The Macroeconomic Dynamics of India's Green Transition within a CCTS Framework

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Overview

India has recently announced a Carbon Credit Trading Scheme (CCTS) – an intensity target-based environmental policy. This policy is different from a carbon tax and emission trading scheme. While traditional policies generate revenue for the government by taxing the emissions or selling permits, the government only acts as a regulatory authority under CCTS. The government announces an intensity target and firms need to achieve the target. The government distributes certificates to firms that surpass the target based on the difference between the announced target and the achieved target. These certificates can be traded to firms that could not achieve the target in the India Carbon Market.

We study the macrodynamics of the green transition within a CCTS framework across three scenarios: A) a government and firms with elevated environmental concerns, B) the current scenario, and C) a government and firms with diminished environmental concerns. The government's elevated environmental concerns are characterized by more rigorous targets, while firms are marked by a greater proportion of green energy consumption.

At present, CCTS only covers large emission producers. However, the power sector is not covered. The government's decision to exclude the power sector from the regulatory framework has drawn significant criticism from economists and policymakers, as this sector is a major contributor to greenhouse gas emissions. To evaluate the implications of this decision, we consider a counterfactual scenario where the power sector is included in the framework, to understand potential implications of integrating this vital sector into the policy.

To the best of our knowledge, an environment-macro model with CCTS featuring the evolution of India Carbon Market is absent in the literature. Our certificate trading process is founded on the government's proposed guidelines. This study presents multiple counterfactuals to evaluate the policy rigorously.

Methods

The paper develops an Environment – Dynamic Stochastic General Equilibrium Model calibrated with parameters derived from the Indian economy. The model features: (i) a representative household that maximizes utility. It consumes goods, energy and provides labor. (ii) Firms that produce goods using energy and labor inputs. (iii) The electricity sector produces green electricity and thermal power. Thermal power production uses fossil fuel as input and green electricity production uses green resources (similar to capital in growth models). Green resources are subsidized by the government. (iv) Green resource producer produces input for green electricity production. (v) The government announces intensity target. It distributes certificates at no cost to firms that achieve the target. These certificates can be traded in the India Carbon Market. It also purchases fossil fuels from domestic and foreign fuel markets.

We analyze our results for two shocks: a) target announcement shock, and b) fossil fuel price shock in the fuel market.

We compare our results with a carbon tax, ETS a counterfactual that covers the power sector.

Results

Under the current scenario, when the economy is subject to a positive target announcement shock, producers put a positive demand pressure on green electricity to increase their share of green consumption. This translates to higher

demand pressure on green resources. Hence, the prices increase. Since the demand for resources has increased followed by a price increase, green investors see it as an opportunity to increase their profit. Hence, green investment increases but with a lag of 2 periods. The lag period is an indication of the time taken to respond to the announcement shock. Green electricity production follows green investment. It takes time to meet the demand needs. This constraint increases the price of green electricity. The increasing demand for green electricity has a positive spillover on the demand for thermal power initially. This is due to the smoothening of power consumption. However, the rate of increment is slower than green electricity.

Industrial emissions start decreasing after ~28 periods. Green electricity prices decrease but thermal prices increase. When the government and firms have elevated environmental concerns, emissions decrease after 20 periods. A higher subsidy further accelerates the transition. Emissions do not decrease in case (C).

When the economy is subject to a positive fossil fuel price shock, it becomes expensive to consume fossil fuel or thermal power. Hence emissions decrease in all cases instantly. The price of green electricity reduces while prices of thermal power and fossil fuel increase. Since the demand for green energy cannot be met instantly with supply, the output decreases.

When the power sector is included in the framework, emissions pricing also includes the emissions due to producing electricity for household consumption. Hence, the scope increases. This leads to improve in the performance of CCTS.

Carbon tax and ETS perform better than CCTS. Both carbon tax and ETS generate revenue for the government from emission pricing. Hence, the government has more funds to work towards a green transition. For CCTS, while target achievers generate revenue, it only compensates for the expensive abatement efforts. Target non-achievers see a decrease in profit since they spend on purchasing certificates.

Conclusions

We study the macrodynamics of India's green transition within a newly introduced CCTS framework. We develop an E-DSGE model calibrated with parameters derived from the Indian economy. The model features trading in the India Carbon Market. We study the policy under various scenarios and compare it with a carbon tax, ETS, and a counterfactual that covers the power sector.

We find that fossil fuel price shock reduces the emissions after 2 periods, it comes at a cost of reduced output. This shock also leads to reduced green investment since the demand for overall energy including green electricity declines. When the economy is subject to a target announcement shock, industrial emissions take almost 7 years to reduce. This period can be reduced when the government and firms are concerned about the environment and an increased subsidy is provided for the purchase of green resources.

In our analysis, we find that including the power sector within the framework improves policy performance in terms of reduced total emissions because it also covers emissions due to household electricity consumption.

A comparison with traditional environmental policies shows that traditional policies perform better in terms of emission reduction. In the coming days, we will compare these three policies through the lens of welfare.