Macroeconomic effects of carbon-intensive energy price changes: A model comparison

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The transition to a green economy, while essential for addressing climate change, poses significant challenges for central banks. Carbon-intensive energy price changes, whether driven by market forces or climate policies, can disrupt inflation and economic growth, complicating monetary policy objectives. This paper investigates the macroeconomic effects of such price changes, focusing on temporary and permanent shocks, and evaluates the role of monetary policy in mitigating their impacts. Using a comparative approach, the study examines results from six advanced multi-sector macroeconomic models developed by central banks and international institutions, with a particular emphasis on the euro area and the United States.

Energy price changes significantly affect the economy

The paper argues that carbon-intensive energy price shocks have significant macroeconomic implications, particularly for inflation and output. Temporary shocks lead to short-term inflationary pressures and output contractions, while permanent shocks result in long-term structural adjustments, including lower output levels. The study highlights the critical role of monetary policy in managing these shocks, emphasizing the trade-offs between stabilizing inflation and supporting economic activity. The authors also explore the importance of sectoral dynamics, price rigidities, and expectation formation in shaping the transmission of energy price shocks.

Temporary Energy Price Shocks

Temporary increases in carbon-intensive energy prices are inflationary, with the euro area experiencing a stronger impact than the United States due to differences in energy dependency and production structures. Inflation peaks at around 2 percentage points in the euro area, while output contracts by approximately 0.3%. Monetary policy responses, such as interest rate hikes, are necessary but insufficient to fully offset the inflationary effects. The timing of inflation peaks varies across models, with some showing immediate impacts and others a more gradual build-up.

Permanent Energy Price Shocks

Permanent energy price increases lead to long-term declines in output and consumption, with GDP falling by about 1% after a decade. Whether the impact is inflationary or deflationary critically depends on how the monetary authority perceives and responds to the new economic equilibrium. If central banks fully account for the lower potential output, deflationary pressures may dominate. Conversely, if they provide more monetary accommodation, inflationary effects are observed. The study underscores the importance of expectation formation during the transition, as alternative

scenarios (e.g., disbelief in permanent price changes) significantly affect real economic outcomes.

Role of Monetary Policy

Different monetary policy rules – targeting headline inflation, core inflation, or average inflation – yield similar outcomes for inflation and output in the case of temporary shocks. However, the degree of interest rate adjustments varies, with average inflation targeting requiring more persistent rate increases. For permanent shocks, targeting core inflation results in tighter monetary policy and greater inflationary effects, as central banks do not react to direct energy price impacts.

Sectoral Dynamics and Price Rigidities

The transmission of energy price shocks depends on sectoral linkages and price rigidities. High-emission sectors with flexible prices pass on costs quickly, amplifying inflationary pressures. Conversely, sectors with stickier prices absorb costs longer, moderating the impact. The input-output structure of economies also plays a crucial role, with countries more reliant on carbon-intensive sectors experiencing stronger macroeconomic effects.

Cross-Country Differences

The euro area, United States, and Chile exhibit varying exposures to energy price shocks due to differences in energy consumption patterns, production structures, and sectoral dependencies. For instance, Chile's reliance on mining amplifies the impact of energy price changes, leading to higher inflation and output losses compared to advanced economies.

Conclusions

This study provides valuable insights into the macroeconomic effects of carbon-intensive energy price changes and the challenges they pose for monetary policy. Temporary shocks are inflationary and require swift policy responses, while permanent shocks necessitate careful management of expectations and structural adjustments. The findings highlight the importance of incorporating sectoral interdependencies into dynamic macroeconomic models to better understand the transmission of energy price shocks. Policymakers must balance the trade-offs between stabilizing inflation and supporting economic activity, particularly during the green transition. Future research should explore the implications of green energy price shocks and the role of fiscal policies in complementing monetary policy efforts.

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