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Climate actions, market beliefs, and monetary policy

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Our research explores the role of uncertainty, expectations, and monetary policy in shaping economic outcomes during a transition to a green economy, implemented via a cap-and-trade or a carbon tax. We show that, when the economy is perturbed by shocks and agents are not fully rational, there is more uncertainty on the time path, the effectiveness, and the impact of climate policies. In this context, achieving emission reduction targets under a carbon tax takes longer than in a model with perfect rationality, while a cap-and-trade system leads to higher volatility in permit prices and inflation and may pose serious risks to price stability. Challenges are further magnified by delays in climate policy implementation, reduced trust in central banks' inflation control, and monetary policies based more on expectations rather than fundamentals. However, we show that a reactive and credible monetary policy can tame market sentiments and ensure a stable macro environment for the implementation of climate actions.

Introduction

The impact of climate policies on macroeconomic stability is a pivotal issue in current policy discussions. Although there is widespread agreement on the necessity of policy measures to achieve climate goals, the short-to-medium-term macroeconomic consequences of climate policies remain unclear. However, we can expect that these policies will influence the environment in which central banks operate and, thus, the conduct of monetary policy.

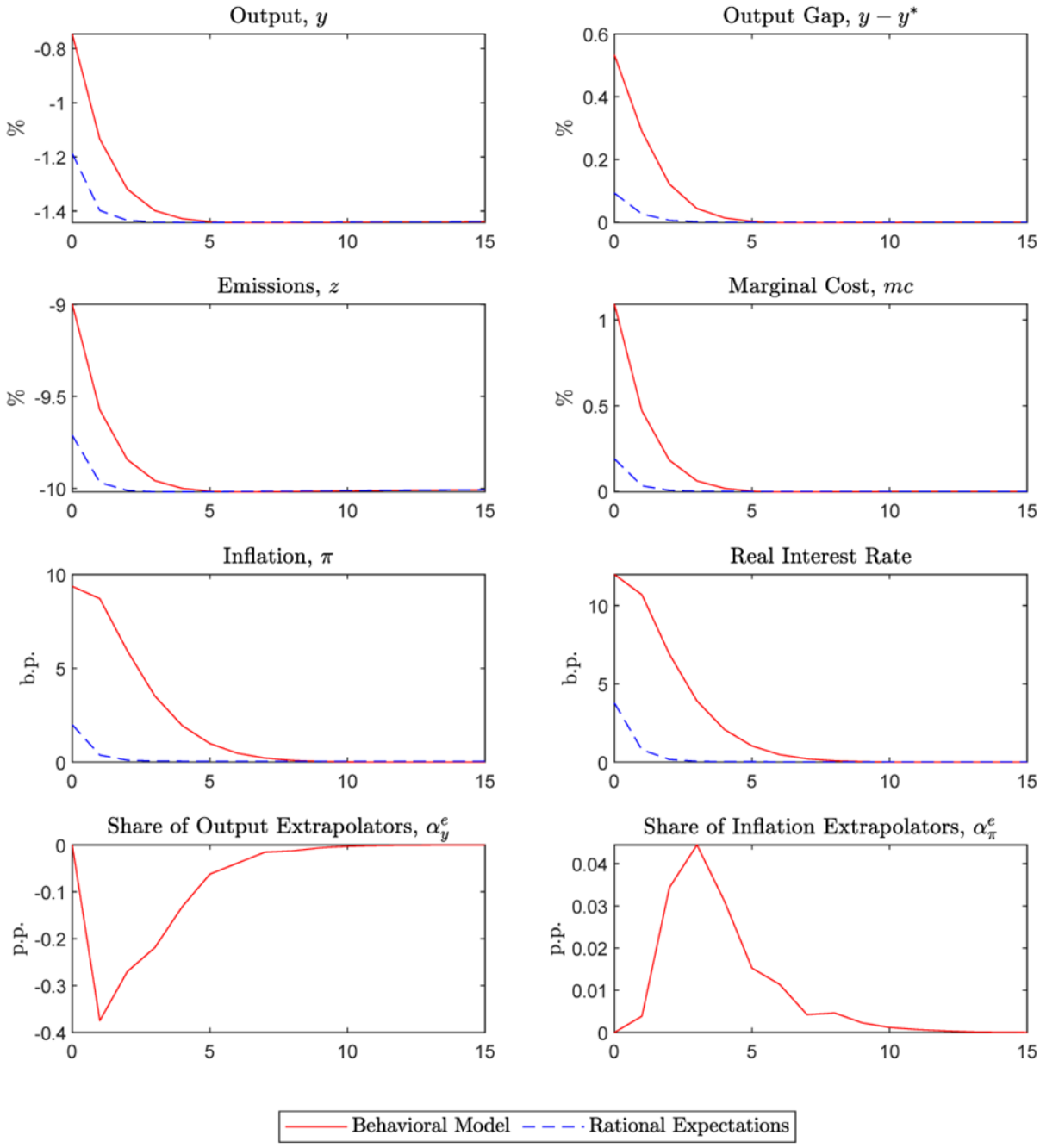
Our study, presented in Annicchiarico et al. (2024), explores the role of monetary policy in the face of climate actions focusing on the challenges posed by short-term uncertainty and the imperfect rationality of economic agents. Our analysis underscores the importance of central banks' stabilization policies, which, by anchoring expectations and dampening the severity of business cycle fluctuations, can also reduce the uncertainty surrounding the transition to a green economy and mitigate short-term adverse macroeconomic effects of climate policies.

The transmission of climate policy: the role of bounded rationality

There is substantial literature, based on survey data, rejecting the rational expectations hypothesis and emphasizing the heterogeneity of private sector forecasts of macroeconomic variables. The presence of agents that are heterogeneous and which may change the way in which they formulate expectations proves relevant when it comes to the macroeconomic impact of carbon pricing policies. Via the expectation channel, these agents shape the economy’s reaction to mitigation policies and may facilitate or hamper the transition to a green economy, based on their forecast of future economic variables.

Figure 1 compares the reaction of the economy to a carbon tax shock under rational expectations (dashed blue line) and behavioral expectations (continuous red line). Behavioral agents follow heuristics rules to forecast future output and inflation as in De Grauwe (2011) and can switch from one rule to another based on their past forecasting performances (see Brock and Hommes, 1997).

Figure 1: Increase in the carbon price under rational and behavioral expectations



Note: the figure plots the response of the economy to a permanent increase in the carbon price aimed at permanently reducing emissions by 10%. All variables in % deviations from their respective business-as-usual value, with the exceptions of the inflation and the real interest rate, expressed in quarterly basis points (b.p.) deviations, and the shares of extrapolators, expressed in percentage points (p.p.) deviations. Extrapolators in this model are backward-looking agents.

We assume emissions in the model are equal to the amount of fossil resources used in production. The carbon tax entails an increase in the cost of these resources and therefore in marginal costs. This, in turn, leads to an increase in inflation and a decrease in output. The output gap is positive: price rigidities dampen the decrease of output which falls less than in the case of a fully flexible price economy. The increase in inflation leads the central bank to raise the nominal interest rate more than proportionally to bring inflation back to its target.

In this context, we can see how expectations shape the behavior of the main macro variables and the adjustment process toward a new steady state. We observe that under the same policy stringency, in the presence of bounded rationality, the time required to achieve the mitigation target almost doubles compared to the rational expectations case. This is due to the fact that aggregate demand is higher in the behavioral model. Under the rational expectations hypothesis, agents can fully internalize the effects of the policy and are aware that the carbon tax, by permanently changing the supply-side conditions, will affect their permanent income, therefore, they react immediately by reducing consumption. The recessionary effects of the policy materialize immediately and this explains the strongest decline in output observed under this scenario. In the behavioral model, instead, the reaction is driven by "extrapolator" agents who are backward-looking and initially perceive the carbon tax as a temporary shock. As a result, these agents adjust their consumption choices more gradually, sustaining aggregate demand and production during the mitigation period and slowing down the transition toward a greener economy. The adjustment of real macroeconomic variables takes longer than in the rational expectation model and inflation remains above the target more persistently. Progressively, households start realizing that the shock is permanent, the share of extrapolators decreases over time, and the economy reaches a new steady state.

In this experiment, we have focused only on the role of bounded rationality and we have not considered the role of uncertainty (business cycle shocks): we have assumed that the economy was in its steady-state equilibrium when the carbon pricing shock arrived. However, the way in which agents perceive the policy and the reaction of the economy might also depend on the phase of the business cycle in which we are when the climate policy is implemented.

The transmission of climate policy: the role of market beliefs

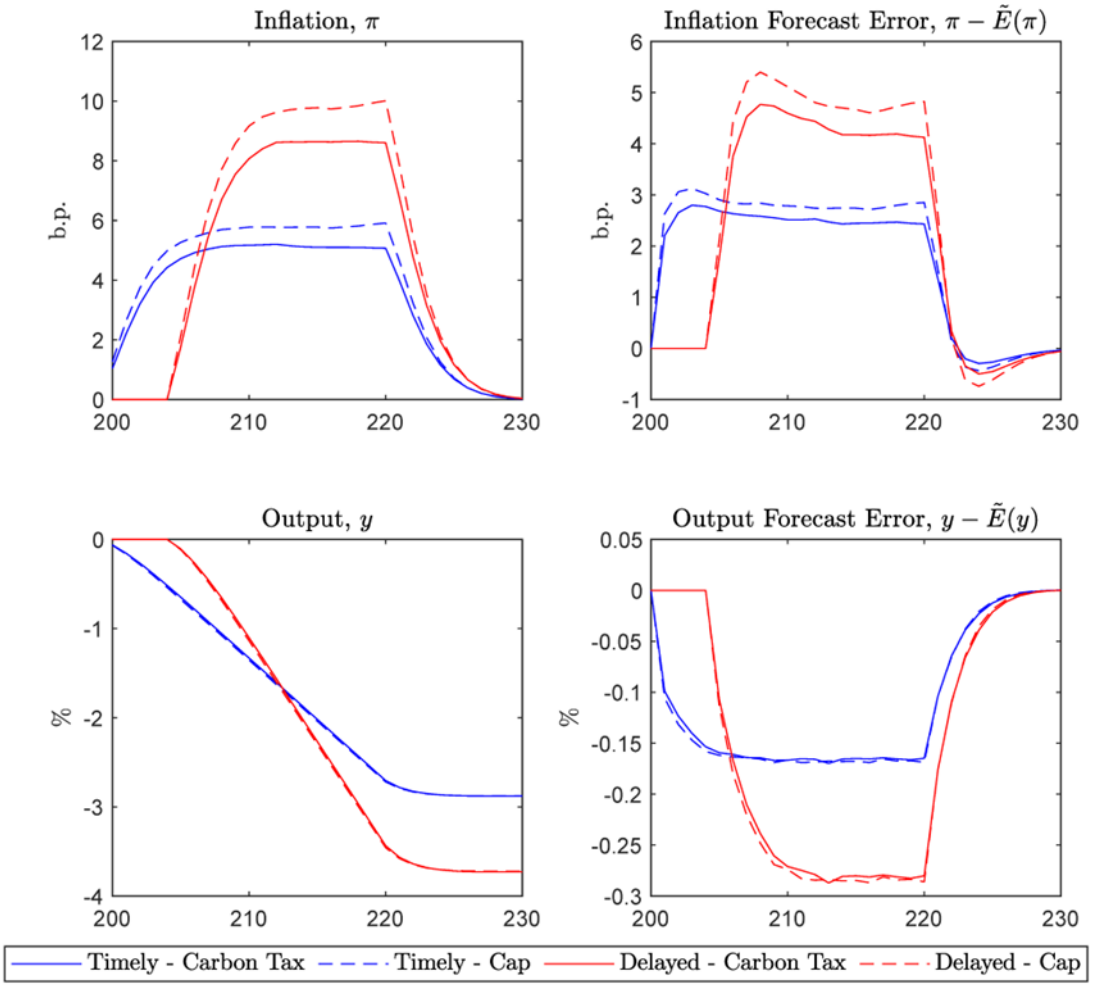
The strength of the expectation channel is magnified when we consider the interplay between expectations and business cycle fluctuations. Bounded rationality, combined with business cycle shocks, in fact, can lead to waves of optimism and pessimism (known as *market beliefs*) exacerbating fluctuations and making the adjustment process during transition not only slower, but highly unpredictable.

To study the role of market beliefs, we consider a mitigation policy implemented through a gradual increase in the carbon tax, or a decrease in the carbon allowances, able to generate a reduction in emissions by 20% in 5 years in a rational expectations economy. The mitigation scenario is in line with the emission reduction targets set by the United States for 2030. In this case, we analyze the effects of carbon pricing conditional on the initial state of the economy: the economy is off the steady state when the carbon pricing policy is implemented and can be in any phase of the cycle. The range of variation in the dynamic response to the climate policy in this case is driven endogenously by self-fulfilling movements of optimism and pessimism.

When comparing the two carbon pricing policies along the mitigation path considered, we find that, by introducing more uncertainty on emission prices and marginal costs, a cap-and-trade scheme delivers higher inflation and higher volatility in the inflation response than a carbon tax. Maintaining price stability looks more challenging under a quantity restriction.

In Figure 2 we also consider a delayed scenario in which the greening policy is introduced one year later. For comparability, we design this scenario so that after 20 quarters the amount of cumulative emission variation is as in the timely case. We show the inflation and the output dynamics, along with their market forecast errors. As expected, a delayed mitigation injects further uncertainty in the economy and increases overall volatility and inflationary pressure. The forecast errors for both variables are larger in the delayed scenario and the inflationary pressure is stronger.

Figure 2: Mitigation scenarios - Macroeconomic dynamics and market forecast errors



Note: the figure plots the mean response of the economy to different mitigation scenarios entailing the same cumulative emissions after 20 quarters in the deterministic counterparts. Inflation and its forecast errors are expressed in quarterly basis points (b.p.) deviations, while output and its forecast errors are in percentage deviations.

The role of monetary policy

Can monetary policy reduce the uncertainty in the economy's response to climate policy? We consider our baseline timely mitigation scenarios and study what happens under a different reactivity of the Taylor rule, different monetary rules, and in the case of a lack of credibility on the ability of the central bank to control inflation.

We find that a more vigorous monetary policy response to output gap or inflation deviations from the target allows to partially correct market beliefs and leads the economy to converge faster to its new long-run equilibrium. Along the same lines, we also find that a high degree of inertia in the Taylor rule delivers higher uncertainty because monetary policy cannot stabilize the economy in response to current economic conditions and this can induce a non-trivial delay in the time needed to reach emissions reduction targets. When monetary policy rules are tied to expectations instead of fundamentals the volatility strongly increases since monetary policy, instead of limiting divergent behavioral dynamics around the mitigation path, somehow validates the 'wrong' expectations that partially ignore the ongoing structural change. Finally, we find that concerns about price stability become severe when agents start casting doubt on the ability of central banks to bring inflation back to target (i.e. there is a de-anchoring of expectations).

Conclusions

Bounded rationality and behavioral biases, coupled with business cycle fluctuations, can prevent agents from fully internalizing the impact of climate policies, conditioning the policy effectiveness and the achievement of climate targets. In this context, active monetary policy can anchor expectations and support the greening process of the economy.

Put another way, conventional monetary policy can work alongside climate policy, reducing the uncertainty surrounding mitigation strategies and at the same time stabilizing both the output gap and inflation. Central banks can then support climate policies without overstretching their competencies.

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