LMU LUDWIG-MAXIMILIANS-UNIVERSITÄT MÜNCHEN

What is Wrong With "Hypotheses Sociology"?

Or: How Theory-Driven Empirical Research Should Look Like

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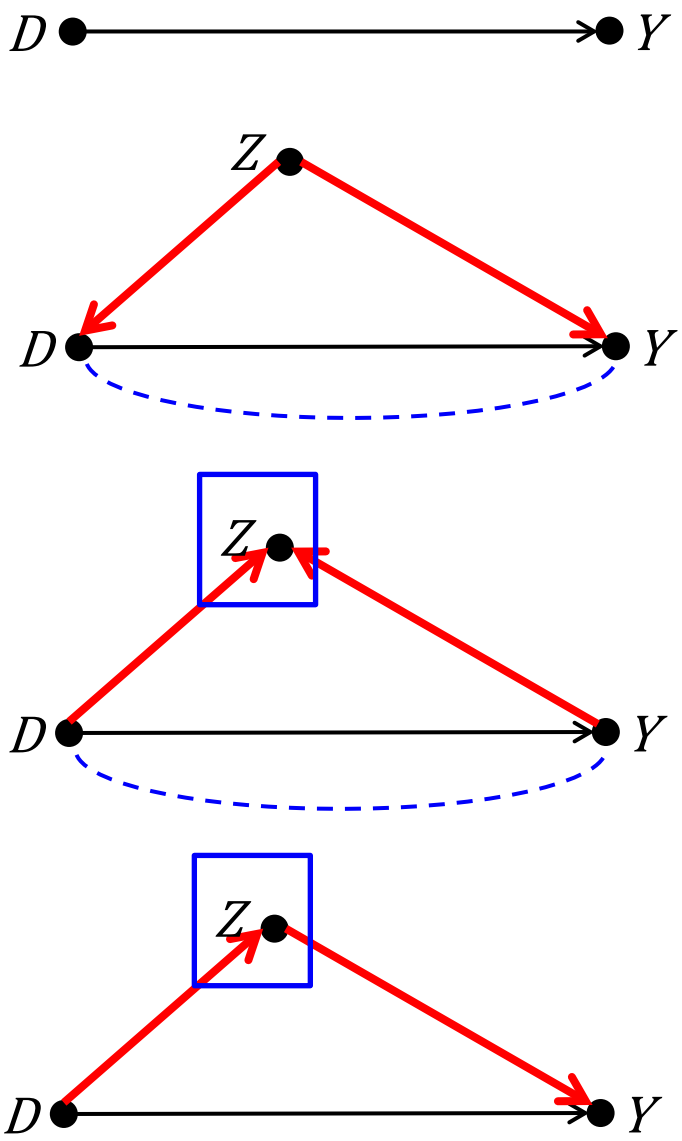
Social Research in the “Era of Regression”

- Since the advent of regression, social researchers struggle with how to best use these statistical tools
- In the 1970ies many social researchers used regression “Y-centered”: they threw in many variables to “explain” variance
- This a-theoretical practice was criticized by many. Instead it was suggested to guide variable selection by theory
  - Theory-driven empirical research
  - However, the practical implementation of theory-driven research often looked like this: researchers used one/several theories, deducted several hypotheses, and simply put **all** variables in the regression (“hypotheses sociology”)
- Some authors argue that hypotheses sociology is often misguided
  - G. King (1986) How Not to Lie with Statistics
  - F. Elwert (2016) Comments On Backdoor-Based Identification

Fundamental Rules of Causal Inference

- Our research problem
  - Identifying a causal effect
- Control for confounders
  - If you do not, you have an **omitted variable bias**
  - If some confounders are unobserved one has to use methods like IV, FE or RD
- Do not control for colliders
  - If you do, you have an **endogenous selection bias**
- Do not control for mediators
  - If you do, you have an **overcontrol bias**
  - [If you want to get at the total causal effect]

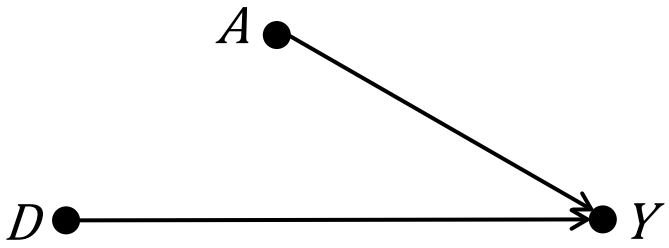


Hypotheses Sociology

- We are interested in the determinants of some outcome Y
- We use one/several theories to derive hypotheses
  - H1: D affects Y positively
  - H2: A affects Y negatively
- Then we estimate the following regression

$$Y = \alpha + \beta D + \gamma A$$

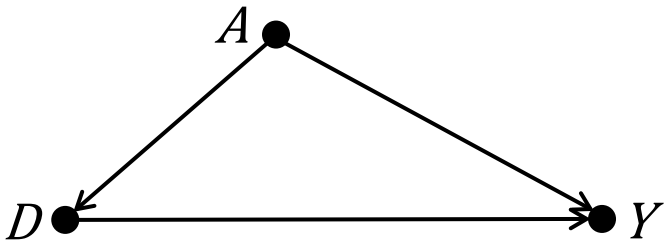
  - β is the causal effect of D (“controlling for A”, or “net of A”)
  - γ is the causal effect of A (“controlling for D”, or “net of D”)
- The fundamental problem of this strategy
  - It works only if the causal structure is of the type “multi-causality”



Hypotheses Sociology

- It no longer works if the causal structure deviates from multi-causality. For instance:

$$Y = \alpha + \beta D + \gamma A$$



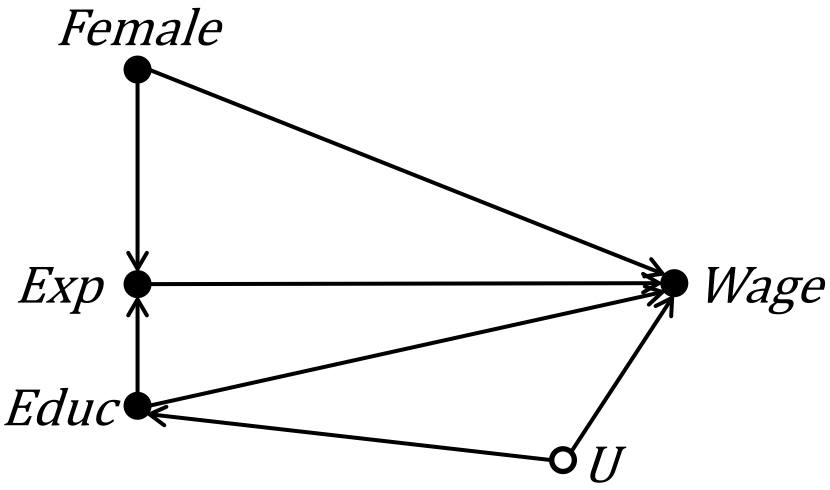
  - Here, only β is a (total) causal effect
  - γ is only the direct effect, left after controlling for the mediator D
  - Thus, it would be erroneous to interpret γ as a total causal effect
    - Nevertheless, this erroneous interpretation is applied by many users

  - Obviously, this is a dramatic insight as much regression based empirical results are likely to be misinterpreted!

Regression needs a Causal Structure

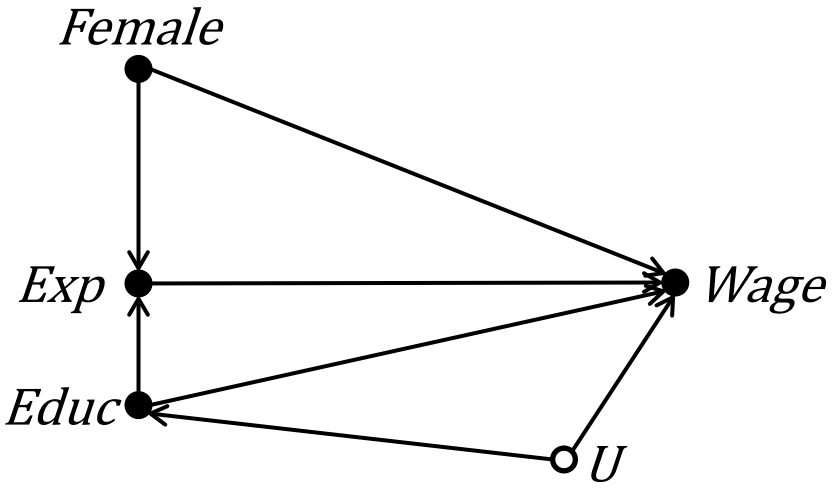
- Here is another example (adapted from Elwert, 2016)

$$\ln(\text{Wage}) = \alpha + \beta\text{Exp} + \gamma\text{Educ} + \delta\text{Female}$$



- β is a total causal effect (all non-causal paths are blocked)
- δ is the direct causal effect (mediator Exp controlled)
- γ is the direct causal effect (mediator Exp controlled) that is confounded (by unobservable U)
- Thus, it would be misleading to interpret each coefficient as a total causal effect

Regression needs a Causal Structure



- For identifying **one** causal effect
  we need **one** specially tailored regression model
- To estimate the causal effect of "Exp"

$$\ln(\text{Wage}) = \alpha + \beta\text{Exp} + \gamma\text{Educ} + \delta\text{Female}$$

- To estimate the causal effect of "Female"

$$\ln(\text{Wage}) = \alpha + \delta\text{Female}$$

- To estimate the causal effect of "Educ"

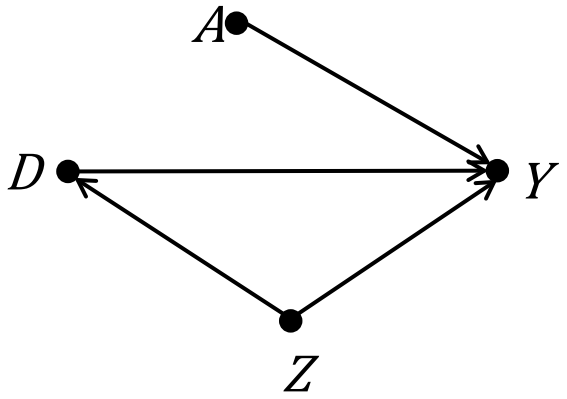
$$\ln(\text{Wage}) = \alpha + \gamma\text{Educ} + \delta\text{Female} + \text{U}$$

  – Somehow one would have to account for the unobservable U

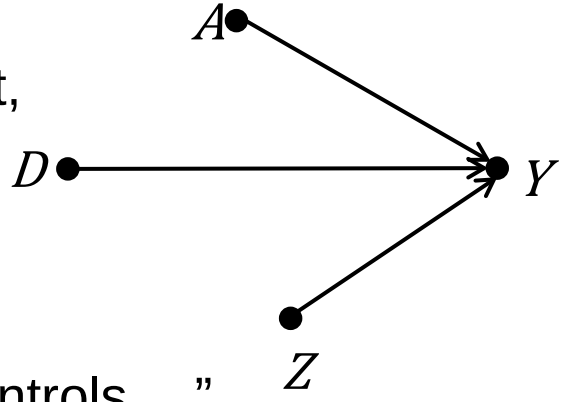
Controls

- Often one adds “controls”

$$Y = \alpha + \beta D + \gamma A + \delta Z$$



- Certainly, the effects of controls should not be interpreted as causal effects
  - δ is not a causal effect! It is only the direct effect, left after controlling for the mediator D
  - Ironically, it works only if Z is not a confounder
- Nevertheless, this is often done
  - “Finally, let’s have a look at the effects of the controls …”



- N.B.: Often “confounders” are included without thought, e.g. “occupation”, “family type” (the usual suspects). Sometimes these are mediators, and will produce overcontrol bias

Current Social Research Practice

- Shortcomings of the standard “hypotheses-driven” social research article:
  - Theory is used to derive hypotheses on the effects of a number of variables on the outcome. But mostly nothing is said on the (complete) causal structure
  - Thus theorizing is only “loosely” coupled to the research problem
  - “Controls” are entered usually without theoretical arguments
  - Therefore, it is highly likely that some of the fundamental rules are violated and that estimates will be biased / misinterpreted

Lessons

- Don’t trust any article that infers many effects from a single regression without theorizing the complete causal structure of the research problem
  - Start yourself thinking about the causal structure. Draw a DAG.
  - From that you might be able to infer which effects are identified

➔ Don’t trust most regression based social science articles

- Stop teaching the hypotheses-driven approach to social research
  - Start teaching a “new style to causal analysis”

The New Style of Causal Analysis

- Focus on just one causal effect (X-centered)
  - What is the causal effect that your research problem aims at?
- Theorize on the complete causal structure
  - What are confounders, what are colliders?
  - Draw a DAG representing the causal structure
- Theorize on the intervening mechanisms (mediators)
  - No causation without a plausible mechanism
  - In the first step do not control for mediators (overcontrol bias)
  - Use them in a second step to explain the causal effect
- Think about identification
  - Given the causal structure, how can I identify the causal effect?

An Example for a Hypotheses-Driven Paper

- Authors BPZ investigate the factors that affect the survival chances of newly founded business firms (published in ASR)
  - Outcome: business failure rate
- Theories used to derive hypotheses
  - Human capital theory
  - Organizational ecology
- Hypotheses:
  - “We expect more schooling to improve a firm's survival chances”
  - “We expect work experience to show a decreasing payoff”
  - “Size at time of founding should increase survival chances”
  - …
  - Altogether 19 hypotheses (“a rich set of hypotheses”)!

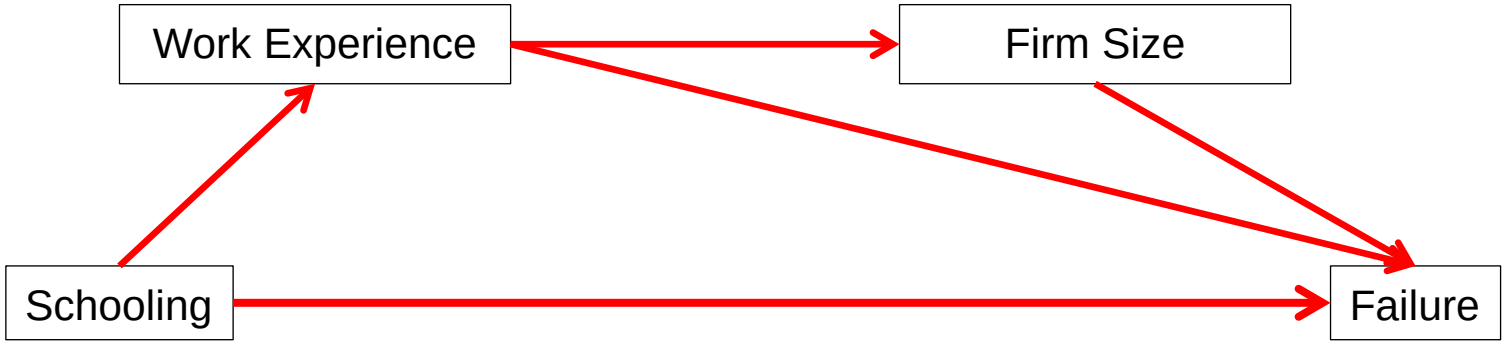
An Example for a Hypotheses-Driven Paper

Independent Variable	Coefficient	*t*-Value
HUMAN CAPITAL		
Years of schooling	-.054*	3.18
Years of work experience	-.051*	3.92
Years of work experience squared/100	.101	2.97
Industry-specific experience	-.332*	3.53
Self-employment experience	.096	.86
Leadership experience	.190	1.39
Self-employed father	-.105	1.09
ORGANIZATIONAL CHARACTERISTICS		
Follower business	-.446*	3.46
Affiliated business	.278*	2.06
Amount of capital invested natural log	-.034*	3.40
Number of employees natural log	-.451*	5.01
Registered in commercial register	-.793*	4.48
Specialist business	-.189	1.94
Innovative business	-.133	1.19
National market-scope	-.363*	3.59
ENVIRONMENTAL CHARACTERISTICS		
Location in Munich	.131	1.49
In construction	.522	1.38
In wholesale/retail trade	.512*	2.74
In transportation	.765*	3.19
Restaurant business	.227	.87
In computer services	.486	1.81
In other services	.249	1.32
Competition intensity	-.205	1.39
Seasonality	.132	1.45
Clustering of orders	-.519*	3.90

- The authors present one regression
- They interpret each coefficient as if it is a (total) causal effect

An Example for a Hypotheses-Driven Paper

- Some theoretical thoughts on the causal structure of the research problem show that the structure very likely is not of the „multi-causality“ type



- Given this causal structure, the regression presented by the authors is plagued by an overcontrol-bias concerning the effect of “schooling”