The Coalition of Finance Ministers for Climate Action

Advancing macroeconomic modeling for the energy transition: harnessing production networks models

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This contribution argues for the integration of recent advances in production networks modeling into the macroeconomic analysis of the transition to net zero by Ministries of Finance.

The primary mechanism through which decarbonization will impact the macroeconomy is sectoral shifts. As carbon-intensive sectors contract and low-carbon alternatives expand, significant reallocations of economic activity and employment can be expected throughout the economy. Traditional models that simply partition the economy into "green" and "brown" sectors fail to capture the intricate network of inter-sectoral linkages that structure modern economies. To overcome this limitation, MoFs must turn to models that incorporate detailed sectoral disaggregation, particularly in the industrial, energy, and transportation sectors, which account for most greenhouse gas emissions.

Recent advances in the modeling of economies as production networks offer a promising avenue for better understanding the macroeconomic impacts of the energy transition. Major contributions such as Baqaee and Farhi (2018, 2024), Luo and Villar (2023), Vom Lehn and Winberry (2022), and La'O and Tahbaz-Salehi (2022) have significantly expanded the tool kit available to analyze complex production networks.

Production networks models offer several key advantages that makes them particularly well-suited for analyzing the transition to net zero. They provide closed-form approximations for decomposing the welfare impacts of policy and price shocks, addressing the "black box" criticism often leveled at traditional large-scale multi-sectoral models such as computable general equilibrium (CGE) models. Further, they allow the simultaneous analysis of critical aspects of the energy transition, such as:

1. Sectoral reallocations of employment and activity
2. Inflationary impacts of carbon pricing, with sticky prices, as in Luo and Villar (2023)
3. Investment needs calculated via explicit capital dynamics, as in Vom Lehn and Winberry (2022)
4. Distributional effects along the income distribution, based on heterogeneous households, as in Baqaee and Farhi (2018).

These frontier academic models do not currently include the core components of the low-carbon transition, such as greenhouse gas emissions or energy consumption. Furthermore, their calibration need not align with the requirements of a climate policy assessment tool. Building a state-of-the-art production networks model that is directly usable by MoFs to conduct climate policy assessments would therefore require several additional features:

- A hybrid calibration that reconciles monetary national accounts with physical energy and emissions data
- Explicit modeling of the links between physical climate-relevant quantities and monetary macroeconomic aggregates
- Precise calibration at a sectoral disaggregation level compatible with energy transition scenarios produced by other Government bodies involved in the decarbonization
- Use of recent national accounts data for calibration
- A flexible calibration algorithm that allows regular updates

Integrating these features would allow the development of a new generation of macroeconomic models that offer MoFs unprecedented insights into the complex dynamics of the energy transition. This class of models would enable policymakers to better anticipate and manage the sectoral shifts, inflationary pressures, investment needs, and distributional impacts associated with decarbonization policies.

References

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