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Central banks should reflect climate risks in monetary policy operations

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The transition to a low-carbon economy requires a shift in capital allocation from incumbent carbon-intensive technologies to new low-carbon technologies.[1] Financial markets play a key role in this process: they influence firms' investment costs and serve as reference point in investors' decisions. Currently, there are strong concerns that financial markets underestimate risks related to climate change. This introduces biases in favour of carbon-intensive economic activities. Such biases slow down the transition to a low-carbon economy.

Central banks play a critical role in this context: monetary policy operations affect financial market prices, which in turn influence capital allocation. Currently, both central banks' asset purchase programs and collateral frameworks extensively rely on financial markets' risk assessment. By doing so, central banks are likely to also underestimate climate risks. This consolidates the biases in financial markets and cements carbon lock-in.

An accurate assessment of risks is essential for central banks. A sound implementation of monetary policy, both through asset purchases and through credit operations, requires a comprehensive and conservative consideration of all risks, including climate risks. Given the current size and composition of central banks' balance sheets, the need for adequate risk assessments becomes even more critical for them.

This policy brief argues that central banks should better reflect climate risks in monetary policy operations. A first step in this direction is for central banks to contribute to the development of appropriate environmental risk measures. A second step is for them to integrate such measures in their asset purchase strategies and in their collateral frameworks. Such adjustments

[1] IPCC (2014), for example, estimates that, to limit global warming to 2°C above pre-industrial levels, annual investments in conventional fossil fuel technologies associated with the electricity supply sector must decline by about 20% compared to 2010 while annual investments in low-carbon electricity supply must double compared to 2010.

would realign central banks' policies with the strong risk standards needed for sound monetary policy. They would also generate financial incentives aligned with the transition to a low-carbon economy and send a strong signal to market participants to reflect climate risks in their decisions.

Financial markets and climate risks

Financial markets are crucial to fund the investments needed for the transition to a low-carbon economy: they intermediate resources from savers to firms, influence corporate funding costs and serve as reference in investors' decisions.[2] Financial market conditions are thus a key driver in shaping the extent and speed of the transition to low-carbon technologies. Today, financial markets do not fully reflect climate risks. This introduces biases in financial conditions that go against the transition to a low-carbon economy and exposes them to potentially large losses.

Financial markets do not fully reflect climate risks

Climate change engenders three kinds of risks for financial markets: physical, transition and liability risks. Physical risks stem from potential economic and financial losses caused by climate-related hazards. Transition risks can be defined as the risks of economic dislocation and financial losses associated with the transition to a low-carbon economy (including the costs of a possible tightening of carbon emission policies). Liability risks materialize when firms are judged legally responsible for climate-related losses and must financially compensate other parties. Note that, while physical risks affect everybody, transition and liability risks are more likely to impact firms using carbon-intensive technologies. Indeed, these firms are more likely to face higher abatement costs resulting from carbon policies, to bear higher costs to adjust to low-carbon standards and to have to compensate other parties for environmental damages.

If investors correctly reflected climate risks in asset valuations, we would expect them to apply higher discount rates for carbon-intensive assets since they are exposed to higher transition and liability risks. Today, this does not seem to be the case. BlackRock Investment Institute (2015) looks at how climate risks are reflected in equity values across all sectors at the global level. They do not find any compelling evidence that assets which are more exposed to climate change include a higher risk premium. In addition, if markets correctly reflected climate risks, we would also expect market prices to react to news about climate risks. Again, this is not the case today. Batten *et al.* (2016), for example, do not find any statistically significant reaction of oil and gas companies' equity price to news on a possible stranding of fossil fuel reserves.[3] In line with these two examples and after an extensive review of the literature on this issue, Marqués Sevillano and Romo González (2018) conclude that climate change has not yet been fully taken on board by the financial sector.

Several reasons could explain why markets do not fully reflect climate risks.[4] The most frequently cited is that market participants fail to take climate risks into account because climate change costs and risks lie behind their analysis horizon (which usually goes up to three years as documented by 2°C Investing Initiative and Generation Foundation, 2017). Central bankers have underlined the dangers and consequences of a discrepancy between investors' and climate risks horizons (see, e.g., Carney, 2015).

The fact that financial markets do not fully reflect climate risks introduces biases towards carbon-intensive sectors, which are incompatible with a 2°C scenario. A study by 2°C Investing Initiative (2015) is

[2] See, e.g., Bond et al. (2012) for a description of the real effects of financial markets.

[3] Griffin et al. (2015) find statistically significant equity price reactions to such news but of negligible economic size, especially when compared to the potential losses at stake.

[4] See, e.g., Christophers (2017) for a review of the potential reasons why financial markets do not fully reflect climate risks.

a case in point. It compares the current exposures of equity markets with a path that would contain global warming to 2°C above pre-industrial levels. The results show that current global market capitalization under-weights renewable power generation by 19-36% and electric car production by 66-96%. It also over-weights coal fired power generation by 7-16%, oil and gas production by 12-14% and coal production by 0-31%.

Climate risks are material for financial markets

There is no comprehensive estimation of the size of climate risks for financial markets. However, some studies assess parts of it. Dietz *et al.* (2016), for example, estimate that, without mitigation efforts, physical risks related to climate change could lead to a loss of $2.5 to $24.2 trillion of the value of global financial assets. Transition risks are not negligible either. Potential losses due to stranded fossil fuel assets are a case in point. Mercure *et al.* (2018) argue that a large part of fossil fuel assets currently valued by financial markets will be stranded because of the ongoing trend toward low-carbon technologies. They estimate that discounted global wealth losses from stranded fossil fuel assets may amount from $1 to $4 trillion.[5]

To put these estimates in perspective, in the 2008 global financial crisis, $300 billion in initial losses related to subprime mortgages amplified to well over $2.5 trillion of write-downs in the global banking system (Baranova *et al.*, 2017). Given these numbers, a financial crisis triggered by the materialisation of climate risks cannot be excluded, the more so given that the level of banks' loan portfolios exposed to carbon-intensive sectors is comparable to banks' capital (Battiston *et al.*, 2017).

Monetary policy operations and climate risks

Traditionally, central banks have implemented monetary policy by lending reserves to commercial banks against collateral. More recently, with interest rates near zero, they have started purchasing financial assets directly. Both types of monetary policy operations influence financial market prices and consequently firms' funding costs. Currently, monetary policy operations heavily rely on the risk assessments made by financial market participants. They are thus likely to display the same biases toward carbon-intensive technologies as financial markets, which contributes to carbon lock-in.

Current monetary policy operations do not fully reflect climate risks

The risk measures used by central banks in their collateral framework are mostly based on credit rating agencies' assessment. To be accepted as collateral by the ECB, for example, an asset must be rated investment grade by at least one out of four main credit rating agencies.[6] Currently, credit rating agencies do not fully integrate climate risks in their ratings. They have started working on the issue, but many open questions remain, and many more steps need to be taken. Critics usually highlight the short-term horizon of credit ratings and their reliance on past information rather than on forward looking analysis (see Mathiesen, 2018).[7] Against this background it is very likely that collateral frameworks based on these ratings do not fully integrate climate risks.[8]

Regarding asset purchases, central banks do not communicate the precise composition of the assets they purchase. They emphasize, however, that they

[5] Similarly, Carbon Tracker Initiative (2013) estimates that, to remain below a 2°C increase in global temperature, 60% to 80% of the coal, oil and gas reserves of listed companies are unburnable – i.e. stranded. According to Carbon Tracker Initiative, this would reduce the current equity valuation of coal, oil and gas companies by 40% to 60%.

[6] The ECB uses ratings from Standard and Poor's, Moody's, Fitch and DRBS.

[7] The limitations of credit rating agencies' methodologies in integrating climate risks have led some financial institutions (like, e.g., Nordea, see Mathiesen, 2018) to develop their own in-house climate risk assessments.

[8] The ECB is a case in point: to be accepted as collateral by the ECB, an asset must be rated investment grade by only one out of four rating agencies. Thus, if only one of the credit agencies does not reflect climate risks in its rating, then the ECB's collateral framework will most probably not reflect it either.

aim at market neutrality and suggest that this goal is aligned with using a benchmark that reflects market capitalization.[9] However, as argued above, current market capitalizations do not fully reflect climate risks and are thus biased toward carbon-intensive technologies. Using market-cap weighted benchmarks will lead central banks to display the same biases and to fail to fully reflect climate risks. Moreover, whether the use of market-cap weighted benchmarks is indeed an adequate compass for market neutrality from the perspective of a central bank is open to debate. The fact that fixed income indexes weight their components according to debt outstanding and that central banks thus allocate a significant part of their corporate bond portfolios to the most indebted companies does not necessarily lend itself to a robust definition of market neutrality.

Current monetary policy operations perpetuate the carbon lock-in

Matikainen *et al*. (2017) document the bias in central banks' asset purchases. They show that the ECB's and BoE's corporate sector purchase programs both display a similar structural bias toward carbon-intensive industry incumbents. According to their estimates, 62% of the ECB's corporate bond purchases are in manufacturing and electricity production sectors, which are responsible for 59% of Eurozone area greenhouse gas emissions, but only 18% of its economy in terms of gross value added. For the BoE, manufacturing and electricity production – the source of 52% of UK greenhouse gas emissions – make up 49% of the estimated purchases, but only 12% of the gross value added. Matikainen *et al.* also underline that renewable energy companies are not represented in the ECB and BoE corporate bond purchases. Moreover, they note that the ECB's asset-backed securities purchase program includes securities backed by car loans and leasing contracts.

The bias in central banks' asset purchases and collateral is not without consequences on the real economy. When an asset is bought by central banks or accepted by them as collateral, its price increases. Consequently, evidence suggests that the yield on bonds purchased by central banks is lower than that of other comparable bonds.[10] Similarly, assets eligible as collateral benefit from a premium.[11] This gives an incentive for financial institutions to issue such assets in larger quantities and to provide funding to the corresponding firms at a lower price.[12] The bias toward carbon-intensive sectors in asset purchase programs and in collateral frameworks is thus likely to result in better funding conditions for carbon-intensive firms. This runs counter to the transition to a low-carbon economy and contributes to carbon lock-in.

Monetary policy operations need to integrate climate risks

Properly and pro-actively assessing risks is a key requirement for monetary policy operations. Omitting or underestimating one source of risk (including climate risks) in these operations results in an overexposure to risks for central banks and does not meet the standards for sound policy

[9] "[…], the ECB aims for a market-neutral implementation of the [Asset Purchase Program], and therefore [Corporate Sector Purchase Program] purchases are conducted according to a benchmark that reflects proportionally the market value of eligible bonds." (European Central Bank, 2017).

[10] See, e.g., Krishnamurthy and Vissing-Jorgensen (2011) who find that the Fed's second quantitative easing program (QE2), which relied on the purchase of Treasuries only, had a disproportionate effect on Treasury yields. Rogers *et al.* (2014) show that quantitative easing programs by the Fed, the ECB, the BoE and the Bank of Japan, which all primarily purchased sovereign bonds, had a bigger impact on sovereign bond yields than on other bond yields. Boneva *et al.* (2018) observe a reduced spread for bonds eligible for the BoE corporate bond purchase program.

[11] Mésonnier *et al*. (2017) show that assets eligible as collateral by the ECB trade at a premium.

[12] Di Maggio *et al.* (2016), for example, provide evidence that purchases of mortgages guaranteed by government-sponsored enterprises (GSE), such as Fannie Mae or Freddie Mac, by the Federal Reserve during the first phase of its quantitative easing program (QE1) increased GSE-eligible mortgage originations significantly more than the origination of GSE-ineligible mortgages. Van Bekkum *et al.* (2018) provide similar evidence for mortgage accepted as collateral by the ECB.

implementation. Given the current size and composition of their balance sheets the need for adequate risk assessments, including climate risks, becomes even more critical for central banks. Climate risks must be an integral component of the risk management framework for their asset purchases and the collateral they accept.

Risk assessment is a key pillar for sound monetary policy operations

Risk assessment and management play key roles in monetary policy operations. Risk is a pivotal criterion in central banks' collateral framework: it delineates which assets financial institutions can pledge to borrow from central banks, as well as the amount of loans that they will get against those assets. Bagehot's rule (1873) is the cornerstone of central banks' collateral policy on this matter: it states that central banks should lend freely to solvent banks, but only against sound collateral and with a haircut large enough to limit moral hazard by commercial banks. This rule implies that central banks should have a conservative policy in terms of risks associated with collateral.[13] Omitting one source of risk, such as climate risks, in this assessment would breach this rule.

Risk assessment and management play a central role in central banks' asset purchases too. It is even more important in this case because, with outright purchases, central banks are directly exposed to financial risks, whereas they are only indirectly exposed to them through counterparty default in the case of credit operations. The ECB's framework provides a good example of the importance of risk management for asset purchases (see European Central Bank, 2015). Its third principle, for example, states that, everything else equal, purchases should minimize the Eurosystem's risk exposure.[14] The ECB uses the same risk criteria as in its collateral framework to define which assets are eligible in its asset purchase programs.[15] In addition, the ECB's pricing framework, which guides the purchases, leaves room for expert judgement to assess the fair value of an asset. This is particularly relevant when market prices do not fully reflect all risks, as it is the case for climate risks.

Long-term climate risks are relevant for central banks

Central banks have accumulated large asset portfolios with their asset purchase programs. These assets are not likely to be sold in the short-term. The Fed, for example, started reducing its balance sheet in October 2017 but, at the current pace, will take more than five years to dispose of all the purchased assets. Many analysts conjecture that the Fed's balance sheet will never return to pre-crisis levels and that it will keep a large asset portfolio in the future. The ECB – with current holdings at €2.46 trillion[16] – announced that it will stop its net purchases by December 2018 but will keep its balance sheet unchanged for an extended period.

Both examples highlight the constraints central banks face about the speed with which they can adjust their portfolios. Given the amounts involved, central banks must shift or reduce their portfolio very slowly and carefully in order to not disrupt financial markets. Thus, whether central banks will be able to reduce their exposures to climate risks if needed is uncertain. As François Villeroy de Galhau, the governor of the Banque de France, rightly highlights: "it is delusional to think that when risks become perceptible, everyone will be able to cut their

[13] The ECB, for example, only accepts investment grade assets as collateral (See Bindseil *et al*., 2017, for a description of the criteria used by the ECB to define which assets are eligible as collateral as well as of the reasons for using conservative risk criteria.)

[14] The first principle states that asset purchases should be an effective tool in helping to achieve the mandate of price stability and the second principle that purchases should be proportionate and should minimize allocative distortions.

[15] Under very strict conditions, the ECB's due diligence can lead to the purchases of covered bonds that credit rating agencies rate below ECB's regular eligibility threshold. The ECB's due diligence can also lead to additional risk control measures for particularly risky covered bonds (see Mersch, 2017).

[16] As of end June 2018.

exposures at the same time and in an orderly fashion." (Villeroy de Galhau, 2018).[17] This also applies to central bank balance sheets.

Given these timeframes and constraints, central banks have a strong interest in properly and pro-actively assessing long-term risks, including climate risks, and in adjusting their portfolios accordingly. Since financial market participants are mainly driven by short-term considerations, relying exclusively on their risk assessment to manage central banks' assets – e.g. by following a benchmark reflecting market capitalizations – could lead to substantial losses in the long term.

Conclusion

There are strong concerns that financial markets currently underestimate climate risks. This misevaluation introduces biases in the allocation of capital in favour of carbon-intensive economic activities, which slows down the transition to a low-carbon economy or even perpetuate carbon lock-in.

By primarily relying on markets participants' risk assessment, central banks' asset purchases and collateral frameworks are likely to present the same biases toward carbon-intensive sectors. Biased monetary policy operations affect financial market prices, influence capital allocation and impede the transition to low-carbon economy. They also expose central banks to long-term climate risks.

Central banks must account for these biases by better reflecting climate risk consideration in their monetary policy operations. They should explicitly evaluate climate risk and include it in their risk management for asset purchases and in their collateral framework. Suitable measures of climate risks for financial assets are still at an early stage of development. Central banks should contribute to their advancement.[18]

Reflecting climate risks in monetary policy would lead central banks to decrease their purchases of carbon-intensive assets and to tighten the conditions to accept such assets as collateral. This would be in-line with sound implementation of monetary policy, based on a conservative assessment of risks, and mitigate central banks' exposure to climate risks. In addition, it would reduce carbon-intensive assets' relative market value, giving financial incentives to investors to shift capital from carbon-intensive to low-carbon economic activities.

Finally, it would deliver a strong signal to financial institutions to incorporate climate risks into their asset valuation practices as well.

[17] A study by the Cambridge Institute for Sustainability Leadership (2015) shows that a short-term shift in market expectations about climate risks could lead to substantial and unhedgeable losses in financial portfolios.

[18] See, e.g., UNEP Finance Initiative and Oliver Wyman (2018) for some leads on how to develop such environmental risk measures.

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