Submission Summary

Conference Name

44th IAEE International Conference - 2023

Paper ID

36

Paper Title

The network effects of carbon pricing

Abstract

How would implementing a price on carbon emissions affect the structure and composition of international production networks? Which sectors or countries would bear the cost of the reconfiguration of global value chains? What will be the impact on energy production and exchange? To answer these questions, we develop a multi-sector open-economy model, and run counterfactual simulations of the macroeconomic effects of three carbon pricing policies: (i) a global uniform tax; (ii) an EU-only tax; and (iii) an EU carbon border tax.

We consider an economy producing a finite number of goods used for both intermediate and final consumption. Each good is produced by a distinct productive sector, which exists in a finite number of countries trading among themselves. Firms produce goods with a CES combination of input factors and intermediate inputs. A representative household derives utility directly from consuming a bundle of differentiated goods, themselves composed of sector-specific final goods produced in all countries. Households earn revenues from labour and taxes. Tax revenues collected on carbon emissions are evenly redistributed among domestic households in a lump-sum fashion.

We then consider the introduction of a carbon tax on direct carbon emission intensities. The new set of intermediate good prices faced by a buyer reflects (i) the price increase resulting from the tax imposed on the direct emissions of sector, and (ii) the indirect price increases resulting from the taxes imposed on suppliers further up the value chain. The new price structure creates a process of adjustment of intermediate input exchanges, with firms recalibrating their purchase decisions towards relatively less expensive inputs. Households also react to changes in final good prices by adjusting their optimal consumption bundles. After introducing the tax, reallocating tax revenues and balancing the new inter-industry matrix, we derive and study the new equilibrium of the system.

We calibrate the model to the country- and sector-specific data provided by the World Input-Output Database (WIOD), and take elasticity values from the current literature on the topic.

Our preliminary results provide multiple insights on the network effects of carbon pricing:
- Introducing a global carbon tax, while helpful in decarbonising the global value chain, comes at a cost that is not equally distributed. High-polluting countries (e.g. China, Russia, Indonesia) lose up to 3% of their output, while others are positively affected from the tax because their relatively less polluting industries become more competitive on international markets (e.g. Sweden, Norway, Denmark).
- A global carbon tax affects the relative positioning of countries within the global value chain: countries most affected by carbon pricing (either directly or via their value chains) become less central in the network, while countries with relatively cleaner production gain access to more interconnected and central value chains (as measured by standard measures of network downstreamness and upstreamness).
- Decomposing the economic effect of carbon pricing, we also find that the impact of consumption choices is stronger than the impact of input substitution by firms. A key role is played by the change in demand driven by the increase in price of intermediate inputs, rather than the direct effect of the tax on the production.
- We are also able to compare the impacts of a global carbon tax with an EU-only tax. Global carbon emissions decrease by 4.4% in the first case, while an EU tax only brings about a 0.3% change. In terms of output costs, a global carbon tax leads to a global decrease in output of 1.6%, while an EU tax generates only a 0.5% decrease, mainly

concentrated in European countries.
- The introduction of an external carbon border adjustment policy in EU only partly affects other regions and redistributes the burden of policy-induced costs onto them.

Created on
8/20/2022, 4:28:10 PM

Last Modified
2/6/2023, 8:53:41 AM

Authors
Emanuele Campiglio (University of Bologna) < emanuele.campiglio@unibo.it> ✅

Primary Subject Area
Energy and the Economy