INDICATORS OF ENVIRONMENTAL POLICY STRINGENCY AND “BURDENS”

Some (very) preliminary results

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December 2013
Outline

• Environmental policy stringency
  – Why measure?
  – Challenges
  – How is it done?
  – A composite index - some preliminary work
• “Burdens” of environmental policies
  – Barriers to entry and competition
Why measure environmental policy stringency?

- Empirical investigations
  - Policy assessments, reviews, effects etc.
  - policy design, market-based instrument claims etc.
  - Pollution Haven Hypothesis/leakage vs. first-mover advantage;
  - Porter Hypothesis vs. burdens of env. policy;
  - Lobbying/political economy questions;
How are these addressed these?

- Case studies, diff-in-diff, reg. discontinuity
  - May work well with info on a single event
  - But lack conclusion generality
- Exploiting cross-country dimension
  - Can help answer these questions, but...
  - ... requires EPS variable, with sufficient time series.
Environmental laws are designed and implemented... 
... to alter firms’ (and consumers’) behaviour...
... and achieve “cleaner” outcomes
Examples of measures of EPS/EP

- Environ. policy instruments
- Environ. policy perceptions
- Changes in actors behaviour
- Changes in environmental outcomes
Examples of measures of EPS/EP

• Single policy events
  – Introduction of a policy, change in a policy, EU ETS price changes, etc.

• Composite index
  – Various aggregation of dummies of selected policy changes
  – CLIMI (EBRD, 2011) – climate policies, 1 year, 95 countries
Examples of measures of EPS/EP

- Environ. policy instruments
- Environ. policy perceptions
- Changes in actors behaviour
- Changes in environmental outcomes
Examples of measures of EPS/EP

• Perception surveys
  – WEF Executive opinion survey 2004+, ~all countries
  – OECD company survey 2003, 7 countries
    • De facto
    • But well known issues
Examples of measures of EPS/EP

- Environ. policy instruments
- Environ. policy perceptions
- Changes in actors behaviour
- Changes in environmental outcomes
Examples of measures of EPS/EP

• Pollution Abatement and Control Expenditures
  – firm surveys (US, EU, Canada, Australia)

• Shadow cost estimates
  – EP’s put an implicit price on pollution – hence idea to estimate this price from the production/input choices,
Examples of measures of EPS/EP

Environ. policy instruments → Environ. policy perceptions → Changes in actors behaviour → Changes in environmental outcomes
Examples of measures of EPS/EP

• Environmental-performance based measures:
  – Brunel and Levinson (2013) – countries relative emission intensity, conditional on industrial structure,
  – landfilling rates (OECD, 2014*),
  – Energy use, ambient pollution...
Examples of measures of EPS/EP

• Other proxies
  – number of environmentally-related inspections (Alpay et al., 2002; Testa et al., 2011; Brunnermeier and Cohen, 2003),
  – environmental treaties signed/ratified (Smarzynska and Wei, 2004; Yörük and Zaim, 2005 or Wu and Wang, 2008).
  – Environmental voting records (Gray, 1997)
Challenges in measuring EPS/EP

- Multidimensionality
Multidimensionality (instruments)

No. of countries that apply the instrument in the given domain (across 29 OECD countries surveyed)
Challenges in measuring EPS/EP

- Multidimensionality
- Selection of respondents/sampling
- Simultaneity (B&L)
- Identification of effects
- Law vs. enforcement
- Definitional issues & Data

Importance differs upon measure
-> selection, scoring, aggregation, use
No measure is ideal

- So what can we do?
  - Use most appropriate measure for each application
  - Corroborate results with other measures (if possible)
  - As an IO - put more effort into a series of policy measures (use experiences from PMR, EPL etc)
Composite index of environmental policies

• Aggregate (selected)
  – link to policies directly (identification!)
  – Respondent selection

• But
  – multidimensionality at its broadest (selection, weights, aggregation structure)
  – De iure -> enforcement issues

• Data?
  – OECD, 1990-2012,
Composite index of environmental policies – underlying assumptions

• If you care about a certain type of pollutant or environmental effect, from one industry – you will care about it in general,

• If you have stringent policy, a number of key instruments should also be relatively stringent (across pollutants, agents etc)

• Weak points:
  • International obligations
  • Instruments hard to cover (VAs, land use regulations, “soft” policies)
  • Covering countries with weak institutions, large grey economy etc.
Selection and scoring

- Focus – largely energy sector (and transport)
  - Data driven
  - Common importance across countries (though not the same)
  - Selected subset of instruments
  - Pollutants fairly common (some exceptions),

- In-sample scores (time-country).
- No a priori weighting method
- Aggregated by instrument types, then equal weights
- Some robustness checks (RW, PCs, correlations)
### B. Categorical scoring for NO\textsubscript{x} Emission Limit Value

<table>
<thead>
<tr>
<th>ELV in mg/nm\textsuperscript{3}</th>
<th>Score assigned</th>
</tr>
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<tbody>
<tr>
<td>=0</td>
<td>0</td>
</tr>
<tr>
<td>X&gt;350</td>
<td>1</td>
</tr>
<tr>
<td>300&lt;x&lt;=350</td>
<td>2</td>
</tr>
<tr>
<td>250&lt;x&lt;=300</td>
<td>3</td>
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<td>200&lt;x&lt;=250</td>
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<td>150&lt;x&lt;=200</td>
<td>5</td>
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<tr>
<td>0&lt;x&lt;=150</td>
<td>6</td>
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</table>
Aggregation structure and weights

Market-based instr.
- 0.25 Taxes
  1. Co₂ tax
  2. NOₓ tax
  3. SO₂ tax
  4. Tax on Diesel
- 0.25 Trad. Sch.
  1. Co₂ Trad. s
  2. Green Trad. s
  3. White Trad. s
- 0.25 FIT
  1. Fit solar
  2. Fit wind
- 0.25 DRS
  1. DRS

Non-market-based instr.
- 0.5 Standards
  1. Elv NOₓ
  2. Elv SO₂
  3. Elv PM
  4. Sulphur content in Diesel
- 0.5 R&D
  1. Gov R&D Exp for renewables

Extended indicator
- 0.5
(preliminary) outcomes

Preliminary results – under embargo
Relative importance of different approaches to env. regulation

Preliminary results – under embargo
Correlation with other measures of stringency - Extended indicator

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>Over the period</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perceived stringency (WEF)</td>
<td>.49 (0.01)</td>
<td>.42 (0.03)</td>
<td>.41 (0.04)</td>
<td>.43 (0.03)</td>
<td>.42 (0.03)</td>
<td>.50 (0.01)</td>
<td>.39 (0.05)</td>
<td>.34 (0.10)</td>
<td>.39 (0.00)</td>
</tr>
<tr>
<td>CLIMI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.54 (0.01)</td>
<td></td>
</tr>
</tbody>
</table>

(Notes: Preliminary outcomes are noted.)
## (preliminary) outcomes

### Correlation with GDP, emission intensity and EPI index

<table>
<thead>
<tr>
<th></th>
<th>GDP per Capita</th>
<th>CO₂/GDP</th>
<th>CO₂/GDP (PPP)</th>
<th>CO₂/KWh</th>
<th>EPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy Index</td>
<td>.35 (0.00)</td>
<td>-0.22 (0.00)</td>
<td>-0.31 (0.00)</td>
<td>-0.15 (0.00)</td>
<td>.36 (0.00)</td>
</tr>
<tr>
<td>Extended Index</td>
<td>.46 (0.00)</td>
<td>-.19 (0.00)</td>
<td>-.25 (0.00)</td>
<td>-.20 (0.00)</td>
<td>.42 (0.00)</td>
</tr>
</tbody>
</table>
Correlation with (environmental) inventing activity proxies

<table>
<thead>
<tr>
<th></th>
<th>Green Patents Index</th>
<th>Green Patents Index (t+2)</th>
<th>Patents (RE)</th>
<th>Patents (RE) (t+2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Index</td>
<td>.17 (0.00)</td>
<td>.15 (.01)</td>
<td>.23 (0.00)</td>
<td>.23 (0.00)</td>
</tr>
<tr>
<td>Mkt based instr</td>
<td><strong>.18 (0.00)</strong></td>
<td><strong>.18 (0.00)</strong></td>
<td><strong>.26 (0.00)</strong></td>
<td><strong>.24 (0.00)</strong></td>
</tr>
<tr>
<td>Non-mkt based instr.</td>
<td>.14 (0.01)</td>
<td>.09 (0.10)</td>
<td>.12 (0.02)</td>
<td>.11 (0.03)</td>
</tr>
</tbody>
</table>
Indicators of “economic burdens of environmental policies”
Indicators of “economic burdens of environmental policies” - Motivation

• Longer-term effects of environmental policy stringency on longer-term productivity growth?
  – Little evidence (e.g. Kozluk and Zipperer, 2013, and OECD, 2014*)

• ...but environmental policies may also affect competition/entry hence innovation, adoption of cleaner technologies, business models,
  – Competition -> potentially important determinant of productivity growth (l.t.)
  – The competition-friendliness of environmental policies may matter more than stringency
OECD’s Product Market Regulation Indicators

- Covers a wide range of anti-competition regulations, administrative burdens, state control, etc.
- 1400+ questions, every 5 years since 1998.
- **Exclude any environment related procedures, laws and permits.**

Economic outcomes (investment, innovation, productivity, GDP)
Idea: How does the design of environmental policies impose administrative barriers & impede entry & competition?

Questionnaire:
- Replies from 29+ countries (2 non-OECD)
- 4 domains, ~12 question per domain
Administrative burdens of permit/license procedures

- Integrated permits, single contact points, legal time limits on approval, silence-is-consent rule.
What aspects are we capturing?

• **Direct impediments to competition**
  • Vintage Differentiated Regulations (eg ELVs), taxes/subsidies that discriminate against new entrants.
What aspects are we capturing?

• **Evaluation of new policies & of existing policies**
  - Are policy makers are obliged to evaluate:
    - effects on competition, entry, administrative burdens, statistics and reporting burdens etc.
    - the possibility, costs and benefits of using alternative tools (e.g. a tax versus an emission limit).
    - Possibilities for streamlining obligations imposed.
  - Evaluation guidelines, stakeholder consultations,
  - Transparency & communication,
(Very) preliminary results

Preliminary results – under embargo
Correlations with PMR,…

Preliminary results – under embargo

Corr. = -0.07

Corr. = 0.01
…with environmental policy stringency,…

Corr.=-0.01

Preliminary results – under embargo
with (past) economic performance

Preliminary results – under embargo

Corr. = -0.5*
Further work/potential extensions

• Improve coverage in terms of instruments/media, years and countries (costs vs. benefits)
• Corroborate with existing measures
• Use subcomponents
• Inquire deeper into anti-competition design features (industrial survey?)
Thank you/Grazie!

Further info, comments:
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