Publication Bias in Measuring Anthropogenic Climate Change

Dominika Reckova, Zuzana Irsova

Institute of Economic Studies
Faculty of Social Sciences
Charles University in Prague

Outline

Introduction

- MRA of the relation between the concentration of carbon dioxide in the atmosphere and changes in global temperature
- Climate sensitivity
- 48 estimates from 16 studies
- Evidence for publication bias in 14 models
- No such analysis has previously been published

Climate Sensitivity

- "defined as the response in global-mean near-surface temperature to a doubling of atmospheric CO2 concentrations from preindustrial levels" (Klocke *at al.* 2011)
- Also other factors influence the temperature change. (Edwards et al., 2007)
- The third assessment report of the IPCC predicts that CS likely ranges between 2 and 4.5 and is very unlikely to be less than 1.5.
- The fifth assessment report of the IPCC predicts that CS probably ranges from 1.5 to 4.5 with high confidence and is extremely unlikely to be lower than 1.
- Michaels (2008) uses vote-counting to analyse 116 issues of two journals that forecast climate change: *Science* and *Nature* and he found bias towards "worse" results.

Data

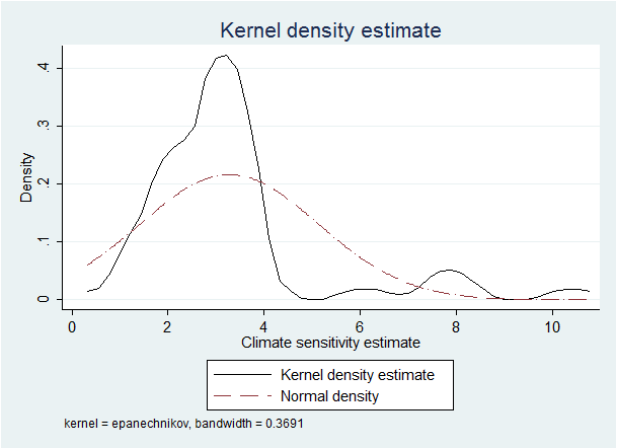

Figure 1: The kernel density of climate sensitivity estimates

- Searching for data till May 13, 2014 in Google Scholar and Web of Knowledge.
- 16 published papers provide 48 estimates of climate sensitivity (mostly mean or median).
- These range from 0.7 to 10.4, with an average of 3.27 °C.
- In the absence of bias the estimates are normally distributed around the hypothetical true effect.

Funnel plot of the estimated CS

- Calculating the Standard Errors:

$$SE_{low} = \frac{estimate - lower\_bound}{z} \tag{1}$$

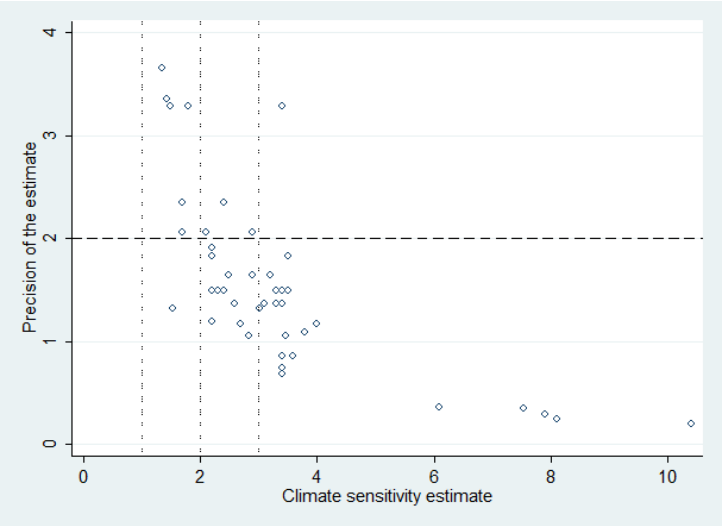

Figure 2: Funnel plot of the estimated CS

Note: This figure excludes the single most precise estimate to zoom in on the relationship.

Results

Response variable: t-statistic	**ME**	**Clus. OLS**	**Clus. FE**
1/SE	1.689***	1.425***	2.15***
	(0.188)	(0.3)	(0.085)
mean/SE	-1.105***	-0.832***	-1.573***
	(0.186)	(0.274)	(0.077)
Constant (bias)	2.192***	2.577***	2.043***
	(0.328)	(0.178)	(0.08)
Observations	48	48	48
Likelihood-ratio test (χ^2)	8.82***		
R^2		0.707	0.637

Table 1: Test of publication bias

Results

- Doucouliagos & Stanley (2013) regard a FAT result of higher than 2 in absolute terms as "severe" selectivity.
- 14 models indicate strong publication bias at least at 5% significance level.
- The estimates of the true CS range between 1.4 and 2.3 in the extreme cases, and the average is 1.74.

Results

Response variable: t-statistic	**ME**	**Clus. OLS**	**Clus. FE**
1/SE (true CS)	1.617***	1.276***	2.087***
	(0.19)	(0.316)	(0.086)
mean/SE	-1.074***	-0.732**	-1.55***
	(0.183)	(0.286)	(0.079)
SE	-0.234*	-0.316***	-0.226***
	(0.132)	(0.086)	(0.017)
Constant (bias)	2.5***	3.054***	2.353***
	(0.369)	(0.232)	(0.068)
Observations	48	48	48
Likelihood-ratio test (χ^2)	8***		
R^2		0.728	0.647

Table 2: Test of true climate sensitivity beyond publication bias

Conclusion

- CS estimates play a crucial role in evaluating the impacts of anthropogenic climate change
- One of the most important inputs into the computation of the social cost of carbon
- Evidence for publication selection bias: researchers tend to report preferentially large estimates of climate sensitivity
- Corrected for publication bias, the bulk of the literature is consistent with climate sensitivity lying between 1.4 and 2.3°C

References

Doucouliagos, C. & T. Stanley (2013)

Are all economic facts greatly exaggerated? theory competition and selectivity.

Journal of Economic Surveys 27(2), pp.316 – 339.

Klocke, D., R.Pincus, & J. Quaas (2011)

On constraining estimates of climate sensitivity with present-day observations through model weighting.

Journal of Climate 24(23), pp. 6092.

Thank you for your attention!