Climate finance and investment allocation in a CGE model

Rafael Garaffa1,*, Angelo Gurgel2, Bruno Cunha3, André Luenea4, Alexandre Sziklo5 and Roberto Schaeffer6

1 Energy Planning Program, Graduate School of Engineering, Universidade Federal do Rio de Janeiro (COPPE/UFRJ), Brazil
2 São Paulo School of Economics, Fundação Getúlio Vargas (EESP/FGV), Brazil
*Corresponding author: rgaraffa@ppe.ufrj.br

1. Background

- Climate finance (CF) can be regarded as an opportunity to address sustainability, change development patterns towards long-term green growth, avoiding a lock-in of carbon intensive infrastructures.
- In 2015/2016: an avg of US$410 bn was disbursed as CF (Buchner et al., 2017). By 2035: investment required to meet credible emissions framework could reach up to US$535 tn (OECD, 2017).

2. Question / Literature gap

- Can climate finance induce productivity shocks in developing countries under constrained GHG emission scenarios?
- Missing links between the real and the monetary sides of the economy in CGE models.

3. Methods

- TEA (Total Economy Assessment) is a CGE model based on the MIT EPPA6 and on GTAPinGAMS, tracking the global economy (18 regions and 16 sectors) in a dynamic recursive setup.
- Capital stock evolves at each period with the formation of new capital, depending on the investment level in that period and the capital depreciation rate, as shown in Equation: \( K_{t+1} = (1 − δ)K_t + I_t \)
- We setup a global carbon market and then simulate it under two carbon budget scenarios: 2°C (1,000 GtCO2) and 1.5°C (400 GtCO2), without regional carbon budget allocation.

4. Data

- CTAP9 database and Climate Policy Initiative – CPI reports
- UNFCCC Submitted Biennial Update Reports
- OECD Stats for ODA, OOF and private flows by country and region

5. Flows

- Figure 1. Capital flows and climate finance estimate (in 2011 USD bn).

6. Stocks

- Figure 2. Capital endowments per region. Values in 2011 USD bn.
  *Source: CTAP9 database

7. Findings

- Table 1. GHG emissions, average price and total value by scenario

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Cumulative GHG emissions by 2050 (MtCO2eq)</th>
<th>Avp Price (USD/MtCO2eq)</th>
<th>Total Value (2050 USD bn)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.0C</td>
<td>300,374</td>
<td>127.5</td>
<td>38,283</td>
</tr>
<tr>
<td>1.5C</td>
<td>235,825</td>
<td>429.6</td>
<td>101,316</td>
</tr>
</tbody>
</table>

- Figure 3. Capital flows in REF, 2.0C and 1.5C scenarios – 2020–2050. Values in 2011 USD bn.

8. Conclusions

- Capital flows are affected under climate scenarios, particularly in the 1.5C scenario. Without budget allocation, a structural break occurs in 2050.
- Climate finance flows can induce productivity in developing economies. However, capital endowments must be examined as part of the allocative criteria debate.

9. Next steps

To decouple flows and stocks of capital, and input equations into the CGE model to represent green capital as climate finance flows.

Acknowledgments

This work was supported by the National Institute of Science and Technology for Climate Change Phase 2 under CNPq Grant 465501/2014-1, FAPESP Grant 2014/50848-9 and the National Coordination for High Level Education and Training (CAPES) Grant 16-2014. The authors also gratefully acknowledge the travel support provided by ICF / DG CLIMA.