The Macrodynamics of India's Green Transition: An RBC Perspective

19th Annual Conference on Economic Growth and Development
Indian Statistical Institute, New Delhi

Saurav Kumar and Taniya Ghosh

Indira Gandhi Institute of Development Research

December 19, 2024

Objectives

- Investigate India's environmental policy to understand macrodynamics of a green transition
  - Environmental policy based on incentivizing economic agents
  - Focus on energy sector
- Environment policy:
  - Carbon Credit Trading Scheme (CCTS)
  - Subsidy on cost of green resources
  - Indian Carbon Market (ICM)

Research Question

- Macroeconomic dynamics of transition in the presence of a CCTS guidelines
- Evolution of Indian Carbon Market
- The interplay between CCTS and the environmental protection attitude of the government and the economic agents - producers
- Role of subsidy in transition
- Is it feasible not to have an explicit carbon tax in the economy to curb impact of climate change?

Literature Review

- Fischer and Springborn 2011, Heutel 2012, Angelopoulos et al. 2010; Angelopoulos et al. 2013, Annicchiarico and Di Dio 2015: Explored effectiveness of various climate policy instruments
- Heutel 2012 and Angelopoulos et al. 2013 focus on cyclical properties of optimal emission taxes in response to economic fluctuations
- Annicchiarico and Di Dio 2015; Annicchiarico and Di Dio 2017 and Economides and Xepapadeas 2018: Environmental and monetary policies simultaneously considered then economic stability improves.

Literature Review (cont...)

- Our place: Energy sector in DSGE framework
- Tumen et al. 2016; Atalla et al. 2017; Argentiero et al. 2018: Substitution effect between energy sources and their impacts on economic dynamics and emissions.
- Dissou and Karnizova 2016: Considering an energy mix is crucial to demonstrate the dynamics of environmental regulations and welfare.
- Silva and Silva 2024: Access to renewable energy leads to substitution in presence of productivity shocks.

Literature Review: India

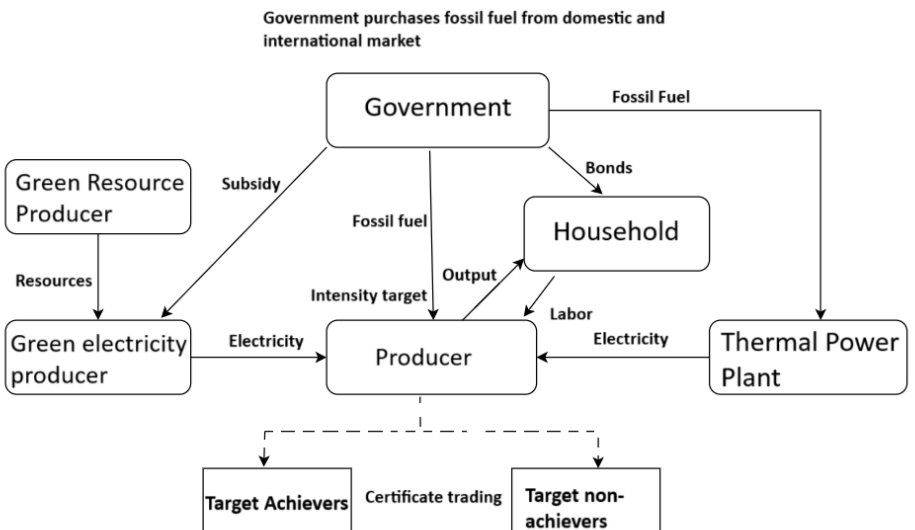
Methodology	Papers
CGE	Weitzel et al. (2014) Pradhan and Ghosh (2019) Ojha et al. (2020) Pradhan and Ghosh (2022)
NK-DSGE	RBI Monetary Policy Report (2024)

Research gap

- A CCTS framework DSGE model for India
- No carbon tax structure
  - Carbon tax: Emissions, GDP, and welfare ↓
  - If carbon pricing is permanently missing, the mitigation costs increase (Kalkuhl et al. 2013)
  - A deviation from optimal level of subsidy can lead to increased emissions (Kalkuhl et al. 2013)
- Model with thermal power plant and green electricity sector (E2-DSGE model)
  - Give a better understanding of impact of energy prices and dynamics (Silva and Silva 2024)
- Interaction between environmental policies and environmental awareness of industries

Model

- An RBC-based E-DSGE framework
  - Similar to E2-DSGE model by Silva and Silva 2024.



- ϱ proportions of the firms are achievers.

Shocks

- Intensity Target announcement shock (θ_t)
- Productivity shock in Green electricity sector (A_t^G)
- Fossil fuel price shock (p_t^o)

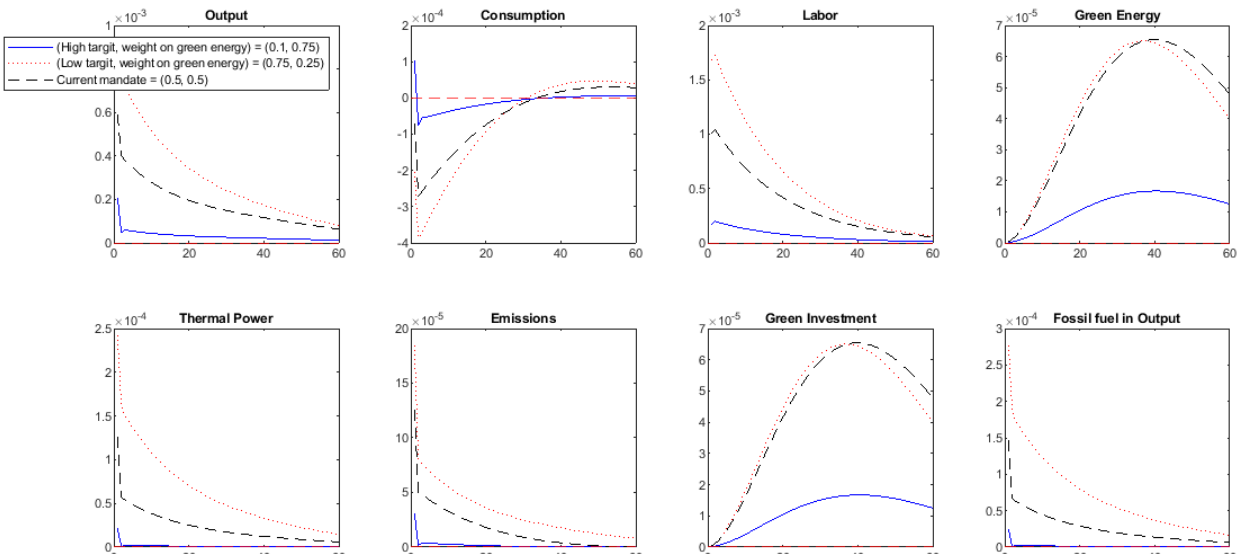
Calibration

- Parameters can be divided into three categories:
  - Standard RBC parameters (Carattini et al. 2023; Banerjee and Behera 2023)
  - Parameters related to environment externalities (Annicchiarico and Di Dio 2015; Carattini et al. 2023)

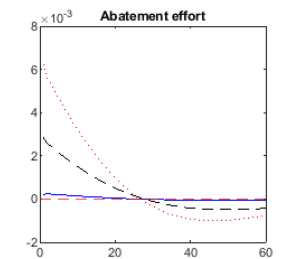
Simulations

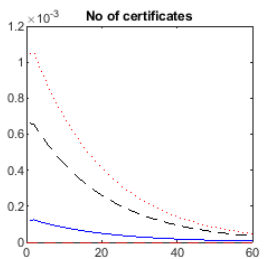
- We simulate for different cases:
  - an ambitious government and producer (ν = 10% of 2005 level, ω_2 = 0.75)
  - current ambition (ν = 50% of 2005 level, ω_2 = 0.5)
  - an unambitious government and producer (ν = 75% of 2005 level, ω_2 = 0.25)
  - an ambitious government but non-ambitious producer
  - Subsidies

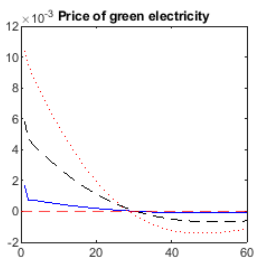
Simulations: Target announcement shock

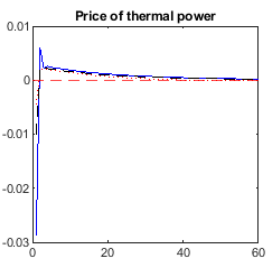


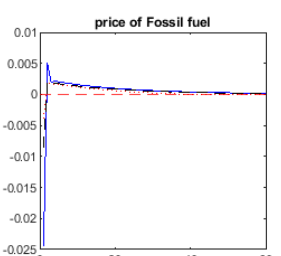
Simulations: Target announcement shock (cont...)

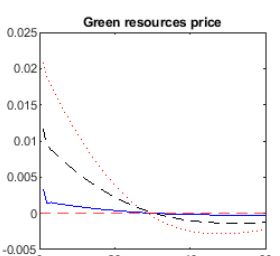


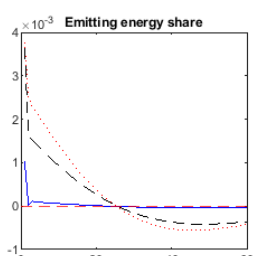








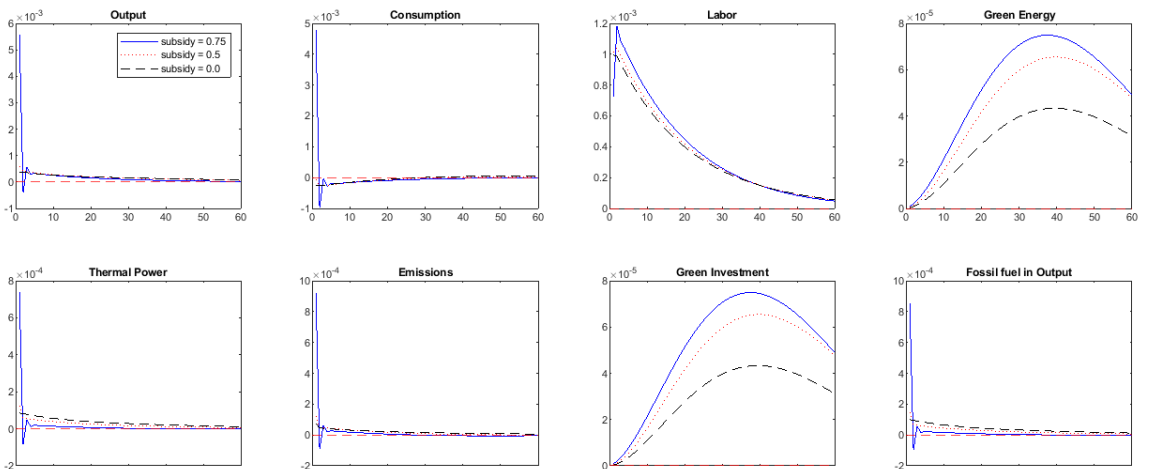




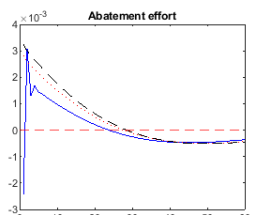
Subsidy

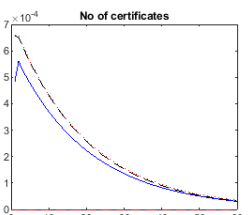
- Assess the role of subsidies in transition
- 3 different subsidies:
  - No subsidy
  - 50%
  - 75%

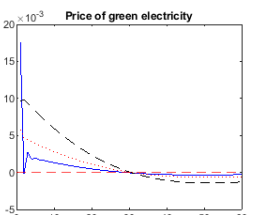
Simulations: Target announcement shock

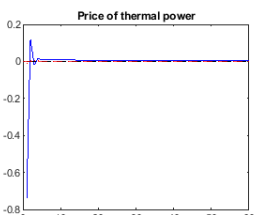


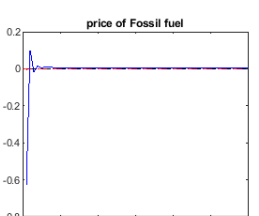
Simulations: Target announcement shock (cont...)

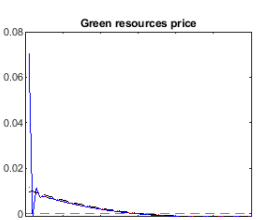


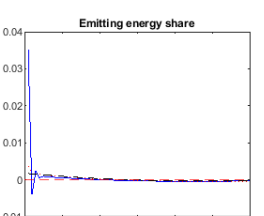












Conclusion

- CCTS would not immediately show results
- It will take around 7-10 years for emissions to stop increasing
- Ambitious government complemented by ambitious industry is better for emissions but only marginally
- Higher subsidy leads to more production of green energy
- It leads to an initial spike in emissions but then it starts reducing

Future work

- Simulate for
  - Carbon tax
  - Intensity target similar to European countries
  - Cap-and-trade
  - Welfare analysis
- Include more Indian features
- Improve calibration for Indian context

Thank You !