Climate Policy and Global Challenges: A Monetary Policy Perspective

Catherine L. Mann
Bank of England

Natalie Burr
Bank of England

The physical and transition risks associated with climate change have important implications for the macroeconomic environment and are therefore relevant for consideration by central banks and monetary policy makers. This paper discusses the challenge of attaining net zero, and highlights that the choice of climate transition policies implemented by home and foreign authorities have consequences for volatility, output and inflation. Overall, however, much more research is needed to understand the full effects of climate change on the macroeconomy. This paper was prepared based on the "The World Economy: Where to from here?" session organized by Dominick Salvatore at the American Economics Association meeting on January 7, 2023.

Keywords: climate change, monetary policy, policy design

INTRODUCTION

In terms of where the world economy might be going from here, which is the topic for this panel discussion, a critical issue is the energy transition. Policies associated with this transition will need to go beyond the near-term path and volatility in energy prices associated with Russia's invasion of Ukraine. For a Central Bank, are there any implications for monetary policy from such policies promulgated for this sustained transition? In short, central banks may need to address implications from the macroeconomic environment within an economy, as well as potential spillovers across economies from the policy choices by authorities outside the sphere of central banks.

To start, it is clear that world CO2 emissions must fall to avoid the excessive rise of global temperatures: this is an existential global, societal, and policy challenge. How will this take place? Given the classic microeconomic problem of market failure, negative externalities of emissions are borne not by those emitting, but by third parties, future generations, different social classes, and different parts of the world. Only a few governments[1] across the world have put in place policies to elicit the missing price incentives through, for example, carbon prices and tradeable emissions schemes that internalise the externalities and elicit the behavioural changes by consumers, producers, and financial markets needed to achieve carbon emission reduction.

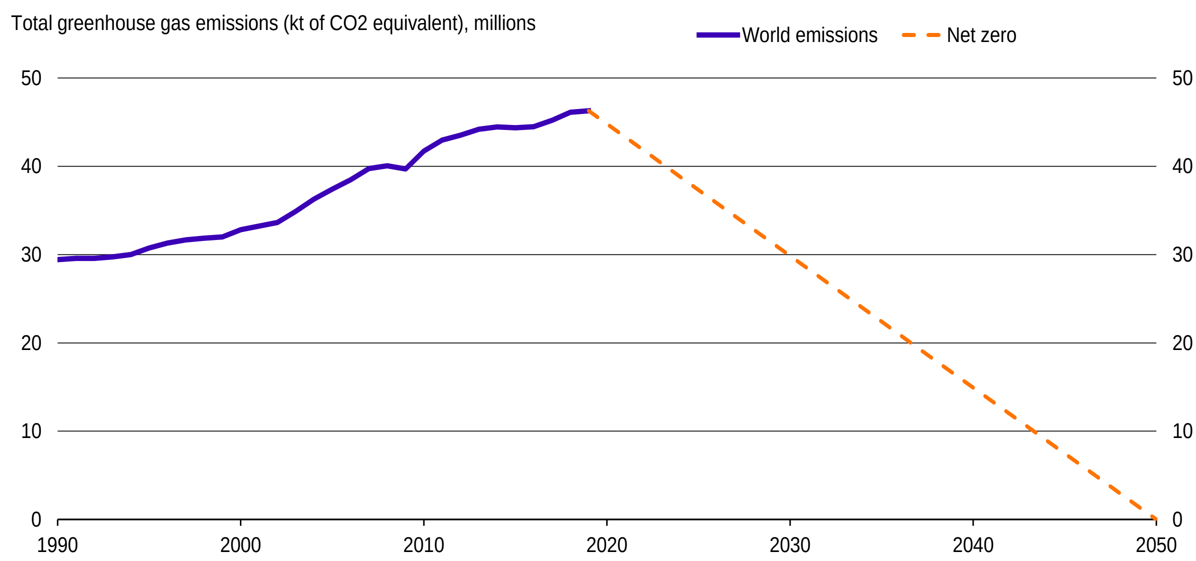
If climate change is a challenge that affects everyone, it will also affect central banks. What are the channels and will they affect central bank policy decisions? It has been well established that climate disasters heighten financial risks so central bank attention has focused on ensuring the resilience of financial institutions and the system. However, climate change and the policies chosen by governments inevitably will affect the macroeconomic environment and the monetary policy transmission mechanism to which a central bank, and in particular a monetary policy maker, will need to respond. And this is regardless of whether that central bank has a remit that includes a climate objective. In the words of Angeli et al. (2022) "the greatest contribution monetary policy can make to facilitate the transition to the green economy is to secure price stability and maintain the credibility of the monetary regime through the transition."

This note briefly outlines the global challenge of reducing emissions to net zero by 2050, and links these to macroeconomic variables a monetary policy maker cares about, such as activity and inflation. The last section discusses some recent structural research on how policy choices by governments, including importantly cross-border spillovers, are likely to be relevant for monetary policy makers, including their central concern for price stability.

THE GLOBAL CHALLENGE: NET ZERO EMISSIONS BY 2050

According to the IPCC 6th Assessment Report (2022), global temperature will stabilise when carbon dioxide emissions reach net zero. To limit the global temperature increase to 1.5°C, this means achieving net zero globally in the early 2050s; for 2°C, it is in the early 2070s. **Figure 1** shows world emissions have been climbing at a steady upwards trend relative to a steep, and rapid fall that needs to be achieved in order to limit the increase in global temperatures to 1.5°C. A big challenge!

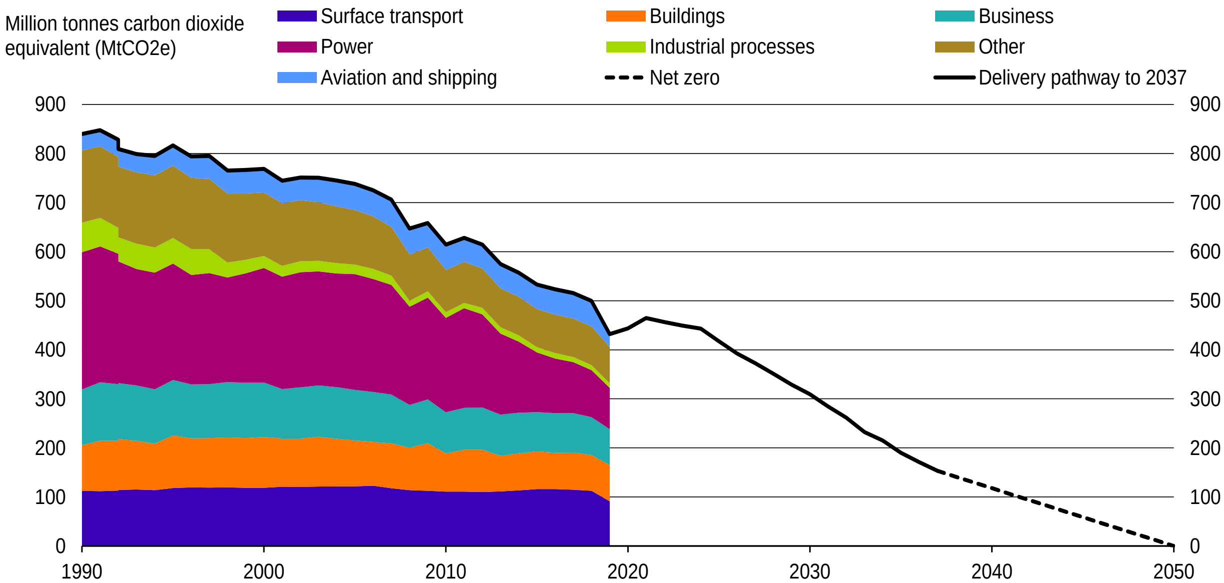
FIGURE 1
WORLD CO2 EQUIVALENT EMISSIONS



Source: World Bank (2020) and authors' calculations. Latest observation: 2019.

In somewhat more positive news, **Figure 2** shows that in the UK, emissions have been on a downward trajectory. One reason for this is likely the change in energy composition in the UK since 1990, showing a marked shift out of coal and into natural gas.[2] More potential drivers could include deindustrialisation and globalisation: the moving of energy-intensive manufacturing to other countries, as well as a shift in the UK consumption basket from goods into services.

FIGURE 2
UK CO2 EQUIVALENT EMISSIONS[3]



Source: Department for Business, Energy & Industrial Strategy and Department for Energy Security and Net Zero (2021) and authors' calculations. Latest observation: 2019.

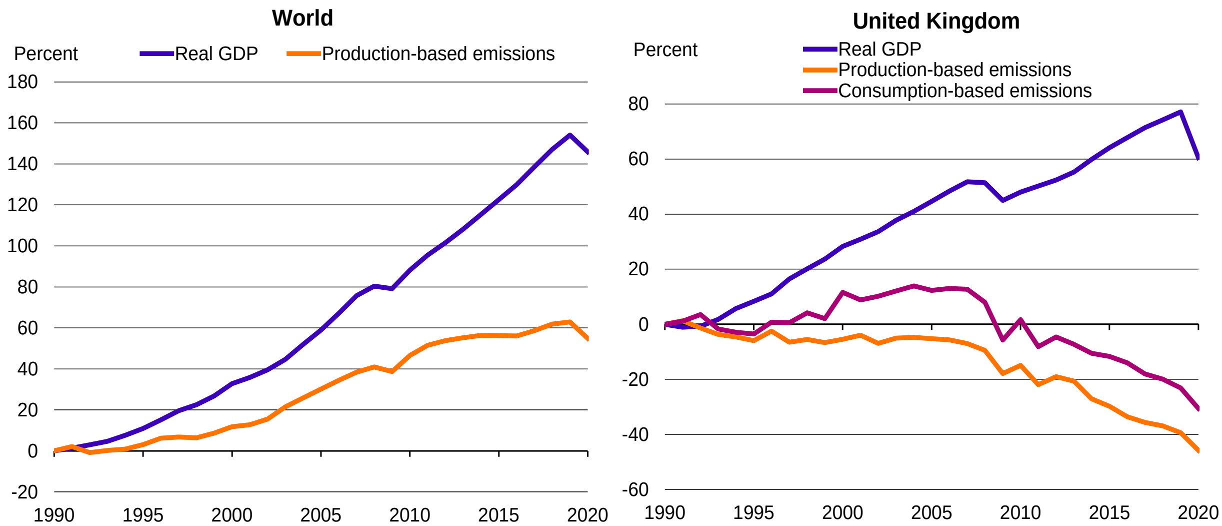
The UK is one of only a few countries to set into law the objective of achieving net zero emissions by 2050. Literature, such as de Silva and Tenreyro (2021) show that having quantifiable targets does lead to reductions in emissions, more so than those not having signed international protocols or quantifiable targets.

While setting a target is a first step, it is unlikely that the transition will occur in as smooth a fashion as displayed on the figure. Considering bumpy paths and the economics of the energy transition links the scientific problem to economics. First, internalizing the externality of carbon necessarily increases the price of carbon, which by itself feeds into inflation, as the energy price surge last year makes abundantly clear. Second, de Silva and Tenreyro (2021) find that a 1% increase in GDP per capita is associated with a 0.84% increase in emissions; so, does this imply that rising living standards and reducing emissions are incompatible? Putting one and two together, does this mean that central banks, all of which have inflation targets and some of which have explicit growth and employment goals, might be caught in the cross-hairs of climate policies?

Figure 3 shows that this need not be the case. On the one hand, at the global level, while both real GDP and emissions are growing, they are not growing at the same rate. So, in economic terms, the aim is to lower the carbon footprint for each unit of GDP per capita generated – thereby reducing the energy intensity. Further, during much of this time period, particularly the latter half, inflation was running below the 2% objective of many central banks.

For the UK, real GDP and emissions suggests that GDP can grow even as emissions fall, and not just by outsourcing carbon. Consumption-based CO2 emissions is a more accurate reflection of UK total emissions by capturing emissions created abroad for UK consumption. While consumption-based emissions have decreased by less than production-based emissions, they have still fallen while real GDP has grown, at least since the 2010s.

FIGURE 3
CUMULATIVE PERCENTAGE CHANGES IN WORLD EMISSIONS AND REAL GDP[4]



Source: Our World in Data (2022) based on Friedlingstein et al. (2022). Latest observation: 2020

THE BANK OF ENGLAND AND THE CLIMATE CHALLENGE

Regardless of whether a central bank has a mandate for climate change, the macroeconomic environment of climate change will influence their day-to-day monetary policy-making. The Bank of England has been at the forefront of advocating for awareness of the risks that climate change present, to society as a whole, to the financial system in the UK and internationally, as well as to monetary policy. The influential speech by Mark Carney, former Governor, "Breaking the Tragedy of the Horizon: climate change and financial stability" (Carney, 2015), highlighted the risks that climate change poses in particular for financial stability. A key point in that speech was that central banks across the world face this issue together, making clear there will be policy spillovers of all sorts. The Bank of England was one of the founding members of the Network for Greening the Financial System (NGFS) – a group of central banks and supervisors set up to sharing analysis, best practice and research on all matters related to climate.[5]

For the Bank of England specifically, the Monetary Policy, Financial Policy, and Prudential Regulation committee remits also include a reference to supporting the economic policies of the government. For monetary policy, this is a secondary objective, with an explicit reference to the delivering of net zero.[6] As a part of this, the Bank of England greened its corporate bond asset portfolio, to reduce its exposure to carbon-intensive industries.[7]

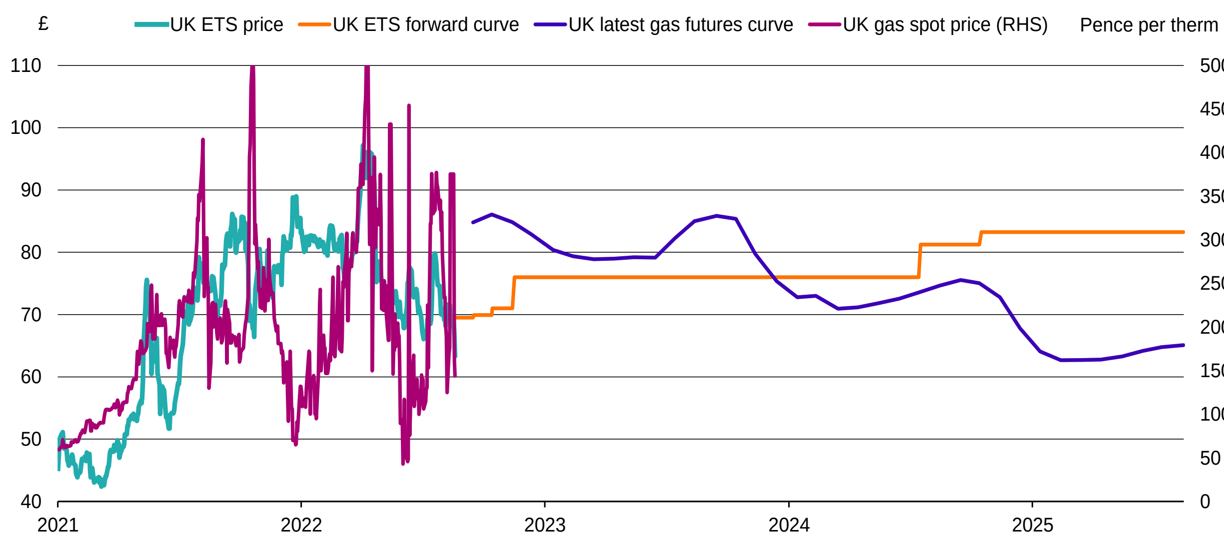
Finally, acknowledging financial sector exposure, the Bank of England undertook a stress test on climate-related risks. This aimed to assess the risks in three different policy scenarios, one with early action on the transition, one with late action, and one with no policy action to achieve net zero. These vary the degree of transition risks (high in the early scenario, but spread out, and none for the no policy actions scenario) and physical risks (particularly high in the no policy action scenario) (Bank of England, 2021b).

POLICIES THAT PROMOTE ENERGY TRANSITION WITH IMPLICATIONS FOR MONETARY POLICY

When talking about the risks of climate change, these are often split into 'physical' and 'transition' risks. Physical risks arise from both extreme weather events and from a gradual increase in the atmosphere's temperature, and transition risks arise from structural changes and policies put into effect in order to move towards a net zero economy. There are a number of different policy approaches to internalizing the externality of carbon emissions.

One policy approach is an exchange-traded system (ETS). The aim of an ETS is to establish a market value for the reduction in emissions. The UK ETS was introduced by the UK government in 2021, based on the EU ETS, at a price of £50. As a cap and trade system, some industries receive free allowances and the remaining permits can be purchased via auctions. The allowance cap has been set 5% lower than the EU ETS, and each year, the price is supposed to rise, restricting supply and thus putting upward pressure on the carbon price in order to induce the behavioural response to reduce the emission. Currently in the UK, the cap applies to energy intensive sectors, aviation, and power generation sectors. **Figure 4** shows the evolution of the UK ETS price since its inception in 2021, which has risen steadily, albeit in a time of high commodity and energy price volatility.

FIGURE 4
UK ETS AND GAS SPOT AND FUTURES PRICES



Source: Bloomberg Finance L.P., ICE and authors' calculations. Latest observation: 3rd January 2023. Notes: UK gas spot price is the one-day forward price of UK natural gas.

A different, but complementary policy is the Carbon Boarder Adjustment Mechanism, which at the time of writing, the EU has agreed to implement in a transitional phase from October 2023 (European Commission, 2022). This CBAM (essentially a tariff) would apply to goods imported from countries that do not have an ETS in place. It protects domestic firms operating under an ETS from being undercut by international competitors not subject to such regulation. Such complementarity of policies are particularly important for small open economies such as the UK – from a competition perspective. However, we could also consider the most obvious approach to internalizing the emissions externality – that is, by imposing a carbon tax.[8]

There is developing a broad-based literature that links the physical and transition risks with macroeconomic outcomes and monetary policy choices. A basic question is whether climate policies enhance or hinder growth and are or are not inflationary. The presumption has tended to be that higher prices for carbon will be both detrimental to growth and raise inflation (Moessner (2022), Känzig (2021)). However, this view has started to come under scrutiny. Conte et al. (2023) for instance find that carbon taxes can expand the economy and generate welfare gains, with a key ingredient being how carbon taxes are distributed. Del Negro et al. (2023) also finds that climate policies may generate a trade-off for central banks, between inflation and output objectives, which depends on the type of policy, and also flexibility of prices in brown and green industries respectively.

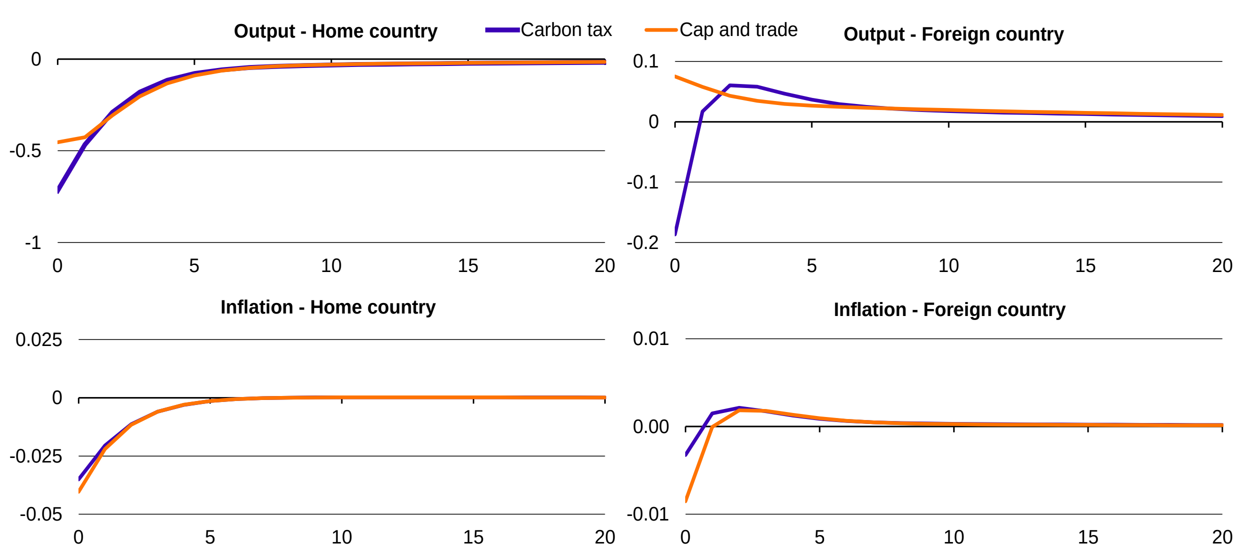
A recent deep dive into strategies towards achieving the climate transition in the UK comes from the OECD (OECD, 2022), with a more explicit consideration of alternative carbon taxes within detailed macroeconomic scenarios in Pareliussen et al. (2022). Among the conclusions of this extensive assessment is that a high carbon price significantly reduces emissions. Redistributing the revenues enhances GDP somewhat, and does not erode the reduction of carbon. The recycling strategies matter for the social, sectoral, and regional outcomes. On the other hand, inflation and interest rates are found to increase as policies to internalize carbon externalities become more stringent. So, a central bank might face a more challenging trade-off.

Two additional examples from recent research offer additional insights of interest to monetary policy makers: 1) a comparison of two different policies a government can put in place to put a price on carbon, and 2) one policy choice but implemented given two different modes of expectation formation.

The first example considers implications for monetary policy under two alternative climate policies: a cap-and-trade system versus a carbon tax (**Figure 5**). The first observation from Annicchiarico and Dilusio (2019) focuses on the home country and the inflation and output outcomes in the home country. Under the quantity-based system (cap-and-trade), output falls by less and inflation by more, given a 50-basis point monetary tightening.[9]

The second observation focuses on the spillover implications for the foreign central bank, which is not undertaking monetary policy tightening, but is affected by the carbon strategy of the home country. The intuition is the following. In the face of the contractionary shock from tighter monetary policy in the home country, firms produce and pollute less. Under cap and trade, firms demand fewer emission permits, and the permit price falls. This price decline partially alleviates the negative effects on production for the home firms. For foreign firms, however, the lower permit price is a cost reduction, which supports output even as inflation there falls. Given the same monetary policy shock by the home central bank, if a carbon tax were deployed instead, the unit cost of emission does not change, output falls in both the home and foreign country, as does inflation. One central bank action but different policy spillovers given the two alternative carbon strategies of the home country.

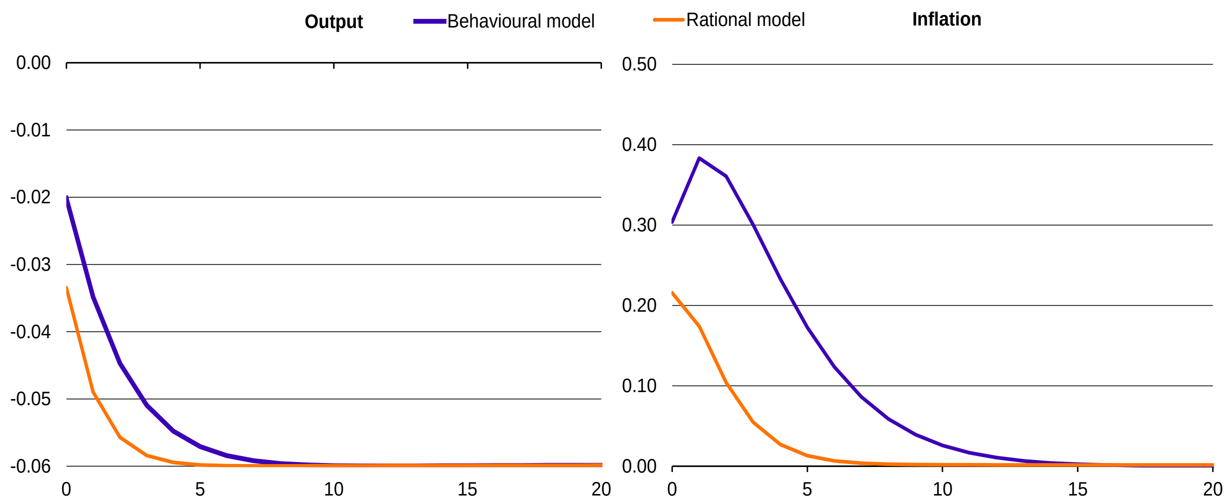
FIGURE 5
DYNAMIC RESPONSE FUNCTIONS TO A 50 BASIS POINT MONETARY POLICY SHOCK TO A HOME AND FOREIGN COUNTRY



Source: Annicchiarico and Diluiso (2019). Notes: Results are reported as percentage deviations from the initial steady state. Inflation dynamic response functions are multiplied by 100.

Another strand of the new literature addresses how the macroeconomic effects of carbon prices can differ depending on how firms set their expectations about those carbon policies. In a closed economy model, Annicchiarico et al. (2022) compare the responses of macroeconomic variables to a permanent increase in carbon prices comparing firms with rational expectations versus behavioural expectations.

FIGURE 6
RESPONSES TO A PERMANENT CARBON PRICE INCREASE AIMED AT PERMANENTLY REDUCING EMISSIONS BY 1%



Source: Annicchiarico, Di Dio and Diluiso (2022).

Figure 6 shows that in the face of a permanent increase in carbon prices, output decreases in both models and inflation rises. Rational agents fully internalise the effects of the policy, and react immediately. Emissions and production fall; so, after the jump in inflation, it returns quickly to baseline. In the behavioural model output adjustment to the higher energy prices is slower and inflation rises even more after the initial jump and also takes longer to return to target. In both cases, the monetary policy maker faces a trade-off, but it is worse in the case of behavioural expectations.

This exercise highlights the potential relationship between monetary policy makers and expectations formation. If the monetary policy maker reacts more forcefully to inflation or the output shock, and agents can be induced to be more 'rational', inflation volatility is moderated, which also helps to reduce price pressures, along with reducing the output cost. If in fact central banks could tame market sentiment, that would help support the green transition. There is increasing empirical evidence of the inter-relationship between central bank policy and expectations formation.[10]

CONCLUSION

Central bank policy cannot solve climate change. Some central banks may support their government's climate policies, depending on scope within their remit. However, all central banks will face the issue of macroeconomic effects of climate change itself, or climate change mitigation policies put in place. This may be responding to, or looking-through weather-related demand or supply shocks, as well as the macroeconomic effects due to structural shifts in the economy resulting from the transition to net zero.

The design of climate policies is particularly important when thinking about macroeconomic effects. A cap-and-trade and carbon price policy differ in terms of the volatility of outcomes. And the certainty provided to economic agents and market participants about expected policies is an important determinant of macroeconomic stability. A monetary policy maker also may face spillovers from domestic to foreign economies under different climate change policy scenarios.

Overall, much more research is needed to understand the full effects of climate change on the macroeconomy. Research on the impacts and interactions between carbon policies domestically and abroad is particularly relevant for the UK, where a government commitment to net zero in 2050 has already been made. The effect of uncertainty around climate policies, and the behaviours of agents under different scenarios is also important for monetary policy makers to understand. But it is crucial that central banks act prudently, by acting within their remit, and acting in a timely way to start building and preparing their tools for the potential consequences for physical and transition risks. In short, the dimension of economic change required to deliver a transition to net zero will undoubtedly have macroeconomic effects, and therefore falls directly within the responsibility of a monetary policy maker.

ACKNOWLEDGEMENT

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ENDNOTES

1. According to the United Nations Framework Convention on Climate Change (UNFCCC, n.d), 40 national jurisdictions currently have put a price on carbon.
2. IEA (2019) find that "since 2010, switching from coal to gas has saved 500 million tonnes in CO2 emissions. While there is a wide variation across different sources of coal and gas, an estimated 98% of gas consumed today has a lower lifecycle emissions intensity than coal […]. Coal-to-gas switching reduces emissions by 50% when producing electricity and by 33% when providing heat". According to a report by the Department for Business, Energy & Industrial Strategy and Department for Energy Security and Net Zero (2022), only 3.4% of inland energy consumption was created using coal, compared to 31.3% in 1990. This implies that there is little more scope in the UK to reduce carbon emissions through this route, and other sources of emissions reductions must now be sought.
3. Surface transport includes passenger cars, buses, motorcycles and railway. Buildings include both public and residential. Business includes industrial combustion and electricity (including iron and steel), as well as commercial combustion and electricity. Power includes power stations, refineries, gas, oil, coal and solid fuel. Industrial processes, include for instance cement, lime, aluminium, ammonia and glass production. A rising share of services in the consumption basket will be reflected in a few categories: business, industrial processes and power.
4. At the global level, production-based emissions equals consumption-based emissions.
5. For more information, see the NGFS website (NGFS, n.d).
6. The remit reads as follows: "The Act states that in relation to monetary policy, the objectives of the Bank of England shall be: a. to maintain price stability; and b. subject to that, to support the economic policy of Her Majesty's Government, including its objectives for growth and employment. The government's economic policy objective (among other things): […] supply side reforms to promote investment, skilled employment, infrastructure, and enterprise to create a more pro-growth environment in all parts of the UK, increasing long-term energy security and delivering Net Zero." For the full remit, please see HM Treasury (2022).
7. "The principles set out […] are consistent with targeting a 25% reduction in the weighted average carbon intensity (WACI) of the CBPS portfolio by 2024, and full alignment with net zero by 2050." (Bank of England, 2021a).
8. For a recent comprehensive review of different approaches to addressing carbon emissions, see OECD (2021) Attachment B Tax Policy and Climate Change.
9. This is the outcome that those familiar with tariffs vs quotas facing a demand shock would find in international trade – prices adjust more because demand adjusts less.
10. For other analyses of how monetary policy makers can influence expectation formation, with benefits to the inflation-output trade-off, see Mann (2022 and 2023) as well as Di Pace et al. (2023).

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