Lecture 4: Data Collection

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Effects must be quantitatively comparable

What does it mean?

- When we compare estimates reported in Study 1 and Study 2, it must be clear which one is larger
- It must be clear how much larger it is
- t-statistics are not useful measures of effect size
- Regression coefficients are not comparable in general if studies use different units

Elasticities

$$\text{x-elasticity of } y: \varepsilon = \frac{\frac{\partial y}{y}}{\frac{\partial x}{x}}$$

$$\text{P-elasticity of Q: } \varepsilon = \frac{\frac{\partial Q}{Q}}{\frac{\partial P}{P}} \text{ if continuous}$$

$$\varepsilon = \frac{\frac{Q_2 - Q_1}{Q_1}}{\frac{P_2 - P_1}{P_1}} = \frac{\text{\% change in quantity Q}}{\text{\% change in price P}} \text{ if discrete}$$

Elasticities can be recovered from regressing **log(Y) on log(X)**.

Semi-elasticities, dollar values, std.dev. changes

- Semi-elasticity: effect of euro adoption on trade, effects of foreign investment on domestic productivity, effects of borders on trade
- Dollar values: statistical value of life, social cost of carbon
- Std.dev. changes: effect of class size on student test scores. What to do here?
- Class size is measured the same way in all studies (number of kids).
- Test scores are measured differently.
- Solution: By how many standard deviations do test scores improve if we decrease class size by 10 students?

Standardized mean differences

$$\theta = \frac{\mu_1 - \mu_2}{\sigma},$$

where μ_1 is the mean for one population, μ_2 is the mean for the other population, and σ is a standard deviation based on either or both populations.

- Very popular in psychology, not much used in economics. Why?
- Generally we need an experiment: treatment group, control group.
- In economics we often focus on observational research.
- For many questions the treatment and control are not binary classifications (we look at the intensity of treatment)

Partial correlation coefficients

Example: **tuition fees and university enrollment**. Ideally, we would need price elasticities of demand (PED), but many studies are not log on log.

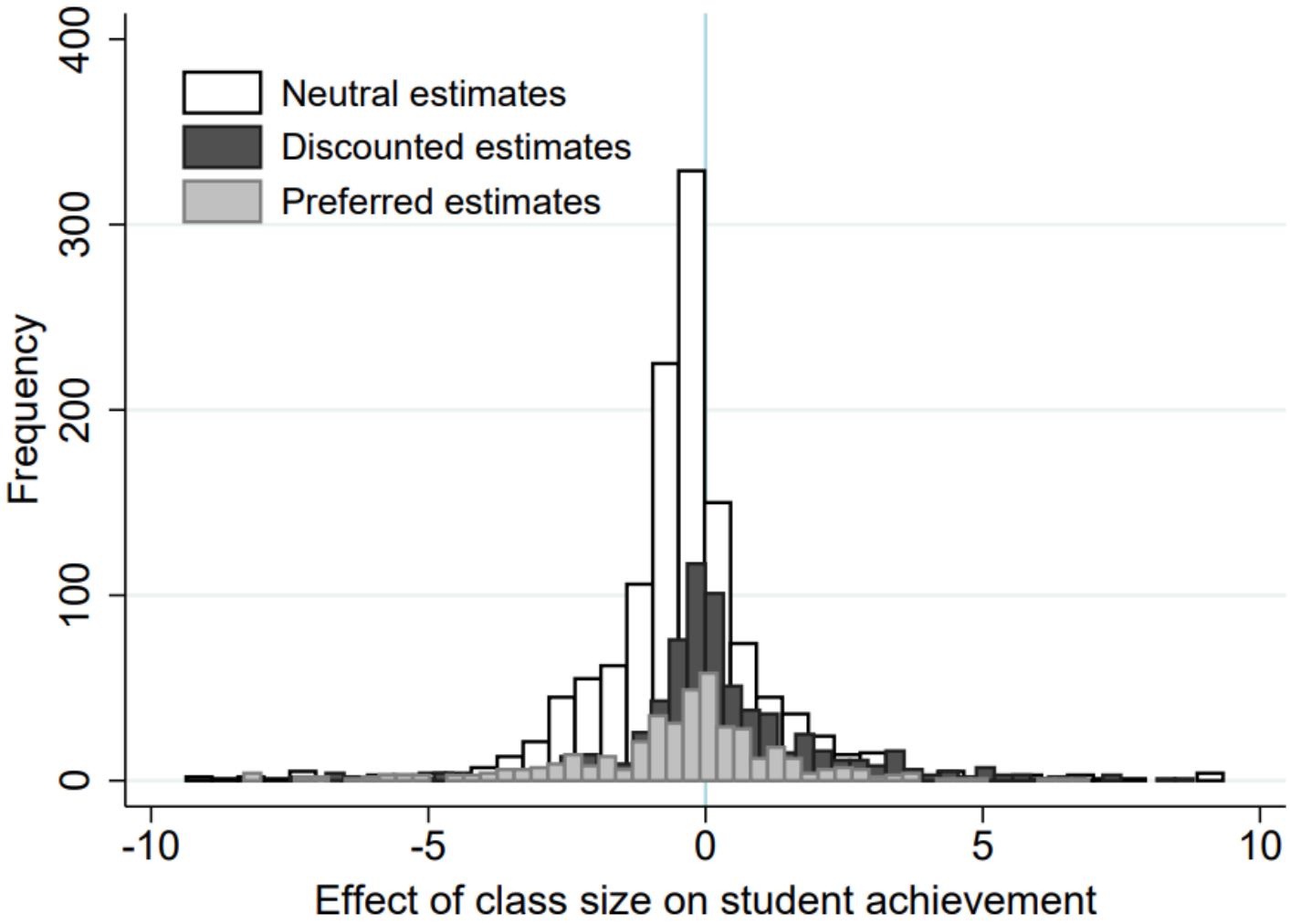
So we transform the estimates to partial correlations using t-statistics and degrees of freedom:

$$PCC(PED)_{ij} = \frac{T(PED)_{ij}}{\sqrt{T(PED)_{ij}^2 + DF(PED)_{ij}}}.$$

PCC caveats

- Last resort: can be used almost always, but we lose a lot of information
- Difficult to interpret (some guidelines provided by Doucouliagos, 2011)
- Statistical problems for meta-analysis methods (but this is the case also for SMD)
- Include robustness checks: e.g. a subsample of elasticities in the case of tuition fees and university enrollment

Collect all estimates



Standard errors

- Absolutely crucial for meta-analysis
- If not reported directly, can be computed from t-statistics or p-values
- Last resort: approximation based on within-study variation (Matousek et al. 2022)
- Interactions, transformations: delta method

Delta method

Based on Taylor series expansion. Basic formula:

$$\text{Var}(Y) = \text{Var}(f(X)) \approx [f'(\mu_X)]^2 \text{Var}(X).$$

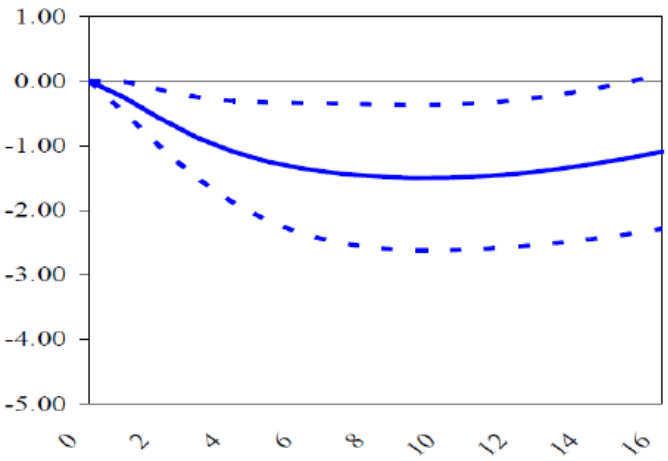
Example: Suppose $Y = X^2$. Then $f(x) = x^2$ and $f'(x) = 2x$, so that:

$$\text{Var}(Y) \approx [2\mu_X]^2 \text{Var}(X) = 4\mu_X^2 \sigma_X^2.$$

Example: Suppose $Y = \frac{1}{X}$. Then $f(x) = \frac{1}{x}$ and $f'(x) = -\frac{1}{x^2}$, so that:

$$\text{Var}(Y) \approx \left[\frac{-1}{\mu_X^2}\right]^2 \text{Var}(X) = \frac{\sigma_X^2}{\mu_X^4}.$$

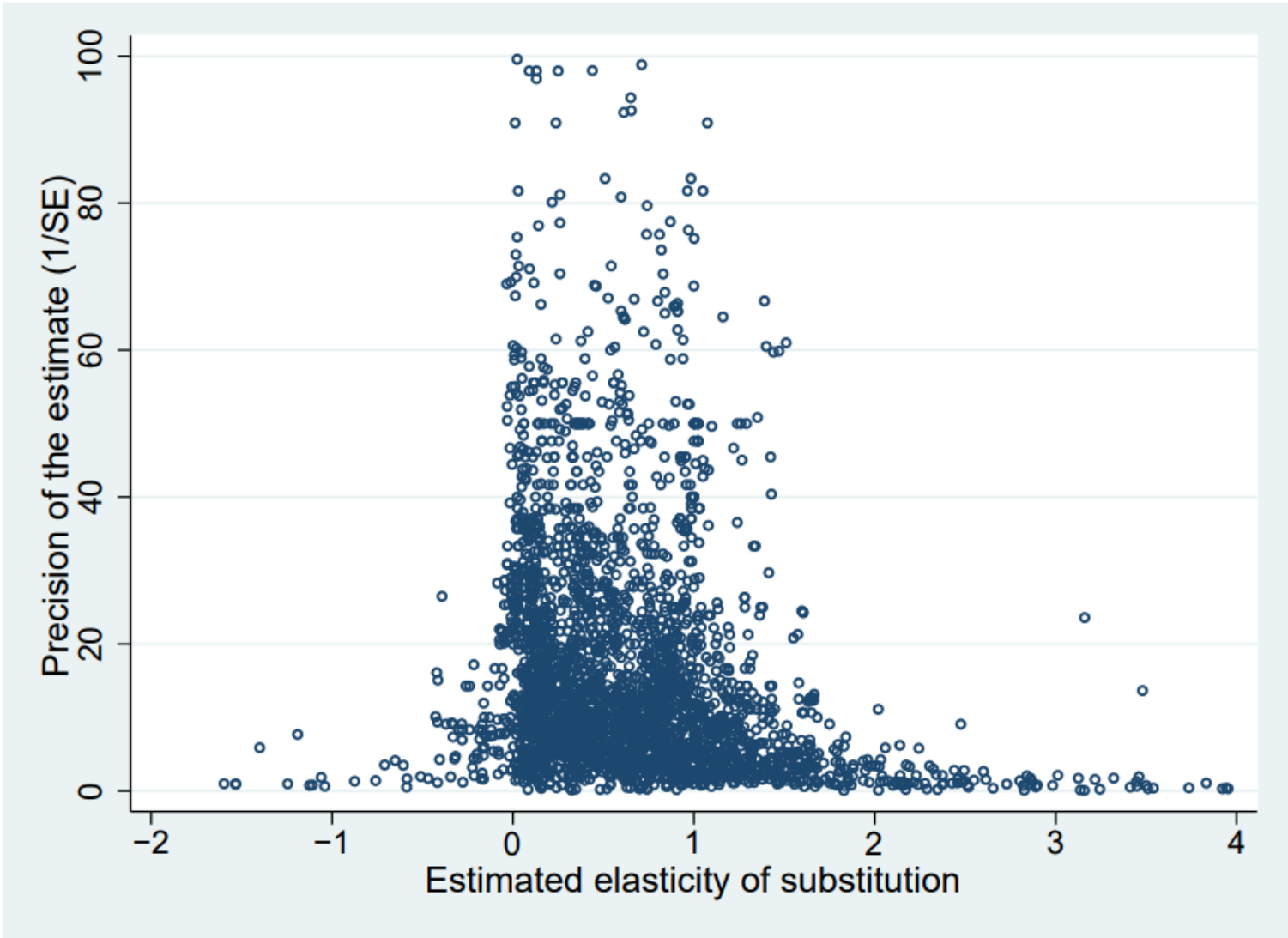
Graphical estimates, measurement error



Canada		
horizon	response	confidence interval
1	-0.231	(-0.407, -0.016)
2	-0.578	(-1.012, -0.135)
4	-1.076	(-1.853, -0.299)
8	-1.454	(-2.554, -0.359)
12	-1.414	(-2.534, -0.287)
16	-1.084	(-2.259, 0.131)
max	n.a.	n.a.

Obtained from: page 50, Figure 2
Frequency: Quarterly
Note: Responses are in %.

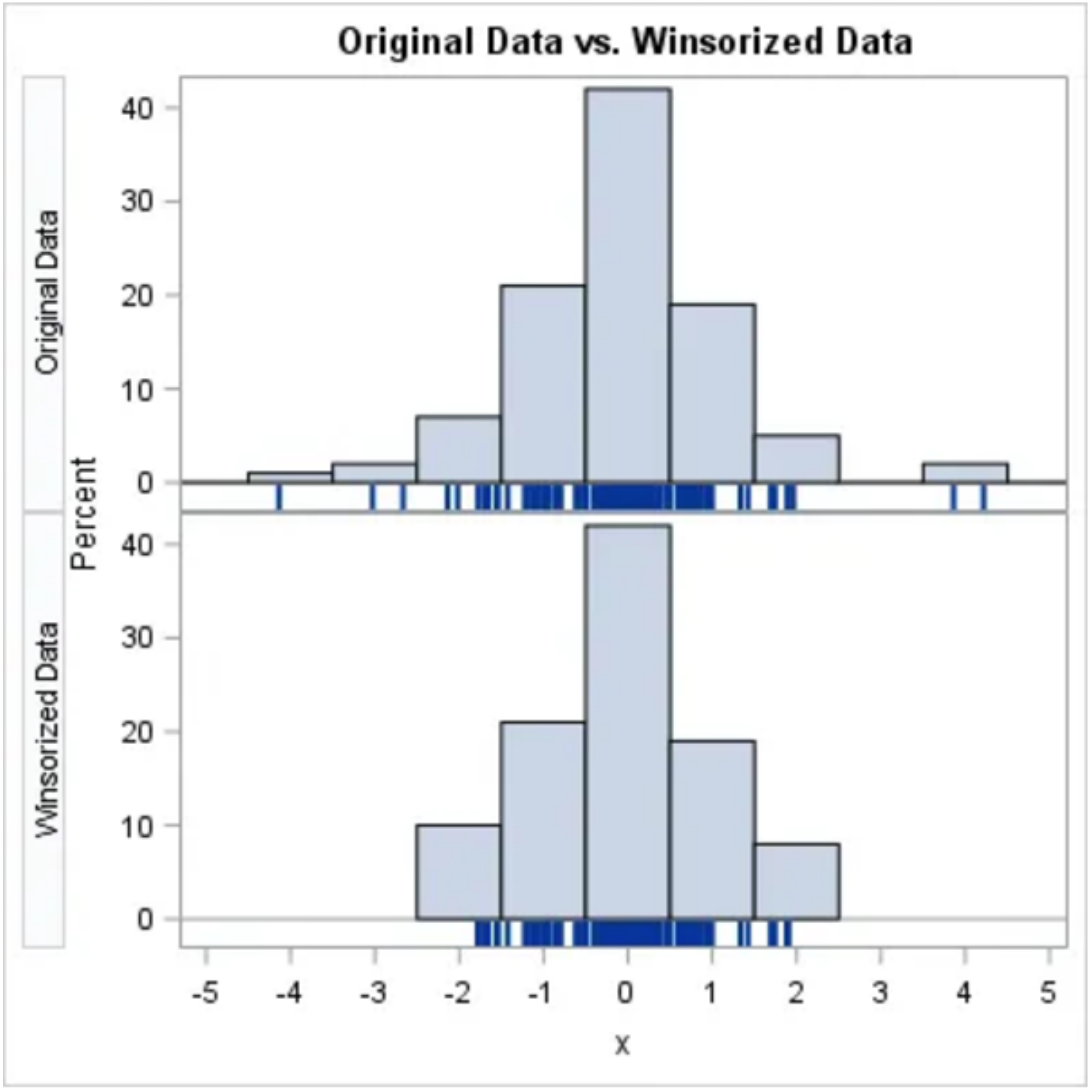
Outliers


Precision of the estimate (1/SE)
0
20
40
60
80
100
−2
−1
0
1
2
3
4
Estimated elasticity of substitution

What to do with outliers?

- No consensus
- Approach 1: omit very large effects (and standard errors), e.g. more than 3 standard deviations away from the mean
- Approach 2: run robust meta-regression or use tools for outlier detection in regression
- Approach 3: use winsorizing (my personal preference)
- Always report robustness checks

Winsorization



Reflecting context: the effect of beauty on success

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1	study_id	study	country	premium	se_premi	precision	tstat_pre	nobs	instrumer	weight	interview	photo_ra	software_	self_rate	dummy_t	categoric	beauty_f	number_	salary	study_ou	teaching_	athletic_:	electoral	other_(
2	1	Ahmed e	United St	8.91	2.9601	0.3378	3.01	1806	42.497	0.1667	0	0	1	0	0	1	0	4.4427	1	0	0	0	0	
3	1	Ahmed e	United St	8.964	5.2729	0.1896	1.7	1806	42.497	0.1667	0	0	1	0	0	1	0	4.4427	1	0	0	0	0	
4	1	Ahmed e	United St	2.484	3.0293	0.3301	0.82	1806	42.497	0.1667	0	0	1	0	0	1	0	4.4427	1	0	0	0	0	
5	1	Ahmed e	United St	9.18	4.8316	0.207	1.9	1806	42.497	0.1667	0	0	1	0	0	1	0	4.4427	1	0	0	0	0	
6	1	Ahmed e	United St	21.6	6.4671	0.1546	3.34	1806	42.497	0.1667	0	0	1	0	0	1	0	4.4427	1	0	0	0	0	
7	1	Ahmed e	United St	15.012	10.075	0.0993	1.49	1806	42.497	0.1667	0	0	1	0	0	1	0	4.4427	1	0	0	0	0	
8	2	Ahn & Le	World	0.0375	1.0124	0.9878	0.037	774	27.821	0.0714	0	1	0	0	1	0	1	2.7726	0	0	0	1	0	
9	2	Ahn & Le	World	0.6186	0.2674	3.7391	2.313	774	27.821	0.0714	0	1	0	0	1	0	1	2.7726	0	0	0	1	0	
10	2	Ahn & Le	World	0.2825	0.1421	7.0396	1.989	774	27.821	0.0714	0	1	0	0	1	0	1	2.7726	0	0	0	1	0	
11	2	Ahn & Le	World	0.0057	0.5684	1.7593	0.01	774	27.821	0.0714	0	1	0	0	1	0	1	2.7726	1	0	0	0	0	
12	2	Ahn & Le	World	0.2691	1.4087	0.7099	0.191	774	27.821	0.0714	0	1	0	0	1	0	1	2.7726	1	0	0	0	0	
13	2	Ahn & Le	World	0.7858	0.8459	1.1822	0.929	774	27.821	0.0714	0	1	0	0	1	0	1	2.7726	1	0	0	0	0	
14	2	Ahn & Le	World	0.2622	0.4685	2.1346	0.5597	774	27.821	0.0714	0	1	0	0	0	1	0	2.7726	0	0	0	1	0	
15	2	Ahn & Le	World	0.4506	0.3763	2.6576	1.1974	774	27.821	0.0714	0	1	0	0	0	1	0	2.7726	0	0	0	1	0	
16	2	Ahn & Le	World	0.1326	2.3261	0.4299	0.057	774	27.821	0.0714	0	1	0	0	0	1	0	2.7726	1	0	0	0	0	
17	2	Ahn & Le	World	1.2183	2.1218	0.4713	0.5742	774	27.821	0.0714	0	1	0	0	0	1	0	2.7726	1	0	0	0	0	
18	2	Ahn & Le	World	0.2301	0.1175	8.5093	1.958	399	19.975	0.0714	0	1	0	0	1	0	1	2.7726	0	0	0	1	0	
19	2	Ahn & Le	World	0.2023	0.2152	4.6471	0.94	375	19.365	0.0714	0	1	0	0	1	0	1	2.7726	0	0	0	1	0	
20	2	Ahn & Le	World	-0.561	0.8199	1.2196	-0.684	399	19.975	0.0714	0	1	0	0	1	0	1	2.7726	1	0	0	0	0	
21	2	Ahn & Le	World	0.3107	0.686	1.4578	0.453	375	19.365	0.0714	0	1	0	0	1	0	1	2.7726	1	0	0	0	0	
22	3	Anyzova	Czech Re	0	7.1	0.1408	0	1031	32.109	0.25	1	1	0	1	1	0	0	0.6931	1	0	0	0	0	
23	3	Anyzova	Czech Re	9.697	5.1087	0.1957	1.8982	1031	32.109	0.25	1	1	0	1	1	0	1	0.6931	1	0	0	0	0	
24	3	Anyzova	Czech Re	17.468	6.9226	0.1445	2.5234	1031	32.109	0.25	1	1	0	1	1	0	0	0.6931	1	0	0	0	0	
25	3	Anyzova	Czech Re	5.4461	5.5562	0.18	0.9802	1031	32.109	0.25	1	1	0	1	1	0	1	0.6931	1	0	0	0	0	
26	4	Arunach.	Ecuador	12.412	2.6304	0.3802	4.7186	1960	44.272	0.0417	1	0	0	0	0	1	0	0	1	0	0	0	0	
27	4	Arunach.	Ecuador	10.672	2.5897	0.3861	4.1209	1960	44.272	0.0417	1	0	0	0	0	1	0	0	1	0	0	0	0	
28	4	Arunach.	Ecuador	6.4388	3.3209	0.3011	1.9389	1960	44.272	0.0417	1	0	0	0	0	1	0	0	1	0	0	0	0	
29	4	Arunach.	Ecuador	4.7912	3.2695	0.3059	1.4654	1960	44.272	0.0417	1	0	0	0	0	1	0	0	1	0	0	0	0	
30	4	Arunach.	Mexico	28.018	5.1207	0.1953	5.4715	923	30.381	0.0417	1	0	0	0	0	1	0	0	1	0	0	0	0	
31	4	Arunach.	Mexico	16.416	5.8208	0.1718	2.8202	923	30.381	0.0417	1	0	0	0	0	1	0	0	1	0	0	0	0	
32	4	Arunach.	Mexico	16.416	5.8208	0.1718	2.8202	923	30.381	0.0417	1	0	0	0	0	1	0	0	1	0	0	0	0	
33	4	Arunach.	Mexico	11.016	6.6609	0.1501	1.6538	923	30.381	0.0417	1	0	0	0	0	1	0	0	1	0	0	0	0	
34	4	Arunach.	Ecuador	10.885	3.0023	0.3331	3.6254	1960	44.272	0.0417	1	0	0	0	1	0	0	0	1	0	0	0	0	

Measurement

Measurement of beauty

- Interviewer-rated beauty
- Photo-rated beauty
- Software-rated beauty
- Self-rated beauty
- Dummy beauty
- Categorical beauty
- Beauty premium
- Beauty penalty

Measurement of success

- Earnings
- Study outcomes
- Teaching & research outcomes
- Athletic success
- Electoral success
- Other outcomes

Data, estimation, publication

Data characteristics
- Male subjects
- Female subjects
- Mixed gender
- High-skilled workers
- Prostitutes
- Other dressy occupations
- Non-dressy occupations
- Western culture
- Other cultures
- Panel data
- Cross-section

Estimation technique
- Ordinary least squares
- Instrumental variables
- Difference-in-differences
- Other method
- Cognitive skill control
- No cognitive skill control

Publication characteristics
- Published study
- Unpublished study
- High-quality peer review

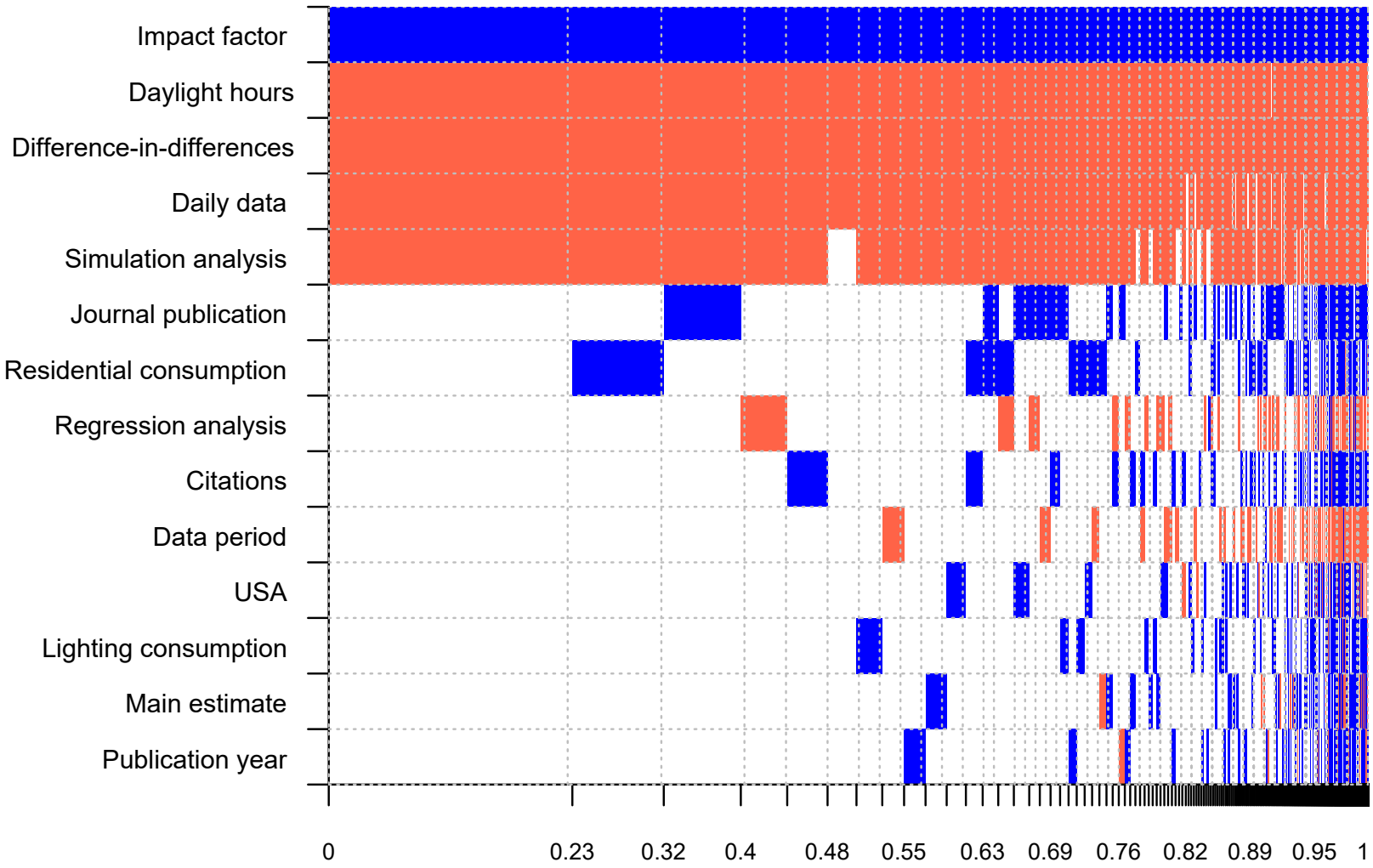
Artificial intelligence and context

- Can be useful for identifying key aspects in which studies vary
- Do not trust AI replies too much, but you can use it at various stages to generate ideas about potential explanatory variables
- You can use it to check whether you missed an important variable

Value added

- Meta-analysis can be used to test hypotheses that primary studies cannot investigate
- Example: the effect of daylight saving time on energy consumption
- Individual studies have data for individual countries (or provinces)
- In meta-analysis, we have data for dozens of countries
- We can investigate the sources of cross-country differences

DST savings and latitude



House prices and monetary policy