The credibility revolution: a scientific approach to economic policy

Prof. Tito Boeri

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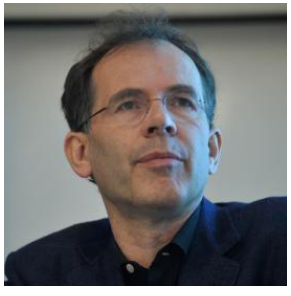
The Prize in Economic Sciences 2021

David Card (University of California, Berkeley, USA)

"for his empirical contributions to labour economics"



Joshua D. Angrist (MIT, Cambridge, USA)
Guido W. Imbens (Stanford University, USA)

"for their methodological contributions to the analysis of causal relationships"

Main contribution

Natural experiments help answer important questions for society

This year's Laureates – David Card, Joshua Angrist and Guido Imbens – have provided us with new insights about the labour market and shown what conclusions about cause and effect can be drawn from natural experiments. Their approach has spread to other fields and revolutionised empirical research.

Press release: The Prize in Economic Sciences 2021

Correlation vs. Causation

Given two variables, X and Y:

- **Correlation**: the values of X and Y move (covary) together
- **Causation**: a change in X implies a change in Y

In economics and policy evaluation, interested in causation:

what is the *effect* of an increase in the minimum wage on employment?
what is the *effect* of schooling on earnings?
what is the *effect* of immigration on natives' wages, employment and political preferences?

Desperately looking for the Counterfactual

Ideally, a researcher would like to compare an outcome for the *same* individual without vs. with the treatment (e.g., a policy)
$\rightarrow$ the *effect* would then be the difference between the two

However: this is not possible (counterfactual is not observed)
$\rightarrow$ look at differences in means btw those affected and a **comparable group**, but problem of **selection bias**

Solutions:

- Randomized Control Trials (RCTs)
- Natural experiments

Natural experiments

In **experimental studies** such as RCTs, the variation in the treatment is exogenous (random assignment)
$\rightarrow$ no selection bias when comparing the outcome for the treatment and control group
but often RCTs not feasible in social sciences

In **observational studies**, the treatment is not determined by the researcher
$\rightarrow$ exploit natural experiments that determine *plausibly exogenous variation* in the assignment to the treatment group (as-if experiments)

Difference-in-Differences

Select a *treatment group A* undergoing a reform from period 0 to period 1, and a *control group B* excluded from the reform, such that:

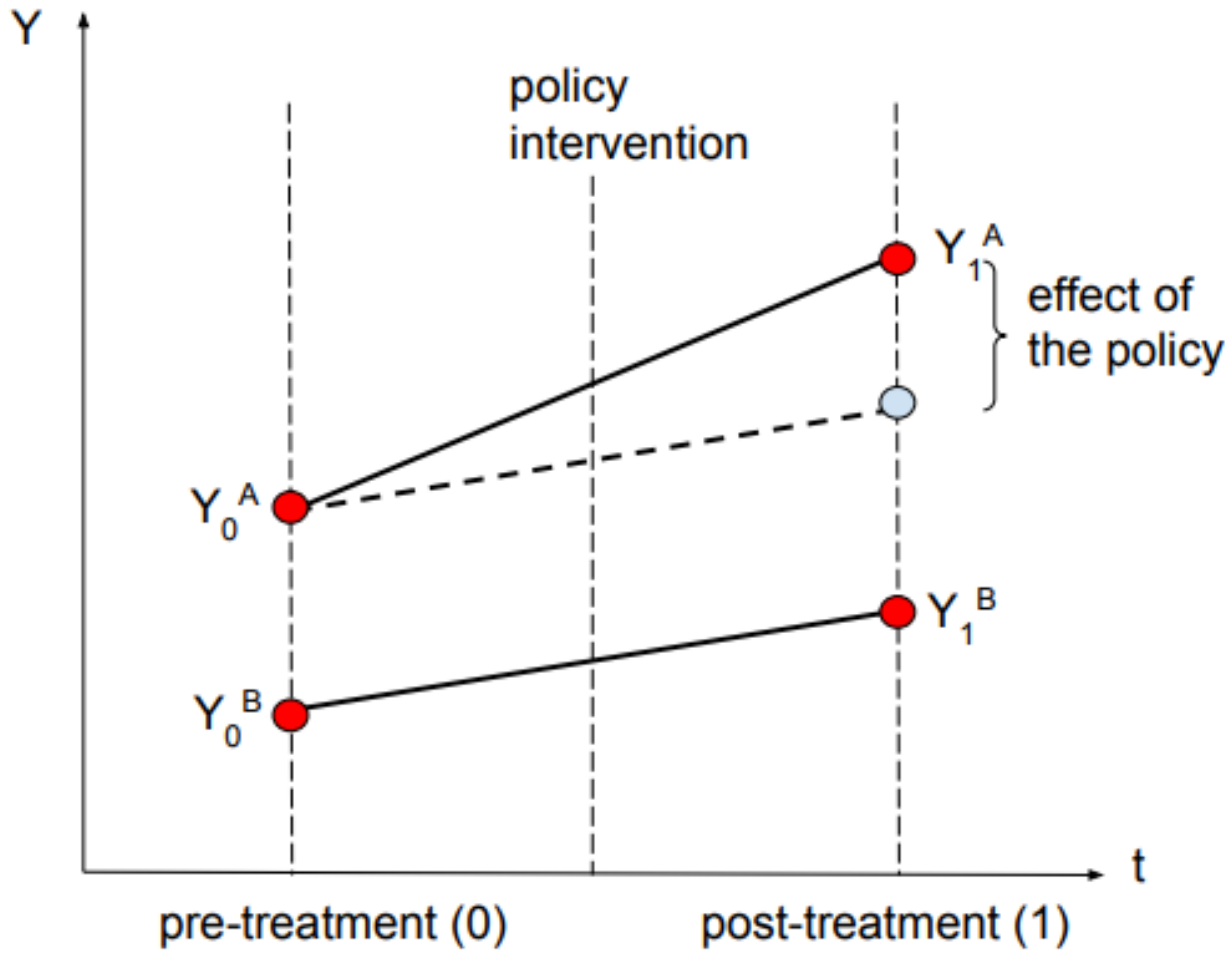
- $\boxed{\Delta E_{01}^{A} = \Delta E_{01}^{B}} \rightarrow$ policy aside, the effect of the variation in economic circumstances can be assumed equal between the two groups
- In the absence of the policy difference between treatmemt and control must be constant over time (*common trend* assumption).
- Also, the reform must be unexpected (*no anticipation effects*).

Then, the policy effect amounts to $\boxed{\Delta\Delta = (Y_1^A - Y_1^B) - (Y_0^A - Y_0^B)}$

	Treatment Group A	Control Group B
Period 0	Y_0^A	Y_0^B
Period 1	Y_1^A	Y_1^B
Δ	$\Delta E_{01}^{A} + Pol$	ΔE_{01}^{B}
$\Delta\Delta$	Pol	

Difference-in-Differences

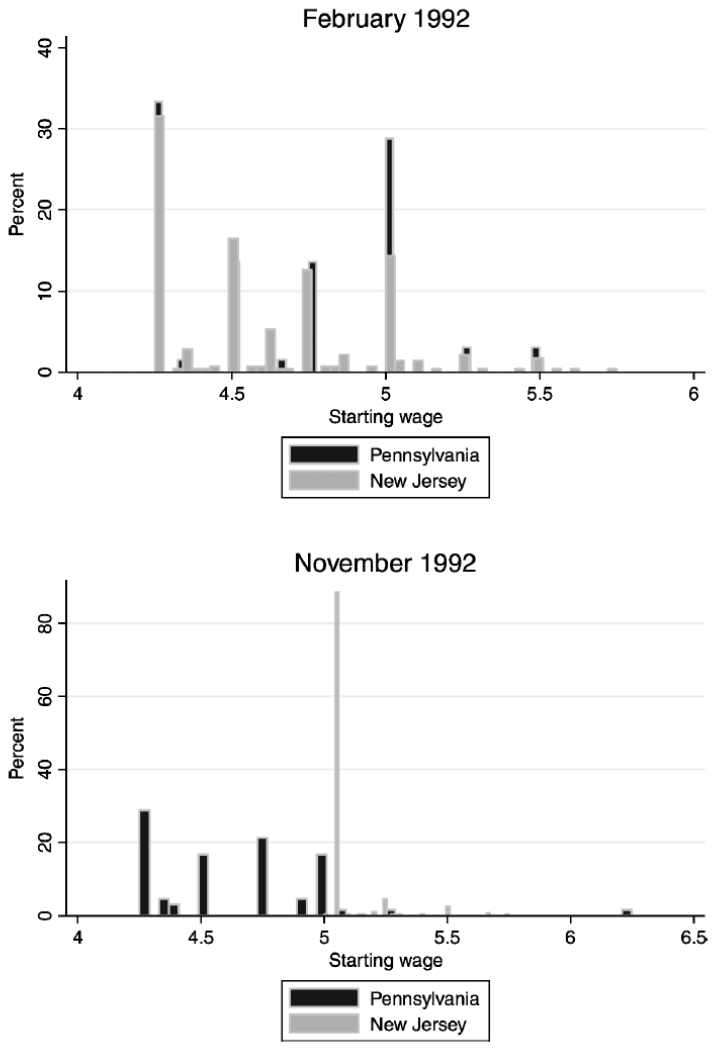
Graphically:



Example 1 DiD: Card and Krueger 1994

- Impact of increases in the hourly MW in New Jersey (treatment group) in April 1992 from $4.25 to $5.05.
- Control group: Pennsylvania, where the MW remained at $4.25 throughout this period.
- New Jersey and Pennsylvania are bordering states with similar economic characteristics.
- Data on employment in 410 fast-foods in the two states in March 1992 (before the MW hike) and in December (after).

Example 1 DiD: Card and Krueger 1994 (continued)



Example 1 DiD: Card and Krueger 1994 (continued)

Number of full-time equivalents working in a full-time restaurant:

	Employment	
	New Jersey	Pennsylvania
March 1992	20.4	23.3
December 1992	21.0	21.2
Difference	+0.6	−2.1
Difference-in-differences	2.7	

Example 1 DiD: Card and Krueger 1994 (continued)

Price of a full meal in $:

	Price	
	New Jersey	Pennsylvania
March 1992	3.35	3.04
December 1992	3.41	3.03
Difference	0.06	−0.01
Difference-in-differences	0.07	

Example 2 DiD: Imbens et al. 2001

Lotteries provide an ideal setup: exogenous shocks in unearned income of the winners of lottery prizes, a pure income effect.

Imbens et al. (2001): survey of a winners' and a non-winners' samples playing the lottery in Massachussets, recording social security earnings during ± 6 *years* around the lottery winning year.

Key identification assumption: magnitude of lottery prizes is random.

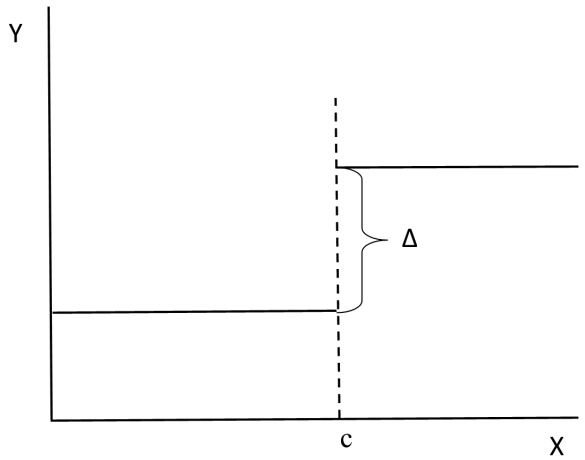
Average earnings	Non-winners	Winners
Pre-lottery years	16,715 USD	12,815 USD
Post-lottery years	17,163 USD	10,938 USD
Δ	448 USD	-1,877 USD
$\Delta\Delta$	-2,325 USD	

Marginal Propensity to Earn (MPE)= $\frac{\Delta \textit{ earnings pre}-\textit{post}}{\Delta \textit{ avg winning two groups}}$ = -0.042

Regression Discontinuity Design (RDD)

- Identify a continuous characteristic X that gets influenced by a policy change from a specific threshold c onwards.
- *Key:* consider a 'small enough' interval around the threshold c s.t. variations in X can be attributed to the policy change only.
- Then, the policy effect on the outcome variable of interest Y is:

$$\boxed{Pol = \Delta = (Y|X \geq c) - (Y|X < c)}$$



Example 1 RDD: Card et al. 2009

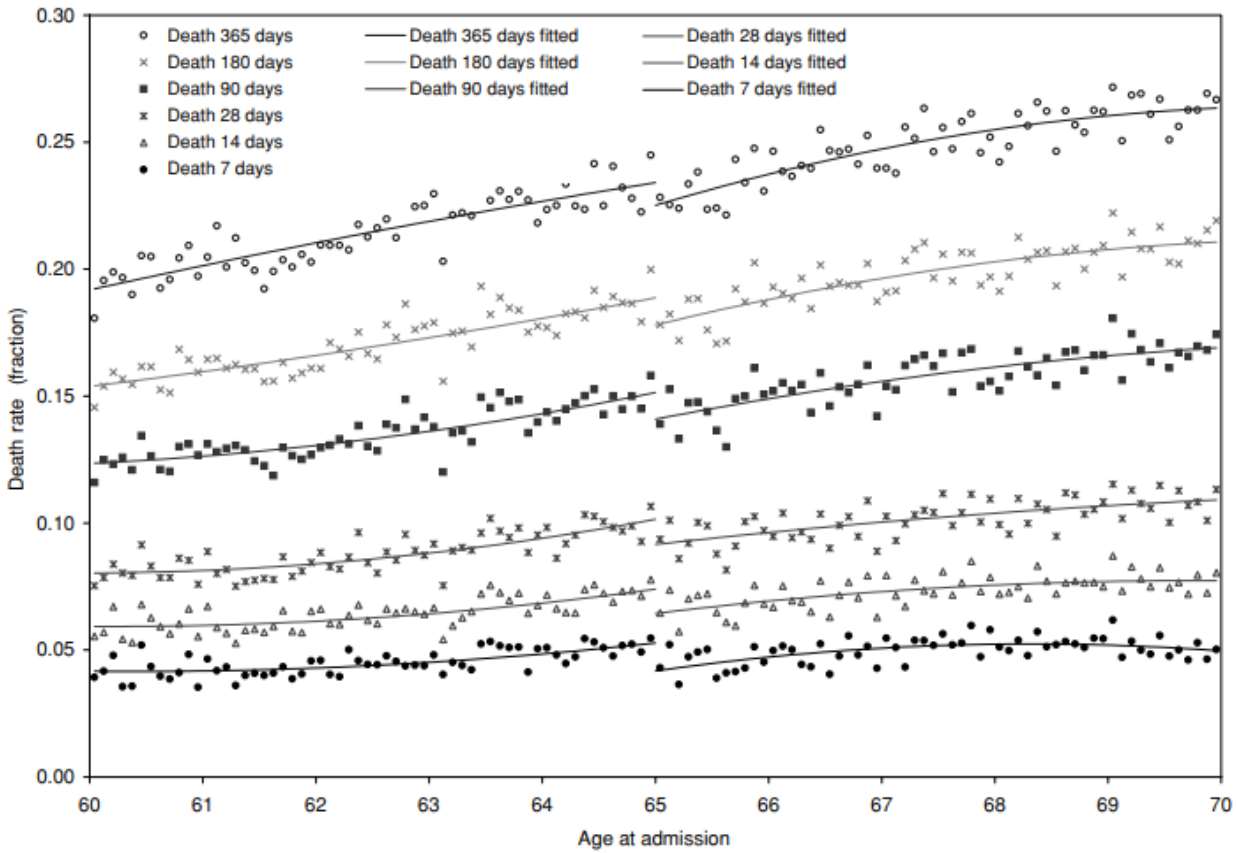
Interested in the effect of better insurance (Medicare) on health outcomes

Use the fact that in the US individuals become eligible for Medicare at 65: compare admissions and deaths among people just before and just after the age of 65 (RDD)

Focus on unplanned admissions through the emergency department (ED) for “nondeferrable” conditions (avoid manipulation at the threshold)

Example 1 RDD: Card et al. 2009 (continued)

Those who are just over 65 have about a 1% lower likelihood of death within a week of admission, or roughly a 20% reduction in 7-days mortality



Example 2 RDD: Card et al. 2007

Analyze the effect of benefit expiration on labor market transitions in Austria

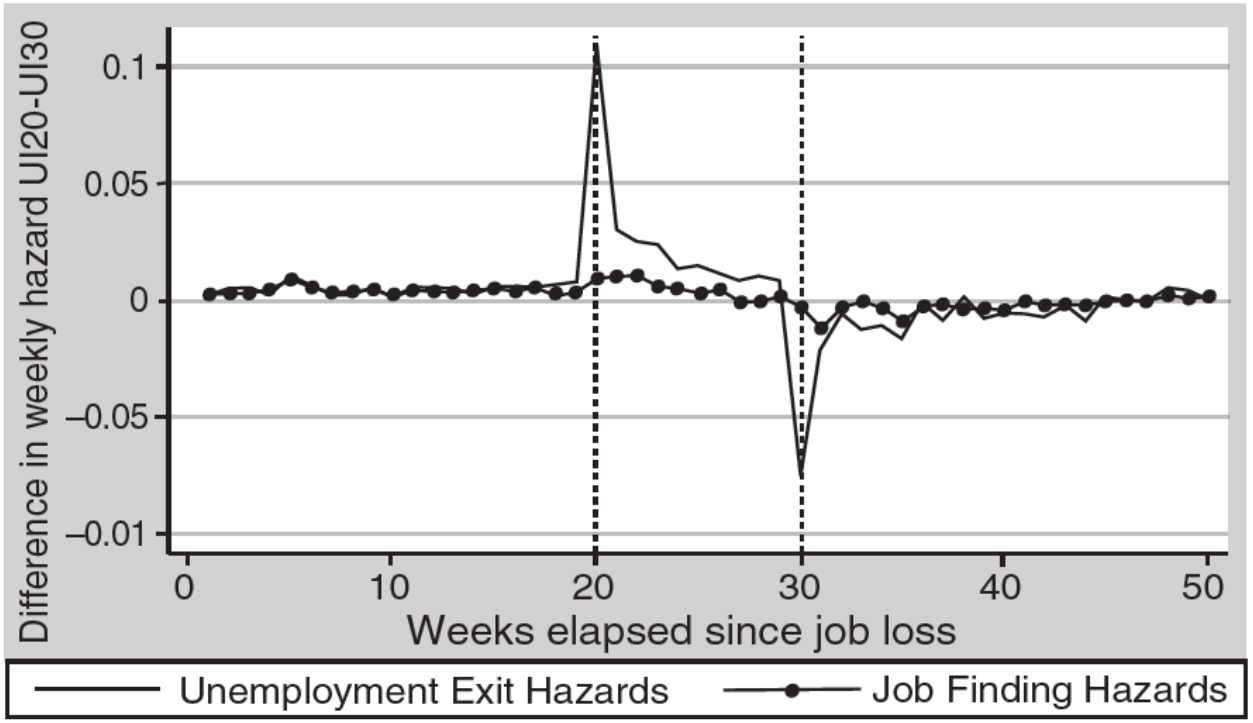
Discontinuity: individuals with under 36 months of employment can receive up to 20 weeks of benefits, while those who have worked for 36 months or more can receive 30 weeks of UI

Restrictions to the sample ($\rightarrow$ want comparable groups):

- individuals between the ages of 20 and 50
- individuals who take up UI benefits within 28 days of job loss, thereby excluding voluntary quitters (who face a 28-day waiting period for eligibility)
- individuals who (a) have worked at their prior employer for at least one year, and (b) have worked for between 33 and 38 months (**3 years ±3 months**) in the past 5 years

Example 2 RDD: Card et al. 2007 (continued)

Larger spike for unemployment exit hazards than job finding hazards, but more important the smooth reduction in job-finding hazards that occurs throughout the spell



Instrumental Variables

Angrist and Imbens combined the use of *instrumental variables* with the *potential outcomes framework*

$\rightarrow$ **Local average treatment effect (LATE)**: effect of a natural experiment where subjects can choose whether or not to comply with the assignment

$\rightarrow$ Under some clearly defined assumptions, possible to estimate the *causal effect* on the subset of compliers

Example: Angrist and Krueger 1991

Interested in monetary returns to education

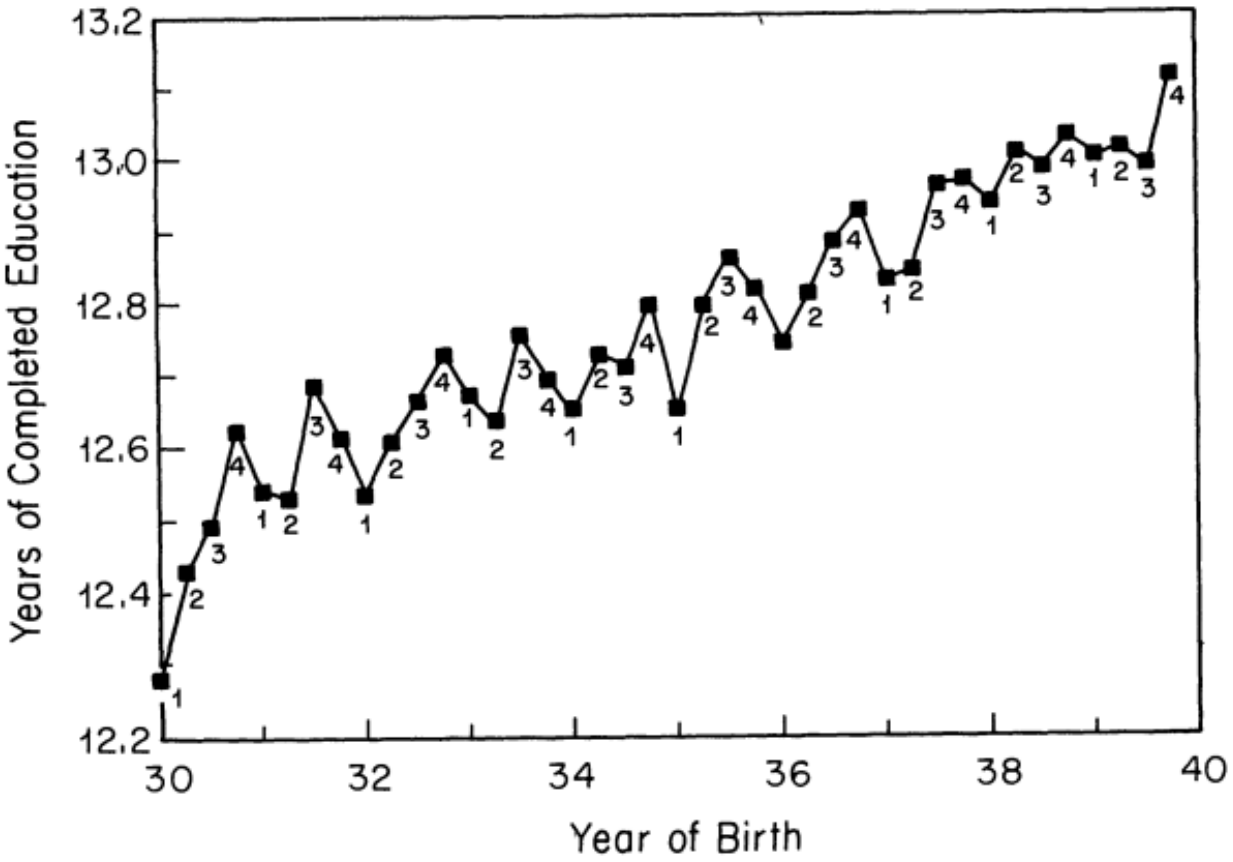
Natural experiment: differences in quarter of birth combined with:

- children born in different months of the year start school at different ages in the US
- US compulsory schooling laws require students to remain in school until their sixteenth or seventeenth birthday

$\rightarrow$ Some students *forced* to attend school longer

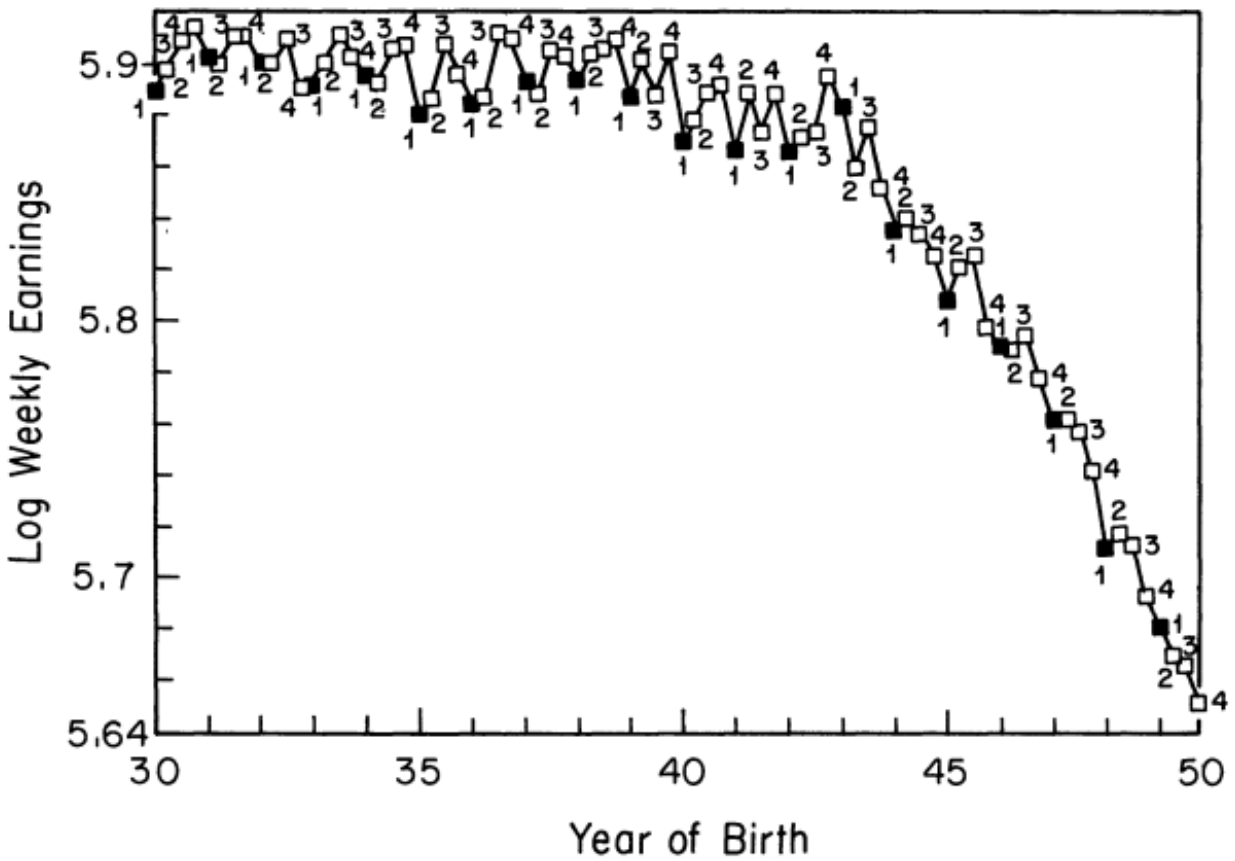
Example: Angrist and Krueger 1991 (continued)

Pattern in years of education by quarter of birth



Example: Angrist and Krueger 1991 (continued)

Estimated a monetary return of about 7.5 percent to an additional year of schooling for those who are compelled to attend school by compulsory schooling laws



Pros and Limitations

The contributions of Angrist, Card, and Imbens (and Krueger) had a huge impact on how policy evaluation is conducted
$\rightarrow$ Natural experiments allow to credibly identify causal effects
However:

- Credible estimates rely on the quasi-randomness of the natural experiment
- Internal consistency vs external validity: the scope of the natural experiment and the restrictions made on the sample (eg RDD) make generalization somewhat hard

Data intensive techniques

- Need of micro data and large samples.
- Potential behind administrative data.
- Evidence based policy should meet big data.
- Use administrative data as a sampling frame and carry out surveys.

A lesson of method

- Angrist and Imbens are also applied social scientists
- Innovation in statistical methods is never and end in itself, but it is useful to investigate and characterize complex and *relevant* social phenomena
- Nobel Prize is not a reward to a carreer, but in the case of Angrist, Card and Imbens all of us can learn from their way to interpret the role of economists
- Along the same lines the (shorter) academic life of a main coauthor of Angrist and Card: **Alan Krueger**

For more: see the *Scientific Background on the Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2021*

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