Climate finance under a CGE framework: decoupling financial flows in GTAP database

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Climate finance and global commitments

- **Climate finance**
  - The financing required for an orderly transition to a low carbon, climate resilient *global economy* (World Bank, 2017).
  - Refers to local, national or transnational financing, which may be drawn from public, private and alternative sources (UNFCCC, 2017).

- **Commitments**
  - Copenhagen (2009) $100bn p.y. commitment to support climate action in developing countries.
  - Paris Agreement (2015) developed countries shall provide scale-up financial resources to assist developing countries with respect to both mitigation and adaptation activities.
Research outline

▶ **Question:** Can climate finance induce productivity shocks on developing countries under constrained GHG emission scenarios?
  ▶ Technological deployment required for negative emissions (bottom-up models)
  ▶ Explore the changes in productivity that result within the CGE model

▶ **Literature gap:** Missing links between the real and the monetary sides of the economy in CGE models.
  ▶ Financial Social Accounting Matrix (FSAM).

▶ **Steps:**
  ▶ Identify the net capital inflows according to regional aggregation (GTAP database)
  ▶ Identify climate finance flows (other databases)
  ▶ Decouple the stock of capital in the CGE model
Modeling framework – CGE and bottom-up models

- TEA (Total Economy Assessment)
- COFFEE (COMputable Framework For the Energy and Environment)
- BLUES (Brazilian Land Use and Energy System)
Regional breakdown in 18 regions

Legend: AFR (Africa), AUS (Australia and New Zealand), BRA (Brazil), CAM (Central America), CAN (Canada), CAS (Caspian Region), CHN (China), EEU (Eastern Europe), IND (India), JPN (Japan), KOR (South Korea), MEA (Middle East), RAS (Rest of Asia and Oceania), RUS (Russia), SAF (South Africa), SAM (South America), USA (United States) and WEU (Western Europe).
### Sectoral breakdown in 18 sectors

#### Table: TEA sectoral breakdown

<table>
<thead>
<tr>
<th>Sector</th>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agriculture</td>
<td>AGR</td>
<td>Agriculture crops and vegetables</td>
</tr>
<tr>
<td>LIV</td>
<td></td>
<td>Livestocks</td>
</tr>
<tr>
<td>Energy</td>
<td>COL</td>
<td>Coal</td>
</tr>
<tr>
<td>CRU</td>
<td></td>
<td>Crude Oil</td>
</tr>
<tr>
<td>ELE</td>
<td></td>
<td>Electricity</td>
</tr>
<tr>
<td>GAS</td>
<td></td>
<td>Natural Gas</td>
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<tr>
<td>OIL</td>
<td></td>
<td>Petroleum coal products</td>
</tr>
<tr>
<td>Industry</td>
<td>I.S</td>
<td>Iron and steel</td>
</tr>
<tr>
<td>CRP</td>
<td></td>
<td>Chemical rubber and plastic</td>
</tr>
<tr>
<td>NMM</td>
<td></td>
<td>Manufacture of non-metallic mineral products</td>
</tr>
<tr>
<td>MAN</td>
<td></td>
<td>Others manufacture</td>
</tr>
<tr>
<td>Transport</td>
<td>OTP</td>
<td>Transport nec</td>
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<td>WTP</td>
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<tr>
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<td>SER</td>
<td>Services</td>
</tr>
<tr>
<td>DWE</td>
<td></td>
<td>Dwellings</td>
</tr>
</tbody>
</table>
1st step: Net capital inflows from the GTAP database

Figure: Net capital inflows in TEA regions (in USD billions) – year 2011.
Source: own elaboration based on [1].
2nd step: Climate finance flows

Figure: Climate finance flows estimates (in USD billions) - year 2011.
Source: own elaboration based on [2],[3],[4].
3rd step: Decoupling capital stock

- Formation of new capital at each period:

\[
K_{r,t}^{cgds} = I_{r,t}^{cgds} + (1 - \delta_r)K_{r,t-1}^{cgds} \tag{1}
\]

\[
K_{r,t}^{cfin} = I_{r,t}^{cfin} + (1 - \delta_r)K_{r,t-1}^{cfin} \tag{2}
\]

where:

- \( K_{t,t}^{cgds} \) is the stock of capital goods in region \( r \) in time \( t \);
- \( I_{r,t}^{cgds} \) is the investment in new capital goods (other than climate finance tagged) in region \( r \) in time \( t \);
- \( K_{r,t}^{cfin} \) is the stock of green capital in region \( r \) and time \( t \);
- \( I_{r,t}^{cfin} \) the climate finance investment in new capital goods in region \( r \) and time \( t \); and
- \( \delta_r \) is the depreciation rate in region \( r \).
Final Remarks

- **Work to date**
  - Data has been prepared to address the research question.
  - Now, introducing green capital into the model to calibrate the baseline.

- **Limitations**
  - Absence of climate finance data at a country level for the base year (2011).
  - Flows might be overestimated depending on the markers used (e.g., Rio markers).

- **Further research**
  - Development of a FSAM database (a task of high complexity) could help the research community.
Thank you!

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References


