

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) 
 - ▶ Some empirical evidence: Pretty and Ward (2001), Poteete et al. (2010)
- 2 Trust may encourage active and passive collective action and raise demand for climate policy (Ostrom 2009)
 - ▶ Some empirical evidence: Stern et al. (1999), Stern (2000), Steg et al. (2005), Steg and Vlek (2009), Owen & Videras (2008)
- 3 Trust may encourage economic growth (Fukuyama 1995, Knack & Keefer 1997, Zak & Knack 2001, Tabellini 2010)

⇒ Do macroeconomic data support Ostrom's hypothesis?

Ostrom's hypothesis at a glance

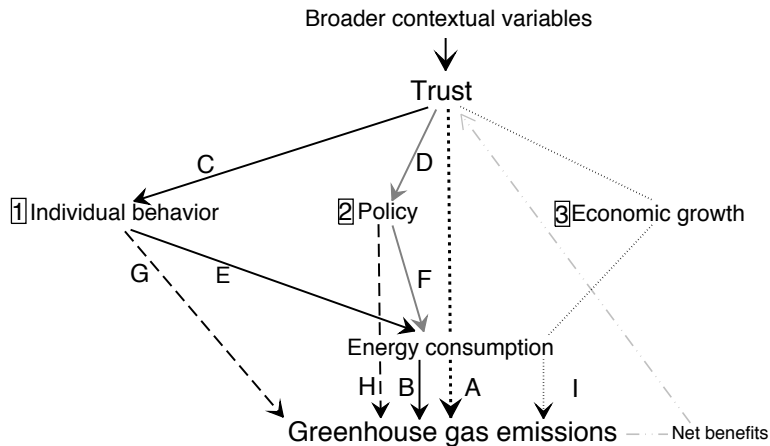


Figure 1 : From trust to emissions, adaptation from Poteete et al. (2010)

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 in the lab (at least trustworthiness, cf. Glaeser et al. 2000, Ostrom & Ahn 2003)
- + 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)

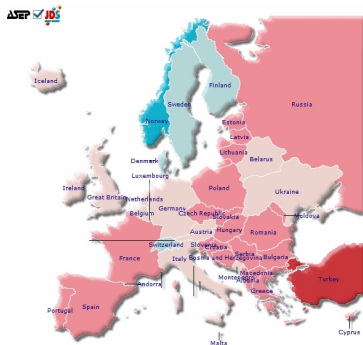



Figure 2 : Distribution of trust in Europe, from WVS (JDS) 

The model

Applying the most recurrent model of the demand for pollution (Antweiler et al. 2001):

$$\begin{aligned} Emissions_{i,t} = & \alpha_i + \beta_1 GDP_{i,t} + \beta_2 Manufacturing_{i,t} + \beta_3 Trade_{i,t} \\ & + \beta_4 Trust_{i,t} + \epsilon_{i,t} \end{aligned} \quad (1)$$

where

$Emissions_{i,t}$ is per capita GHG emissions at time t in country i (in log)

$GDP_{i,t}$ is real GDP per capita (in log)

$Manufacturing_{i,t}$ is the industrial sector's share in the economy

$Trade_{i,t}$ measures trade openness

$Trust_{i,t}$ is trust from the WVS

a_i is a country-specific fixed effect

$e_{i,t}$ represents the error term

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* (\pm)
 - ▶ *trust* (-)
 - ▶ *fixed effects* (\pm)

How to include energy consumption? Testing mediation:
trust (-) \rightarrow *energy* (+) \rightarrow *emissions*

Mediation

- 1 Effect of trust on energy

$$\begin{aligned} \text{Energy}_{i,t} = & \alpha_i + \beta_1 \text{GDP}_{i,t} + \beta_2 \text{Manufacturing}_{i,t} + \beta_3 \text{Trade}_{i,t} \\ & + \beta_4 \text{Trust}_{i,t} + \epsilon_{i,t} \end{aligned} \quad (2)$$

- 2 Effect of energy on emissions

$$\begin{aligned} \text{Emissions}_{i,t} = & \alpha_i + \beta_1 \text{GDP}_{i,t} + \beta_2 \text{Manufacturing}_{i,t} + \beta_3 \text{Trade}_{i,t} \\ & + \beta_4 \text{Trust}_{i,t} + \beta_5 \text{Energy}_{i,t} + \epsilon_{i,t} \end{aligned} \quad (3)$$

- 3 The effect of trust on emissions controlling for energy should disappear (or at least decline)

Sample and descriptive statistics

Panel: 1990-2007 for EU27 w/o Greece + EFTA. Sources: Eurostat, WVS (World Bank).

Table 1 : Summary statistics

Variable	Unit	Mean	Std Dev	Min.	Max.	N
GHG emissions p.c.	1000 tons of CO ₂ equivalent	0.011	0.004	0.004	0.035	539
Real GDP p.c.	Euros of 2000	19747.18	12622.49	1218.981	71428.57	438
Trust	Share of positive answers	0.352	0.148	0.099	0.68	340
Manufacturing	Share of GDP	0.197	0.056	0.075	0.453	460
Trade openness	Share of GDP	0.494	0.250	0.165	1.764	484
Energy consumption p.c.	1000 tons of oil equivalent	0.004	0.002	0.002	0.014	538

Special case: transition economies

Some estimations do not include transition economies:

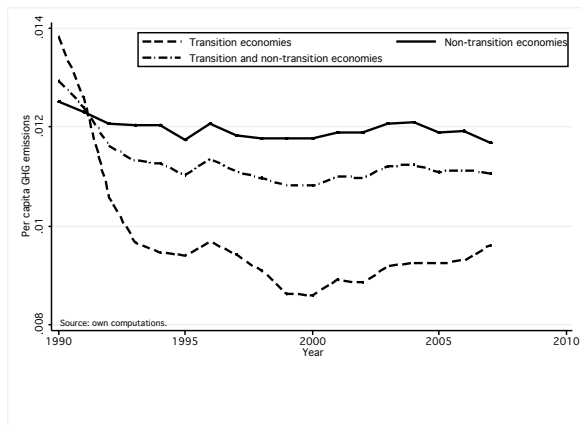


Figure 3 : Evolution of GHG emissions per capita over 1990-2007 for the whole sample and subsets of countries.

Empirical results (1)

	Greenhouse gas emissions p.c.			Energy consumption p.c.
	Model (1)		Model (2)	Model (3)
	(1)	(2)	(3)	(4)
Trust	-0.269** (0.114)	-0.242** (0.110)	0.022 (0.744)	-0.321*** (0.101)
Real GDP per capita	-0.023** (0.011)	0.088*** (0.033)	-0.070*** (0.024)	0.192*** (0.030)
Manufacturing	1.414*** (0.240)	2.241*** (0.344)	1.106*** (0.238)	1.384*** (0.317)
Trade	-0.210*** (0.068)	-0.569*** (0.115)	-0.440*** (0.076)	-0.157 (0.105)
Energy consumption	-	-	0.821*** (0.054)	-
Constant	-4.045*** (0.152)	-5.080*** (0.333)	0.805* (0.446)	-7.171*** (0.307)
Country fixed-effects	Yes	Yes	Yes	Yes
Observations	257	197	197	197
Countries	29	20	20	20
Within- R^2	0.277	0.287	0.694	0.327
R^2	0.970	0.970	0.987	0.983

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 and 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 