

# Economic Commentaries

## Is climate change relevant for central banks?

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In this Economic Commentary, I highlight the consequences that global warming could have for both monetary policy and financial stability. I also discuss the extent to which central banks should have a greater focus on understanding the effects of climate change. I start by providing a brief explanation of the greenhouse effect and the causes of global warming, after which the implications for central banks are discussed in a little more detail. I conclude that global warming and its consequences are relevant for central banks as these consequences may conceivably have an impact on both financial stability and monetary policy in the long run. In my conclusions, I also note that central banks can primarily contribute towards long-term sustainability by implementing a successful stabilisation policy for both monetary policy and financial stability.

### The greenhouse effect

The United Nation's Intergovernmental Panel on Climate Change has established that it is beyond reasonable doubt that human emissions of greenhouse gases are affecting the climate. The human impact on the climate is primarily a result of the fact that the combustion of fossil fuels produces carbon dioxide (CO<sub>2</sub>). The result is an increase of the amount of CO<sub>2</sub> in the atmosphere, which, in turn, affects the balance between incoming and outgoing radiation and thereby the planet's temperature. This relationship, known as the greenhouse effect, was demonstrated as early as 1896 by the Swedish Nobel laureate Svante Arrhenius and can easily be verified in a laboratory.<sup>2</sup> Despite the certainty over the greenhouse effect, there remains relatively great uncertainty over exactly how increased levels of CO<sub>2</sub> may affect the planet's temperature. This is due to the presence of both positive and negative feedback mechanisms that could either amplify or weaken global warming.<sup>3</sup> However, the most common opinion among scientists today is that these feedback mechanisms can be expected to amplify the effects of a greater concentration of CO<sub>2</sub>.

### Damage caused by global warming

A warmer climate will mean that we will have to deal with phenomena such as droughts, floods, hurricanes and heat waves more often. It will also generate

Global warming and its consequences are relevant for central banks as these consequences may conceivably have an impact on both financial stability and monetary policy. Central banks should therefore prepare themselves by investing resources in the analysis of the possible effects of climate change on the real economy, as well as the implications for monetary policy and financial stability. However, monetary policy does not have the appropriate tools for counteracting global warming, but global fiscal policy is significantly better suited for this purpose.

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<sup>2</sup> See Arrhenius (1896).

<sup>3</sup> Airborne particles in combination with cloud formation are examples of feedback mechanisms that could either amplify or weaken global warming.

increased damage and costs due to rising sea levels and changed ecosystems.<sup>4</sup> The Paris Agreement of 2015, ratified by 195 states and the EU, states that climate change represents an urgent and potentially irreversible threat to human societies and possibly also the entire planet. From a global perspective, the effects will probably not be catastrophic in this century but they are nevertheless too large to be ignored. The fact that it is uncertain how extensive global warming may be is no argument for ignoring it, as this uncertainty also means that warming may be significantly greater than previously expected.<sup>5</sup>

## The problem comes from an externality and the solution is a global fiscal policy

The greenhouse effect thus comes from the carbon dioxide formed by the combustion of fossil fuels. As concentrations of CO<sub>2</sub> even out relatively quickly in the atmosphere, it is unimportant exactly where in the world it is released. In other words, the damage that can be expected to be caused by an extra unit of emissions has no link to where that unit was emitted. This means we are dealing with a so-called externality in which the causative party, for example a consumer or a company, generates a cost for another party without paying for this cost. To take a concrete example: a consumer pays for his or her petrol but does not pay for the damage caused by the global warming following from that consumer's CO<sub>2</sub> emissions.

An externality implies a market failure and we can thus not expect an unregulated market to be able to manage such a problem. According to economic theory, the classic solution is to introduce a so-called Pigovian tax (named after the British economist Arthur Pigou who first studied the problems of externalities).

In this case, a Pigovian tax would involve the price of a unit of fossil fuel including the private cost companies have for producing and supplying the unit plus the social cost the unit generates by contributing to global warming.

However, it is decisive that the tax be introduced at a global level, which is to say it applies to most large and small countries. Introducing such a tax in only one country would have, at best, a negligible effect and, at worst, would be completely ineffective. This is due to so-called carbon leakage, which means that the reduced oil consumption that could be expected to follow from a tax in one country would only be met by an equally large increase of oil consumption in the rest of the world.<sup>6</sup> Such a scenario is conceivable as long as there are large countries that are not prepared to reduce either their consumption or production of oil. In this case, the tax would not affect the supply of oil. Reduced demand for oil from certain countries would then only lead to a lower oil price and increased demand from other countries that are unwilling to reduce their consumption of oil.

Another solution could be to utilise global quantity regulation, which is to say setting a ceiling on the size of total emissions that may be made on a global level. Taxes and quantity regulation are two excellent fiscal policy tools to manage the kind of market failure formed by externalities.

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<sup>4</sup> See, for example, Nordhaus and Moffat (2017) for a detailed attempt to estimate future damage from global warming.

<sup>5</sup> See, for example, Hassler, Krusell and Olovsson (2018).

<sup>6</sup> See, for example, Hassler, Krusell, Olovsson and Reiter (2017), who demonstrate that the implementation of an optimal tax by Europe alone would, in principle, be ineffectual in mitigating global warming.

In addition to fiscal policy solutions, economic policy is also conducted by central banks in the form of monetary policy, which aims, among other things, to stabilise the economy in the short term and maintain a low and stable rate of inflation. A relevant question is therefore whether monetary policy is suitable for counteracting global warming. For three reasons, the answer to this question is no.

Firstly, monetary policy uses cyclical instruments, which aim to stimulate or subdue activity in the economy about a couple of years ahead, while climate change is expected to continue for significantly longer periods of time – up to several hundred years. Monetary policy is therefore less suitable to be used to make the economy less fossil-based.

Secondly, the monetary policy instruments are fairly few in number, meaning that the central banks' primary goal, attaining price stability, risks suffering if the instruments are to be used to reduce global warming.

Thirdly, climate change is a global problem that demands a global solution. This entails a direct problem for monetary policy, which should not necessarily be coordinated between countries with different rates of inflation.

The conclusion is that the solution lies in global fiscal policy, not monetary policy.<sup>7</sup> The fact is that, should one of the fiscal policy solutions described above be actualised, it would be possible, in principle, to achieve an optimal distribution of emissions and then other authorities, such as central banks, would not have to adopt further measures to reduce CO<sub>2</sub> emissions.

## How is climate change relevant to a central bank?

The increased risks of climate change can be divided up into two types: *physical risk* and *adaptation risk*. Physical risk includes the direct damage mentioned above, which is to say from meteorological phenomena such as droughts, floods, hurricanes and heat waves, as well as the damage ensuing from rising sea levels and changing ecosystems. Adaptation risk is instead comprised of the economic risks and financial losses that may be linked to a sudden adjustment to a less fossil-based economy.

Even in the ideal situation in which a global tax is introduced, global temperatures are expected to increase by up to about two degrees Celsius.<sup>8</sup> This is partly because some fossil fuel usage is economically justifiable and partly due to the inertia of the carbon cycle, which means that future temperature increases also depend on emissions that have already taken place. Consequently, even in an ideal situation, we can therefore expect an increase of climate-related damage and events. If no global solution can be attained, we can expect an even more significant increase of the temperature with comprehensive climate-related damage as a result. Under every circumstance, we will thus have to live with anything from limited to significant climate-related damage.

In plain language, this means that global warming is highly relevant to a central bank, as it will have a possible impact on both financial stability and monetary policy. These two areas are discussed separately below.

<sup>7</sup> Golosov, Hassler, Krusell, and Tsyvinski (2014) deduce a simple formula for an optimal tax on carbon dioxide.

<sup>8</sup> See Golosov, Hassler, Krusell, and Tsyvinski (2014).

### Effects of climate change on monetary policy

As described above, central banks conduct monetary policy by balancing and influencing the development of inflation and the real economy. Climate change could conceivably affect both of these variables as well as the balance between them. For example, the physical risk from climate change is expected to affect the level and/or the growth rate of GDP. One risk of completely ignoring the effects of climate change is that this could lead to misjudgements of potential GDP.<sup>9</sup> However, it seems reasonable that the effects on GDP will be relatively small in the first half of this century as the temperature rise in this period will probably be modest.

The expected effect of climate change on inflation comes, not least, from its impact on the agricultural sector. Extreme weather can impact global food production, which, in turn, could lead to increased food price inflation in countries importing foodstuffs. Such an effect could be seriously worsened if the exporting countries reduce their food exports with the aim of restraining domestic price increases for food. As an example, this was the case in 2010, when Russia stopped exporting cereals due to a heat wave and drought. The result was a significant international increase in the price of cereals and increased inflation due to increased food prices in many countries. Climate change can therefore be expected to lead to greater volatility in inflation due to this greater volatility in food prices.

It is also possible to imagine that higher CO<sub>2</sub> taxation and related technological adjustments may lead to increased costs for companies, with increased inflation for a period as a result.

### The effects of climate change on financial stability

Physical risk and adaptation risk may both be relevant for financial stability. This is because some of the costs for damages arising from the physical risk may be borne by insurance companies.

About 26 per cent of all losses arising from the world's largest natural disasters between 1980 and 2015 were covered by insurance policies.<sup>10</sup> Losses from one or more sufficiently large and concentrated events could cause financial stress and/or bankruptcy among the insurance companies affected. For example, in 1992, Hurricane Andrew led to the insolvency of a number of insurance companies in the United States. Another possibility is that such losses would result in fire sales of assets from the affected companies, with falling asset prices as a consequence.

The risk that insurance companies would be impacted by financial stress after natural disasters caused by climate change can reasonably be expected to be significantly greater if the climate risk has been underestimated *ex ante* so that the insurance companies thus do not have sufficient capital. At present, there are some signs that this may be the case.<sup>11</sup> As it is difficult to estimate the risks of climate-related natural disasters, it has become increasingly common for insurance companies instead to stop offering insurance against risks of this type. Such a development is probably not beneficial from a social perspective, as the cost of damages would instead impact private companies and households, as well as the banks that have granted loans to these companies.

<sup>9</sup> Dell et al. (2012) show that higher temperatures have a negative effect on economic growth, particularly in poorer countries. Cavallo and Noy (2010) find that natural disasters have a negative effect on economic growth over the short term.

<sup>10</sup> See, for example, Batten et al. (2016).

<sup>11</sup> See Batten et al. (2016).

The largest part of the volume of credits to individuals and a majority of all loans to companies use real estate as collateral. Natural disasters capable of entirely or partly destroying the capital that these pledges represent may substantially lower the value of this collateral and thereby reduce the borrowers' ability to meet their loan payments. There is also some empirical research indicating that a reduction in the value of collateral and a weakening of household and corporate balance sheets as a consequence of natural disasters tends to have a negative effect on the banking system.<sup>12</sup> Not least, risks of this kind can increase the likelihood of banks entering bankruptcy. Another potential consequence is the banks being forced to reduce their lending due to having incurred capital losses and being unable to directly increase their capital. One solution for the banks would then be to reduce lending to meet the prevailing capital requirements, which could have a negative effect on credit granting.

Another possible effect could be suddenly increased demand (precautionary demand) for liquidity among financial institutions, households and companies, not least if the natural disaster has led to a breakdown of certain banking services. If the central bank does not then increase the supply of liquidity, such a liquidity shock may destabilise the financial sector and possibly the entire economy.

Adaptation risk is also a potentially important factor for financial stability. For example, this could concern demands from politicians that certain resources such as coal and oil not be extracted but be left in the ground. Such 'stranded assets' could generate financial stress among the companies owning these assets. The value of these companies could then fall substantially, which could have negative short-term consequences if these companies are heavily indebted.

## What should a central bank do?

In light of the potentially large and uncertain effects climate change is expected to have, it is highly justifiable for central banks to make an assessment of the total risk this implies for both financial stability and monetary policy going forward. Among other things, this involves determining exactly how financially exposed different players and institutions are to climate risk, as well as how climate change may affect inflation, resource utilisation and monetary policy.

There may also be reason to investigate whether climate-related costs can and should be incorporated into the economic models used by central banks to make forecasts and analyses.

Finansinspektionen (FI) has recently made an assessment of the financial risks related to climate change in Sweden. It notes that Sweden is less exposed to climate risks than many other countries.<sup>13</sup> For Sweden, the long-term costs and revenues of climate change are expected largely to cancel each other out.<sup>14</sup> In addition, Sweden is generally less exposed than other countries to natural disasters. Adaptation risk is also deemed to be low, among other reasons because banks, insurance companies and capital investors do not have any

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<sup>12</sup> See, for example, Klomp (2014) and Lambert, Noth and Schüwer (2014).

<sup>13</sup> See Finansinspektionen (2016)

<sup>14</sup> See National Institute of Economic Research (2017).

comprehensive investments in assets with climate-related risks. At the same time, the forecast seems more pessimistic for Europe, and a small, open economy like Sweden is heavily dependent on what happens there and in the rest of the world.

For the institution that takes care of banking supervision, it is therefore valuable to investigate whether capital requirements should be increased for loans to companies that are heavily exposed to climate risks.<sup>15</sup>

Some researchers have expressed the opinion that central banks should make use of so-called green quantitative easing. This easing could be manifested in several ways, but I focus here on the form in which the central bank purchases corporate bonds for monetary policy purposes. The green aspect of such a measure arises from the aim of purchasing bonds from companies with a lower usage of fossil fuels than others.<sup>16</sup> It is sometimes argued that central banks should “show the way” with green investments so that other financial agents then follow suit.<sup>17</sup> To the extent that central banks actually have better information than other actors, this may signal to the market that this category of asset is more liquid and less risky.

However, even if this may seem appealing at first glance, there are reasons to be sceptical towards the ability of such a policy to reduce the problems of global warming.

Quantitative easing is a monetary policy instrument and, as was mentioned above, such instruments are less suitable for use if the aim is to make the economy less fossil-based. Other measures, such as taxes and quantity regulation, are significantly better suited to this purpose. As was also mentioned above, climate change is also a global problem that demands a global solution.<sup>18</sup> Similar efforts from individual agents can therefore be expected to have minor, almost insignificant effects on global temperatures.

One possible objection to such a standpoint is that, if many institutions adopt such measures and thereby put the matter high on the agenda for politicians, households and companies, it may be possible, in the longer term, to achieve significantly greater indirect effects by working towards a readjustment of climate policy in general. The problem with such an objection is that it is not a task of central banks to attempt to influence the general political discussion in one way or the other.

What is relatively clear at any rate is that central banks should prepare themselves by investing resources in the analysis of the possible consequences of climate change (such as droughts, floods and hurricanes) on the real economy and price formation, as well as the implications for monetary policy and financial stability.

Central banks can primarily contribute towards sustainable development in terms of CO<sub>2</sub> emissions and the climate by implementing a successful stabilisation policy for both monetary policy and financial stability. A stable economy makes it easier for the political system to implement a prudent long-term sustainable policy to benefit the climate and other vital social challenges.

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<sup>15</sup> See Monnin (2018).

<sup>16</sup> See Campiglio et al. (2018).

<sup>17</sup> UN Environment (2017).

<sup>18</sup> Other variants of green easing include easing in green collateral that is offered by central banks and accepted into their payment systems, as well as taking consideration in asset management. It is possible that these variants are more justifiable than the quantitative easing made for direct monetary policy purposes.

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