Unconventional Determinants of Greenhouse Gas Emissions: The Role of Trust

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Competition or cooperation?

We observe unilateral initiatives to curb greenhouse gas emissions from both single countries and individuals: looking at the roots of cooperation

- Climate change mitigation is a global public good
- Free-riding is expected according to the theory of collective action (Olson 1965; Hardin 1968)
- But cooperation exists: updated theory based on local dilemmas (cf. e.g. Ostrom 1990, Ostrom & Ahn 2003)
- Cooperation explained by social norms (social capital), viz. trust
- Does trust play a role also with global dilemmas such as climate change?
- Testing Ostrom’s (2009) hypothesis
Trust and greenhouse gas emissions?

Mechanisms possibly at work:

1. Trust may encourage green behavior: sharing the climate effort with the community (Ostrom 2009)
   - Theoretical background: Nyborg et al. (2006)

2. Trust may encourage active and passive collective action and raise demand for climate policy (Ostrom 2009)


⇒ Do macroeconomic data support Ostrom’s hypothesis?
Ostrom’s hypothesis at a glance

Broader contextual variables
- Trust
  - Individual behavior
  - Policy
  - Economic growth

Greenhouse gas emissions
- Energy consumption
  - Net benefits

Figure 1: From trust to emissions, adaptation from Poteete et al. (2010)
How to measure trust?

Trust is not directly observable but can be approximated from individual perceptions in surveys:

- Most common measure from the World Values Survey: ”In general, do you think that most people can be trusted, or you cannot be too careful in dealing with other people?”
- First waves not available for all countries, underlying sample size differs from country to country
- Subject to selection bias (education and income in developed countries), translation bias, response bias (Knack & Keefer 1997)

+ Generally successful in predicting cooperation also outside the lab (lost wallets experiment, see e.g. Knack & Keefer 1997)
+ Satisfactory internal validity: expected sign in correlations between trust and other questions in the WVS
Where to measure trust?

Observations for both trust and emissions are available in Europe at least since 1990 → panel data and fixed effects to limit the risk of omitted variable bias (cf. Grafton & Knowles 2004)

Figure 2: Distribution of trust in Europe, from WVS (JDS)
Applying the most recurrent model of the demand for pollution (Antweiler et al. 2001):

\[
Emissions_{i,t} = \alpha_i + \beta_1 GDP_{i,t} + \beta_2 Manufacturing_{i,t} + \beta_3 Trade_{i,t} + \beta_4 Trust_{i,t} + \epsilon_{i,t}
\]  

where

\begin{itemize}
  \item \textit{Emissions}_{i,t} is per capita GHG emissions at time \(t\) in country \(i\) (in log)
  \item \textit{GDP}_{i,t} is real GDP per capita (in log)
  \item \textit{Manufacturing}_{i,t} is the industrial sector’s share in the economy
  \item \textit{Trade}_{i,t} measures trade openness
  \item \textit{Trust}_{i,t} is trust from the WVS
  \item \(a_i\) is a country-specific fixed effect
  \item \(\epsilon_{i,t}\) represents the error term
\end{itemize}
Variable selection

- Standard model: keeping economic growth as control variable and focusing on channels (1) and (2).
- FE: intertemporal variation in trust and controls.
- Expected signs:
  - real income per capita (+)
  - manufacturing (+)
  - trade (±)
  - trust (−)
  - fixed effects (±)

How to include energy consumption? Testing mediation:

\[ trust \, (−) \rightarrow energy \, (+) \rightarrow emissions \]
Mediation

1. Effect of trust on energy

\[ Energy_{i,t} = \alpha i + \beta_1 GDP_{i,t} + \beta_2 Manufacturing_{i,t} + \beta_3 Trade_{i,t} + \beta_4 Trust_{i,t} + \epsilon_{i,t} \]  

2. Effect of energy on emissions

\[ Emissions_{i,t} = \alpha i + \beta_1 GDP_{i,t} + \beta_2 Manufacturing_{i,t} + \beta_3 Trade_{i,t} + \beta_4 Trust_{i,t} + \beta_5 Energy_{i,t} + \epsilon_{i,t} \]  

3. The effect of trust on emissions controlling for energy should disappear (or at least decline)
Sample and descriptive statistics


Table 1: Summary statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Min.</th>
<th>Max.</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>GHG emissions p.c.</td>
<td>1000 tons of CO₂ equivalent</td>
<td>0.011</td>
<td>0.004</td>
<td>0.004</td>
<td>0.035</td>
<td>539</td>
</tr>
<tr>
<td>Real GDP p.c.</td>
<td>Euros of 2000</td>
<td>19747.18</td>
<td>12622.49</td>
<td>1218.981</td>
<td>71428.57</td>
<td>438</td>
</tr>
<tr>
<td>Trust</td>
<td>Share of positive answers</td>
<td>0.352</td>
<td>0.148</td>
<td>0.099</td>
<td>0.68</td>
<td>340</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>Share of GDP</td>
<td>0.197</td>
<td>0.056</td>
<td>0.075</td>
<td>0.453</td>
<td>460</td>
</tr>
<tr>
<td>Trade openness</td>
<td>Share of GDP</td>
<td>0.494</td>
<td>0.250</td>
<td>0.165</td>
<td>1.764</td>
<td>484</td>
</tr>
<tr>
<td>Energy consumption p.c.</td>
<td>1000 tons of oil equivalent</td>
<td>0.004</td>
<td>0.002</td>
<td>0.002</td>
<td>0.014</td>
<td>538</td>
</tr>
</tbody>
</table>
Special case: transition economies

Some estimations do not include transition economies:

![Graph](image)

**Figure 3**: Evolution of GHG emissions per capita over 1990-2007 for the whole sample and subsets of countries.
### Empirical results (1)

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td></td>
<td>Model (1)</td>
<td>Model (2)</td>
</tr>
<tr>
<td>Trust</td>
<td>-0.269** (0.114)</td>
<td>-0.242** (0.110)</td>
</tr>
<tr>
<td>Real GDP per capita</td>
<td>-0.023** (0.011)</td>
<td>0.088*** (0.033)</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>1.414*** (0.240)</td>
<td>2.241*** (0.344)</td>
</tr>
<tr>
<td>Trade</td>
<td>-0.210*** (0.068)</td>
<td>-0.569*** (0.115)</td>
</tr>
<tr>
<td>Energy consumption</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Constant</td>
<td>-4.045*** (0.152)</td>
<td>-5.080*** (0.333)</td>
</tr>
<tr>
<td>Country fixed-effects</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Observations</td>
<td>257</td>
<td>197</td>
</tr>
<tr>
<td>Countries</td>
<td>29</td>
<td>20</td>
</tr>
<tr>
<td>Within-$R^2$</td>
<td>0.277</td>
<td>0.287</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.970</td>
<td>0.970</td>
</tr>
</tbody>
</table>

**Notes:** (SE). *,**,***: 90%, 95% and 99%. Unbalanced panels. (2) to (4) without transition economies.
Empirical results (2)

- GDP is positive except with transition economies, energy (scale vs. technique effect, see Millock et al. 2008, Jobert et al. 2010, Lin ad Li 2011)
- Manufacturing is positive (see Jobert et al. 2010)
- Trade is negative (technique effect, see De Melo & Mathys 2010)
- Energy is positive (scale effect, see Buehn & Farzanegan 2013)
- Trust affects emissions through energy (mediation)
Conclusions

- Preliminary evidence suggesting a negative effect of trust on greenhouse gas emissions through lower energy consumption
- Within country effect: as average trust increases within a country, its emissions decline, *ceteris paribus*
- Ostrom’s hypothesis deserves to be explored
- The inclusion of social capital as determinant of emissions addresses Esty & Porter’s (2005) quest for an explanation beyond the EKC for differences in environmental quality, carbon footprint

Caveats and avenues for future research