Economic Commentary

How does the climate transition affect inflation?

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Economic Commentaries

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Summary

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An important part of the strategy to limit global warming is to make it more expensive to use fossil fuels. This is one of the reasons why the climate transition may in various ways affect inflation and thereby the conditions for monetary policy. During the transition we can expect that energy prices will increase and that there will be negative effects on the aggregate supply in the economy when CO2-intensive technologies are phased out. Investment in new technologies contributes to higher demand in the economy, and when the new technologies are put into use, there will be positive effects on the aggregate supply. Most of these effects point to higher inflationary pressures during the transition, but how inflation will develop ultimately depends on monetary policy.

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The climate transition presupposes higher costs for emissions

In recent years, the climate transition has risen ever higher on the global agenda.[2] An important part of the strategy to limit global warming is to make it more expensive to use fossil fuels. Products and services that contribute to greenhouse gas emissions will thus become more expensive than those that do not – their relative price will increase. In this way, demand and production are steered towards more environmentally friendly alternatives.

Making the use of fossil fuels more expensive can be achieved in different ways. The most commonly discussed methods are a tax on carbon emissions and other greenhouse gas emissions and emission rights trading. Carbon tax and emission rights are essentially two ways of achieving the same goal, but they function in slightly different ways.

A carbon tax is added to the market price and increases the *price* to consumers, who will therefore try to avoid paying this higher price by instead choosing less carbon-intensive alternatives that are not affected by the tax to the same extent.

Emission rights instead regulate the *quantity* of emissions. The number of emissions is limited, and traded on an open market, where the buyers are companies that have a need to emit more than their original allowance and the sellers are those that, for example, have undertaken energy-saving measures. By gradually reducing the number of emission rights, the price of these allowances will increase and thus also the price of goods produced with fossil-based energy.

Both of these methods thus redirect demand and production in an environmentally more sustainable direction. In this commentary, these two ways of achieving a climate transition are not discussed separately. The premise is instead that both will make it more expensive to emit greenhouse gases.

What effects on inflation can be expected?

The impact of the climate transition on inflation in the coming decades is a relatively small and delimited question in relation to the broader discussion of the socio-economic consequences of climate change. But it is nevertheless important for central

[2] COP26, the most recent annual UN climate conference, was held in Glasgow on 31 October – 12 November 2021. The results of the meeting were that countries were encouraged to increase their climate targets in 2022, support for climate adaptation should be doubled by 2025, and that the role of fossil fuels in the climate transition was mentioned for the first time in the meeting's final document. The results have been described as keeping alive the goal of the Paris Agreement to limit global warming to 1.5 degrees, but that further measures are required to succeed in this. See COP26 – The Glasgow Climate Pact, https://ukcop26.org/wp-content/uploads/2021/11/COP26-Presidency-Outcomes-The-Climate-Pact.pdf and press release from the Swedish Government Offices on 14 November 2021, https://www.government.se/press-releases/2021/11/conclusiouns-from-the-un-cop26-climate-change-conference/.

banks to try to identify the challenges that may have to be faced in the future, when it comes to keeping inflation low and stable.

One can expect the following main effects that may have an impact on inflation:

- Higher energy prices
- A negative effect on the economy's aggregate supply when existing carbon-intensive technologies are phased out
- Increased aggregate demand in connection with investments in new technologies, and
- A positive effect on aggregate supply when the new technology is put to use.

These effects are discussed in more detail below. The aim is not to quantify the effects, but to describe on a general level the various mechanisms by which economic actors adapt to more expensive emissions, and to discuss the consequences for inflation and monetary policy.

It should be emphasised that the analysis is partial and focuses on the possible effects of the climate transition as such. Other things can of course happen that also affect inflation, including the effects of climate change that has already occurred and that will occur.[3]

Higher prices for energy and energy-intensive products

Increased carbon taxes or higher prices for emission rights will lead in the short term to higher prices for fossil-free energy, too, and for products in which energy is an important input. The world's energy supply comes largely from the burning of fossil fuels, such as coal. When the cost of this type of energy production increases, so does the price of energy generated without major emissions of greenhouse gases, such as hydroelectric power. This is a consequence of the energy market being largely international and of the price being determined by the relationship between supply and demand. Swedish energy production is largely fossil-free, although electricity is traded to a certain extent on an integrated European market, where the element of fossil fuel is usually larger.

The impact of energy prices on consumer prices depends on price elasticity, that is, how demand responds to changes in the price. If a product has a high price elasticity, this means that even a small price increase will lead to a sharp decrease in demand. It will therefore be difficult for producers to pass on the higher costs to consumers, and they will have to bear them themselves to a greater degree in the form of lower mark-

[3] For a review of global warming in an economic perspective, see, for example, Olovsson (2020). For a description of how the Riksbank works with climate-related risks within the framework of its mandate, see Sveriges Riksbank (2021).

ups and profits.[4] Correspondingly, a low price elasticity means that it is easier to pass on the price increase to consumers.

Increasing consumer environmental awareness may also lead to changes in preferences and consumption patterns. This, too, would make it more difficult for companies to pass on the increase in costs.

Nevertheless, in the short term, it is reasonable to assume that the prices of energy and energy-intensive products will increase. This means that the consumer price index, CPI, will rise. There is a risk of higher prices for energy and energy-intensive products spreading to other prices. This can lead to a broader increase in consumer prices, higher wage demands and rising inflation expectations.

Phase-out of carbon-intensive technology

When the costs of using technology based on fossil fuels increase, it becomes less profitable and starts to be phased out. The speed at which this happens depends on the rate at which it becomes more expensive for companies to use carbon-intensive technology. It also depends on the extent to which the higher costs can be passed on to consumers – and profitability can thus be maintained – as well as the extent to which alternative technology is available or is being developed.

If the higher costs are largely borne by producers, the profitability of companies and of production processes dependent on fossil fuels will come under pressure, and they may be eliminated more rapidly. This would hasten the structural transformation, but could also lead to shortages during the transition process.

The phasing out of the old technology will lead to a reduction in aggregate supply in the economy, a negative supply effect. This means that economic activity declines and that prices rise at the same time. If the initial increase in energy prices has provided an inflation impulse that has started to take hold, the inflationary pressures may therefore be further reinforced.

Introduction of new technology

New technology will be gradually introduced. Technological change tends to focus on the input where the most savings can be made, in this case fossil energy. However, in the short term, and for a given production technology, the possibilities of replacing fossil energy with other types of energy are limited. In the longer term, when the

[4] A study in the United States by Ganapati, Shapiro and Walker (2016) finds that an increase in energy prices does not have a full impact on consumer prices. They also argue that consumers bear a smaller share of the burden than standard methods indicate.

technology is also changed, the possibilities are significantly greater. Economic research indicates that the oil price shocks of the 1970s spurred rapid technological change to reduce the need of fossil energy.[5]

Initially, increased investment in new technology will increase demand in the economy, a positive demand effect, which will push prices up. As the new technology is phased in and replaces the old, the aggregate supply will increase, which dampens prices. Assuming players live up to the environmental agreements that have already been made or will be made, the transition to zero net carbon emissions will eventually be implemented. The central question for a central bank is what happens to inflation during the transition period.

One possibility is that the new technology will be phased in more or less parallel with the phasing-out of the old. In this case, the aggregate effect on supply – the negative effect of the phasing-out of the old technology and the positive effect of the introduction of the new – will be relatively small and have limited effects on inflation.[6]

Summing up, one can expect that energy prices will initially increase and that there will be negative effects on the aggregate supply in the economy when CO2-intensive technologies are phased out. Investment in new technologies will then have positive effects on demand, and when the new technologies are put into use, positive effects will arise on the aggregate supply. A possible scenario is that inflationary pressures will increase, particularly in the beginning of the transition process.

The challenge for monetary policy

How inflation develops is ultimately determined by monetary policy. But inflation is continuously affected by cyclical and structural forces that the central bank must take into account. Examples of the latter are globalisation and digitalisation, which have had a dampening effect on inflationary pressures in recent decades.

If the climate transition initially leads to higher inflationary pressures, a challenge for monetary policy will arise: To maintain confidence in the inflation target at as low a cost, in the form of lower demand, output and employment, as possible.[7] Time plays a central role here: The longer inflation is allowed to remain high, the greater the risk of expectations being affected in the long term, and the greater the real economic costs will be of bringing inflation back down.

One specific challenge is therefore to try and determine the extent to which inflation will rise persistently. If long-term inflation expectations do not rise, that is, economic agents see the price increases as more transitory, it is easier for monetary policy to disregard them and refrain from counteracting them with tighter policy. Assessing

[5] See Hassler, Krusell and Olovsson (2021), who also develop an intellectual framework around technological advances as the economy's response to finite natural resources – so-called endogenous technological development.

[6] Some economists even highlight the possibility that the development of new energy sources can proceed so quickly and be associated with such major technological breakthroughs that the positive supply disruption they imply will assert a downward pressure on inflation; see, for example, Cœuré (2018).

[7] For a discussion of monetary policy challenges, see, for example, Schnabel (2022).

how higher energy prices and negative supply effects affect inflation in the long term is not in itself a new challenge, but something that monetary policy has always had to deal with from time to time.

One possibility is that investments in new technologies are made so soon and are so large that their effect on demand in the economy not only dampens but also dominates the negative supply effect that arises when CO2-intensive technologies are phased out. In such a scenario, the net effect on the level of activity in the economy will be positive and higher inflation will to a large extent be demand driven.[8] Monetary policy considerations will then be easier, as a tighter monetary policy is motivated to dampen both inflation and demand.

It should be emphasised that although the climate transition would give rise to a broader increase in inflation, such a development would in one respect be easier to manage than when inflation is persistently too low. Since the global financial crisis, there have been problems in many countries in bringing inflation *up* to the target. One reason is that the global real equilibrium rate has fallen to historically low levels. Driving forces behind this development that are often highlighted include demographic factors and high global savings, that is, conditions that monetary policy cannot influence.[9] One consequence has been that central banks' policy rates have needed to be cut to ever lower levels. But there is a limit as to how far the policy rate can be cut, and in many countries it has been at or near this lower bound for a long time. It has therefore been difficult to make monetary policy sufficiently expansionary. When it comes to counteracting excessively *high* inflation by raising the policy rate, there is no corresponding restriction.

Energy prices have been rising faster for a long time

What guidance can be given on how inflation will develop by studying the impact of energy prices in the past? That energy prices are rising more rapidly than the CPIF, that is, the relative price of energy is increasing, is no new phenomenon in Sweden. As can be seen from figure 1 , they have increased considerably more than the average of other prices in the consumer basket in recent decades, partly as a result of the introduction of, and increases in, energy and climate taxes.

During the 2000s, energy prices in the CPIF have increased by an average of 3.9 per cent per year, while the CPIF excluding energy has increased by 1.4 per cent. Inflation measured in terms of the CPI or the CPIF has nevertheless not been particularly high, 1.6 per cent on average. The fact that energy prices have risen faster than other prices has thus not given rise to difficulties in keeping down inflation.[10] If anything, inflation

[8] See Schnabel (2022).

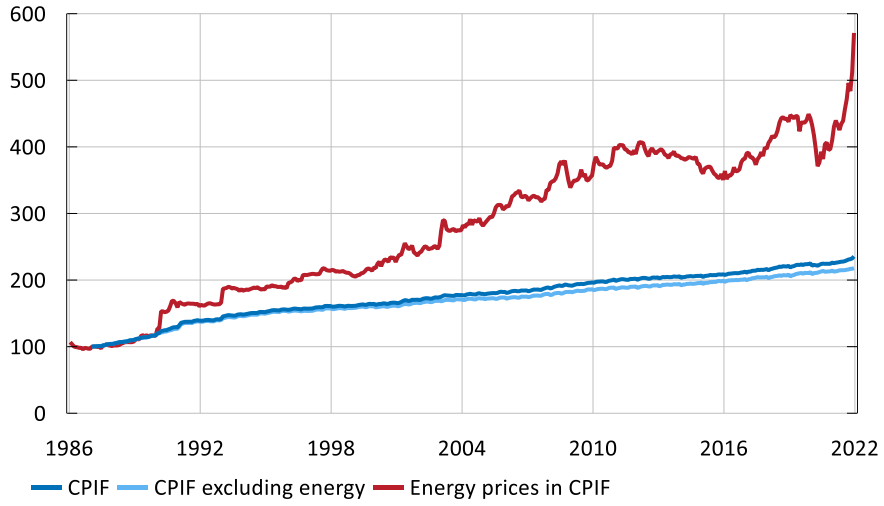
[9] See, for example, Lundvall (2020).

[10] Konradt and Weder di Mauro (2021) study the effects on inflation of a carbon tax in a number of countries in Europe and three provinces in Canada and find that it has not been inflationary.

has tended to be below the target of 2 per cent. However, as shown in Figure 1, energy prices have *varied* greatly. This has also contributed to fluctuations in CPIF inflation.

Figure 1. CPIF, CPIF excluding energy and energy prices in the CPIF

Index 01 January 1987 = 100



Note. Energy prices refer to electricity and fuel

Source: Statistics Sweden.

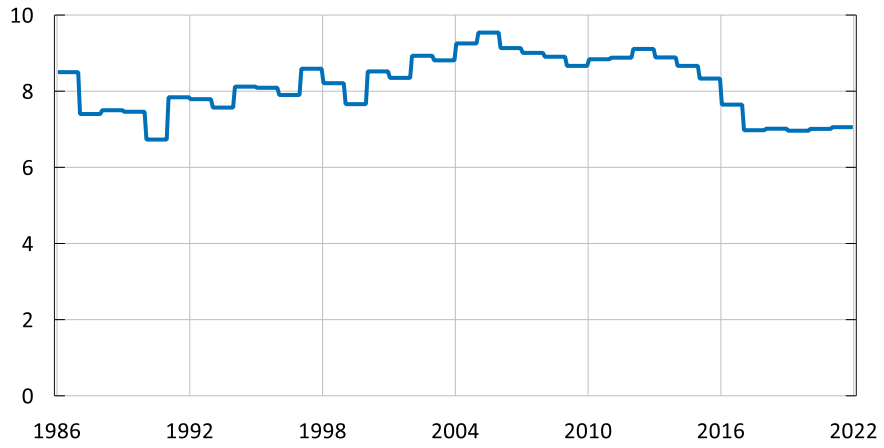
Energy-saving technological development a continuous process

One of the explanations for why the faster rising energy prices have not had a major impact on inflation is that the *weight* given to energy in the CPI basket has remained relatively constant at 7-9 per cent (see figure 2). The cost of the average consumer's energy consumption has thus not increased in relation to the cost of other products – it does not constitute a greater share of the consumption basket, despite the relative price of energy having more than doubled.[11]

[11] Since 1987, energy prices have increased by more than 2.5 per cent on average per year (but also varied greatly), while the CPIF excluding energy has increased by 2.1 per cent.

Figure 2. Energy weights in the CPI

Per cent



Source: Statistics Sweden.

One explanation for this is that producers and consumers are constantly striving to produce and buy products and technology that save on the increasingly expensive energy, such as ground-source heating and fuel-efficient cars, as this has been profitable for both parties. Energy-saving technological advances are thus a continuously ongoing process.

Greater effects when large countries transition?

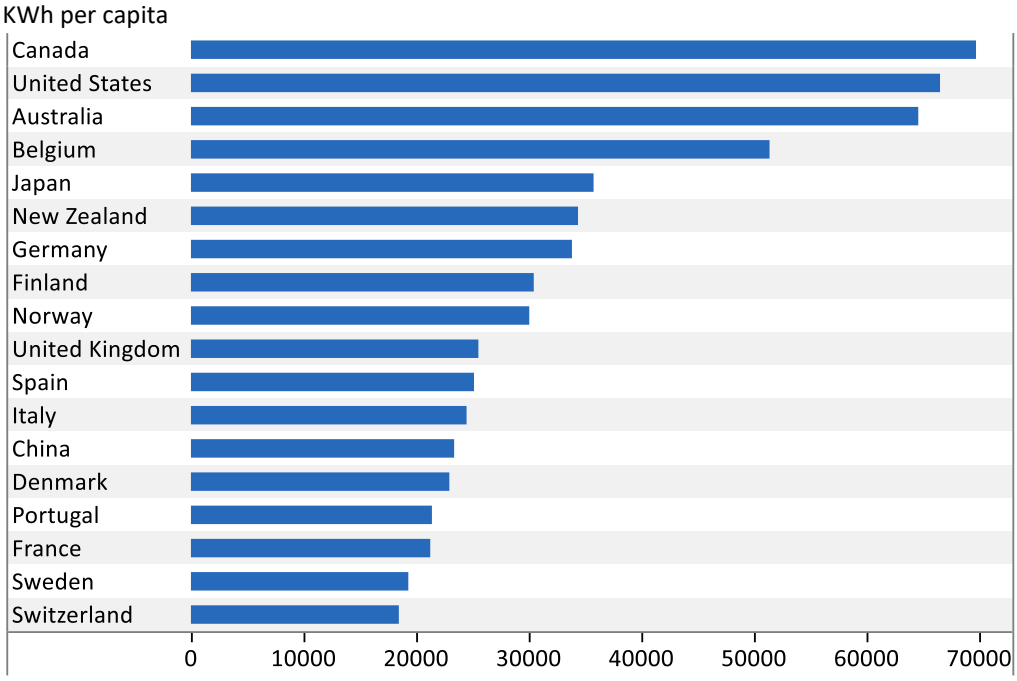
It is possible that the information obtained from studying the effects on inflation of the climate measures introduced by various countries so far is not representative of developments going forward. For example, it is mainly relatively small countries that have introduced carbon taxes at levels that are likely to have a significant impact on emissions, and they have done so at different times. The continuing climate transition will lead to the burning of fossil fuels also becoming more expensive for larger countries that are of greater significance for the global economy and that, in many cases, are more dependent on fossil fuels. The transition in various countries will now also be more or less simultaneous, over a relatively short period of time. This could have a greater effect. For instance, price increases on energy and the negative supply shock when carbon-intensive technology is phased out could be more noticeable for the global economy as a whole.

At the same time, the speed of technological development is affected by how much profit can be made. As is noted above, the pace of energy-saving technological development increased markedly in conjunction with the oil price shocks of the 1970s. It is possible that rapidly rising costs for using fossil fuels may cause a corresponding increase the pace of innovation and stimulate the emergence of new technology. This would facilitate the transition process and have less dramatic effects on the economy and inflation.

However, the adjustment to a less fossil-based economy may also cause problems in the financial system if it is too fast and is not carried out in a sufficiently orderly manner.[12] The risks associated with such a development are usually referred to as transition risks. The financial sector has an important role to play in that it prices risks and mediates capital to investments. This applies, among other things, to the risks associated with loans to companies in CO2-intensive industries. It is important that these transition risks are correctly taken into account in the risk premiums reflected in prices of assets and natural resources. Price changes can otherwise be significant when these risks need to be rapidly taken into account. This can ultimately affect financial stability and, via this route, also have effects on inflation. To highlight the risks, it is necessary to impose high demands regarding how companies report information related to transition risks.

Different countries are dependent on fossil fuels to a varying degree, in their capacity of both consumers and producers. As far as Sweden is concerned, dependence is not particularly significant in either of these respects. Figure 3 shows that the consumption of fossil fuels in Sweden, measured as consumption per capita, is low in an international perspective.

Figure 3. Consumption of fossil fuels 2019



Note. Fossil fuels consist of coal, oil and natural gas.

Sources: Our World in Data and BNP Statistical Review of World Energy.

Sweden's low dependence on fossil fuels, together with the fact that Swedish energy and climate taxes are already on a high level internationally speaking, suggests that the direct effects of the climate transition could be smaller in Sweden than in many

[12] See, for example, Bolton et al. (2020).

other countries. Of course, this does not rule out the possibility of Sweden, in its capacity as a small, open economy, being affected by the possible impact on the real economy and inflation of the climate transition in the rest of the world.

Difficult to quantify the effects

The aim of this commentary is to give *a qualitative* description of the effects of climate transition that can be expected on inflation in the coming decades. This means that it only shows the direction in which the various effects can be expected to impact inflation. It is more difficult to *quantify* the effects. Their more precise size, when they will have the greatest impact on inflation and what their overall effect will be at any given time, is determined by a complex relationship between consumption, production and technological development, as well as by the fact that the pace of climate transition is largely determined by future political decisions.

Possible effects on the economy as a whole have been studied in various contexts, with the aid of simulations in econometric models. These often indicate that the transition will be relatively smooth and that the effects on the world economy will be relatively small.[13] However, there is considerable uncertainty and some observers believe that significant problems will arise during the transition.[14]

Finally, it should be stressed that if the climate transition were to lead to higher inflationary pressures than in recent decades, this would not necessarily be a problem. In recent decades, structural forces such as digitalisation and globalisation have contributed to low inflationary pressures. This in turn has meant that many central banks have had difficulty in bringing inflation to the target, despite cutting policy rates to historically low levels, at or near the lower bound. If the underlying pressure on inflation were instead upwards in the future, there is no corresponding restriction on using the interest rate tool to maintain the inflation target. Instead, it could help to ensure that central banks' policy rates can move more permanently away from the lower bound.

[13] See Bylund and Jonsson (2021) for an overview of the economic consequences of different climate scenarios that the Network for Greening the Financial System (NGFS) has estimated using models. McKibbin, Konradt and Weder di Mauro (2021) find in their simulations that climate risks and transition risks associated with a carbon dioxide tax have long-term negative effects on production, but transitory effects on inflation.

[14] See, for example, Pisani-Ferry (2021).

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