The economic consequences of putting a price on carbon

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Overview

The looming climate crisis is one of the greatest challenges in the history of mankind. Fighting climate change has proved very difficult because of the pervasive externalities involved. There is a consensus among economists that putting a price on carbon emissions is the most effective way to mitigate climate change. While it has proved to be very difficult to make progress at a global level, several countries have enacted national carbon pricing policies either via carbon taxes or cap and trade systems. Yet, little is known about the economic effects of such policies -- information that is crucial for policy design and calibration. This paper aims to contribute filling this gap. I propose a novel approach to estimate the dynamic causal effects of a carbon policy shock, exploiting institutional features of the European carbon market and high-frequency data.

Methods

The European Union Emissions Trading System (EU ETS) is the largest and oldest carbon market in the world, accounting for around 40 percent of the EU's greenhouse gas (GHG) emissions. The market was established in phases and the regulations have been updated continuously. Following an event study approach, I have collected 113 regulatory update events concerning the supply of emission allowances. By measuring the change in the carbon futures price in a tight window around the regulatory news, I am able to isolate a series of carbon policy surprises. Reverse causality can be plausibly ruled out as economic conditions are known and priced by the market prior to the regulatory news and unlikely to change within the tight window.

Using the surprise series as an external instrument allows me to identify a structural carbon policy shock. To estimate the dynamic causal effects I employ both an efficient SVAR-IV estimator and an LP-IV approach, which relies on somewhat weaker assumptions.

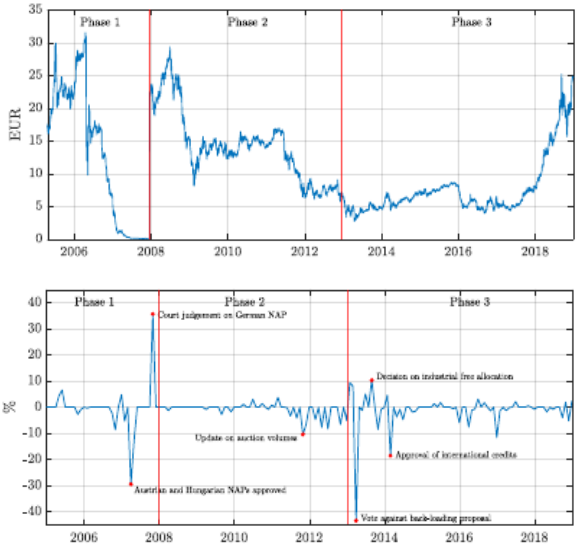

Figure 1: The carbon price and the carbon policy surprise series

Results

I find that carbon pricing has significant effects on emissions and the economy. A carbon policy shock tightening the carbon pricing regime causes a strong, immediate increase in energy prices and a persistent fall in overall GHG emissions. Thus, carbon pricing appears to be successful in reducing emissions. However, the fall in emissions does not come without cost. Consumer prices rise significantly and economic activity falls which is reflected in lower output and higher unemployment. Interestingly, the fall in activity appears to be somewhat less persistent than the fall in emissions. This is also reflected in the stock market response, which displays a significant fall in stock prices for about one and a half years but then rebounds and turns even positive after. The shock also leads to a real depreciation of the euro, which in turn causes a significant decline in imports. While the shock leads to somewhat heightened financial uncertainty and a short-term deterioration of financial conditions, the main transmission channel appears to work through higher carbon prices,

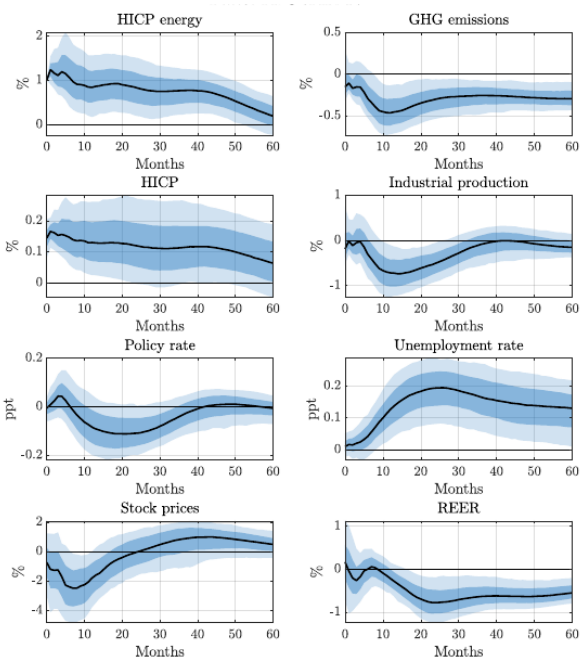

Figure 2: Impulse responses to carbon policy shock

which passing through energy prices lead to lower consumption and investment. Reassuringly, the SVAR-IV and LP-IV approaches produce, at least qualitatively, consistent results.

Carbon policy shocks have also contributed meaningfully to historical variations in energy prices and emissions. At the one year horizon, they account for over a third of the variations in energy prices and for a quarter of the variations in emissions. They also explain a non-negligible share of the variations in macroeconomic and financial variables. Looking at the historical decomposition, we can also see that carbon policy shocks played an important role in many historical episodes but importantly, they do not account for the fall in emissions associated with the economic downturn following the global financial crisis -- supporting the validity of the identified shock.

My results illustrate that carbon pricing is successful in reducing emissions and thus the future costs of climate change which, however, comes at the cost of lower economic activity today. Importantly, these costs are not equally distributed across society. Using detailed household-level data, I document pervasive heterogeneity in the expenditure response to carbon policy shocks. While the expenditure of higher-income households only falls marginally, low-income households reduce their expenditure significantly and persistently. These households are more hardly affected in two ways. First, they spend a larger share of their disposable income on energy and thus the higher energy bill leaves significantly less resources for other expenditures. Second, they also experience the largest fall in income, as they tend to work in sectors that are more exposed to carbon pricing. In contrast, the fall in earnings for high-income households gets partially offset by an increase in their financial income. These findings suggest that targeted fiscal policies could be an effective way to reduce the economic costs of carbon pricing. To the extent that energy demand is inelastic, which turns out to be the case especially for poorer households, this should not compromise the reductions in emissions.

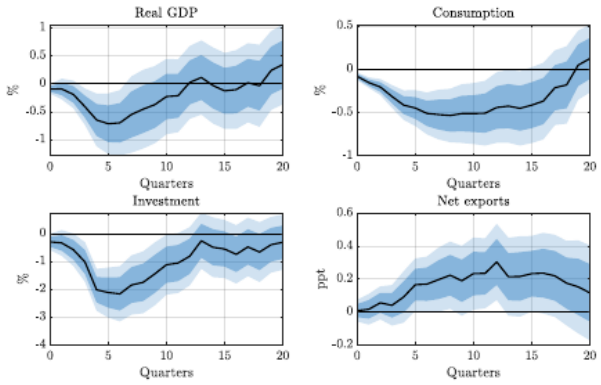

Figure 4: Effects on GDP and components

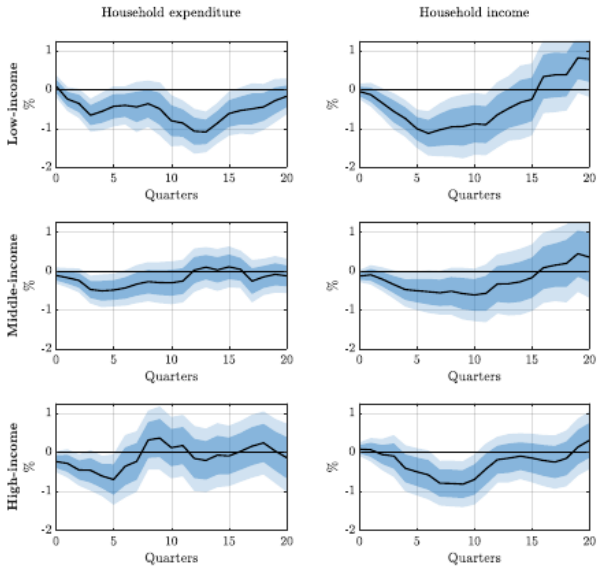

Figure 3: Household expenditure and income by income group

Conclusions

Fighting climate change is one of the greatest challenges of our time. While it has proved to be very difficult to make progress at the global level, several national carbon pricing policies have been put in place. However, still little is known about the effects of these policies on emissions and the economy. This paper provides new evidence on the effects of carbon pricing, exploiting institutional features of the European carbon market and high-frequency data. I show that tightening the carbon pricing regime leads to a persistent fall in emissions and a significant increase in energy prices. The fall in emissions comes at the cost of temporarily lower economic activity. The results point to a strong transmission mechanism working through energy prices leading to lower consumption and investment. Importantly, these economic costs are not borne equally across society. Lower-income households lower their consumption significantly and are driving the aggregate response while richer households are hardly affected. Thus, re-distributing some of the auction revenues to the most affected groups in society may be an effective way to reduce the economic costs of carbon pricing.