

Aggregate and Distributional Effects of a Carbon Tax

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- The global economy has been affected by a number of supply shocks in recent years
- Looking forward: green transition
 - How do we model the transmission of a carbon price tax?
 - What are the distributional effects across households and sectors?
 - How does this shape aggregate dynamics?
- Many empirical studies capture partial equilibrium or static effects
- But there are a number of opposing forces in general equilibrium
- Transitional dynamics will also matter for the outcome

Model the transitional dynamics of a permanent tax of \$100 per ton of carbon

- Multi-sector input-output structure with segmented factor markets
- Energy and capital as complementary production inputs
- Sectoral heterogeneity: tax exposure calibrated to sectoral carbon emissions, U.S. EPA
- Household heterogeneity: differences in exposure due to consumption basket, employment, share of income derived from capital versus labour
- Transitional dynamics: putty-clay model to capture increasing elasticity of energy demand to prices over time

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 - Capture (and decompose) income vs expenditure channels
 - Expenditure channel: pass-through to output prices
 - Income channel: transmission through sector of employment and households' sources of income

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 - Energy efficient capital stock is an endogenous function of carbon price tax and price of energy
 - Fall in return on capital leads to fall in investment and a change in its composition over time

Why we need to model this carefully:

- Conventional view: carbon price tax is regressive
- This paper: carbon price tax may be progressive

Results

- Carbon tax is progressive in the short run: effectively a tax on capital
- Progressive income channel outweighs regressive expenditure channel
 - Income channel: labour income falls in capital-producing rather than carbon-intensive sectors
 - Expenditure channel: less-than-one-for-one pass-through into consumer prices

Many related recent strands of literature:

- **Energy price shock:** pass-through along the supply chain (Ahlander, Carlsson and Klein, 2023; Lafrogne-Joussier, Martin and Mejean, 2023; Minton and Wheaton, 2023)
- **Household heterogeneity:** aggregate dynamics dependent on which households bear the costs
 - ... of inflation (Del Canto et al., 2023; Ampudia, Ehrmann and Strasser, 2024; Pallotti et al., 2023)
 - ... of the energy price shock (Auclert et al., 2023; Gnocato, 2023; Pieroni, 2023; Chan, Diz and Kanngiesser, 2024; Peersman and Wauters, 2024)
- **Structural change**
 - Climate transition not necessarily inflationary (Del Negro, di Giovanni and Dogra, 2023)
 - Globalization may not have been deflationary (Roberts, 2006; Sbordone, 2008; Attinasi and Balatti, 2021)
 - Trade fragmentation may not necessarily be inflationary (Ambrosino, Chan and Tenreyro, 2024)

- The carbon tax is assumed to be permanent and immediate – this paper studies the transitional dynamics.
- A permanent increase in the carbon tax leads to a strong incentive to invest in energy efficient machines, leading to more energy efficient energy stock.
- How might these dynamics play out if the tax takes place further in the future? (Ferrari and Landi Nispi, 2024)
- How do the strength of the various channels change if the tax takes place via a gradual ratcheting up in prices rather than a one-off change in the level?

- Embed financial accelerator mechanism (Gertler and Karadi, 2011) to study macroprudential implications
 - Gelain and Lorusso (2022) do this for an oil price shock:
 - An increase in carbon price tax leads to a fall in production
 - This leads to a fall in investment, lower demand for capital, and a fall in the price of capital ("stranded" assets)
 - If asset side of banks' balance sheet is evaluated at the price of capital, a deterioration in their financial position can disrupt borrowing and lending.
 - This raises firms' borrowing costs through an increase in the credit spread.
 - Firms reduce demand for capital even further and invest less, thereby amplifying the fall in economic activity.
- Effect of higher energy costs is large, despite small size of energy as a share of production.
- Gradual ratcheting up of carbon tax may be enough to induce financial instability.

- Robustness: variations in how production is nested (energy, labor, capital)
- Policy implications: given the importance of distributional effects for aggregate dynamics, how should tax revenues be rebated?

- Very rich model, insightful on a highly topical issue
- Wide-ranging applications: pass-through of recent supply shocks, deglobalisation/fragmentation

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