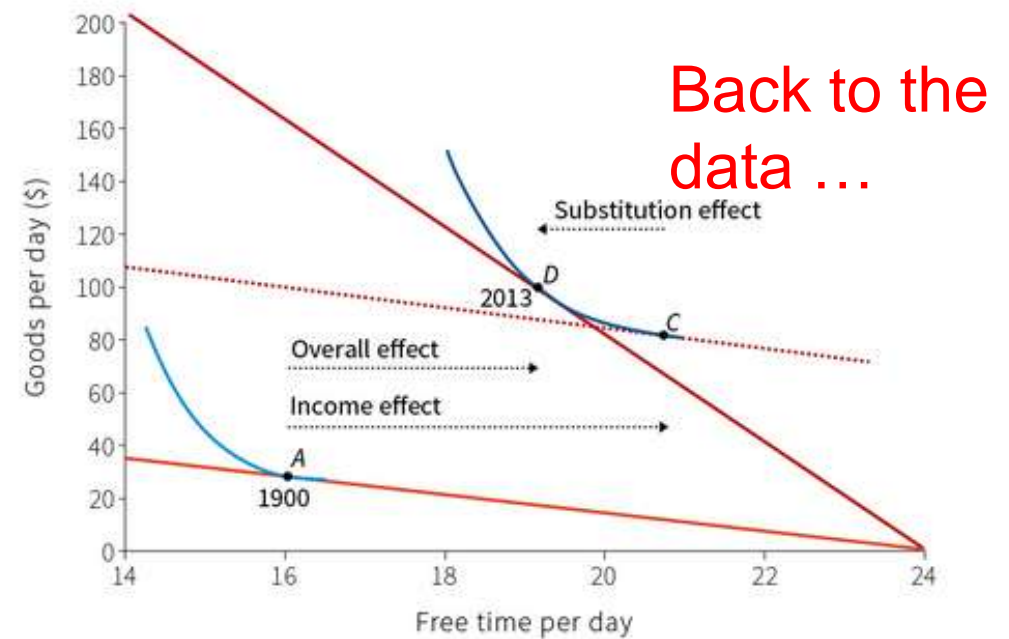
Constrained optimization (indifference curves, feasible set)

- Critically evaluate the model

Can workers really choose? Influence of culture, norms, and politics



Motivate income and substitution effects



What do economists really do?



Petra Moser: How copyright improved Italian opera

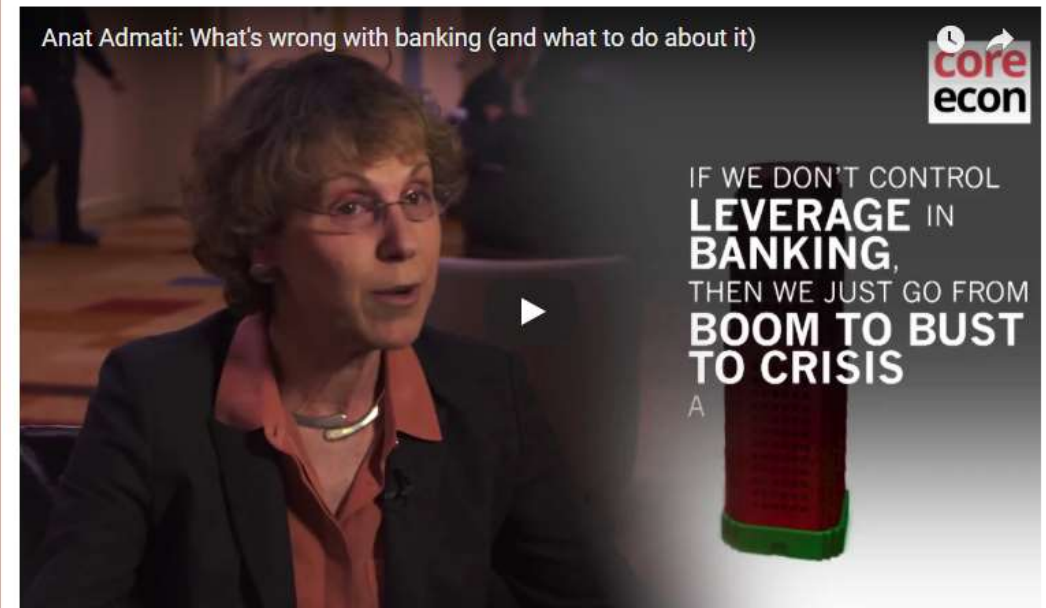
EXERCISE 3.9 EFFECTIVE POLICYMAKING FOR INTELLECTUAL PROPERTY RIGHTS

Watch the 'Economist in action' video, in which Petra Moser discusses copyright protection for nineteenth-century Italian operas.

1. Outline Petra Moser's research question, and her approach to answering it.
2. What were Petra Moser's findings about patents and copyrights?
3. What factors should governments consider when deciding on the effective time period of IPR protection laws, such as patents and copyrights?

EXERCISE 17.9 BANKING REGULATIONS CAN HELP BRING ON FINANCIAL CRISES

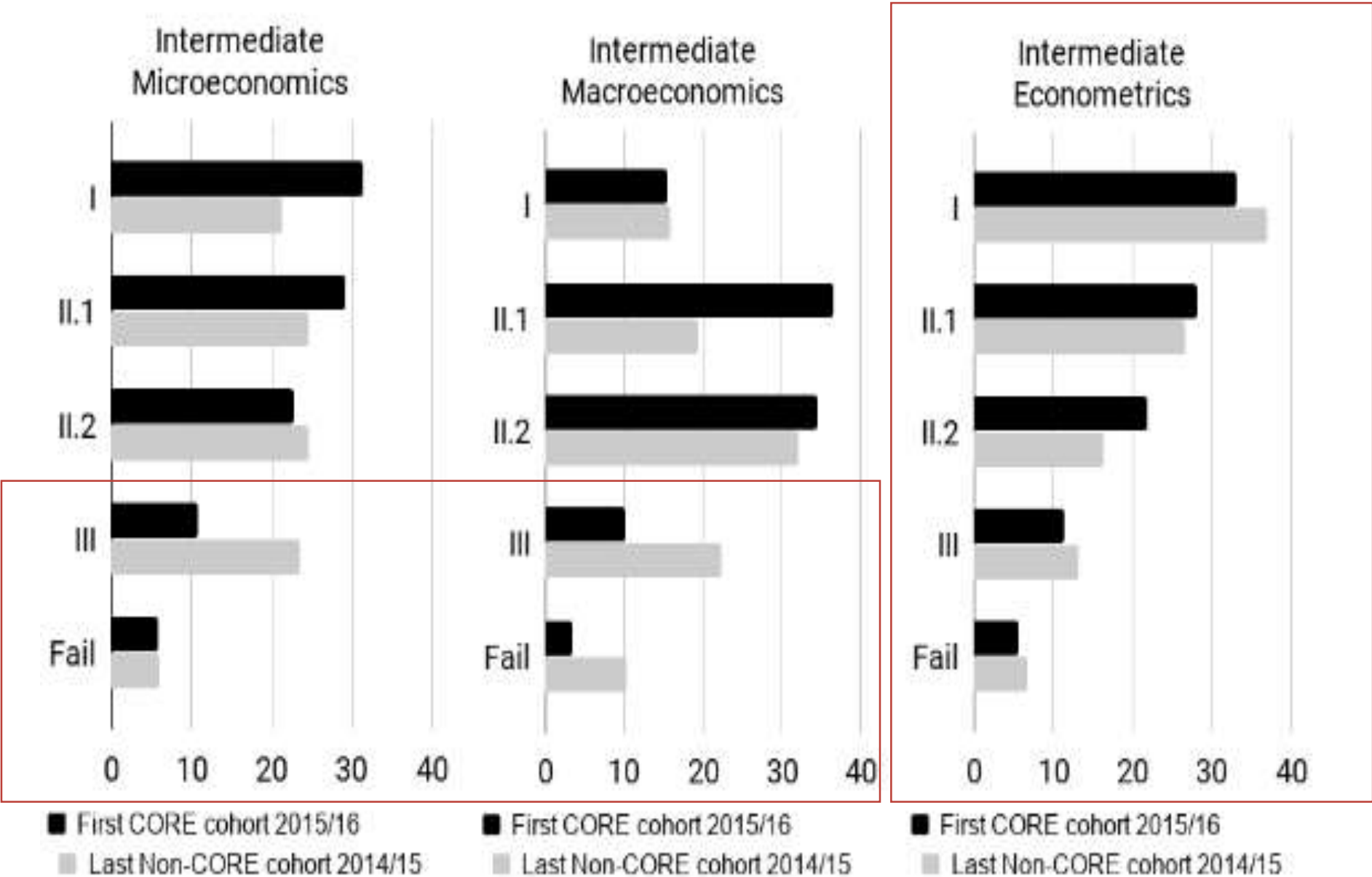
An 'Economist in action' video shows Anat Admati, an economist, explaining the problems with the regulation of the banking system.



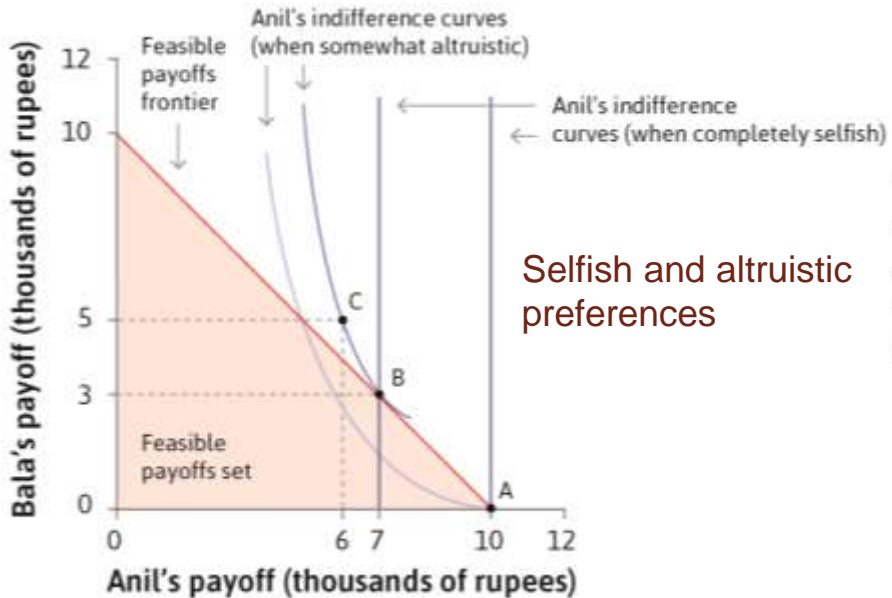
Anat Admati: What's wrong with banking (and what to do about it).

1. Using housing prices as an example, explain the upsides and downsides of leverage.
2. According to the video, what is the key difference between banks and other corporations, and why is this dangerous for the banking system?
3. What are some factors that contribute to the fragility and riskiness of the banking system, and how can we prevent future financial crises from occurring?

Does it work? Student outcomes in unchanged intermediate courses



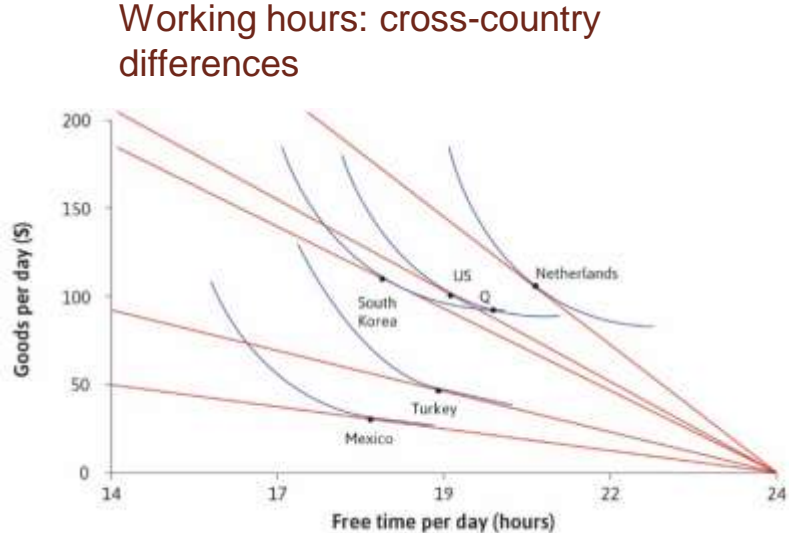
Why does it work? Teaching the tools of economics – e.g. feasible sets and preferences – motivated by and applied to real problems in the world



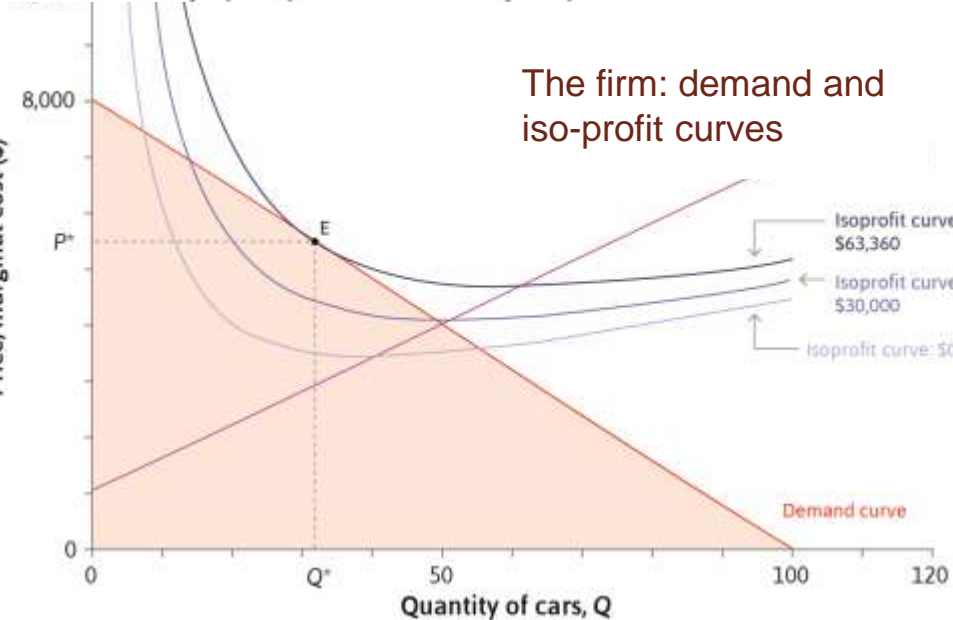
Selfish and altruistic preferences



Strategic interaction: mutual gains and their distribution

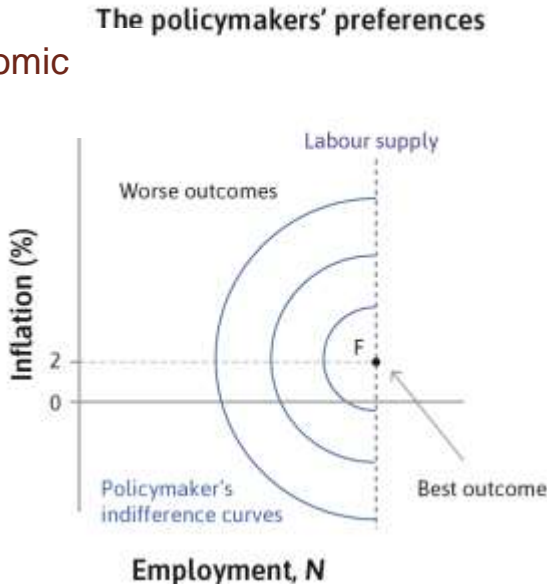


Working hours: cross-country differences

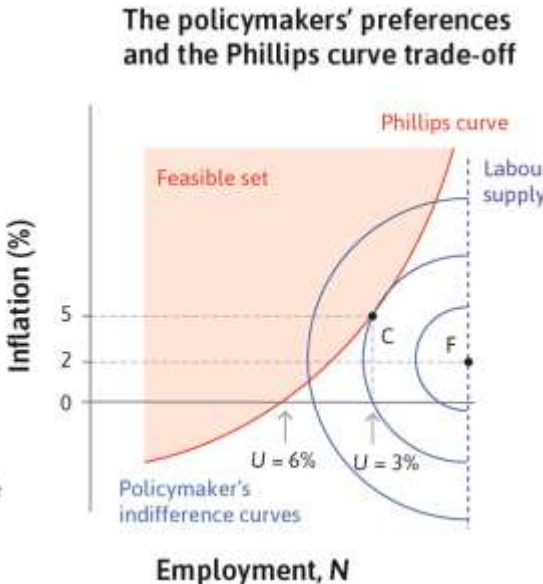


The firm: demand and iso-profit curves

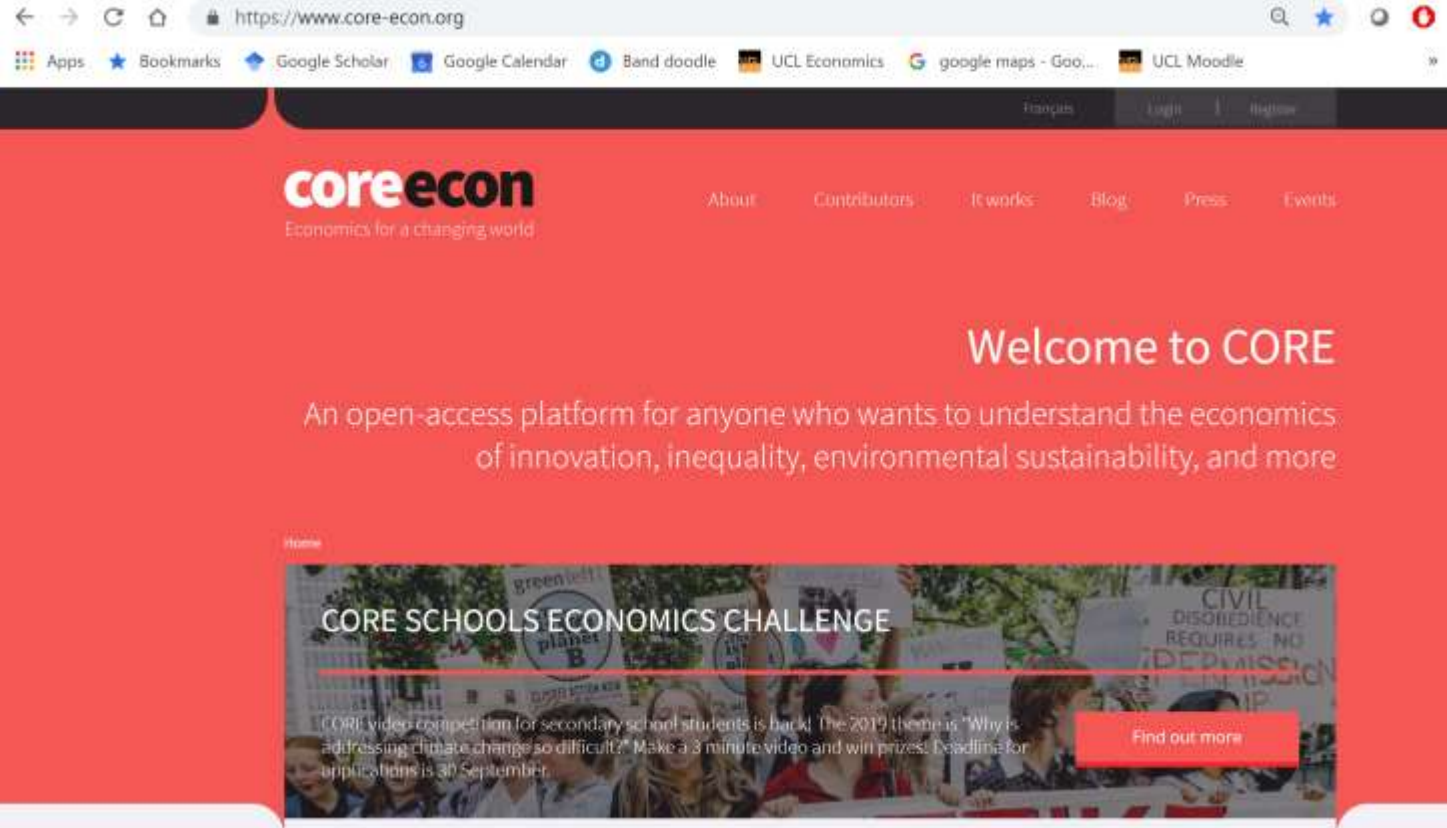
The macroeconomic policy maker



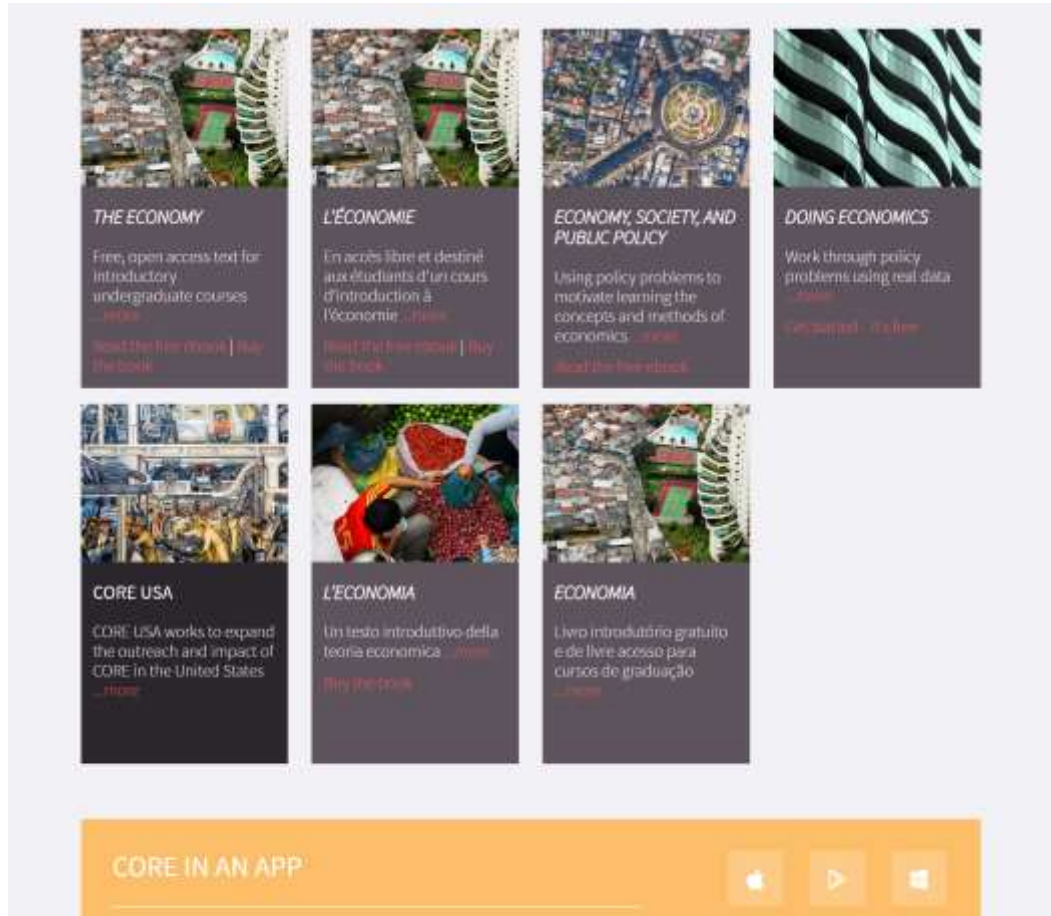
The policymakers' preferences



The policymakers' preferences and the Phillips curve trade-off



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THE EVOLUTION OF ECONOMICS AND THE FUTURE OF ECONOMICS EDUCATION: INSIGHTS FROM MACHINE LEARNING

Wendy Carlin, UCL, CEPR, and CORE

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