Carbon pricing and inflation: a dilemma?

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Executive summary

Carbon pricing will likely create inflationary pressures in the short term

- Carbon pricing influences both supply and demand, but in opposite directions.
- Due to low demand elasticity and prices flexibility, **fossilflation** will take place in the short term.
- Surging demand for cleaner energy will likely push mineral prices up, creating **greenflation**.
- Structural changes in labour markets will likely create **pressure on wages**.
- Latest research suggest that the impact on inflation is **modest**. But the overall response to inflation will **depend on the carbon pricing instrument, the level of coverage and underpinning price.**

In the long run, inflation will gradually decelerate unless we delay climate action

- Inaction is even more costly and will also generate **climateflation**.
- The inflationary impact of higher carbon prices will **lessen with time**.
- The magnitude and timing of the impact will depend on the energy mix as well as inflation expectations
- The sooner we act, the better.

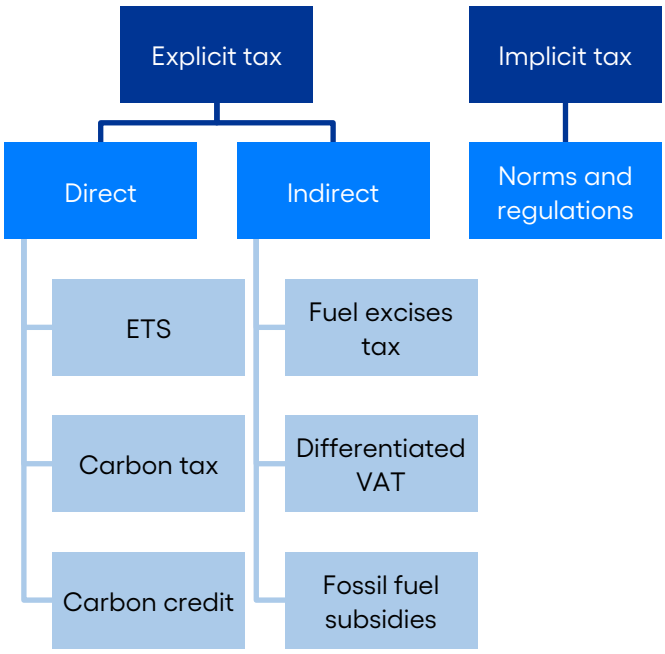
The impact on inflation could be mitigated in different ways

- Both **monetary and fiscal policies** play a crucial role in ensuring an orderly transition and tempering the negative distributional impacts on the most vulnerable businesses and households.
- In a context of high inflation, central banks grapple with the dilemma of controlling inflation or fomenting green investment. But **price stability is a pre-condition for the green transition**
- Given the varying level of acceptability, **carbon pricing will not be sufficient** to achieve climate goals. That is why it should be **implemented with sectoral and complementary policies.**

Introduction

Rising climate change concerns are putting carbon pricing in the spotlight. As the year 2023 is on course to be the warmest year on record, carbon pricing is increasingly seen as a key tool to reduce carbon emissions. A carbon price sets a signal to market participants to either reduce their emissions or pay to pollute. This allows the market to internalise the costs carbon creates on the environment such as air pollution and extreme weather events.

Many countries have already put a price on carbon, but it is still too little to mitigate the impact of climate change. Many developed countries have already put a price on carbon, reflecting growing ambition. As of March 2023, the World Bank Carbon Pricing Dashboard registered 73 carbon pricing initiatives implemented in 39 countries. Out of this total, carbon tax accounted for 37 and Emissions Trading Systems (ETS) for 36. The majority of implemented initiatives are covering developed economies, but carbon pricing initiatives are also active in developing economies such as Argentina, China, Colombia, Indonesia, Mexico, and South Africa. Direct carbon pricing, via ETS, carbon tax and carbon credit, is expanding at a faster rate than indirect carbon pricing. Despite their introduction decades ago, prices have been too low to prevent climate change, and coverage is limited to specific sectors. As a result, only 23% of greenhouse gas (GHG) emissions are covered by carbon pricing initiatives. Carbon taxes accounted for 6% of GHG.



As a result, we expected an increased interest in carbon pricing. As of March 2023, 35 new carbon pricing initiatives were already under consideration. Two-thirds of them are associated with developing economies and most of the initiatives are considering the implementation of an ETS. Concerns over climate change and the sharp reduction of fiscal space in several governments, will further push them to find additional source of revenues. ETS and carbon taxes are increasingly seen as an effective tool to raise revenue and finance the energy transition. In 2022, total carbon revenues from ETS and taxes increased by over 10% in 2022, hitting about US$95 billion (World Bank, 2023).

But, in a context of high inflation, higher carbon prices may stoke consumer prices, creating a policy dilemma. In a context of high inflation, central banks grapple with the dilemma of controlling inflation or fomenting green investment. But tightening monetary policy to bring down inflation may ultimately impede the pace of decarbonisation. Furthermore, the political feasibility of decarbonisation measures is challenging when households and businesses are already struggling with inflation.

Against this background, this report will analyse the effect of carbon pricing on inflation. It aims to answer the following questions.

- Will higher carbon prices accelerate inflation? If so, for how long?
- Is there any policy that could help to mitigate this inflationary shock?

I. Carbon pricing will create inflationary pressures in the short-term

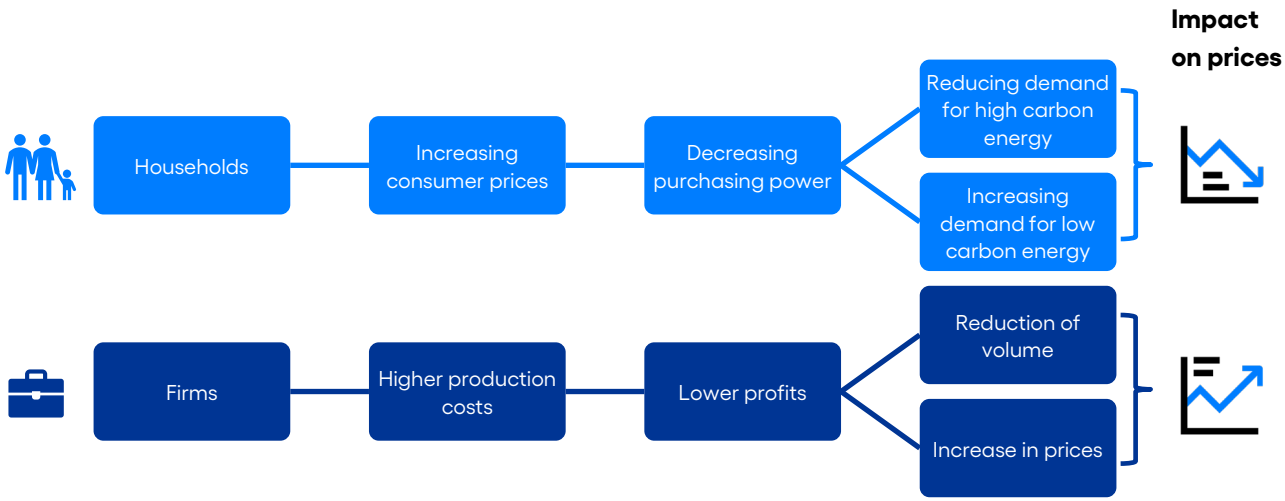
Carbon pricing translates into fossilflation by pushing up energy and electricity prices. The main objectives for carbon pricing are to capture the external cost of greenhouse gas (e.g., damages to crops, health care costs from heat waves and droughts, and loss of property from flooding), deter the use of fossil fuels and encourage substitution to cleaner energies. By increasing the price of fossil fuel energy, carbon pricing leads to higher electricity prices for economies reliant on fossil fuels.

Carbon pricing – via higher energy prices – influences both supply and demand primarily, but in opposite directions. On the supply side, the increase in production costs fuels inflation and results in lower production. If businesses anticipate this carbon price increase, they can decide whether to increase their final price or adjust their production volumes. The more firms do so when the carbon pricing policy is implemented, the stronger the inflation impact will be upfront. On the demand side, higher carbon prices negatively impact household incomes and firm profits. This in turn reduces consumption and investment, eventually creating downward pressure on inflation. So, there are two forces moving inflation in opposite directions (Figure 1).

Due to low demand elasticity and price flexibility, the inflationary impact on energy will likely prevail in the short term. Consumers – especially small- and medium-sized enterprises as well as low-income households – may find it difficult to rapidly switch to cleaner energy. In other words, their consumption of fossil fuels will change minimally in the short term. Similarly, firms will switch to cleaner energy sources only if the technology is available and affordable. If not, they will likely increase the final price of their products to offset the increase in production costs. Fabra and Reguant (2014) found that consumers felt the impact of the EU ETS through higher electricity prices. This was mainly associated with cost shocks among firms, inelastic demand, and the absence of relevant price rigidities.

In theory, higher carbon prices can have opposite effects on prices.

Figure 1. Impact of higher carbon prices on inflation

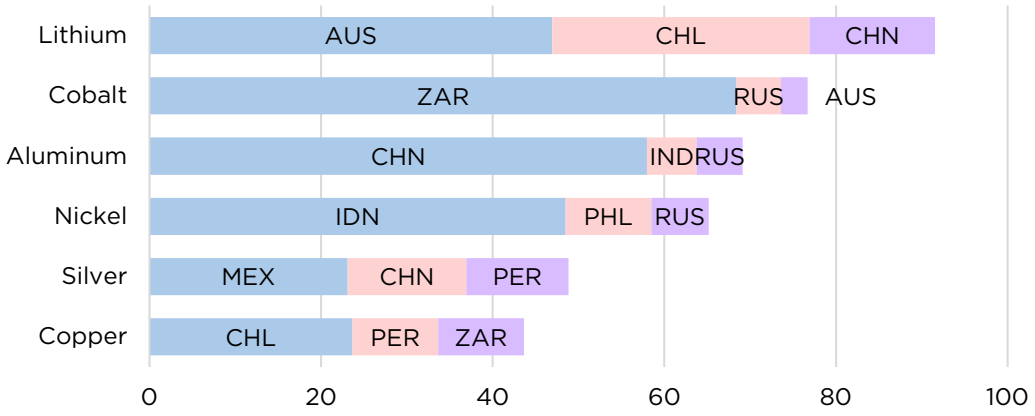


Source: ICC, Carbon pricing and inflation: a dilemma?, 2023

At the same time, surging demand for cleaner energy will likely push mineral prices up, creating greenflation. Demand for critical minerals such as lithium, aluminium, cobalt will strongly increase, while supply will not adjust at the same pace. Indeed, supply of critical minerals for the energy transition, such as lithium, cobalt, is highly concentrated in a handful of countries (Figure 2). Furthermore, the production of these minerals is a lengthy process. As a result, prices for critical minerals will probably expand quickly. Increases in fossil fuel prices and taxes will not expand the green sector in the short term but will improve the energy efficiency use. As a consequence, inflation is expected to increase at maximum in the second year from 4% to 8.6% (Airaudo, Pappa and Seoane, 2022). In fact, they already have increased: Over the past ten years, copper, aluminium, and nickel prices have gone up by 16%, 23% and 50% respectively (Figure 3). As countries race to secure lithium supplies (critical to electric vehicles batteries), lithium prices have skyrocketed and reached historical highs in 2022 (close to US$ 80 per kilogramme).

Several metals that are critical for the energy transition are concentrated in a handful of countries.

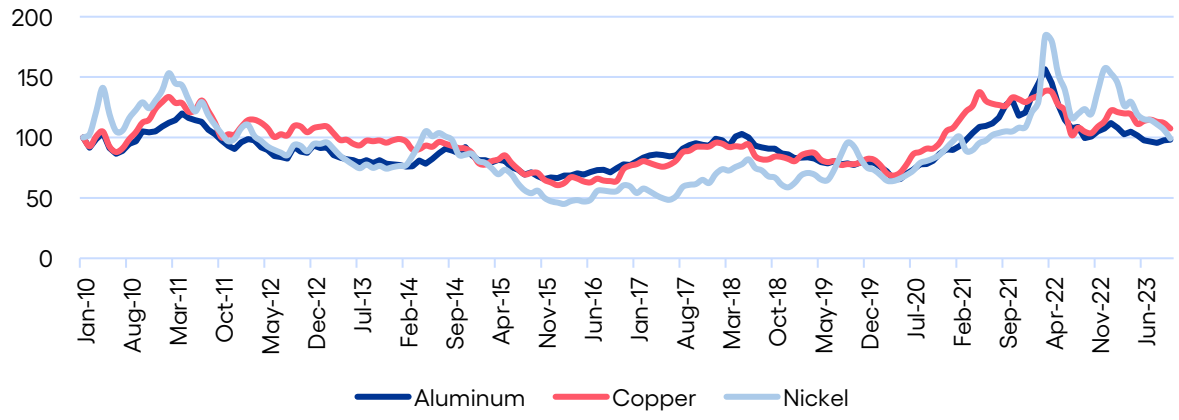
Figure 2. Share total market size, in %



***Source**: ICC calculations based on US Geological Survey, Mineral Commodities Summaries, 2022*
Note: AUS= Australia, CHL= Chile, CHN= China, ZAR= Congo, Dem. Rep., IND= India, IDN= Indonesia, MEX= Mexico, PER= Peru, PHL= The Philippines, RUS= Russia.

Greenflation is accelerating.

Figure 3. Mineral prices index, 2010=100



***Source**: ICC calculations based on World Bank Pink sheet data, 2023, accessed in November 2023*

Furthermore, the energy transition will generate structural changes in labour markets that will likely create upward pressures on wages. The effects of the green transition on the labour market are likely to be uneven across sectors and countries. The European Central Bank (ECB) differentiates the impact according to the type of jobs: green, brown, and white[1]. As the economy decarbonises, demand for skilled labour for green jobs will increase while job destruction will occur in brown sectors. However, supply of skilled labour in green sectors might be inadequate in the short term. In addition, low-carbon jobs tend to be concentrated in occupations that pay higher wages. As a result, this might create upward pressures on wages in these sectors, and potentially stoke wage-price spirals. This overall impact on inflation will depend on the size of the green sectors, the reallocation of workers and the degree of wage indexation. Active labour market programmes and skill development systems will be critical to facilitate a smooth reallocation of workers from brown to white and green sectors, bringing down wage pressures.

Overall, latest research suggests that the impact on inflation is modest. The effects of carbon pricing on inflation are moderate because the fall in the aggregate demand for goods and services mitigates the inflationary consequences of the supply shock. Konradt and Weder di Mauro (2021) found that for Europe and Canada higher carbon taxes were not inflationary and may even have been deflationary as the increase in energy prices was offset by the fall in the prices of services and other non-tradables. McKibbin et al. (2021) find for the euro area that the inflationary effects of carbon taxes on headline inflation have been contained, and that the impact on core inflation (excluding food and energy prices) tended to be negative. They concluded that carbon taxes mainly affected relative prices rather than the overall price level.

The overall response to inflation will be different according to the carbon pricing instrument, the level of coverage and underpinning price.

- **Choice of instrument:** Using data from OECD countries, Moessner (2022) found that an increase in prices of ETS by $10 per ton of CO2 equivalents increases energy Consumer Price Index (CPI) inflation by 0.8 percentage points (pp), and headline inflation by 0.1pp. A similar increase in carbon taxes will translate into an increase of food CPI inflation by 0.1pp, but has no significant effects on energy CPI inflation, headline and core CPI inflation.
- **Level of coverage:** Coverage differs substantially from country to country— for example Uruguay has implemented a carbon tax that only covers gasoline whereas Singapore's carbon tax is applied to around 80% of national GHG emissions. The more a country expands the coverage of carbon pricing, the broader its impact might be. Limited coverage will contain the inflationary impact but will also curb the effectiveness of carbon pricing policies.
- **Price level:** Similarly, a large and abrupt increase in carbon prices could cause more inflationary pressures and could lead to unwinding reforms. Against this background, the IMF is advocating for an international carbon price floor (ICPF) agreement to complement the Paris Agreement. The floor price of $25-75 per ton of carbon would be implemented by large emitters (The United States, the European Union, China, India, Canada, and United Kingdom) and would vary by level of economic development. According to PwC and the WEF (2021), the IMF proposal could reduce emissions by up to 12.3% and could address competitiveness issues by limiting carbon leakage (rather than relying on a carbon border adjustment mechanism).

[1] Green jobs that involve developing, producing or maintaining green technologies (e.g. renewables) and processes (e.g. recycling and reusing). Jobs with a low pollution intensity, but no specific green task content are identified as white jobs. Brown jobs are occupations in (sub)sectors with a high pollution or emissions intensity in process or product.

II. Carbon pricing-induced inflation will gradually decelerate in the long run, unless we delay climate action.

A. Inaction is costly and will also generate "climateflation".

Inaction is even more costly and will foment climateflation. Extreme temperatures and weather events (flood, drought) will also dramatically impact the supply and demand, fuelling inflation. For instance, the 2022 summer extreme heat in Europe increased food and headline inflation in the region by 0.7 and 0.4pp, respectively. The impacts from an equivalent extreme would be amplified by 50% under 2035 projected warming (Kotz, Kuik, Lis, and Nickel, 2023).

Insurance premiums will likely increase to incorporate additional climate risks. Catastrophes will become more frequent and more severe, making insurance critical for a quick recovery. This will also push up insurance premiums to cover infrastructure damages or destructions. In Florida, a US state where climate events happen frequently, the average annual property insurance payment was US$4,231 in 2022, nearly triple the national rate of US$1,544 (Insurance Information Institute, 2023). Property insurance rates in Florida were expected to increase by 40% in 2023.

Moreover, coverage is likely to shrink as rising premiums choke demand and insurers withdraw from particularly exposed areas. People generally underestimate the likelihood and impact of serious climate events. Furthermore, they often believe governments will compensate them for losses and that they therefore do not need their own insurance. Consequently, insurance coverage will likely decrease as insurance become more expensive.

Therefore, a growing climate insurance gap will undermine the recovery and could fuel inflation. The climate insurance gap is already significant. Indeed, in the European Union, only a quarter of the losses from climate-related disasters are covered. In some countries, it is less than 5% (ECB, 2023a). By promptly providing funds for reconstruction, insurance allows economic activities to return to pre-catastrophe levels more quickly. So, lower coverage rates can amplify the economic damage, delay the recovery efforts, and fuel inflation pressures.

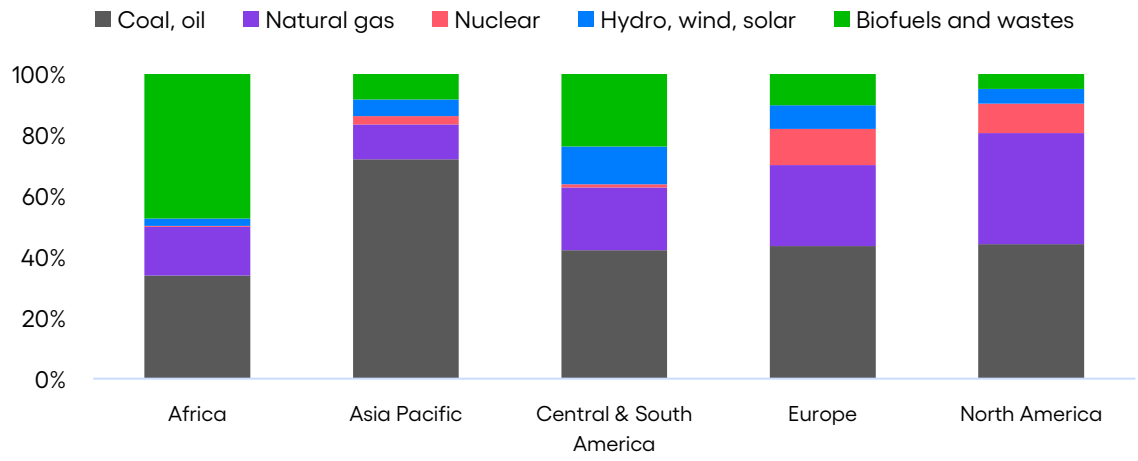
B. Inflation associated with higher carbon prices should gradually decrease.

The inflationary impact of higher carbon prices will lessen with time. By fostering substitution to less carbon-intensive energy sources, carbon pricing policies aim at gradually reducing the relative price of clean energy. McKibbin et al. (2021) find that carbon taxes in the euro area between 1985 and 2020 only had a transitory effect on inflation in the medium term (three to five years). The enactment of a €40 carbon tax with 30% emission coverage is estimated to lead to an increase in headline CPI by 0.3 points in the same year, increasing to 1 point on average over the next two years and an average increase of 0.3 points in the following three years. Since firms foresee long term increases in energy prices, they adjust their production by decreasing investment, generating a recession in the short run. This results in a surge in inflation in the short and medium run that fades away as the firms allocate more resources to efficient energy usage increasing its productivity (Airaudo, Pappa and Seoane, 2022).

The magnitude of the impact will depend on the energy mix. The extent to which firms would be prone to energy price shocks will also depend on their energy mix and level of brown energy and electricity consumption. Countries and sectors with low level of electrification and higher dependency on fossil fuels will suffer from higher carbon prices. In 2022, the share of fossil fuels in the total energy supply accounted for 70% in Europe, 80% in North America and 83% in Asia Pacific (Figure 4). This makes the region more vulnerable to higher carbon prices. Sectors such as agriculture and transportation could most likely be impacted as they will continue to rely substantially on fossil fuels, given that the electrification of certain vehicle categories is unrealistic in the short term.

Fossil fuels still account for a high share of energy supply.

Figure 4. Total energy supply by source, in % of total



***Source**: ICC elaboration based on data from the International Energy Agency, World Energy Balances, 2022, accessed in September 2023*

Inflation expectations will also influence the magnitude and timing of inflationary impact of carbon pricing. With forward-looking expectations, firms will anticipate the impact of higher carbon prices, pass it through final prices. As a result, the inflationary impact will be stronger in the first years of implementation of higher carbon prices. However, firms with backward-looking expectations will use present and past information to make a decision, potentially delaying the impact on inflation. Changes in carbon policy shocks have a sizable and positive effect on inflation expectations. As evidenced by Hensel et al. (2023), low energy-intensive firms in France have relatively overreacted to higher carbon prices between 1999 and 2019 – in comparison to high energy-intensive firms – because of higher inflation expectations. If monetary authorities become unable to anchor inflation expectations, the effectiveness of monetary policy to bring down inflation could be compromised.

The sooner we act, the better. The energy transition has already started but is not enough. According to the 2023 ECB stress test (ECB, 2023b), firms and households clearly benefit from a faster (and orderly) transition. While a speedier transition initially involves greater investment and higher energy costs, financial risks decrease significantly in the medium term. In the late-push transition, banks can expect their credit risk to rise by more than 100% by 2030 compared with 2022, while in the accelerated transition, the increase is only 60%. In addition, the faster we decarbonise the energy sector, the faster green energy providers will generate and retain economic rent that will provide a competitive advantage for first comers. The later you act, the more you will need to invest to adapt and mitigate the impact of climate change.

III. The impact on inflation could be mitigated in different ways.

A. The role of monetary policy: Ensure an orderly transition towards a greener future.

Even in case of inaction, climate change will affect price and financial stability, thus monetary policy. Climate change is expected to increase the frequency and impact of extreme weather events. As a supply shock, extreme weather events tend to increase prices and lower output. As a demand shock, they can reduce consumption and investment, leading the downward pressures on prices. Climate change is also a source of financial risk. Balance sheets of central banks are exposed to climate risks through the securities they purchase, and the assets pledged as collateral by banks. As a result, climate change will affect the ability of central banks to deliver on their price and financial stability.

Likewise, monetary policy plays a crucial role in mitigating the inflationary shock of carbon pricing. Monetary policy will face a trade-off between stabilising inflation relative to output. However, central banks cannot afford to look through energy price increases if they pose a risk to medium-term price stability. Furthermore, persistently rising energy prices could contribute to de-anchoring of inflation expectations. A credible monetary policy is critical to maintain long-term inflation expectations anchored to the inflation objective of the central bank and to mitigate the inflationary pressures. This could avoid spiralling inflation and a disorderly transition.

Various central banks have been progressively moving from market neutrality towards market efficiency. Given the existence of climate externalities, the current market neutrality principle may lead to a suboptimal allocation of resources. In addition, as climate change will affect price stability, some central banks are already adjusting their monetary policy to incorporate and reprice climate risks. For instance, the ECB aims to play an active role in fighting climate change as its mandate stipulates that the ECB should support the eurozone's economic policies. The US Fed, on the contrary, is sticking to its tightly defined mandate of seeking "maximum employment and price stability."

Furthermore, central banks can act as catalysts by facilitating the transition to a greener economy. In addition to ensuring pricing stability, central banks have different policy tools to facilitate the transition to a carbon-free economy. Central banks can impose mandatory climate-risk disclosure rules, conduct stress tests of banks' assets for climate-related risks and make it more expensive for banks to lend to carbon-intensive companies. While purchasing corporate and public bonds, central banks are currently favouring large firms in carbon-intensive sectors since the latter are more likely to enter and issue in the bond market. To counter this bias, central banks could tilt their exposure towards industries with less GHG emissions based on climate criteria. For instance, the ECB has begun to tilt its asset purchase towards compagnies with better climate scores. China and Japan provide preferential interest rates for green credits and bonds (Figure *5*).

Some central banks are actively adjusting their policy to reprice climate risks and foster a greener economy.

Figure 5. Green Central Banking Scorecard

	Monetary policy			Financial regulations	
	Green lending scheme	Green asset purchase	Green collateral	Capital requirements	Climate Disclosure
France	●	●	●	●	●
Italy	●	●	●	●	●
Germany	●	●	●	●	●
European Union	●	●	●	●	●
United Kingdom	●	●	●	●	●
Brazil	●	●	●	●	●
China	●	●	●	●	●
Japan	●	●	●	●	●
Indonesia	●	●	●	●	●
Canada	●	●	●	●	●
Mexico	●	●	●	●	●
India	●	●	●	●	●
South Korea	●	●	●	●	●
Russia	●	●	●	●	●
Australia	●	●	●	●	●
United States	●	●	●	●	●
Turkey	●	●	●	●	●
South Africa	●	●	●	●	●
Argentina	●	●	●	●	●
Saudi Arabia	●	●	●	●	●

***Source**: ICC elaboration based on 2022 Green Central Banking Scorecard data, accessed in September 2023*[2]

In a context of high inflation, central banks face a dilemma to control inflation or foment green investment. By tightening monetary policy to bring down inflation, central banks may ultimately slow down the pace of decarbonisation as it will be more expensive to finance green technologies. But failing to address inflation in a timely manner can also lead to an inflationary spiral and could jeopardise the green transition.

But the green transition can only thrive with price stability. High inflation acts like a tax on investment as it increases the cost of capital, creates uncertainty and distortions that could deter investment. High inflation needs to be brought down in a timely manner to avoid de-anchoring inflation expectations and generating an inflation spiral (ECB, Schanel, 2023). Furthermore, in a period marked by high inflation, the cost of living remained the biggest global concern for 18 consecutive months, surpassing climate change. In September 2023, almost 40% of the surveyed population by the market research institute IPSOS ranked inflation as their biggest concern, compared to 19% expressing concerns over climate change. Price stability is thus a precondition for the green transition.

[2] Note: Only high to medium impact measures are considered in the figure.

B. The role of fiscal policy: Cushion the impact on vulnerable households and firms.

Proactive fiscal policy can temper inflationary impacts. Based on the experiences of Europe and Canada, Konradt and Weder di Mauro (2021) found that the most inflationary impacts will occur in countries that do not recycle the carbon tax revenue. Indeed, redistributing the proceeds from carbon pricing back to the most vulnerable households and firms can dampen the price impact on incomes and profit (ICC, 2021). The IMF also highlighted the contribution of green subsidies to address market failures and foster the adoption of low carbon technologies (IMF, 2023). Furthermore, public investment can complement private capital when large-scale investments are required, for instance, for carbon capture and storage, charging stations for electric vehicles.

Nevertheless, governments could face a policy trilemma between achieving climate goals, fiscal sustainability, and political feasibility (ICC, 2021). If governments rely mostly on public spending (green public investment, transfers, and subsidies) to achieve climate goals, it will be politically feasible but can put at risk debt sustainability. The IMF estimated that climate policies could increase debt-to-GDP ratio by 15% of GDP by 2050. Nevertheless, the impact on debt sustainability for developing countries would be more detrimental as they would face higher interest payments due to higher borrowing costs. As a result, this could reduce their fiscal space and threaten their capacity to redistribute carbon revenues or expand public investment (IMF, 2023).

C. Carbon pricing should be part of a policy mix.

Carbon pricing is necessary but will not be sufficient to achieve climate goals. Carbon pricing has to be combined with other policies to significantly reduce GHG emissions, especially in hard-to-abate sectors such as construction. Besides, as mentioned previously, carbon pricing can be tricky to implement when inflation is already at a high level. Furthermore, the political acceptability of this tool is low as demonstrated by the Yellow Vests movement leading protests in France in 2018, which halted the planned increase in the carbon tax. Similarly, Canada faced a carbon tax backlash in 2018. As demonstrated in the survey conducted by Dabla-Norris & al. (2023), perceived costs and the negative impacts of carbon pricing are high in Europe, Canada, and Japan as between 60-70% of respondents think small businesses will lose.

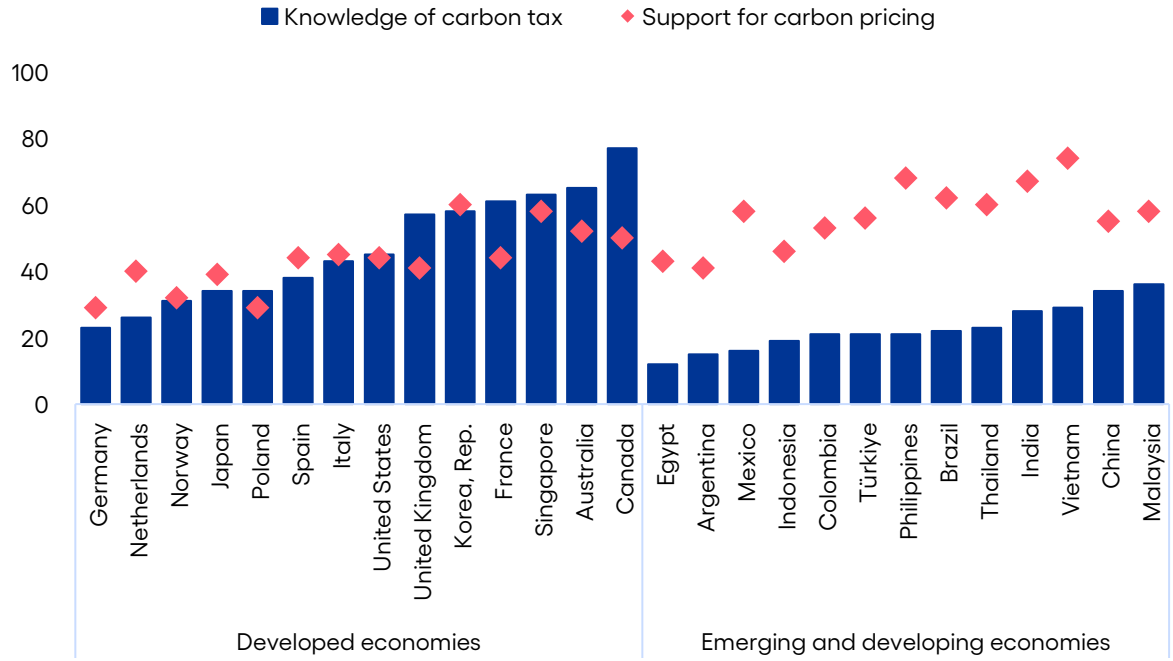
Carbon pricing should be implemented with sectoral and complementary policies. In addition to carbon pricing, countries should consider the implementation of sectoral and complementary policies. Sectoral policies include feebates, tradable performance standards, green subsidies, regulation, or minimum standards. Complementary policies need to address market failures, enhance the business environment to facilitate private investment and job creation. For instance, government can undertake public investment to complement private investment. Transfers could be used to compensate the negative impact of carbon pricing on the most affected households and firms.

The timing and order in which carbon policies are implemented matter. Carbon pricing tends to be implemented last. Prior implementation of complementary climate policies can enhance the adoption of carbon pricing, highlighting the advantages of policy sequencing. Countries that adopted a carbon price in a given year already had diverse climate policy portfolios to pave the way for carbon pricing. The bigger a country's climate policy portfolio, the higher probability it will have to adopt carbon pricing policy (Linsenmeier, Mohommad, and Schwerhoff, 2022).

Clear communication on benefits and costs of carbon pricing is crucial to enhance effectiveness. As shown by Dabla-Norris & al. (2023), people tend to have neutral or negative views of carbon pricing when there is insufficient information on the effectiveness of these policies. Therefore, providing information about the effectiveness of carbon pricing policies does increase public support, especially in developing economies (Figure 6). Furthermore, carbon pricing policies will be more accepted if revenues are used to address distributional concern or to subsidise green infrastructure and low-carbon technologies. Between 40-50% of respondents to a survey conducted by Dabla-Norris & al. (2023) think carbon pricing revenues should be used to mitigate the regressive impact on low-income households or to finance renewables or low-carbon technologies.

The more you know about carbon pricing, the more you will support it.

Figure 6. Knowledge of carbon tax vs. support for carbon pricing policies, % of responses



***Source**: ICC elaboration based on survey data from Dabla-Norris & al. (2023)*[3]

[3] This figure shows the distribution of responses in each country to the questions: "Thinking about all of the impacts of a carbon pricing policy, to what extent do you support or oppose such a policy in your country?" and "Which, if any, of the following ways of reducing climate change have you previously heard of? Please select all that apply."

Conclusion

In conclusion, higher carbon prices may create not only changes in relative prices but also inflationary pressures in the short-term, especially in economies reliant on fossil fuels. Nevertheless, the latest research suggests that the overall impact on prices should be modest. Furthermore, delaying climate action is even more costly and will cause climate inflation. In the medium-to-long term, the inflationary impact of higher carbon prices will weaken.

In the meantime, both monetary and fiscal policy play a crucial role in ensuring an orderly transition and in tempering the negative distributional impacts on the most vulnerable businesses and households. Finally, given its relatively low political acceptability, carbon pricing will fall short if it is not part of a policy mix that includes sectoral and complementary policies.

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