‘Rerum Cognoscere Causas’

The Problem of Causality in Economics

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RERUM
CAUSAS
COGNOSCERE

Beatrice and Sidney Webb (1895)

Science against Metaphysics

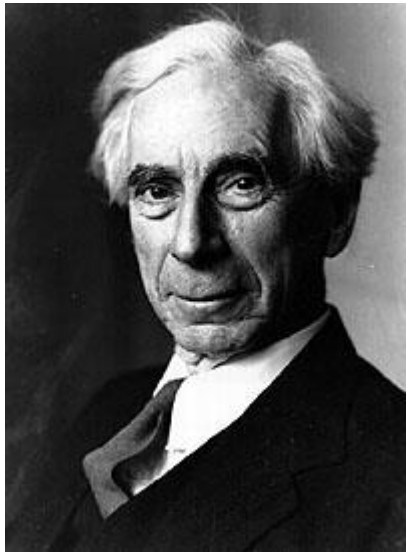
"The classification of facts, the recognition of their sequence and relative significance is the function of science, and the habit of forming a judgment upon these facts unbiassed by personal feeling is characteristic of what may be termed the scientific frame of mind".

Karl Pearson (1892)

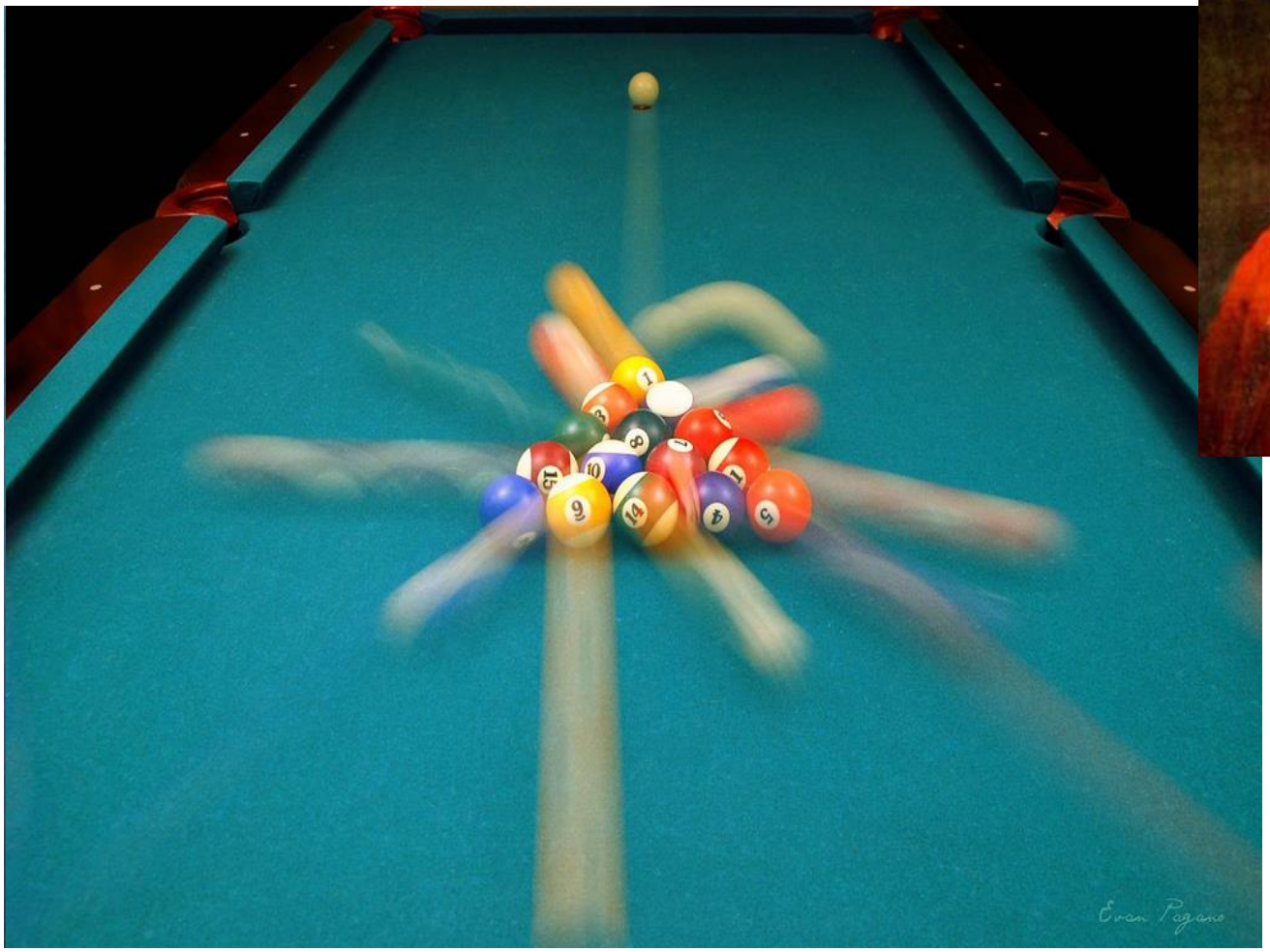
Positivism against Causality

"…a relic of a bygone age, surviving like the monarchy, only because it is erroneously supposed to do no harm".

Bertrand Russell (1905)



There is no ‘fact’ of causality



David Hume
(1748)

The eliminativist programme:

All ‘causal’ relations can be expressed (replaced) by scientific laws written in mathematical form:

‘X causes Y’ really means $y = f(x)$

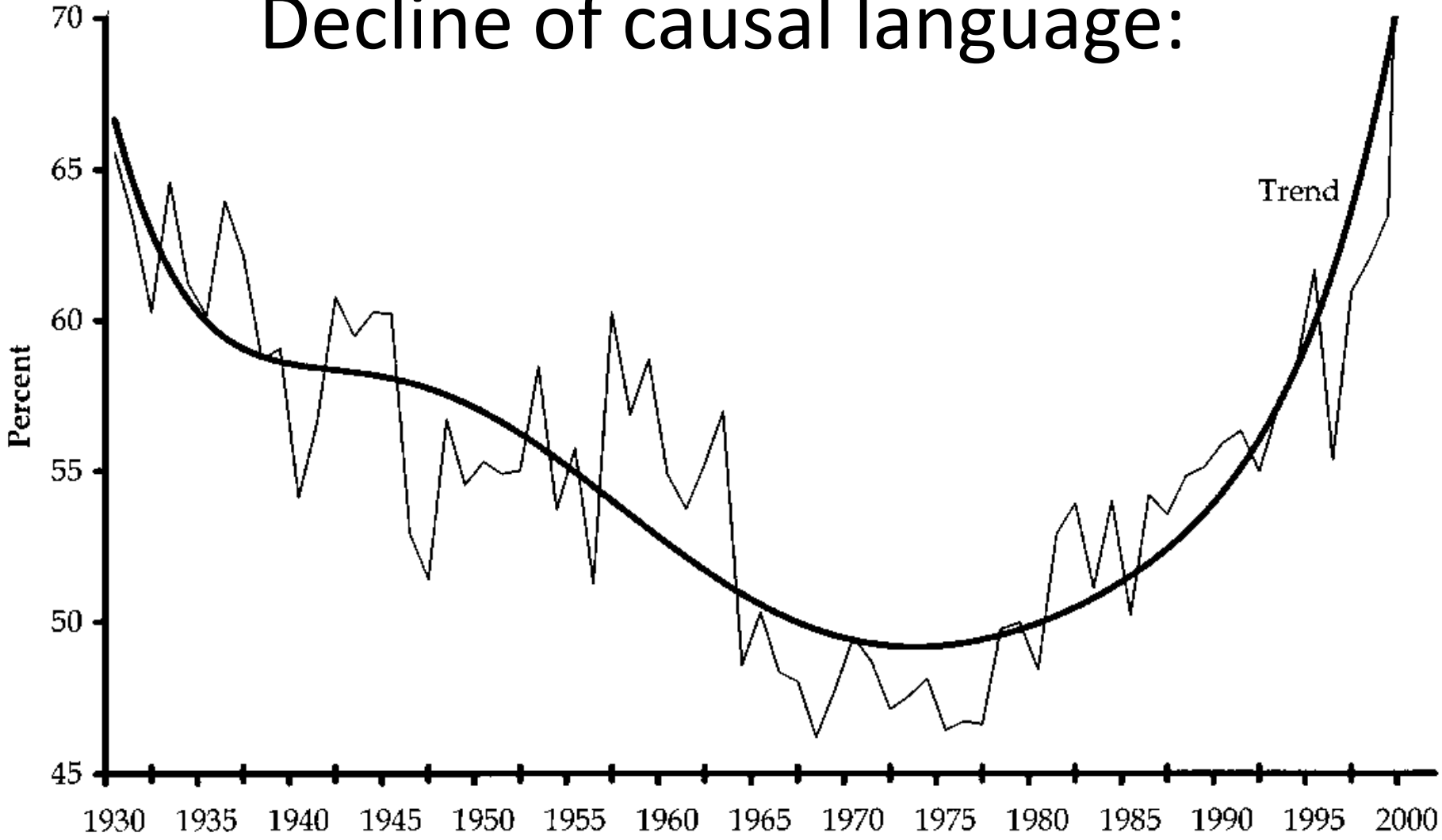
And functional relations can be measured empirically (using statistics)

Economics against Metaphysics

"Our principal scope in writing the present book was to put forward a sketch of economic science taken as a natural science founded on facts only."

Vilfredo Pareto (1896)

Decline of causal language:



Articles using the causal family as a fraction of all articles in the JSTOR archive of economics journals, 1930–2001. *Causal Family*: ‘‘cause,’’ ‘‘causes,’’ ‘‘causal,’’ ‘‘causally,’’ ‘‘causality,’’ or ‘‘causation.’’ (Hoover 2004)

Friedman's positivism

"Viewed as a body of substantive hypotheses, theory is to be judged by its predictive power for the class of phenomena which it is intended to 'explain'. […] The only relevant test of the validity of a hypothesis is comparison of its predictions with experience."

Milton Friedman (1953)

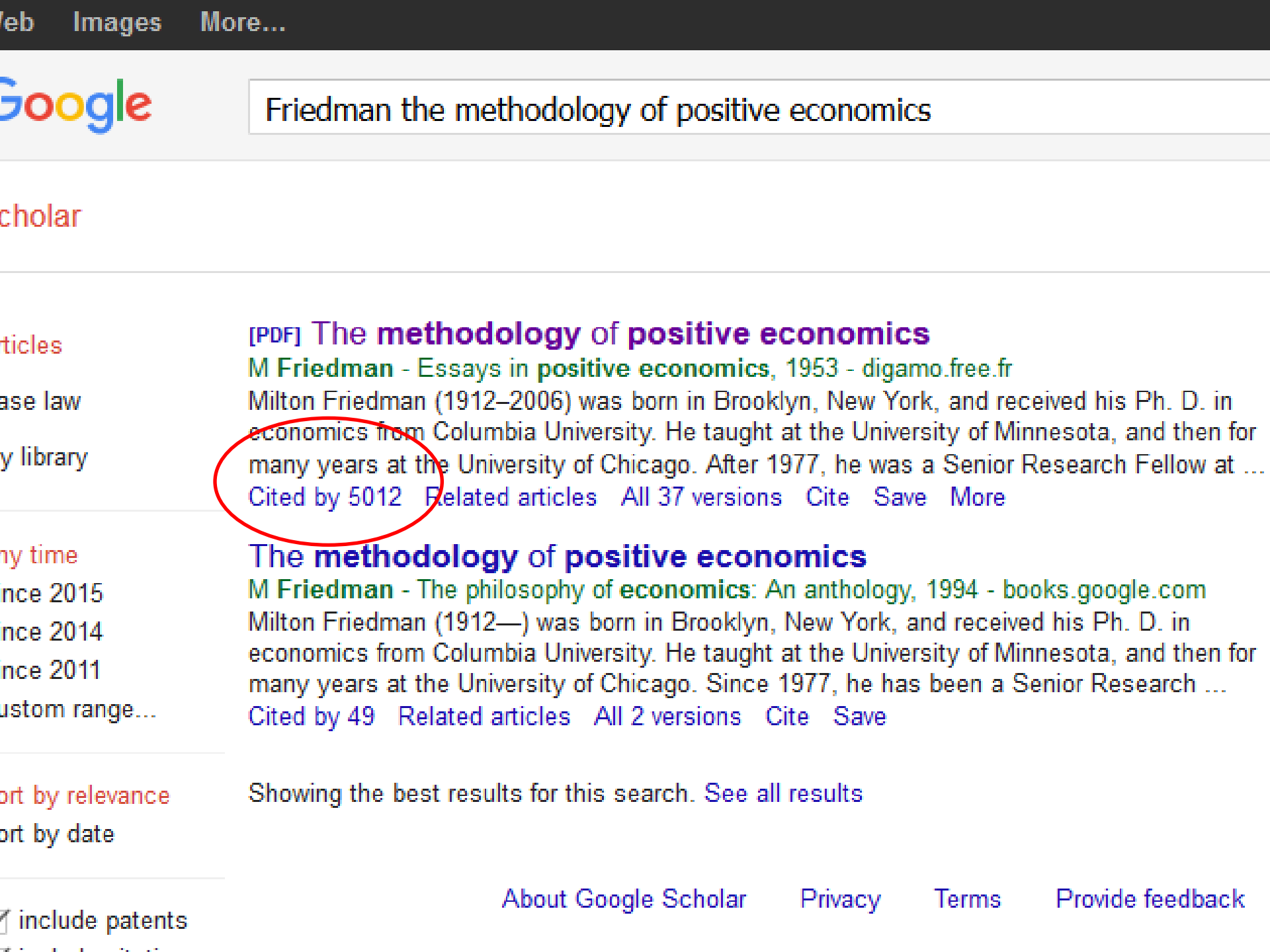
“Consider the problem of predicting the shots made by an expert billiard player. It seems not at all unreasonable that excellent predictions would be yielded by the hypothesis that the billiard player made his shots as if he knew the complicated mathematical formulas that would give the optimal directions of travel, could accurately estimate by eye the angles, etc., describing the location of the balls, could make lightening calculations from the formulas, and could then make the balls travel in the direction indicated by the formulas”

(Friedman 1953)

…similarly…

"Under a wide range of circumstances individual firms behave as if they were seeking rationally to maximize their expected returns and had full knowledge of the data needed to succeed in this attempt."

(Friedman 1953)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Milton Friedman (1912–2006) was born in Brooklyn, New York, and received his Ph. D. in economics from Columbia University. He taught at the University of Minnesota, and then for many years at the University of Chicago. After 1977, he was a Senior Research Fellow at ...
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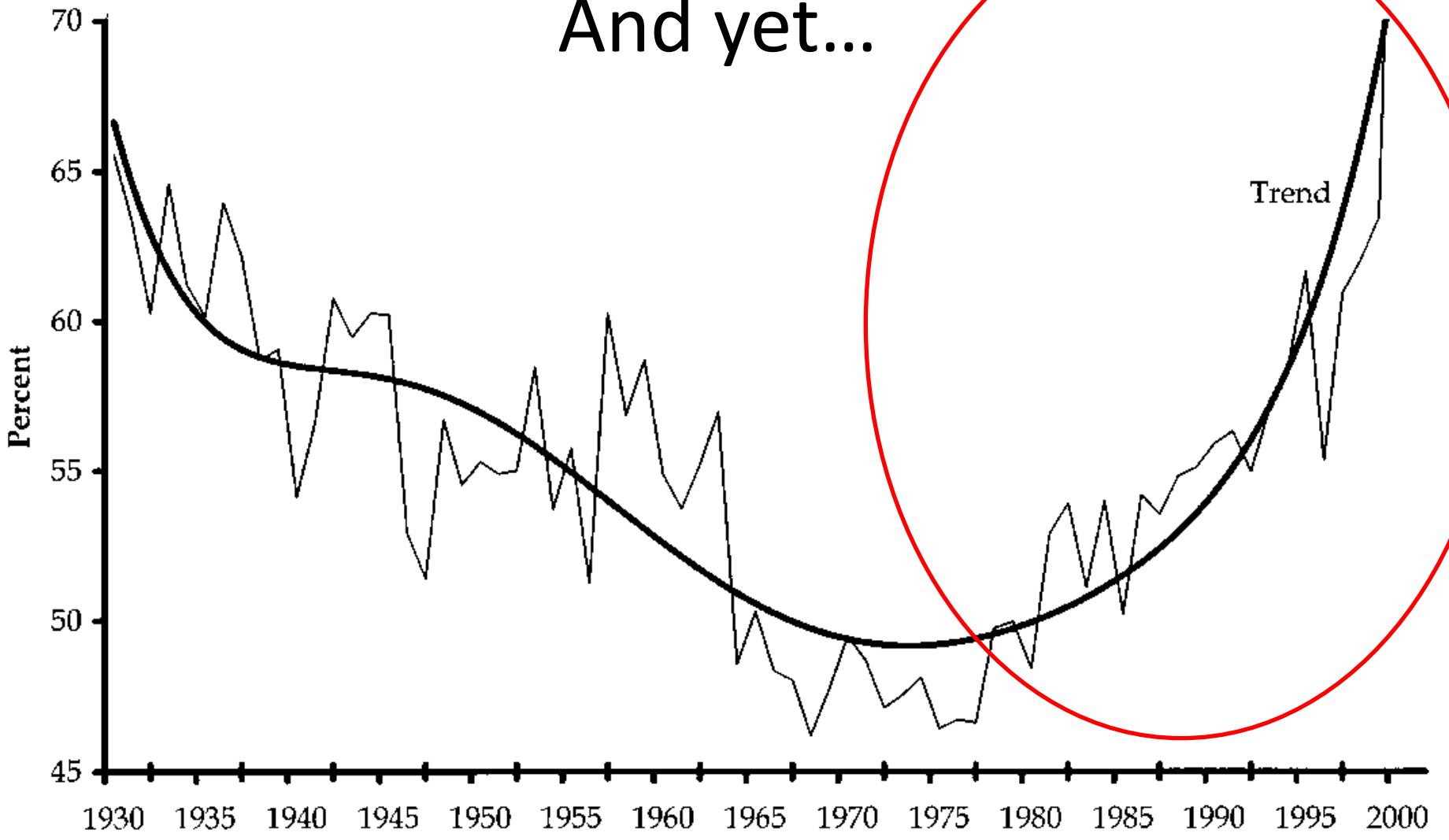
And yet…



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Why?

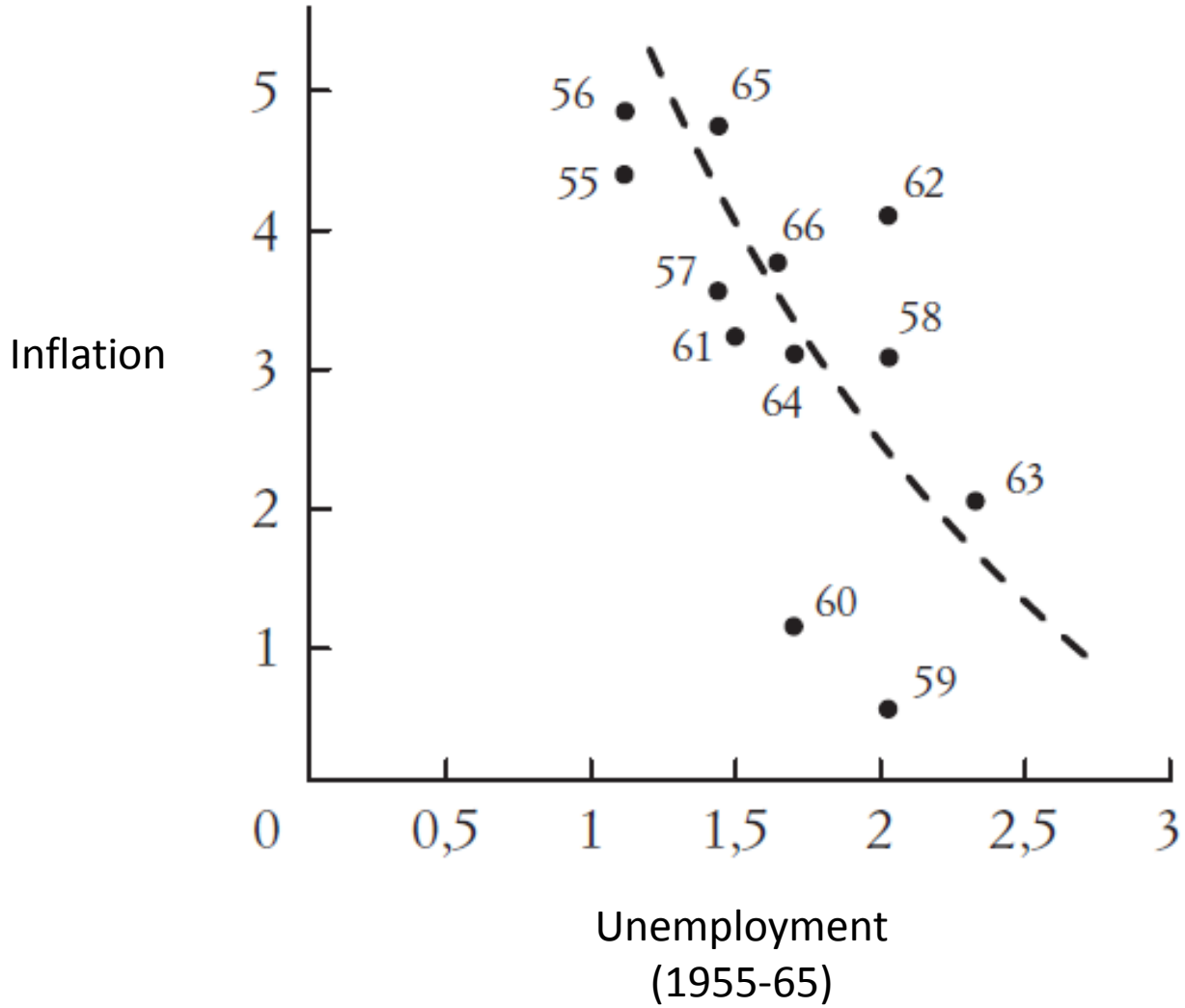
- Causal thinking seems inevitable:

"Proponents believe (predict) that legal minimum wages diminish poverty by **raising** the wages of those **receiving** less than the minimum wage as well as of some **receiving** more than the minimum wage without any counterbalancing increase in the number of people entirely unemployed or employed less advantageously than they otherwise would be. Opponents believe (predict) that legal minimum wages **increase** poverty by **increasing** the number of people who are unemployed or employed less advantageously and that this more than **offsets** any **favorable effect** on the wages of those who remain employed.

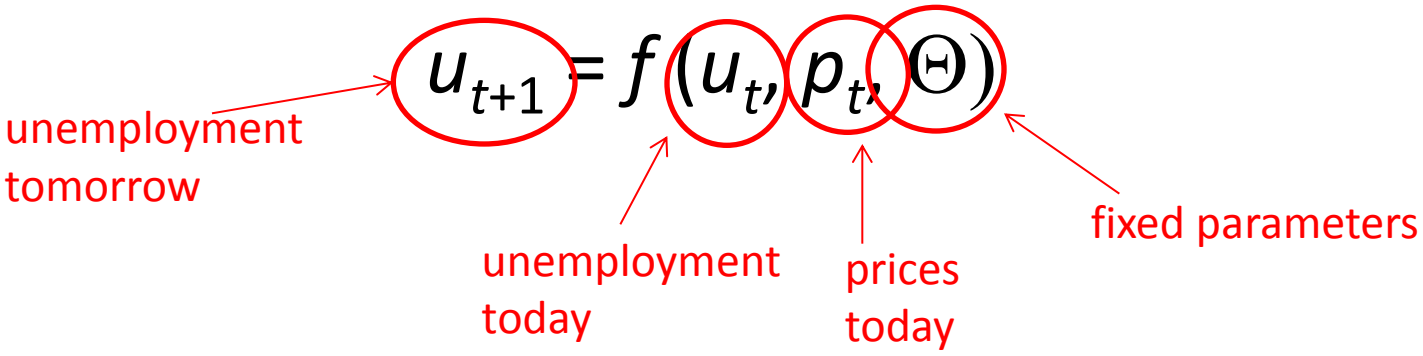
Agreement about the economic **consequences** of the legislation might not **produce** complete agreement about its desirability, for differences might still remain about its political or social **consequences**; but, given agreement on objectives, it would certainly go a long way toward **producing** consensus."

(Friedman 1953)

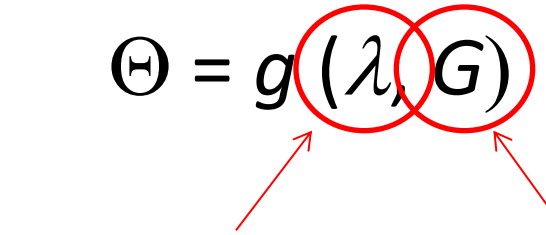
For example: the Phillips Curve

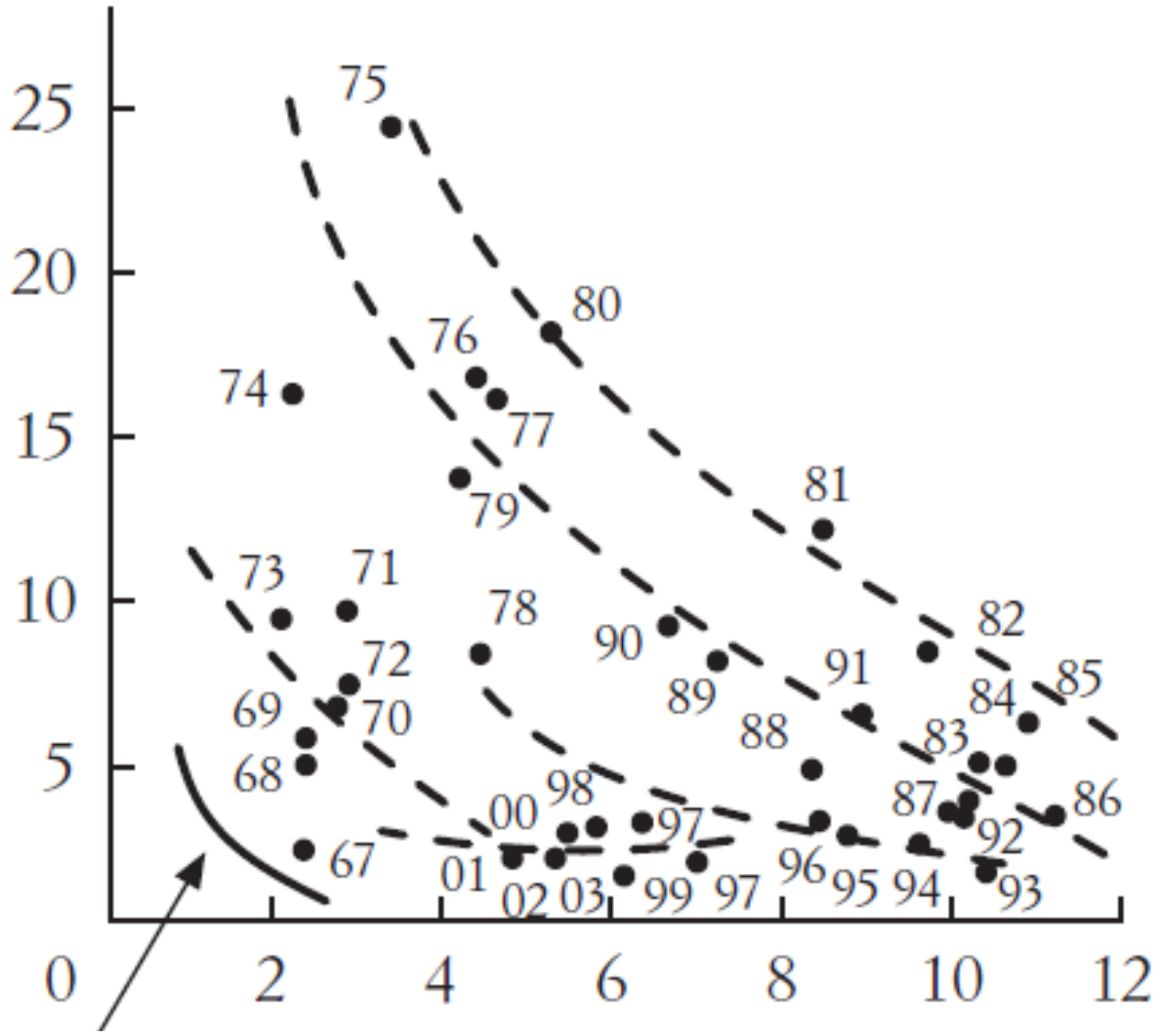


Is it robust?



Friedman, Phelps, Lucas: No, it's not!





1955-66 curve

(b) 1967-2003

- Up until the 1970s, the Phillips curve had been a reliable predictive tool
- Friedman, Phelps and Lucas criticized it for theoretical reasons
- But what made their theory «better», if not predictive adequacy?
- What is the difference between a «good» theoretical relation and a «bad» one?

Intuitively:

Many relations that can be used for prediction are not reliable for intervention:

- Cumulative rain in Scotland and prices in UK (Hendry)
- Tom's taking contraceptive pills and his not getting pregnant (Salmon)
- The dial of my barometer indicating «rain», and raining (Hempel?)

- If a child has been vaccinated, she is unlikely to have chickenpox
- Sara has been vaccinated
- Therefore Sara has (probably) not had chickenpox

- If a child hasn’t got chickenpox, she is likely to have been vaccinated
- Sara hasn’t got chickenpox
- Therefore Sara has (probably) been vaccinated

Think about it:

- Would you give the vaccine to your kids?

- Does the vaccine cause kids' health, or does kids' health cause vaccination?

The problem:

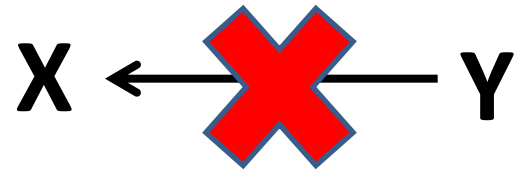
- Statistical correlations and mathematical equations are symmetric:

- If $P(A|B) > P(A|-B)$, then $P(B|A) > P(B|-A)$

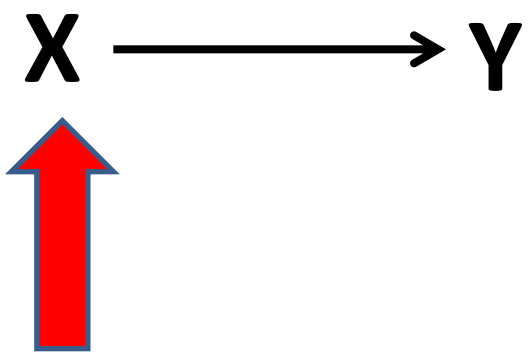
- If $y = f(x)$, then $x = g(y)$

Causality is *asymmetric*:

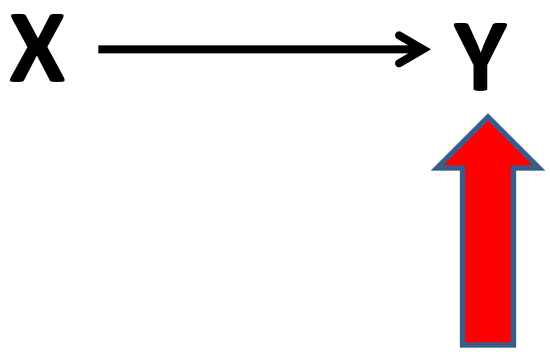
If 

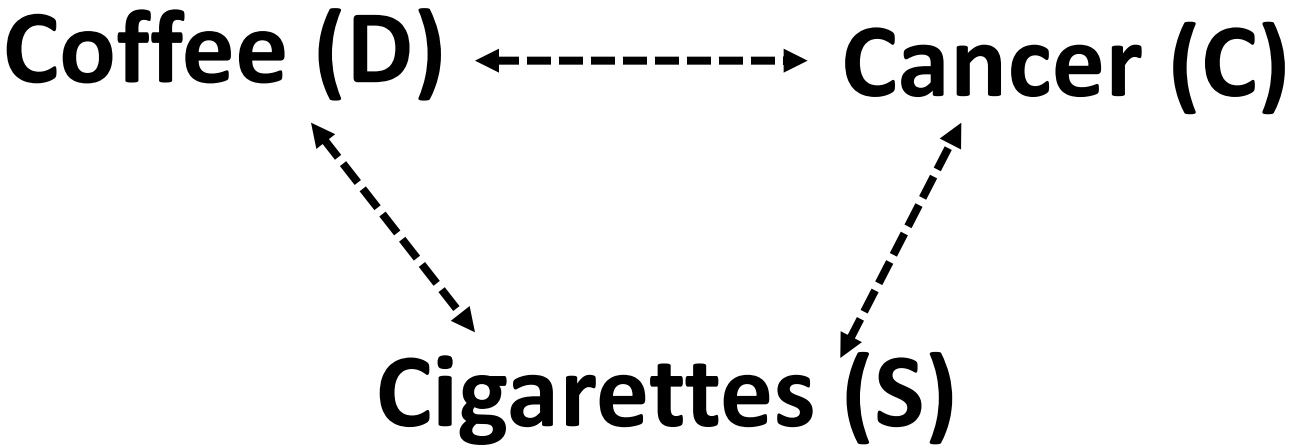
Then (usually) 

Causality is robust to specific manipulations



…but not to others




Coffee (D)
Cancer (C)
Cigarettes (S)

$P(C|S\&D) > P(C|\text{-}S\&D)$

$P(C|S\&\text{-}D) > P(C|\text{-}S\&\text{-}D)$

But:

Coffee (D) **Cancer (C)**

Freeze!! **Cigarettes (S)**

$P(C|D\&S) = P(C|\text{-}D\&S)$

$P(C|D\&\text{-}S) = P(C|\text{-}D\&\text{-}S)$

Moral:

- We can infer that Cigarette Smoking causes Cancer because the correlation between D and C is «screened off» by S
- Whereas the correlation between S and C is not «screened off» by D

What is causality then?

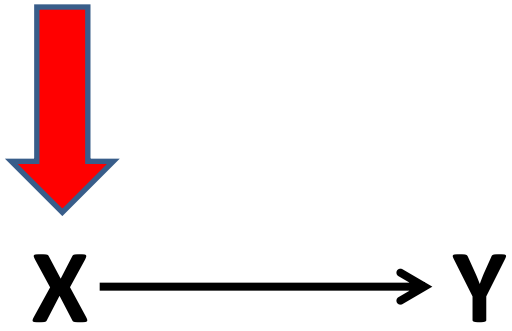
(CC): X causes Y if and only if X and Y are associated in causally homogeneous background conditions

- Notice: it's a bad definition: 'cause' appears on both sides of 'if and only if'
- But perhaps 'cause' is a primitive notion
- And in any case CC is a good guide for causal discovery

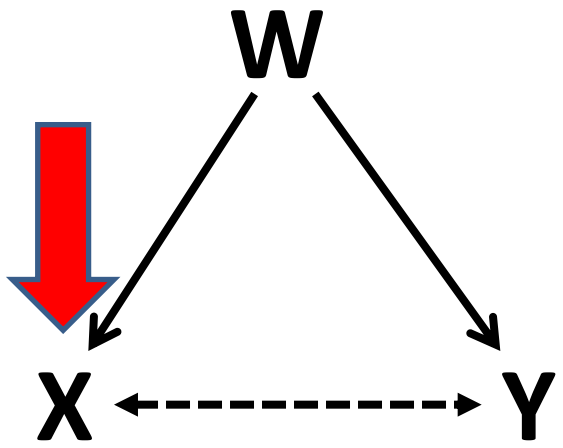
The perfectly controlled experimental design:

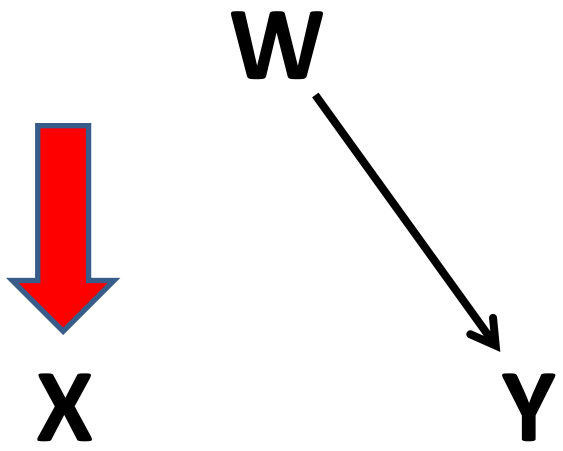
	Treatment (putative cause)	Dependent variable (putative effect)	Other factors
Experimental Group	X	Y1	Constant
Control Group	O	Y2	Constant

Causal inference and experiments:



A good experiment is a ‘surgical’ manipulation that varies X without interfering with other variables that may be among the causes of Y


W
X
Y


W
X
Y

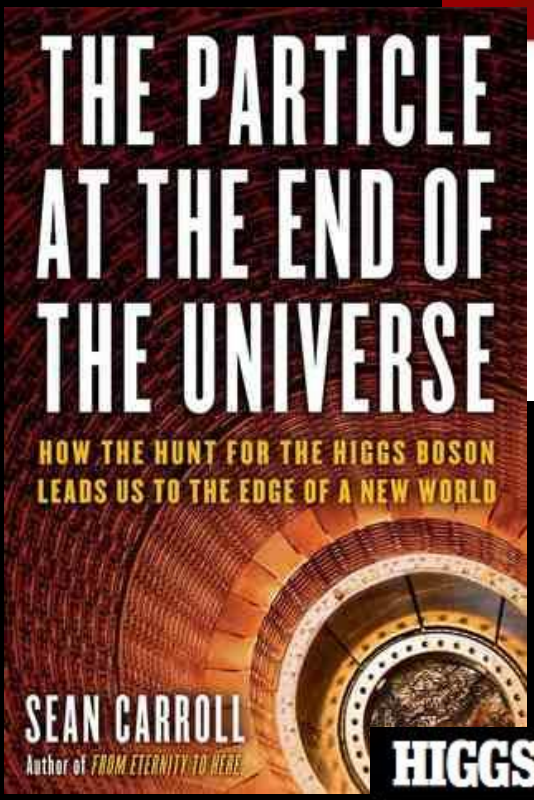
«NO CAUSES IN, NO CAUSES OUT»

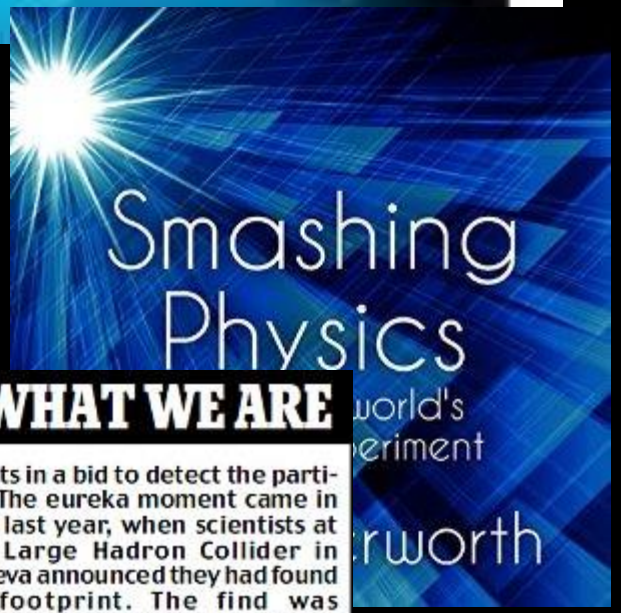
- You need background causal knowledge in order to find out about causes
- But what you need to know is different from what you are looking for
- There is no algorithm and causal inferences can go wrong

Causal knowledge is **cumulative**, **progressive**, and **fallible**

Economics as a science

- We can know the causes of things
- And it's important that we try hard, because economics is one of the few sciences that matter a lot





HIGGS BOSON: THE VERY ESSENCE OF WHAT WE ARE

THE Higgs boson is part of a theory that explains why the tiny particles that make up atoms have mass.

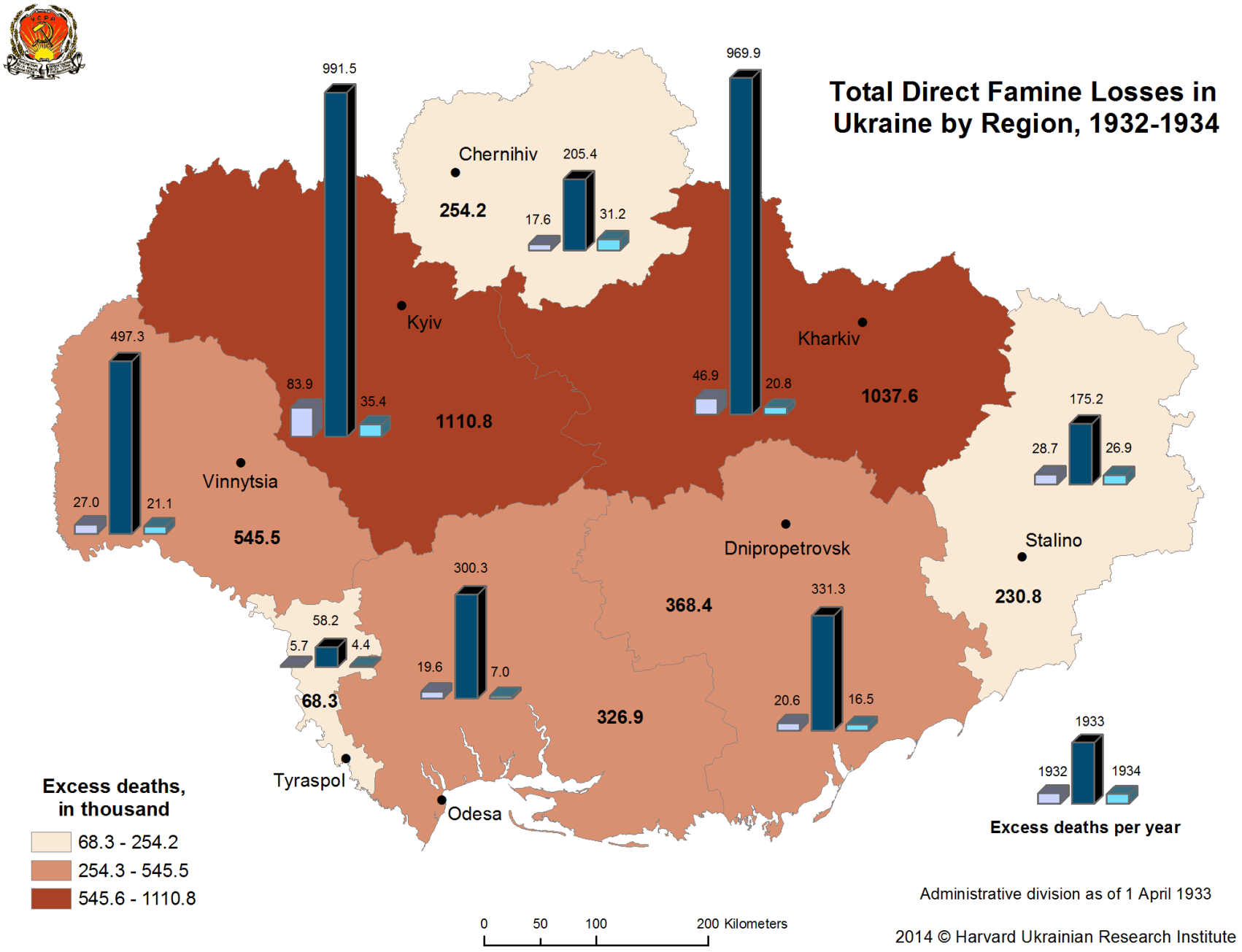
It states that a fraction of the second after the building blocks of life were created in the Big Bang, an invisible force field called the Higgs field was formed.

This field, which permeates the cosmos, is bubbling with tiny Higgs boson particles. As other particles pass through it, they pick up mass.

Without this mass, they would whizz around space at the speed of light. The mass makes them slow down and allows them to bind together to make the atoms that make stars and planets – and people.

Since Peter Higgs came up with the theory in 1964, physicists have built bigger and bigger experiments in a bid to detect the particle. The eureka moment came in July last year, when scientists at the Large Hadron Collider in Geneva announced they had found its footprint. The find was described as being the physics equivalent of Columbus discovering America.

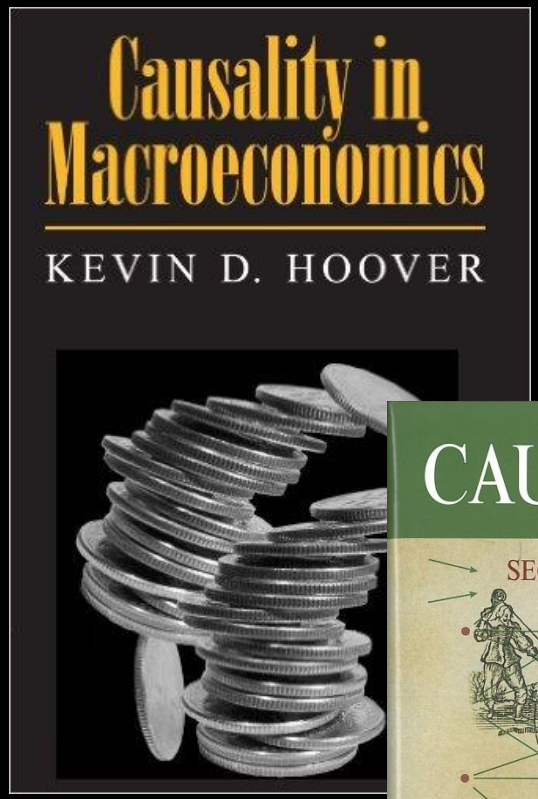
Professor Higgs said that day that he had never expected the discovery to be made in his lifetime.

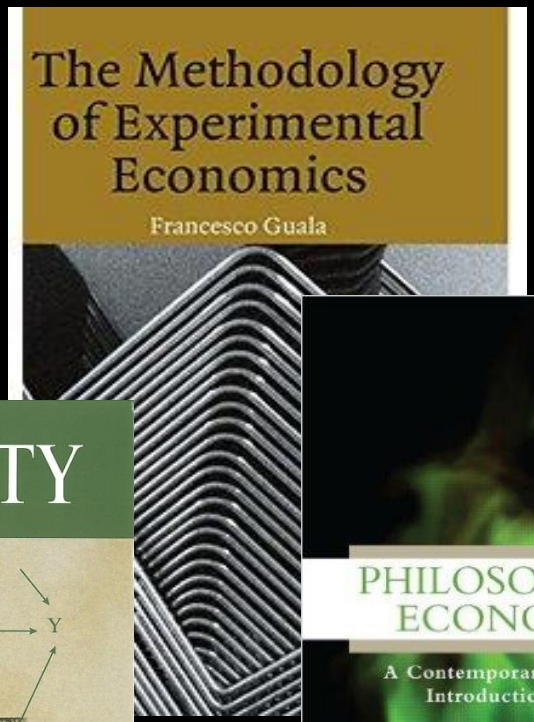

Total Direct Famine Losses in Ukraine by Region, 1932-1934
Chernihiv
254.2
205.4
17.6
31.2
991.5
83.9
35.4
Kyiv
1110.8
969.9
46.9
20.8
Kharkiv
1037.6
497.3
27.0
21.1
Vinnytsia
545.5
175.2
28.7
26.9
Stalino
230.8
Dnipropetrovsk
368.4
300.3
19.6
7.0
331.3
20.6
16.5
58.2
5.7
4.4
68.3
326.9
Tyraspol
Odesa
Excess deaths, in thousand
68.3 - 254.2
254.3 - 545.5
545.6 - 1110.8
1933
1932
1934
Excess deaths per year
0 50 100 200 Kilometers
Administrative division as of 1 April 1933
2014 © Harvard Ukrainian Research Institute

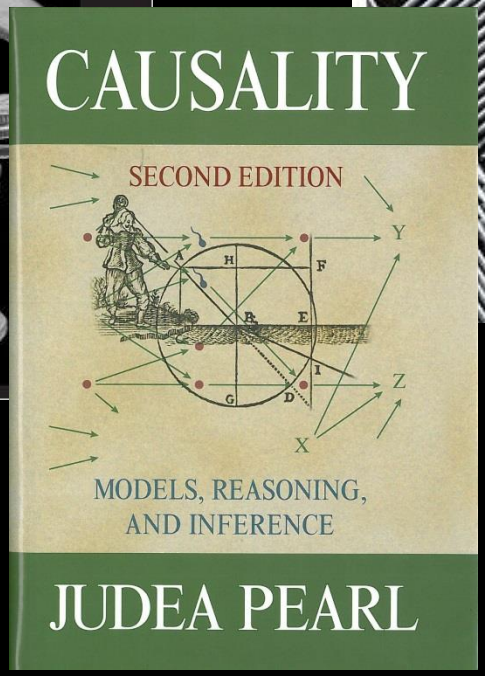
"After all, it is not our stupidity which hampers us, but chiefly our lack of information, and when one has to make do with bad guesses in lieu of information the success cannot be great. But there is a significant difference between the natural sciences and the social sciences in this respect: experts in the natural sciences usually do not try to do what they know they cannot do; and nobody expects them to do it. They would never undertake to predict the number of fatalities in a train wreck that might happen under certain conditions during the next year. They do not even predict next year's explosions and epidemics, floods and mountain slides, earthquakes and water pollution. Social scientists, for some strange reason, are expected to foretell the future and they feel badly if they fail."

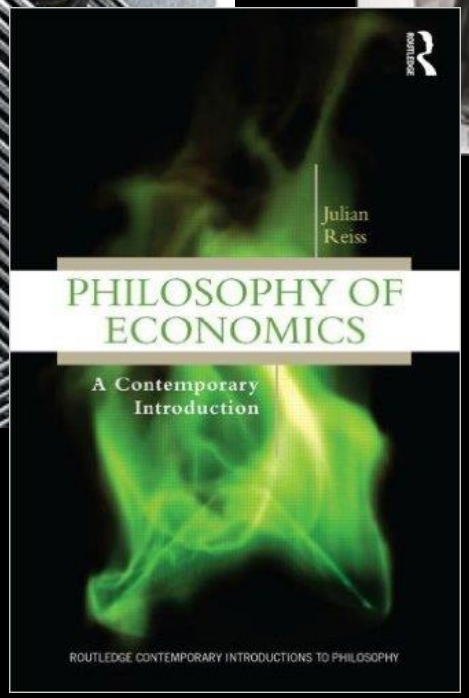
(Fritz Machlup)

If you want to know more:









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