应用微观计量经济学
Applied Microeconometrics

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Lecture 1　开篇

Prerequisite equivalency.

- 《计量经济学》(*Introduction to Econometrics*),斯托克 (James H. Stock)、沃森 (Mark W. Watson) 著。中文第三版，格致出版社，2012 年（中国人民大学出版社，2014 年)。
- 《计量经济学导论：现代观点》(*Introductory Econometrics: A Modern Approach*)，伍德里奇 (Jeffrey M. Wooldridge) 著。中文第六版，中国人民大学出版社，2018 年。

Required software. STATA

Recommended texts.

- 《基本无害的计量经济学》(*Mostly Harmless Econometrics: An Empiricist's Companion*), 安格里斯特 (Joshua D Angrist)、皮施克 (Jorn-Steffen Pischke) 著。格致出版社，2012 年。
- 《精通计量：从原因到结果的探寻之旅》(*Mastering 'Metrics: The Path from Cause to Effect*), 安格里斯特、皮施克著。格致出版社即出。
- 《用 Stata 学计量经济学》(*An Introduction to Modern Econometrics Using Stata*), 鲍姆 (Christopher F. Baum) 著。中国人民大学出版社，2012 年。
- 《用 Stata 学微观计量经济学》(*Microeconometrics Using Stata, Revised Edition*), 卡梅伦 (A. Colin Cameron)、特里维迪 (Pravin K. Trivedi) 著。重庆大学出版社，2015 年。

- 《横截面与面板数据的计量经济分析》(*Econometric Analysis of Cross Section and Panel Data*), 伍德里奇著。中文第二版，中国人民大学出版社，2016 年。
- 《微观经济计量学：方法与应用》(*Microeconometrics: Methods and Applications*)，卡梅伦、特里维迪著，上海财经大学出版社，2010 年。
- 《计量经济分析》(*Econometric Analysis*), 格林 (William H Greene) 著。中文第六版，中国人民大学出版社，2011 年。英文第七版，中国人民大学出版社，2013 年。英文最新版，8th edition, 2017.
- 《计量经济学》(*Econometrics*), 林文夫 (Fumio Hayashi) 著。中文版，上海财经大学出版社，2005 年。

What is THE econometrics that we are interested in?

- The evolution of economic research: a popular view of star economists from *The Economist*.
  - Cohort 1988.

    "Economics in America's Cambridge reached its peak of influence in the 1960s; in the 1970s it fell quiet; now it is flourishing again ⋯ Economics has lost patience with the paradigm of perfect competition ⋯ Out will go the presumption that markets clear smoothly ⋯ In will stay the idea that agents are not stupid … "

- ▷ Sanford Grossman: then Princeton - ’87 Clark.
- ▷ Paul Krugman: then Princeton, now CUNY - ’91 Clark; ’08 Nobel.
- ▷ Jeffrey Sachs: Columbia.
- ▷ Lawrence Summers: Havard - ’93 Clark.
- ▷ Alberto Alesina: Harvard.
- ▷ Gregory Mankiw: Havard.
- ▷ Andrei Shleifer: Havard - ’99 Clark.
- ▷ Jean Tirole: IDEI Toulouse - ’14 Nobel.

– Cohort 1998.

> "Unlike the stars of the 1980s, today's impressive young academics are using the tools of economics in fields on or beyond the traditional borders of their discipline ⋯ [They] tend to eschew the big traditional themes of economics ⋯ The erosion of traditional barriers within economics and the increased meshing with other disciplines will continue. A decade hence it will not only be hard to distinguish empirical economists from theorists; it may also be hard to disentangle economics from other strands of social science ⋯ "

- ▷ Michael Kremer: Havard.
- ▷ Edward Glaeser: Havard.
- ▷ Casey Mulligan: Chicago.
- ▷ Steve Levitt: Chicago - ’03 Clark.
- ▷ Caroline Hoxby (F): Stanford.
- ▷ Glenn Ellison: MIT.
- ▷ Matthew Rabin: then Berkeley, now Harvard - ’01 Clark.
- ▷ David Laibson: Havard.

– Cohort 2008.

"Today's economists show no great attachment to the rational model of behaviour that guided Mr Becker. Economic theory has become so eclectic that ingenious researchers can usually cook up a plausible model to explain whatever empirical results they find interesting. Economics is now defined neither by its subject matter nor by its method ⋯ Economists still share a taste for the Greek alphabet: they like to provide formal, algebraic accounts of the behaviour they explain. And they pride themselves on the sophistication of their investigative methods. They are usually better at teasing confessions out of data than their rivals in other social sciences. What defines economics? Economics is what economists do — the best of them, anyway."

▷ Jesse Shapiro: then Chicago, now Brown.
▷ Roland Fryer: Havard - ’15 Clark.
▷ Esther Duflo (F): MIT - ’10 Clark.
▷ Amy Finkelstein (F): MIT - ’12 Clark.
▷ Raj Chetty: then Berkeley, now Harvard - ’13 Clark.
▷ Iván Werning: MIT.
▷ Xavier Gabaix: then NYU, now Harvard.
▷ Marc Melitz: then Princeton, now Harvard.

– Cohort 2018.

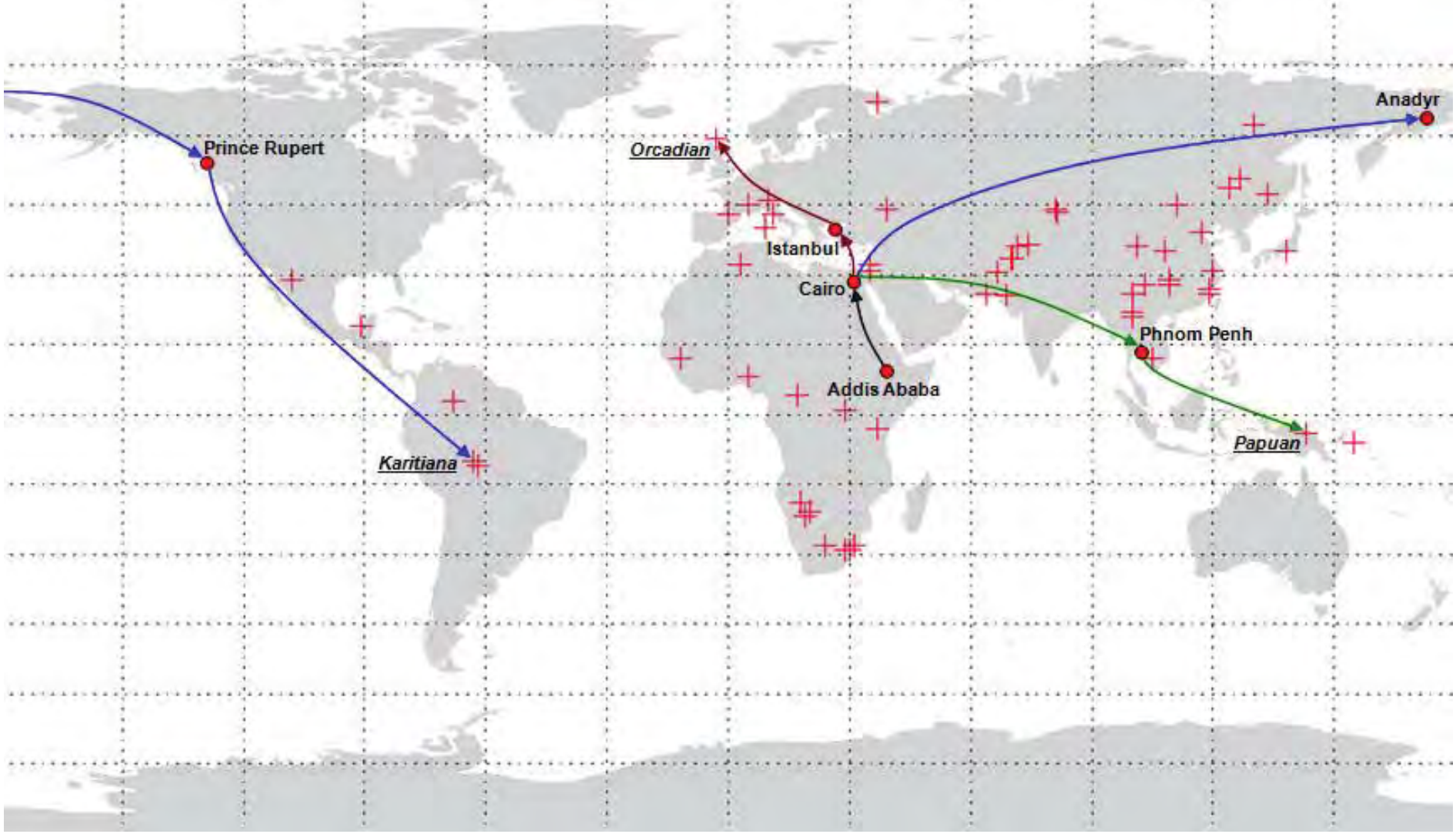
> "The critics lodged three related objections. The first was a neglect of theory: the new empiricists were not always particularly interested in testing formal models of how the world worked ... The second objection was a lack of seriousness. 'Freakonomics' had encouraged an emerging generation of economists to trivialize their subject ... The new empiricists were also accused of looking for keys under lampposts. Some showed more allegiance to their preferred investigative tools than to the subject or question under investigation."

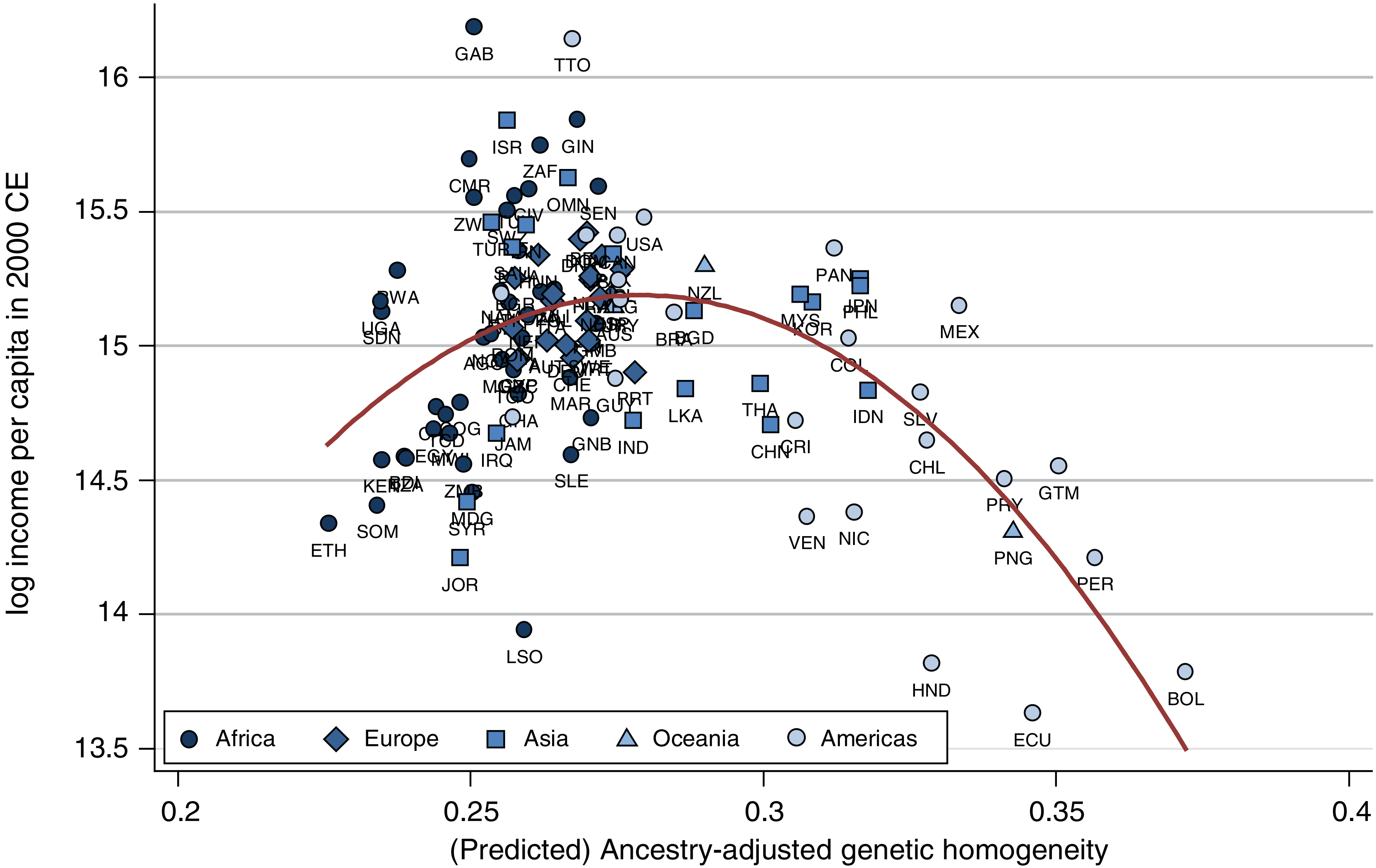
"The 2018 cohort's combination of clever methods and dogged snuffling out of data comes along with a rejection of some of the more frolicsome manifestations of earlier new empiricists. Many of them display an admirable millennial earnestness. They are mostly tackling subjects that are both in line with long-standing economic concerns and of grave public importance ... Because they want to change the world, not just delight in its perversity, many of these economists engage closely with policy ... Intriguingly, this concern for real-world outcomes is pushing some of these young economists back towards theory."

▷ Melissa Dell (F): Harvard.
▷ Isaiah Andrews: Harvard.
▷ Nathaniel Hendren: Harvard.
▷ Stefanie Stantcheva (F): Harvard.
▷ Parag Pathak: MIT - ’18 Clark.
▷ Heidi Williams (F): MIT.
▷ Emi Nakamura (F): Berkeley.
▷ Amir Sufi: Chicago.

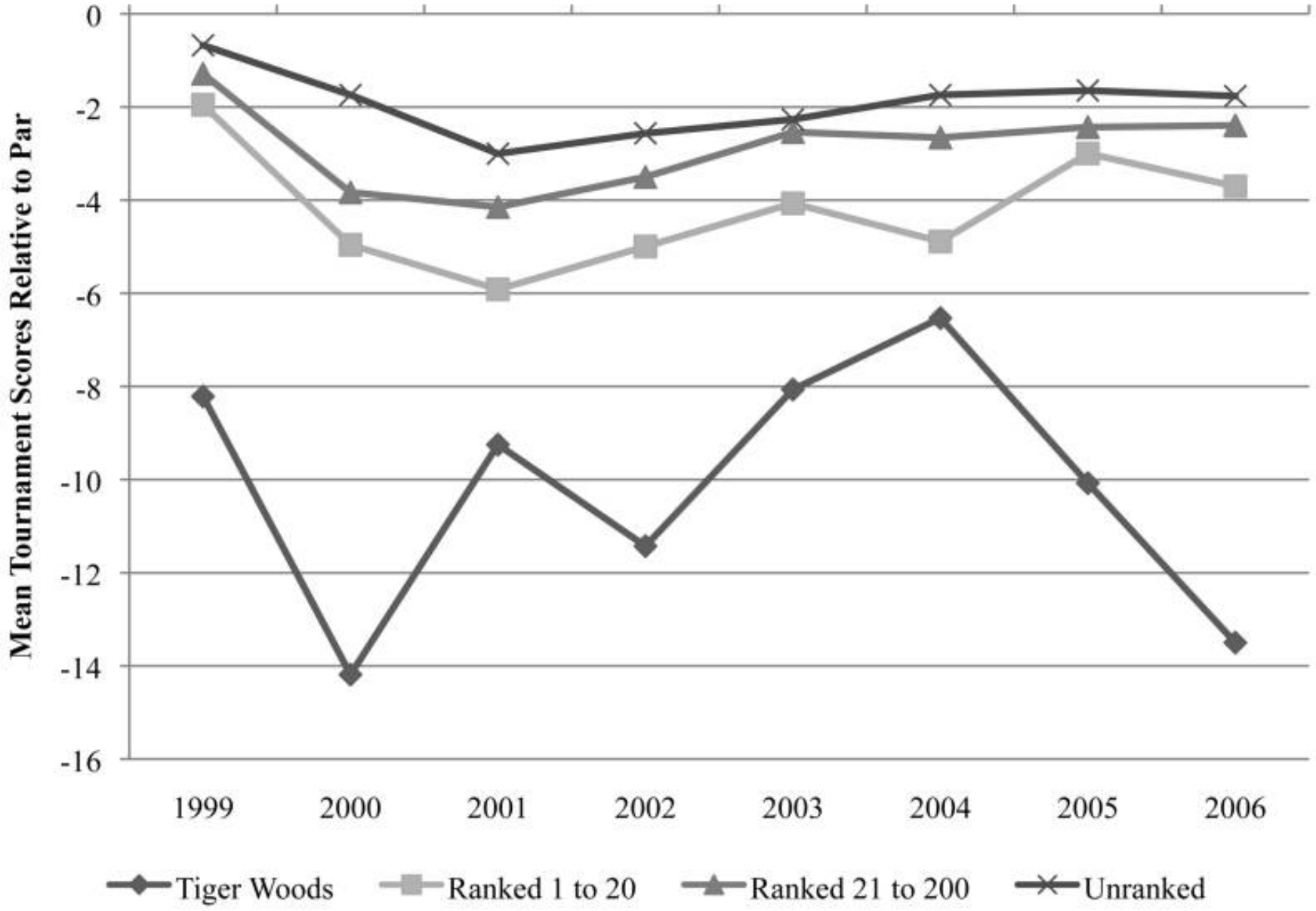
- It is important to make four distinctions.
  - Positive science vs. normative science.
  - Quantitative approach vs. qualitative/narrative approach.
  - (Big) data science vs. case study (few observations), theoretical modeling (weak predictions), or numerical simulation (strong assumptions).
  - Explaining what has occurred vs. forecasting what is to occur, or causation vs. correlation.
- The kind of econometrics we are particularly interested in may be labeled as **causal inference in quantitative social sciences**.

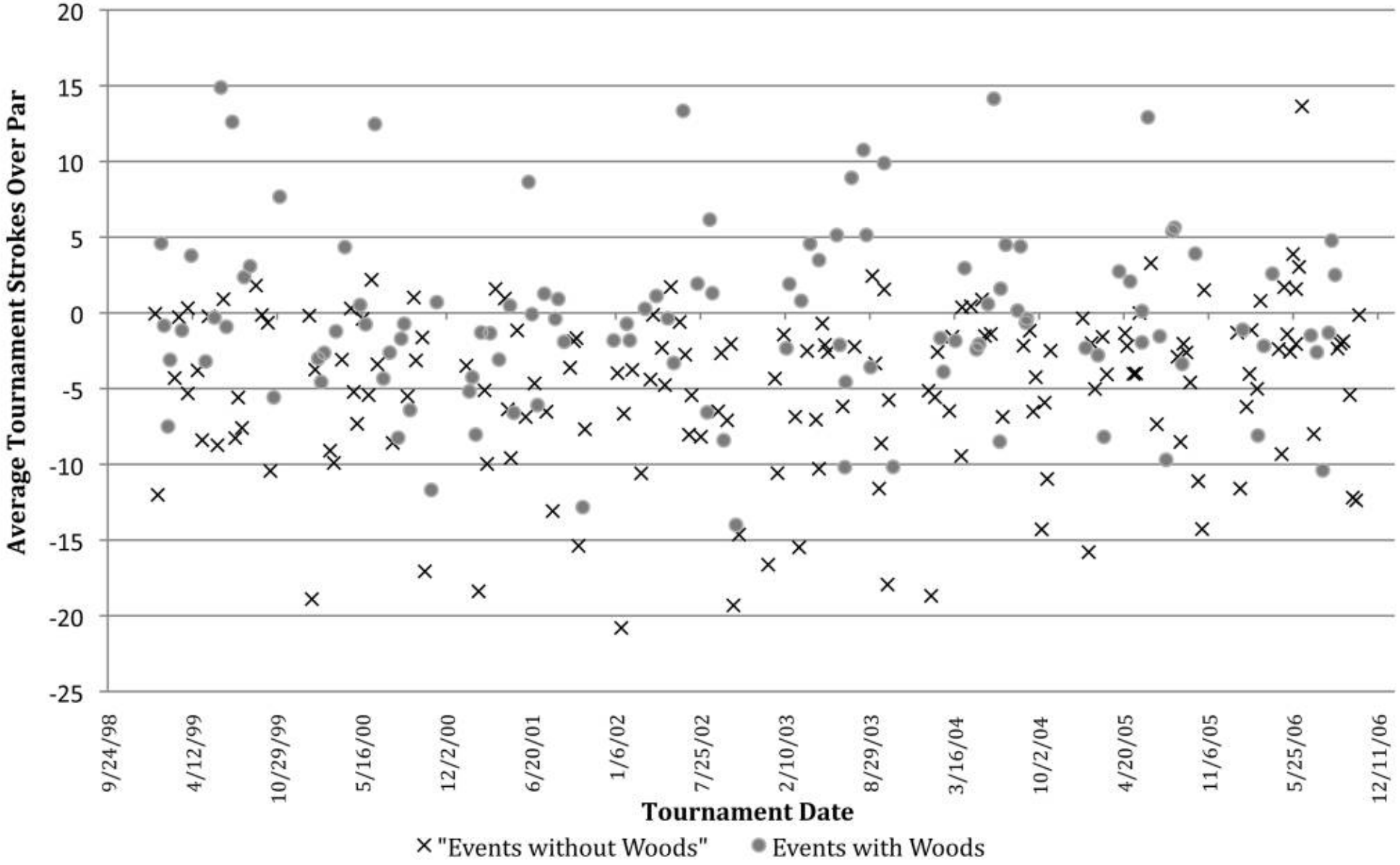
示例 1. “走出非洲”假说 (Ashraf and Galor, 2013, *AER*).

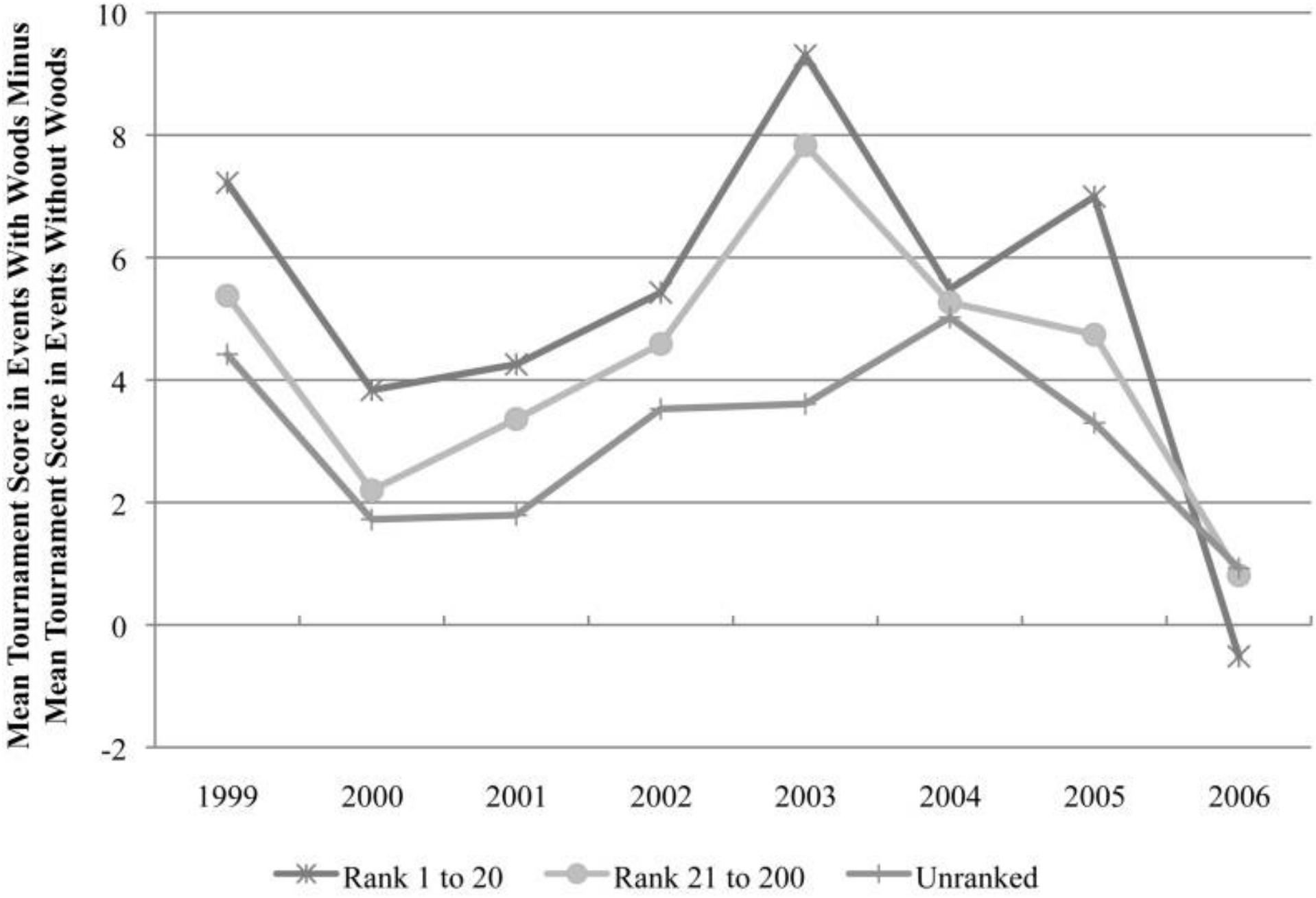




示例 2. 超级明星效应 (Brown, 2011, *JPE*).







Average Number of Eagles, Birdies, Pars, Bogeys, and Double Bogeys in Tournaments With and Without Tiger Woods from 2002 to 2006

	Average Number per Round in Tournaments		
	With Tiger Woods	Without Tiger Woods	H_0: Equal Number With and Without Tiger Woods (Unpaired t-Test)
Eagle (2 strokes under par)	.080	.093	p-value = .065
	(.004)	(.006)	
Birdie (1 stroke under par)	3.815	3.866	p-value = .194
	(.021)	(.033)	
Par (equal to par)	11.323	11.354	p-value = .515
	(.026)	(.038)	
Bogey (1 stroke over par)	2.510	2.448	p-value = .069
	(.020)	(.028)	
Double bogeys (2 strokes over par)	.242	.218	p-value = .035
	(.006)	(.009)	

	Tournament Types			
	First Round Regulars and Majors (1)	First Round Regulars (2)	Tournament Regulars and Majors (3)	Tournament Regulars (4)
Superstar effect for players:				
Ranked 1–20	.596**	.535*	1.358**	.996
	(.281)	(.302)	(.726)	(.786)
Ranked 21–200	.161	.141	.804***	.672**
	(.113)	(.117)	(.318)	(.328)
Unranked	.202	.212	.596	.311
	(.126)	(.131)	(.396)	(.400)
Observations	34,986	29,167	18,805	15,651
Adjusted R^2	.29	.21	.48	.38

But there are more ...

- 定量研究 vs. 质性研究
  - King *et al* (1994) in *Designing Social Inquiry*:

    > [T]he differences between the quantitative and qualitative traditions are only stylistic and are methodologically and substantively unimportant. All good research can be understood — indeed, is best understood — to derive from the same underlying logic of inference ... neither quantitative nor qualitative research is superior to the other ... Since many subjects of interest to social scientists cannot be meaningfully formulated in ways that permit statistical testing of hypotheses with quantitative data, we do not wish to encourage the exclusive use of quantitative techniques ... Rather, we argue that nonstatistical research will produce more reliable results if researchers pay attention to the rules of scientific inference — rules that are sometimes more clearly stated in the style of quantitative research.

– Goertz and Mahoney (2012) in *A Tale of Two Cultures*:

> We reject the assumption that a single logic of inference founded on statistical norms guides both quantitative and qualitative research. Nor do we believe that the quantitative-qualitative distinction revolves around the use of numbers versus words. Instead, we see differences in basic orientations to research, such as whether one mainly uses **within-case analysis** to make inferences about individual cases (as qualitative researchers do) or whether one mainly uses **cross-case analysis** to make inferences about populations (as quantitative researchers do) ... quantitative research is grounded in **inferential statistics** (i.e., probability and statistical theory), whereas qualitative research is (often implicitly) rooted in **logic and set theory** ... [They] differ in the extent to which and the ways in which they address **causes-of-effects** and **effects-of-causes** questions.

- 因果推断 vs. 预测 (Francis Diebold)
  - 当 DGP 是线性、同方差、前定解释变量模型，OLS 可以同时实现因果推断和预测；假设不成立，对预测没有影响，但对因果推断有影响。
  - 旧因果推断，主要致力于对函数形式的敏感性分析，和对扰动项方差结构（异方差、自相关）建模。
  - 新因果推断，运用实验和准实验数据，强调研究设计，将函数形式和扰动项方差结构视作非核心问题不予关注。
  - 新因果推断无助于预测。
    - ▷ 控制变量的选择可能是重要的，影响对 DGP 的近似。
    - ▷ 扰动项方差结构可能是重要的，自相关影响点预测，异方差影响区间和密度预测。
    - ▷ 非线性可能是重要的，可能要进行远离解释变量均值处的预测。

- 什么是新因果推断所谓的研究设计 (research design)？**把任何实证研究都看成一场实验，强调寻找外生冲击 (specific sources of exogenous variation).**
- 计量经济学的实验主义进路其实是一种妥协：既然不可能控制所有相关因素，那么就诉诸于特定的事件和情境。因此，它会遭遇批评是很正常的。
  - 外部有效性
  - 作用机制和政策含义：Lack of interpretability; the "so what" test (Michael Keane)

- 实验主义 vs. 结构主义 (Kenneth Wolpin)
  - 结构主义方法：待估计的关系由理论推导而来。
  - 准结构主义方法：待估计的关系是对可以由理论推导而来的结论的某种近似。（比如待估计参数是深层参数的某个未知函数，或扰动项是理论模型中的随机因素的某种未知组合。）
  - 约简主义（实验主义）方法：待估计的关系不直接来自于理论，但可能用理论直观解释估计得到的关系。
- 实验主义的单方程因果推断在宏观经济学中基本行不通，在产业组织中应用性也比较有限。

My teaching philosophy: 术、道、趣、艺、业

- 关于**tech (术)**.
  - Richard Freeman on the three laws for econometrics you can trust:
    1. It had better be there in the ordinary-least-squares regression.
    2. It had better still be there in the econometrically sophisticated high-tech instrument procedures.
    3. It had better still be there for small technical tweaks to the econometrically sophisticated procedures.
  - 两条免责声明：
    1. 没有不随研究情境而变的标准流程。
    2. 只能告诉你什么是对的，听不听是你的事。

- 关于**belief (道)**. “三重境界说”:
  - 第一重境界：计量就像中餐，成功全凭大胆。
  - 第二重境界：中餐西做，理无二致，起承转合，皆有定法。
  - 第三重境界：中餐是一种信仰。

- 关于**taste (趣)**.
  - Peter Klenow:

$$\frac{\partial \text{Welfare}}{\partial \text{Research}} = \frac{\partial \text{Welfare}}{\partial \text{Knowledge}} \cdot \frac{\partial \text{Knowledge}}{\partial \text{Research}}$$

Micro	> 0	High	Low
Macro	≈ 0 ?	Low	High

  - Andrew Gelman: Randomized experiments give you accurate estimates of things you don't care about; Observational studies give you biased estimates of things that actually matter.
  - James Heckman: In some quarters of our profession, the level of discussion has sunk to the level of a *New Yorker* article: coffee-table articles about "cute" topics, papers using "clever" instruments. ... Most of this work is without substance, but it makes a shortlived splash and it's easy to do. Many young economists are going for the cute and the clever at the expense of working on hard and important foundational problems.

- 关于**craft (艺)**. Good empirical research is like detective stories. Often you don't have strong evidence, but a collection of compatible weak evidence speaks for itself, reminiscent of the famous saying:

  > *Once you eliminate the impossible, whatever remains, no matter how improbable, must be the truth. — Arthur Conan Doyle*

  示例 3. Corruption in sumo wrestling (Duggan and Levitt, 2002, *AER*).

- 关于**exp (业)**. 文献阅读的几点建议：
  - 既要广泛地读，也要深入地读。了解进展、激发灵感的读导论、摘要、公众号；与 project 有关的文献读主干；主题或技术上的 key paper 精读。
  - 跟踪最顶级的期刊。
  - 不必读经典，重视“老”文献。
  - 精读包含三个方面：分析文本 ;“复制”结果；勤做笔记。
  - 读是为了写服务。

  下面的段落摘自 Dixit, Avinash K (1998), “My System of Work (Not!)” *Passion and Craft: How Economists Work*, Michael Szenberg (ed.), University of Michigan Press.

• Read other people's papers either seriously, or not at all. When you read them seriously, read them as you read papers when you were a graduate student, checking all the details and questioning everything. This is a good way to get new research ideas of your own. I owe my own understanding of the importance of this principle to Richard Feynman. He describes how he came to discover the law of beta decay.[10]

> `At that particular time I was not really quite up to things. Everybody seemed to be smart, and I didn't feel I was keeping up. ... At one point there was a meeting in Rochester, ... and Lee was giving his paper on the violation of parity. ... I was staying with my sister in Syracuse. I brought the paper home and said to her, "I can't understand these things Lee and Yang are saying. It's all so complicated." "No," she said, "what you mean is not that you can't understand it, but that you didn't invent it. You didn't figure it out your own way, from hearing the clue. What you should do is imagine you're a student again, and take this paper upstairs, read every line of it, and check the equations. Then you'll understand it very easily." '

She was right. Not only did Feynman understand the paper, but he remembered something he had done a while ago, used that method to simplify Lee's solution, and forged ahead to develop the whole new theory.

读别人的论文，要么不读，要么精读，要像你在上研究生时那样考究文章的所有细节，质疑文章的所有内容。这是一种产生新的研究思路的好方法。我对这条原则之重要性的理解要归功于 Richard Feynman。他是这样描写自己如何发现 beta 衰变定律：

“那时候我还什么都不是。每个人都很聪明，我却怎么也赶不上。……有一次李政道在罗彻斯特的某个会议上报告宇称不守恒，那时我正和姐姐一起住在雪城。我把文章带回家，对她说 :‘根本搞不懂李政道和杨振宁在说啥，太复杂了 !’姐姐说 :‘不对，不是因为你不懂，而是因为这不是你发现的，你听是听了，可还没有用自己的方法加以理解。你应该当自己是个学生，带着文章上楼，仔细去读每一行，推导每一个方程，然后就很容易懂了。”

姐姐是对的。Feynman 不但理解了那篇文章，而且记起了自己之前做过的东西，以此简化了李政道的解，并进而开创了一个全新的理论。

- 总结起来就是三句话：

入门须正

取法须高

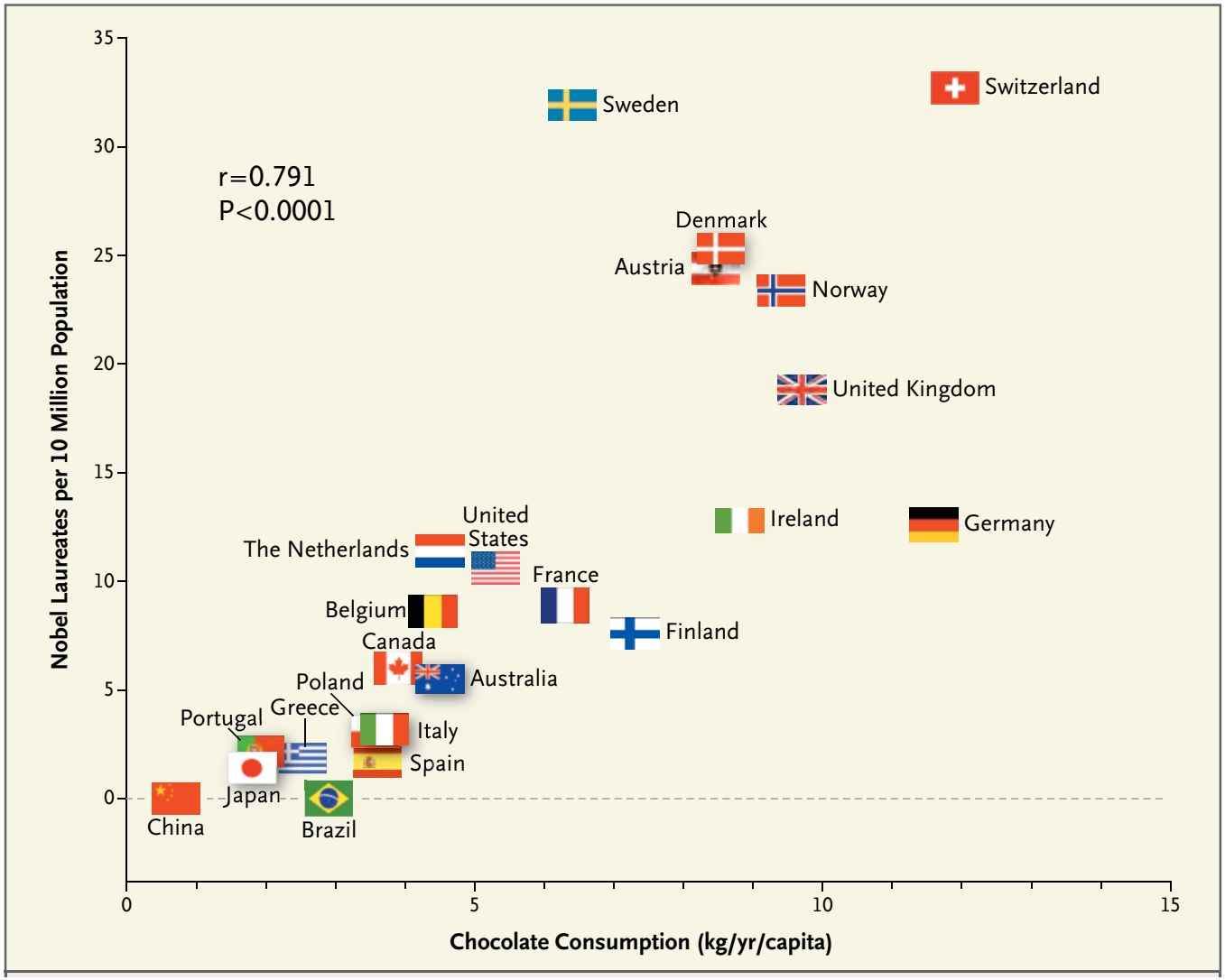
立志须远

The relationship between econometrics and statistics.

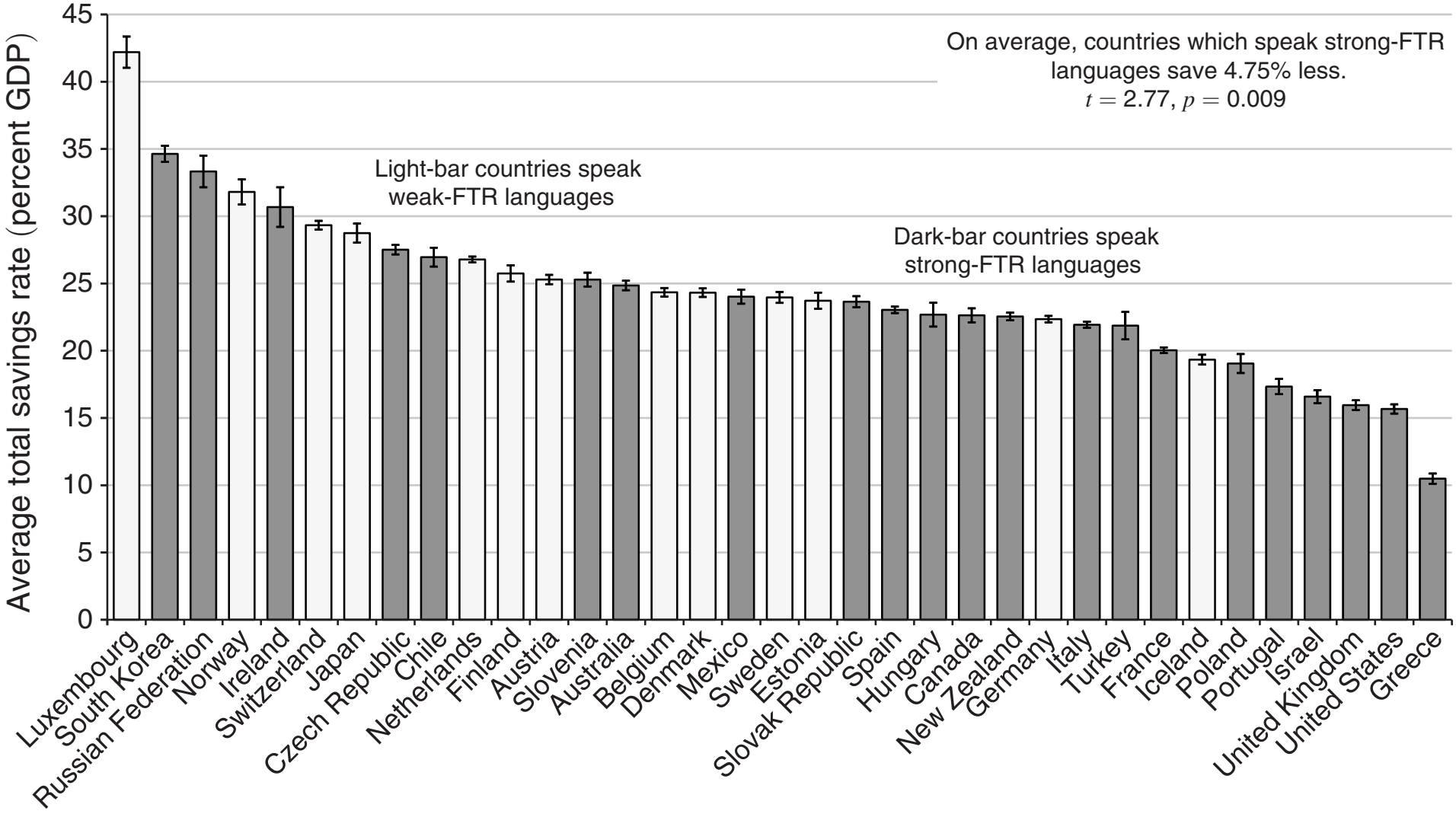
- Every causal inference problem has two components: a causal identification component and a statistical inference component.
  - **Identification (识别)**: How much can we learn about parameters from infinite amount of data?
  - **Inference (推断)**: Learn about what you do not observe (parameters) from what you do observe (data).
- If a model is identified, then there exists no other model that is observationally equivalent. In the Tiger Woods example, we would like to ask if there are alternative explanations, other than the super-star-effect story, that also permit positive regression parameters, or under what assumptions is there no such alternatives. This is where **economic theory** plays the pivotal role.

- Statistics detects **correlation**, but it is economic theory that establishes **causation**.
- Causation implies correlation, not the other way round. If the correlation is not observed, then the causation is falsified; if the correlation is observed and there is no other plausible causation that implies the same correlation, then the causation in interest is verified.
- Therefore, **correlation is not causation, but it is the mother of causation**.

示例 4. 诺奖的决定因素 (Messerli, 2012, *N Engl J Med*).



示例 5. 语言与储蓄率 (Chen, 2013, *AER*).



Linear regression model.

- In the Out of Africa example,

$$\begin{aligned}\ln(\texttt{Pop Density})_i =& \beta_0 + \beta_1 \texttt{Genetic Index}_i \\ &+ \beta_2 \texttt{Genetic Index}_i^2 + \beta_3 \mathbf{W}_i + \varepsilon_i\end{aligned}$$

- In the Tiger Woods example,

$$\begin{aligned}\texttt{strokes}_{ij} =& \beta_1 \texttt{star}_j \times \texttt{HRanked}_i + \beta_2 \texttt{star}_j \times \texttt{LRanked}_i \\ &+ \beta_3 \texttt{star}_j \times \texttt{URanked}_i + \alpha_1 \texttt{HRanked}_i + \alpha_2 \texttt{LRanked}_i \\ &+ \gamma_0 + \gamma_1 \boldsymbol{\Delta}_i + \gamma_2 \boldsymbol{\Pi}_j + \varepsilon_{ij}\end{aligned}$$

- In general notation,

$$y_i = \mathbf{x}_i' \boldsymbol{\beta} + \varepsilon_i$$

- The equality is supposed to hold for any possible observation from a well-defined population, thus rendering the name **population relationship**, while we only observe a sample of (say) n observations.
- A common case is when the key explanatory variable x only takes values 0 or 1. We usually call such x a treatment (处理) or an intervention (干预). y is called an outcome (结果).

Statistical inference.

- Statistical inference essentially involves the attempt to acquire information about a population or process by analyzing a sample of elements from that population or process.
- The ability to make correct inferences about a population based on a sample from it depends on the sample being **representative** of the population.
- We also need some measure of the **reliability** of our method of inference. What are the odds that we could be wrong.

Sampling.

- The sampling process describes how the sample is taken from the population and, as a result, determines the randomness of the sample.
- **Simple random sampling (简单随机抽样).** n objects are selected at random from a population and each member of the population is equally likely to be included in the sample. The n observations in the sample are denoted $\{(y_i; x_i)\}_{i=1}^n$. Because the members of the population included in the sample are selected at random, the values of $(y_i; x_i)$ are themselves random and can be treated as random variables. Before they are sampled, they can take on many possible values; after they are sampled, a specific value is recorded for each observation.

- The marginal distribution of $(y_i; x_i)$ is the same for each $i = 1, 2, \ldots, n$. It is just the population distribution. Moreover, knowing the value of $(y_1; x_1)$ provides no information about $(y_2; x_2)$, so the conditional distribution of $(y_2; x_2)$ given $(y_1; x_1)$ is the same as the marginal distribution of $(y_2; x_2)$. We say $\{(y_i; x_i)\}_{i=1}^{n}$ are **independently and identically distributed (i.i.d., 独立同分布)**.
- Random sampling rules out cases of **sample selection (样本选择).** For example,
  - Rich people hesitate to respond to income surveys.
  - Quitters of a fitness program inflate its effect.

2018高考作文
全国卷II

材料作文

“二战”期间，为了加强对战机的防护，英美军方调查了作战后幸存飞机上弹痕的分布，决定哪里弹痕多就加强哪里。然而统计学家沃德力排众议，指出更应该注意弹痕少的部位，因为这些部位受到重创的战机，很难有机会返航，而这部分数据被忽略了。事实证明，沃德是正确的。

要求：综合材料内容及含义，选好角度，确定立意，明确文体，自拟题目。不要套作，不得抄袭，不少于800字。

大雪

想在网上买个降落伞，看看差评怎么说的，找了好久也没找到差评。

后来想想终于知道为什么没有差评了。

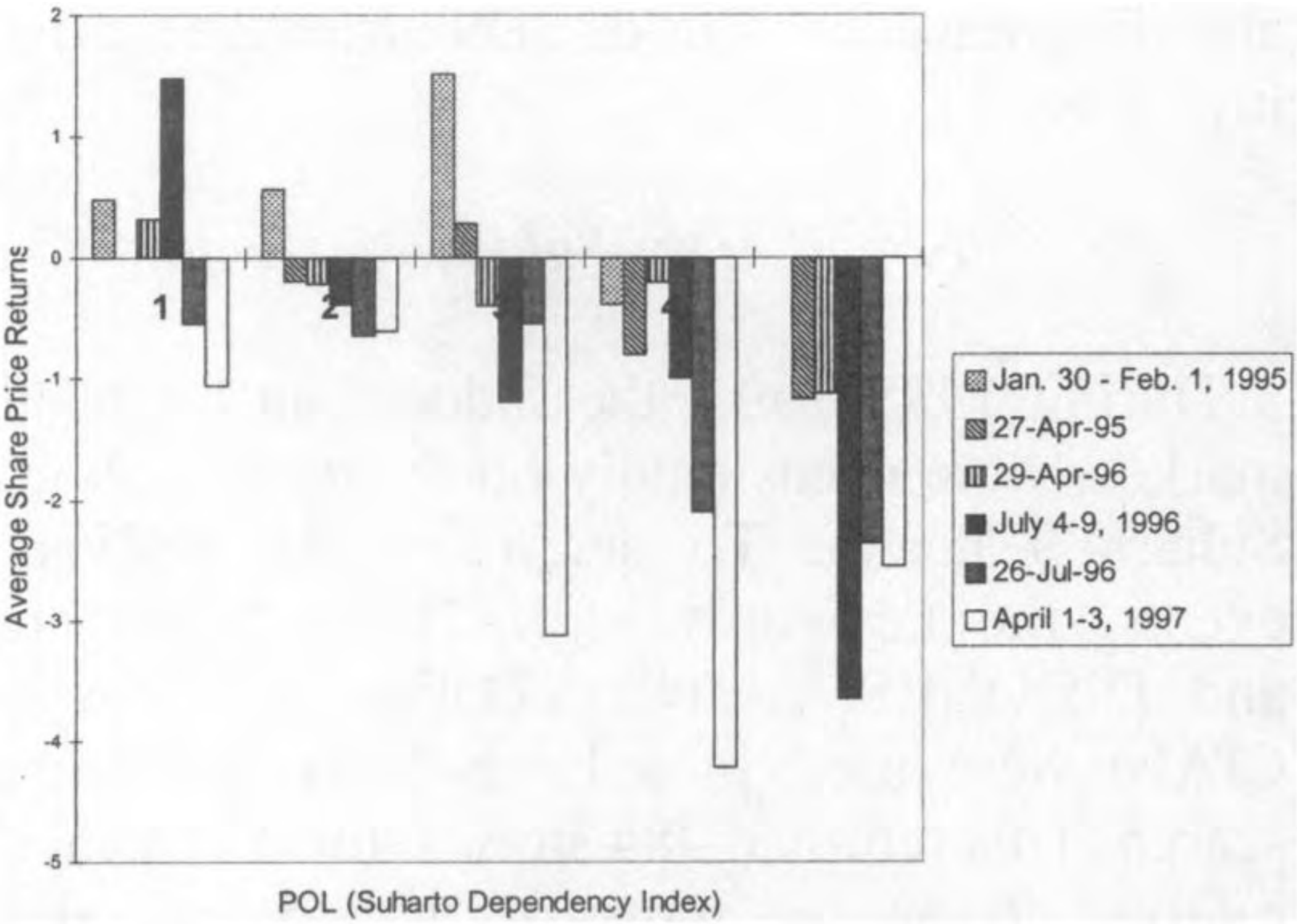
3分钟前

♡ 腿[illegible], 损友

腿[illegible]: 哈哈哈哈哈哈哈哈哈哈

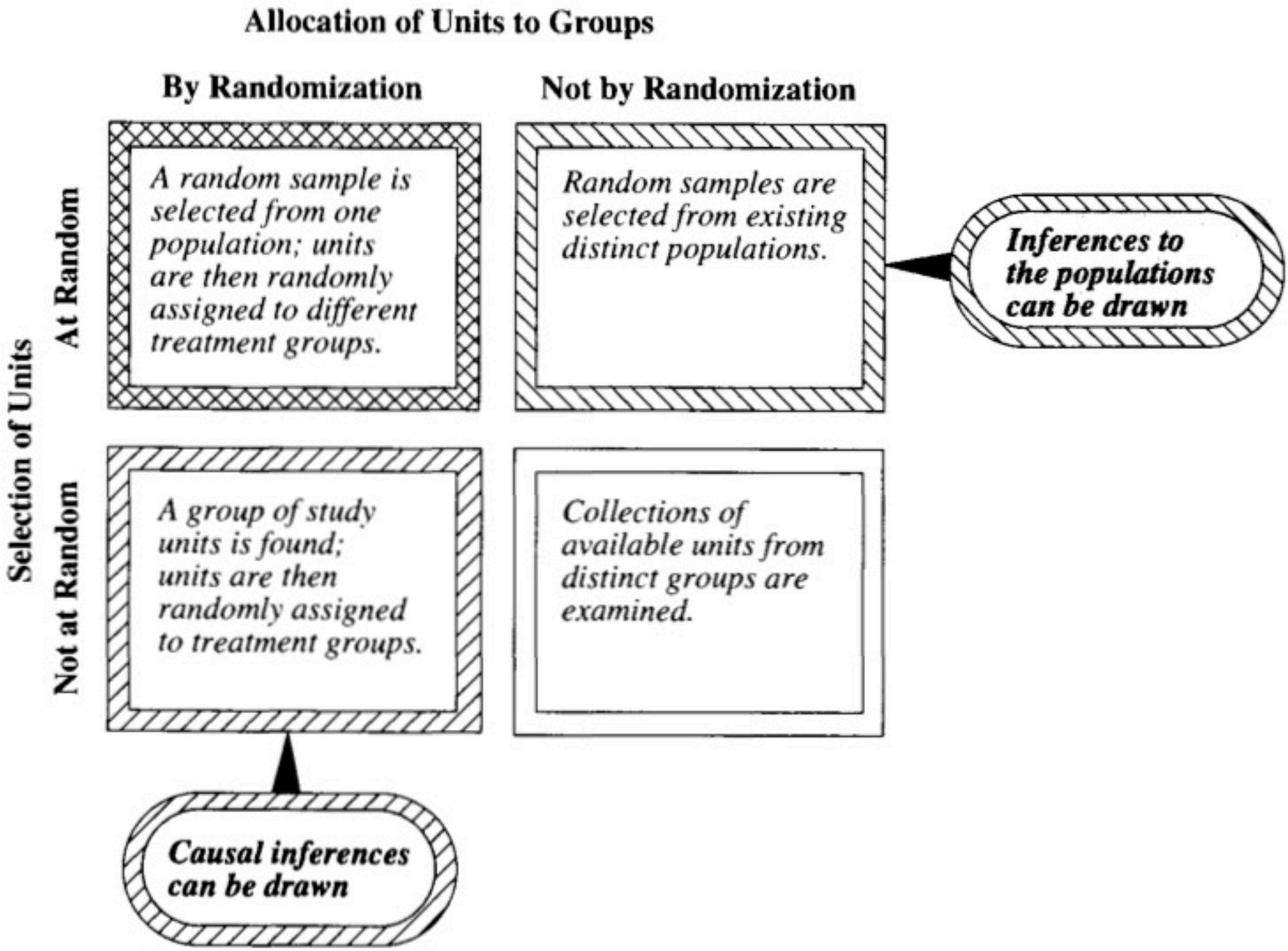
Data sources.

- Experimental data. x_i is considered as deterministic. Researchers manipulate (set values of) x_i and then observe values of y_i. A new sample implies new values for ε_i, or equivalently, for y_i.
  - Randomized controlled experiment (lab or field).
  - Natural experiment / quasi-experiment.
    示例 6. 政治关联与企业价值 (Fisman, 2001, *AER*).
- Non-experimental / observational / retrospective data. A new sample implies new values for both x_i and ε_i, so that each time a new set of n observations $\{y_i; x_i\}_{i=1}^n$ is drawn.
- Most economic data are non-experimental, meaning all variables must be treated as random and possibly jointly determined, in particular **the distribution of ε_i may depend upon x_i.**



Challenges to observational studies.

- One major challenge is that, most human actions are chosen rather than assigned, *i.e.*, **people are self-selected (自选择) into the treatment**, so it is generally difficult to sort out the effect of the treatment from other relevant factors.
  - Selection on observables: the notion of **ceteris paribus** (other things being equal/other things held constant).
  - Selection on unobservables.
- Sample selection vs. self-selection. The following diagram provides a nice summary.
- A second major challenge is **simultaneity (联立性)**, an important case of which is **reverse causality (反向因果)**. The reverse causality problem can be viewed as a special case of selection problem where selection is based on the outcome variable.



Internal validity vs. external validity.

- Internal validity (内部有效性): The statistical inferences about causal effects are valid for the population being studied.
- External validity (外部有效性): The inferences and conclusions can be generalized from the population and setting studied to other populations and settings. Potential threats to external validity include
  - Differences in populations.

    示例 7. The weirdest people in the world? (Henrich et al., 2010, *Behav Brain Sci*).
  - Differences in settings. The importance of a well-spelled-out economic theory.