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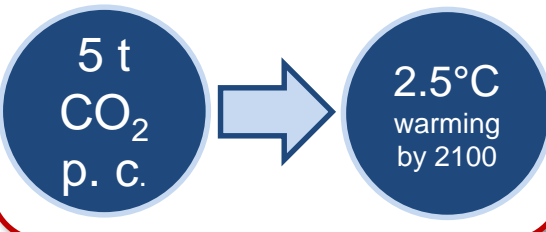
Sebastian Mader

Predictors of national CO₂ emissions: Do international commitments matter?

I. Objective

- > CO₂ emissions play a central role for climate change mitigation (see Boxes 1 and 2).
- > Thus, extended knowledge on anthropogenic drivers of per capita CO₂ emissions (Figure 1) is essential.

Baseline Scenario



Box 1: World average CO₂ p. c. in 2014: Baseline Scenario expiring global fossil fuel reserves by 2100.

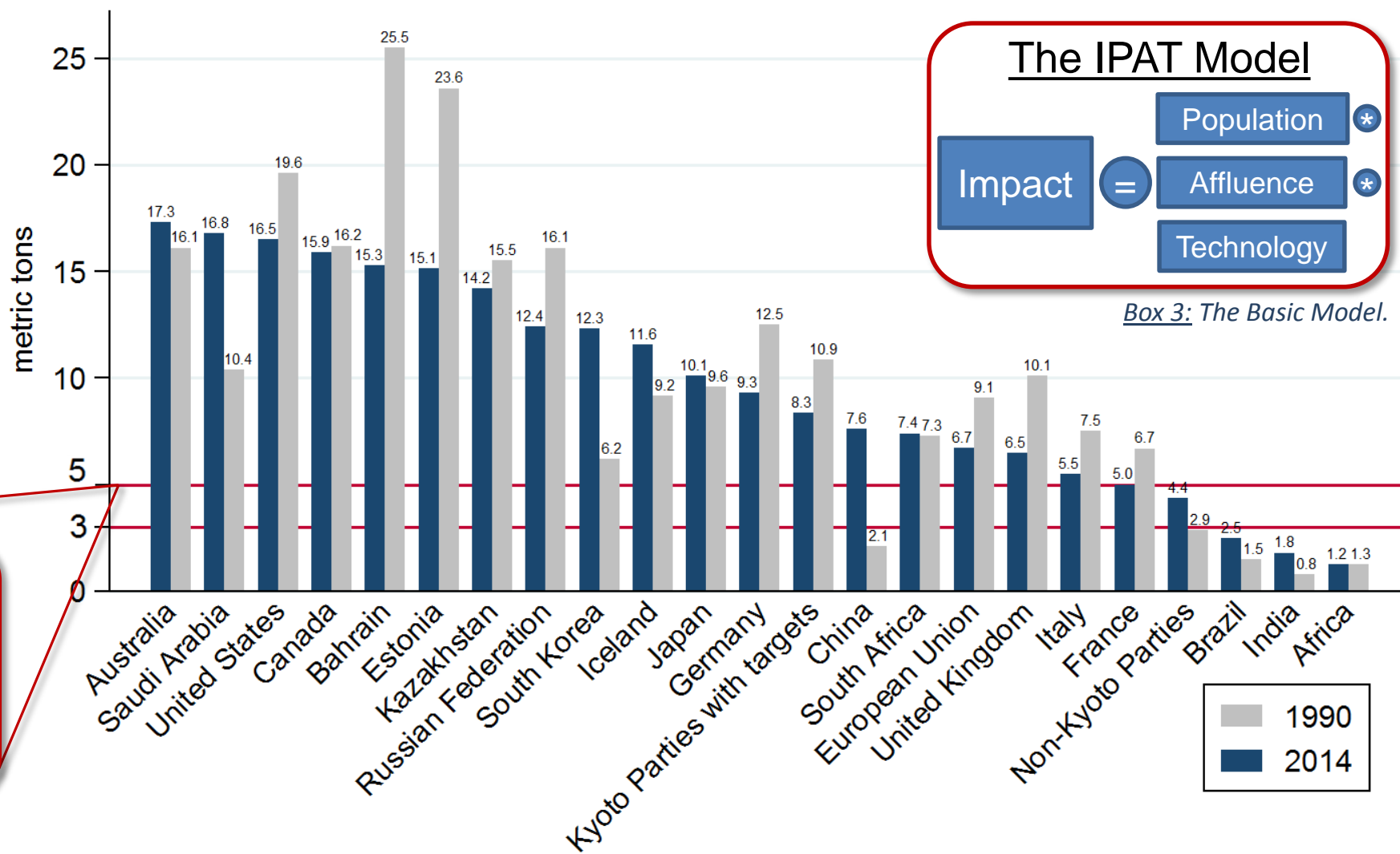
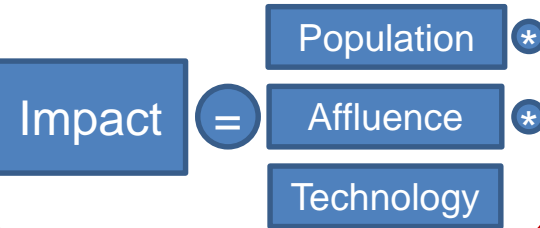


Figure 1: CO₂ emissions per capita (p. c.) in international comparison for 1990 and 2014 (Source: EDGAR 2015).

The IPAT Model

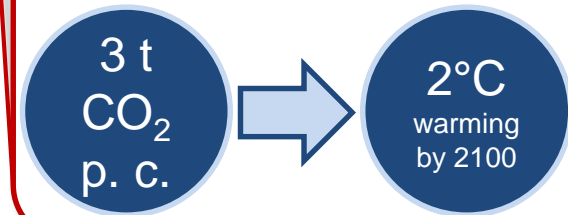


Box 3: The Basic Model.

II. Methods

- > Extended IPAT Model (see Box 3 and Figure 2)
- > Enhanced Dataset
 - 147 countries
 - time span: 1980-2014
- > Reliable Analytics
 - Two-Way Fixed Effects Panel Regression (FE)

The 3 tons target



Box 2: Sustainable per capita CO₂ emissions per year.

III. Main Results

Description:

- > Given IPAT, a huge variance in CO₂ p. c. is no surprise.
- > However, Figure 1 reveals that variation is also large between countries with a similar living standard.
- > Highest dynamics lie within BRICS countries, led by China (+362 % from 1990 to 2014).

Causal Inference:

- > CO₂ emissions are simply proportional to population.
- > GDP p. c. (PPP) is the main driver of CO₂ p. c., but there is no reliable evidence for an Environmental Kuznets Curve.
- > Surprisingly, foreign trade (% of GDP) is not related to CO₂ p. c. (see also Figure 3).
- > Similarly, a shift from industries to services does not determine p. c. CO₂.
- > Mitigation efforts stemming from international commitments to environmental protection, an Energiewende, and energy prices do matter, albeit to a rather small extent.

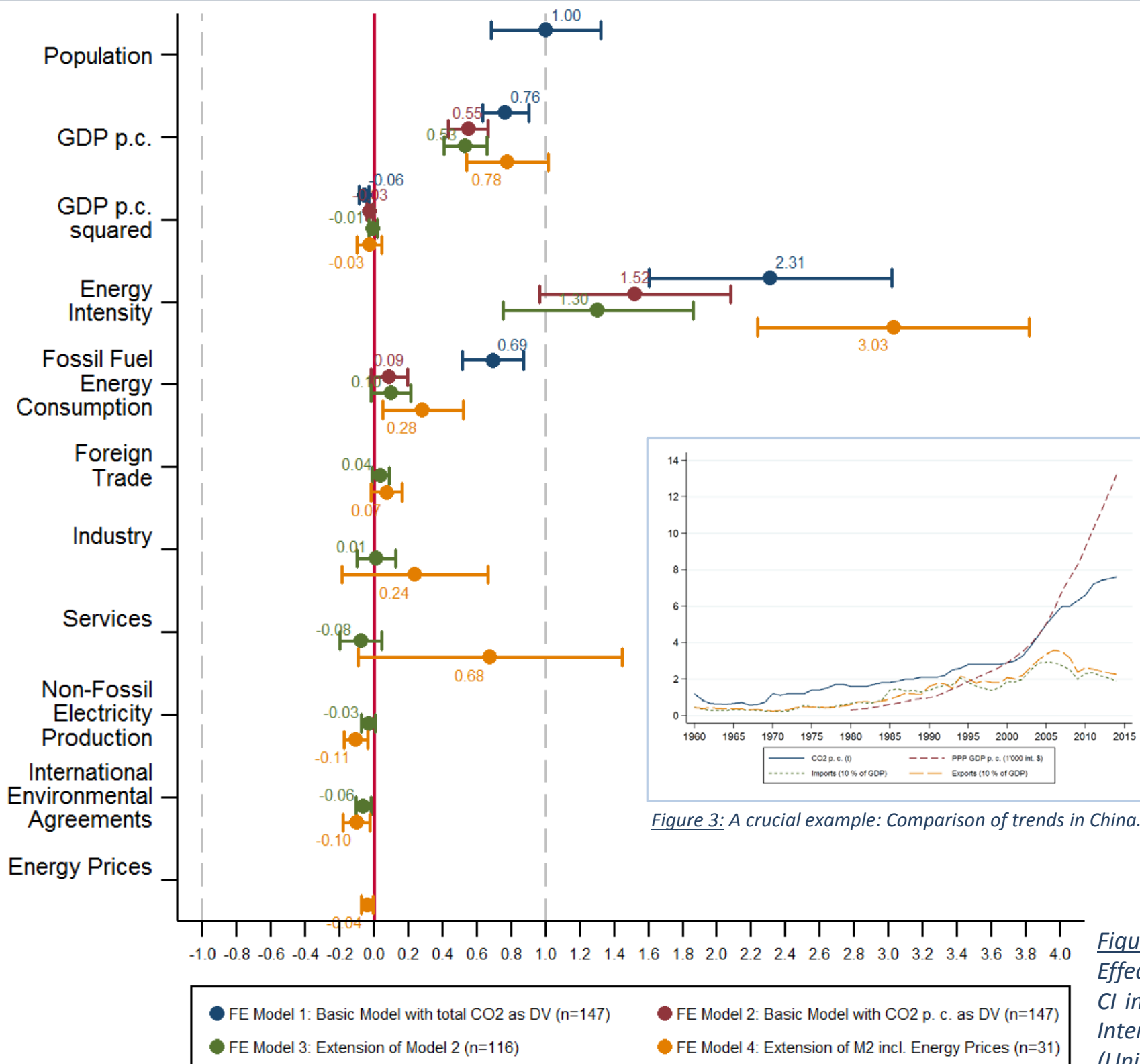


Figure 3: A crucial example: Comparison of trends in China.

IV. Conclusion

Scientific:

To summarise, this study replicates prior IPAT research and extends it with respect to coverage of countries, the time span observed, quality and topicality of data, and political as well as economic predictors considered over and above the already known factors.

Political:

- > In the light of the 2°C or 3 tons target, climate change mitigation is an ambitious challenge even for countries like France and Switzerland (-40 % in CO₂ p. c. required), and unfeasible for countries like the USA and Canada (-80 %).
- > Hence and as the results for mitigation efforts show, the study at hand refers to the necessity of an enforceable international CO₂ compensation framework for an effective climate policy.

Figure 2: Unstandardized Two-Way Fixed Effects Panel Regression estimates with 95 % CI indicating percentage changes except for International Environmental Agreements (Unit: 100).