



CENTRAL BANKS, CLIMATE CHANGE AND THE TRANSITION TO A LOW-CARBON ECONOMY

The 2015 Paris Agreement commits the world to limiting the global temperature rise to well below 2° Celsius. In this context, a number of initiatives have been launched to help stimulate financial support for achieving the transition to a low-carbon economy. These market-orientated initiatives focus mainly on mobilising existing private capital from institutional investors. So far, the results have been disappointing and the low-carbon investment ‘gap’ remains huge.¹

The role of central banks and the banking sector more generally in supporting the transition to a low-carbon economy has been largely neglected. This is striking given the significant influence central banks have over our economies, and it must be rectified.

In modern economies, the banking system creates between 85% and 97% of the money supply.² Whilst governments and non-bank financial intermediaries – like pension funds –

tax and spend existing money, banks create new money and purchasing power via the act of lending. At the aggregate level, their lending decisions have the power to shape the long-term trajectory of the economy.

Central banks have responsibility over large swathes of financial regulation and their powers enable them – should they choose – to influence the allocation of private-sector credit and financial flows.

But while central banks have played an increasingly interventionist role in our economies since the financial crisis, this has not coincided with any significant adjustment of their policies to support a low-carbon transition. With few exceptions, there has not been notable pressure for this to change from politicians, the media, civil society or citizens. Monetary policy and financial regulation are generally viewed as technocratic fields, best left to experts.

This briefing seeks to help address this problem. Below we:

- 1) Explain how central banks should play a more prominent role in supporting a low-carbon transition rather than maintain the status quo;
- 2) Identify some policy interventions that could help central banks address the growing challenges of climate change. In particular, we recommend a green macroprudential policy approach, green credit allocation interventions, and greening central bank balance sheets (also known as 'Green QE').

KEY POINTS:

- Central banks are publicly owned institutions. Their mandates should support the long-term public good, and environmental sustainability should be included in these objectives.
- Financial stability is a key part of existing central bank mandates, and climate change poses systemic risks to the financial system. There is therefore a clear case for a more interventionist approach.
- Current central bank policy risks reinforcing the current 'carbon lock-in' of energy systems centred upon fossil fuels, which endangers financial stability and undermines the Paris Agreement on climate change.
- The focus of financial regulators on encouraging greater disclosure of financial institutions' exposure to climate change related shocks is welcome but insufficient given the urgency of action required.
- Policy must be redesigned to strengthen financial resilience, so that policy responses help the financial system absorb shocks, whilst adapting and transforming it so that it is less susceptible to future risks of climate change.

**BOX 1: WHAT MODERN
CENTRAL BANKS DO**

Central banks are public institutions and their mandates are usually determined by governments. Since the 1990s their mandates have been strongly focused on price stability, typically an inflation target of around 2%. Since the 2008 financial crisis, there has been an acceptance that this must be balanced at all times with ensuring financial stability – one of the key lessons of the crisis was that price stability can coincide with the build-up of excessive financial risk. Central banks typically also have a secondary objective to support general government economic policy in their mandates.

Since the 1990s, most central banks in advanced economies have been granted ‘operational independence’, meaning they are free to apply their toolkit to pursue the goals set by politicians in whatever fashion they prefer.

Generally speaking, central banks influence the economy through:

1) *Monetary policy*, which involves influencing the flow of money and credit in the economy in order to achieve price stability (i.e. preventing excessive inflation or deflation). This is mainly achieved via adjustments to interest rates and the purchase or selling of existing financial assets (such as government bonds) via central bank money creation. The latter has been conducted on a very large scale since the financial crisis via ‘Quantitative Easing’ programmes.

2) *Financial regulation*, which defines the rules for financial institutions at both the individual level (‘prudential’ policy) and at the systemic level (‘macroprudential’ policy) to safeguard financial stability. These can include rules around the amount and type of capital banks must hold relative to their loans in case of defaults and also specific restrictions on certain types of lending, e.g. conditions on the possible size of mortgage loans.

PART 1: WHY CENTRAL BANKS ARE ESSENTIAL TO THE LOW- CARBON TRANSITION

1.1 Central banks are public institutions with a responsibility to support wider public objectives

Central banks are public institutions. Although their primary objectives are predominantly price and financial stability, most central banks also have secondary objectives around supporting the general objectives of government (*see box 1*). The rapid transition to a low-carbon economy is one such objective, as mandated by the Paris Agreement.

The role of the central bank is not carved in stone: it has changed through history. The first central banks were established to enhance the financial power of the sovereign – primarily to help finance wars; and in some cases, to help develop financial markets and promote domestic economic development.³ Over time, the roles and responsibilities of central banks have ebbed and flowed in response to economic events and changing monetary theory and practice.⁴

For the majority of the 20th century central banks have had a range of different objectives within their mandates. These have included high or full employment, managing and reducing government deficits, supporting strategic industrial sectors and exchange rate stability as well as price and financial stability.⁵ For example, central banks worked closely with ministries of finance to support post-war reconstruction and investment in infrastructure.⁶

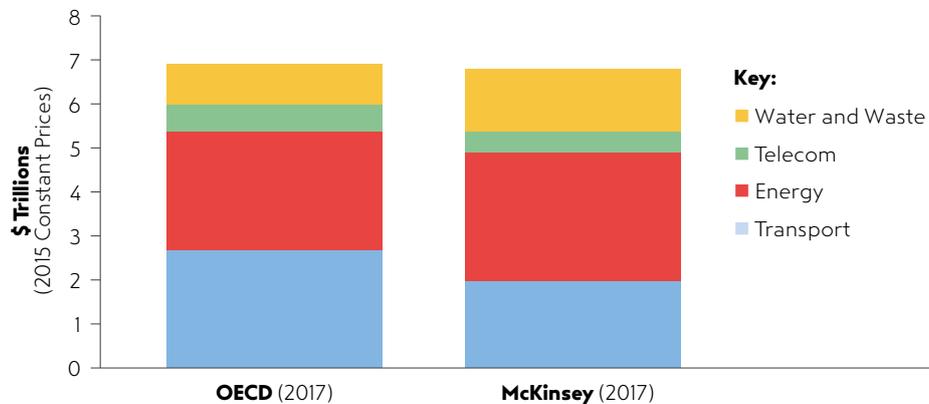
Central bank responsibilities have always been focused on the economic context and challenges at hand. Climate change is one of the greatest and most urgent challenges facing modern economies. It should be integral to central bank policy agendas, even aside from the legal obligations facing all signatories to the Paris Agreement.

1.2 All potential funding sources must be tapped to deliver the vast sums needed for the low-carbon transition

A successful transition will only be possible if agents of the state and financial sector act collaboratively in the same direction and bring the market with them. Ministries of finance, regulators, and central banks need to coordinate their activities and adapt their policies to address climate change, ensuring the credit and monetary system is fully aligned with the transition to a low-carbon economy.

One argument against central banks incorporating climate change into their policy agenda is that it is unnecessary and the ‘job of government’ or financial markets more generally. But there is a vast amount of investment required for a low-carbon transition. As shown in Figure 1, the total infrastructure investment required for a successful low-carbon transition from 2015 until 2030 is estimated to be around the \$95 trillion mark. Therefore, on an annual basis, investment would have to more than double from around current actual investment of \$3 trillion to just under 7 trillion every year.⁷ The extent of this challenge is put into perspective by the fact that the required investment is nearly two times the value of the total global infrastructure stock (approximately \$50 trillion).⁸

FIGURE 1: THE GREEN FINANCE GAP: ESTIMATED GREEN INVESTMENT REQUIREMENTS PER YEAR, 2015-2030



Source: Authors calculations based on ‘OECD (2017). Investing in Climate Growth: a synthesis. OECD publishing; Paris,’ ‘Brookings (2016). Delivering on sustainable infrastructure for better development and better climate,’ and ‘McKinsey (2016) Bridging global infrastructure gaps. McKinsey & Company, London.’

Market-based attempts at boosting green finance, such as the creation of carbon trading schemes, have been largely disappointing.⁹ There is also considerable resistance to a carbon tax from vested interests. Policy must do better to ‘price in’ externalities caused by carbon emissions, including the costs of climate change and air pollution.

A mixture of high-risk appetite and very long-term, patient capital is needed on a huge scale. Government spending and taxation (fiscal policy) and existing flows of private finance are unlikely, on their own, to be consistent with what is needed for the 2 degree transition stipulated in the Paris agreement.¹⁰ Economic growth remains sluggish, with high levels of public and private debt relative to GDP and uncertainty about the future due to a lack of policy credibility.¹¹ All of these factors are likely to hinder the kind of patient capital required for a rapid low-carbon transition.

Given this, the role of finance plays an ever more important part in driving forward innovation and radical shifts in production. Historical evidence suggests this is unlikely to come from the large, incumbent ‘status quo’ industries with easy access to finance. Rather, radical innovation is likely to come from small and medium sized enterprises (SMEs) – supported by government policy – that are most dependent on bank finance since they are unable to raise money on capital markets. Financial regulation could be used to steer bank credit towards these sectors.

1.3 Climate change is a major risk to financial stability

Some central banks are recognising that climate change will have a substantial impact on financial stability and economic growth, and therefore central bank policy. For example, the Bank of England notes,¹² “[F]undamental changes in the environment could affect economic and financial stability and the safety and soundness of financial firms, with clear potential implications for central banks.”

Against this backdrop, many economists have argued that climate change will have direct consequences for macroeconomic stability through its impact on (for example) food and energy prices.¹³ These factors will directly influence price stability and inflation, and therefore they warrant consideration by central banks when considering long-term inflation.¹⁴

The Bank of England’s Prudential Regulation Authority and the European Systemic Risk Board note that there are broadly three types of risk to financial system stability presented by climate change.^{15,16}

- *Liability risks* are the types of risk that may arise when individuals or businesses suffer losses/damages related to climate change, and look to hold certain entities responsible. Third party liability insurance also means this risk could be significant to insurance sectors.¹⁷
- *Physical risks* refer to the impacts of climate-related weather events (e.g. droughts, floods, and storms) that could have a profound impact on the productive economy. For example, disrupting global supply chains, resource availability, and entire industries.¹⁸ With scientists almost

certain that we will experience an increase in certain extreme weather events in the future, physical and liability risks will become even more pronounced.

- *Transition risks* arise from the processes of mitigation and adjustment towards a lower-carbon economy, which are likely to have significant effects on carbon-intensive sectors. Forecasts suggest that **only one fifth of remaining fossil fuel reserves** (oil, gas, and coal) **can be burned if we are to keep temperatures below 2°C**.¹⁹ If the Paris Agreement is met, most of these reserves will have to be left in the ground; fossil fuel companies may be hugely overpriced, and infrastructure built to extract the reserves may become useless (known as ‘stranded assets’).

The Governor of the Bank of England, Mark Carney, has suggested that the stranded assets problem could result in a ‘**climate Minsky moment**’ involving a rapid, system-wide (downward) repricing of carbon assets which would threaten financial stability.²⁰ For example, approximately 30% of the market value of the FTSE 100 stock exchange is derived from oil, gas and mining companies.

Importantly, stranded assets would not only have a direct detrimental impact on fossil fuel companies, but also the institutions that have invested or financed them and other industries that are dependent on the fossil fuel sector.²¹ Fossil fuel assets might not only become ‘stranded’ due to new regulation and government policies, but also changes in consumer preferences, resistance by communities (e.g. fracking in the UK²²) and technological innovations (e.g. growth of electronic car industry²³).

1.4 Central banks have a critical role in looking to the long-term

The three types of risk identified above are interdependent. The more fossil fuels we continue to extract and burn, the greater the economic risk from the liability and physical risks of climate change. We either proactively manage the transition risk on our own terms, or expose our economies to the incalculable economic cost of an unwinding climate system. Either way, it is a matter of the utmost significance for those tasked with delivering a stable and resilient financial system.

Lord Nicholas Stern has described climate change as the world's 'greatest market failure,' which risks unprecedented social and economic costs 'on a scale larger than the two world wars of the last century.'²⁴ In 2015 and 2016, the world's major banks lent an estimated \$198 billion to fossil fuel projects (mainly oil, coal mining and generation, and gas exports).²⁵ Carbon intensive activities benefit the financiers, producers, and consumers involved in the economic transactions whilst the environmental costs of burning these fossil fuels are indirectly imposed on the rest of society.²⁶ Given central banks' ability to influence financial flows and bank lending, these environmental market failures present a strong case for central banks to implement preventative or corrective policies.²⁷

Market failure can manifest in the form of 'missing markets,' where free markets fail to allocate financial resources efficiently – or in a way that is most beneficial for society. The green financing gap (see 1.2) is evidence that despite governments' intention to act on climate change, markets will not necessarily follow

suit. Signals from central banks are critical for correcting this. Historically central banks in advanced economies played an important role in developing financial markets. Where green finance is essentially 'missing,' central banks could have a role, working with ministries of finance to support the development of green financial markets.

More generally, in order to deal with major global challenges like climate change, the state needs to see its role as a proactive 'market maker' as well as well as simply correcting market failures.²⁸ Indeed, public actors, in particular development finance institutions (development banks), have been notable in taking a leading role in climate change and green energy investment.^{29,30}

Finally, climate change is a complex process, the impacts of which could be unpredictable and non-linear. Take, for example, the potential for 'tipping points,' which create runaway feedback loops – such as the melting of permafrost unleashing potent methane into the atmosphere. Markets are ill-equipped to deal with such dynamics. Financial analysis is generally calibrated on specific short-term time-frames.³¹ While long-term investors (are supposed to) seek returns over a 15-30 year time horizon, financial analysts focus on the next 1-5 years. According to new research by the 2 Degrees Lending Initiative,³² "non-cyclical, non-linear risks that will only materialise after the forecast [analysis] period are likely to get missed by analysts and therefore mispriced by markets."

Climate change has been referred to as ‘tragedy of the horizon,’ because as Governor Mark Carney explained,³³ “once climate change becomes a defining issue for financial stability, it may already be too late.”

It is not just financial analysts’ horizons that are too short. Political cycles create inherent pulls to the short-term. In contrast, central banks’ independence – from both short term political and market drivers – behoves them to focus on the long-term financial stability issues associated with climate change.

1.5 Monetary policy and the low-carbon transition

Central banks have expanded their monetary policy interventions significantly in the face of economic stagnation following the financial crisis of 2008. New money has been created – ‘printed’ in the pre-digital terminology – and pumped into the economy to stimulate the purchase of assets and thus, indirectly, wider spending. **The world’s four major central banks have expanded their balance sheets on average from 10% of GDP in 2008 to 45% today.**³⁴ However, central banks have generally not aligned their policy objectives with the threats of climate change. Indeed, some central bank policy is even having unintended negative implications for the environment.

One example is the European Central Bank (ECB), which has embarked on a ‘Quantitative Easing’ (QE) program through which it is creating €60 billion a month in new money to purchase government and commercial bonds alongside other financial assets. By the end of June 2017 the ECB held €96.5 billion of corporate bonds and it is expected that by the close of the programme at the end of 2017 it will hold approximately €140 billion of corporate bonds. Similarly, the Bank of England runs a £445 billion QE

programme, and whilst the majority of purchases have been government bonds, it also holds £10 billion in corporate bonds.

In both cases, these corporate bond purchases are intended to be ‘market-neutral’: central bank purchases are determined by similar criteria that are used by market investors. Environmental sustainability is not incorporated in to this criteria. As a result, these programmes are not ‘climate-neutral,’ but instead disproportionately skewed towards high-carbon sectors. A recent study³⁵ by the London School of Economics found that:

- 62% of ECB corporate bond purchases were from manufacturing, electricity and gas sectors, which are responsible for almost 60% of Eurozone greenhouse gas emissions but only 18% of Gross Value Added³⁶ (GVA).
- Nearly 50% of the Bank of England’s purchases were from manufacturing and electricity sectors, generating 52% of emissions but providing just 11.8% of GVA.

This matters because by intervening in financial markets to purchase carbon-intensive assets, central banks QE purchases are supporting the very carbon lock-in discussed in section 1.3, reinforcing the current arrangement of energy systems centred upon fossil fuels. Finally, by inadvertently subsidising carbon-intensive industries, cleaner green alternatives are indirectly discouraged.³⁷ Renewable energy companies and other types of green bonds are virtually un-represented in the corporate bond holdings of the Bank of England and the ECB.³⁸

PART 2: RECOMMENDATIONS

Central banks are in a powerful position to support and accelerate a low carbon-transition both via monetary policy and financial regulation. Their activities should strengthen financial-system resilience,³⁹ so that policy responses help the financial system absorb shocks, whilst adapting and transforming it so that it is less susceptible to future risks of climate change.

Below, we examine three potential interventions that central banks could pursue to help achieve these goals: 1) green macroprudential policy, 2) green credit allocation and 3) green quantitative easing (or Green QE).

2.1 Green macroprudential policy – taking away the carbon punch bowl

In the run up to the global financial crisis of 2007-08, a small number of economists warned that the build up of credit in the real estate and financial sector was unsustainable and posed serious risks to the financial system. They were ignored. Economists and central bankers argued it was not possible to ‘know’ a bubble had occurred until after it had burst, or that credit expansion was a benign and natural outcome of an increasingly sophisticated understanding of risk within the financial sector.

The crisis made clear that this approach was deeply flawed. Left to their own devices, financial markets were prone to excessive risk-taking with potentially disastrous consequences for the real economy as well as the financial sector itself. A new approach was required. Whereas traditional financial regulation focused on the safety of individual institutions (prudential policy), the crisis made it clear that there were *system-wide* macroeconomic risks – including for example the build-up

of mortgage debt and house prices relative to incomes across a whole economy – which also required monitoring and, where necessary, *preemptive* intervention.

A new policy approach to financial regulation was necessary, one that did not simply focus on the safety of individual institutions, but that aimed to mitigate the systemic financial risks to the macroeconomy. This approach is known as ‘macroprudential’ policy.

A key feature of macroprudential policy is that it empowers central banks to reduce the emergence of instability in the first place, allowing central banks to make interventions in the *opposite* direction of the lending activity of the market. In other words, central banks are given powers to reign in those activities that lead to bubbles, cyclical swings and economic shocks.

Specific policies include increasing the commercial banking sector’s capital requirements, e.g. by forcing banks to hold a higher portion of capital against certain types of loans they make. For example, when mortgage credit growth is high relative to household incomes (indicating a heightened risk of financial instability) capital requirements might be raised to limit the rate of growth in new mortgage lending.⁴⁰ In fact, evidence suggests that capital requirements placed on mortgage lending in Switzerland have helped curb the rate of new lending.⁴¹

Similarly, macroprudential policy may involve implementing quantitative limits on certain type of banks loans. The job of the central bank is to ‘take away the punchbowl’ when the party is beginning to get out of control.

2.2 Beyond voluntary disclosure

The primary response so far by central banks to the financial stability risks posed by climate change has been to encourage companies and financial institutions to voluntarily disclose their exposure to such risks. The Financial Stability Board of Bank of England, for instance, has begun a *Taskforce on Climate-Related Financial Disclosures*.⁴² In theory, this shall allow the market to understand and price in those risks, permitting the efficient flow of capital.

Whilst better information is to be welcomed, this faith in the market seems inconsistent with macroprudential policy, which is primarily focused on systemic and long-term risk that market participants with shorter-term time horizons (see section 1.4 above) may not appreciate.

Green macroprudential policy must therefore go further. A number of options could be examined.^{43,44} The most obvious would be the imposition of increased capital requirements – the amount of shareholder equity banks are required to hold for a given amount of assets – against loans carrying carbon-risk ('brown' loans). This was advocated by the recent interim report of the EU high-level expert group on sustainable finance:⁴⁵

"A 'brown-penalising' factor, raising capital requirements towards sectors with strong sustainability risks, would yield a constellation in which risk and policy considerations go in the same direction. Moreover, it would be more focused and easier to rationalise as capturing the risk of sudden value losses due to 'stranded assets.'"

Alternatives to simply raising capital requirements on carbon-intensive loans would be to implement a 'counter-cyclical buffer,' which simply means requiring banks to

hold increasing amounts of capital as the growth rate of lending to carbon intensive sectors increases; or to introduce direct limits to credit extension for businesses that are severely reliant on fossil fuels.⁴⁶

From a systemic risk perspective, these sorts of measures could help to reduce carbon emissions that are yet to be priced-in, and would help central banks curb the threat of a carbon bubble. The inverse approach could also be taken – lowering requirements on low-carbon assets in order to encourage greener investments.

2.3 Green credit allocation

Green credit allocation policies would guide lending and investment towards prioritised low-carbon sectors. Such measures could help develop 'missing' green financial markets until they reached an appropriate scale.

The principle of controlling credit flows and interest rates to serve specific national interests was extensively applied in many Western countries after World War II.^{47,48} Such practices were also key to the East Asian 'economic miracle' of the 1970s and 1980s and the more recent growth of the Chinese economy.

There are various credit allocation policies that could be adapted to promote green investment:

- **Limits on 'brown' lending or quotas for green lending:** limits or quotas on the amount of commercial bank lending to particular sectors. General lending quotas were previously used by the Bank of Japan and proved very successful in promoting the development of the Japanese economy in the 1970s and 1980s.⁴⁹

- **Green refinancing:** green targeted refinancing lines that would allow commercial banks to borrow from the central bank (or refinance) at lower rates to ease financing constraints in green sectors and to encourage banks to lend for green purposes. By establishing these lines, central banks can encourage banks to lend more into green sectors by rewarding them with higher profits for doing so. The ECB's refinancing lines encourage lending to non-financial businesses and households (except for mortgage lending).⁵⁰ Accordingly, the more banks lend to these entities, the more attractive the interest rate on their borrowings from the ECB becomes. While a framework would need to be devised to certify what constitutes 'green' loans, this programme could potentially be tweaked to offer cheaper rates for certain types of green lending – especially for green SME lending.
- **Green reserve requirements:** An alternative option would be for central banks to implement 'green' reserve requirements. Reserve requirements are the share of deposits that commercial banks must be retained in central bank money. Higher or lower reserve requirements could be set depending on the 'brown' or 'green' nature of a commercial bank's lending portfolio. Commercial banks would be allowed to hold fewer reserves when lending to a green cause, which would increase the banks' lending to this sector as a result of it being more profitable.⁵¹

2.4 Greening central banks' balance sheets, or 'green quantitative easing'

The considerable amount of assets currently being purchased by central banks via Quantitative Easing (see section 1.5) presents an excellent opportunity to re-channel financial flows more strategically towards greener, low carbon alternatives – what is often termed 'Green QE.'

A Green QE programme could take different forms. On the one hand, central banks could simply begin purchasing green bonds issued by corporates. Current QE programmes could be redesigned so that existing central bank money is strategically used to purchase green bonds.

Another possible approach is to purchase green bonds from development banks, green banks or similar public intermediaries – such as the European Investment Bank.⁵²⁻⁵⁴ These intermediaries could then finance lending for green infrastructure investments or green SME loans. Central banks might be more comfortable with this approach since the bonds would ultimately be underwritten by the state. Alternatively, in certain cases these public intermediaries could fund grants to support green public investment projects (in which case no private debt would be accumulated).

Targeting 'Green QE' in this way would provide considerable long-term demand for green bonds issued by corporates or public intermediaries. Caution in conducting such a programme would be warranted, as it could in principle contribute to mispricing of lower carbon versus high-carbon assets, leading to a green bond bubble.⁵⁵ But the programme could be designed prudently⁵⁶ by:

1. A thorough assessment of the underlying market structures and bottlenecks in funding low-carbon investments.
2. Detailed analysis of the extent to which the purchase of green bonds is an option for central banks, how much money could currently be absorbed through low-carbon asset purchases, how such purchases would change the funding situation for green investments, and how to measure success.
3. Rigorous evaluation of what institutional set-up could underpin a Green QE program, how to mitigate the risk of greenwashing, what role external rating agencies, research providers and auditors might play in that context, and whether the European Investment Bank could be a key pillar for such an initiative.

3. CONCLUSION

The transition to a below 2-degree economy, compatible with the Paris Climate Change agreement, will require a vast mobilisation of resources. Whilst greening fiscal policy and capital markets are important in financing such a transition, they are far less likely to be successful unless the monetary and banking system – which generates the money supply and can create new purchasing power – is also directed towards a 2 degree target.

Central banks are a key part of the monetary system. Not only do they create new money themselves on a massive scale via Quantitative Easing but they have the power to influence the flows of money and credit emanating from the commercial banking system via regulatory interventions. This paper has advocated the implementation of ‘Green macroprudential policy’ to incentivise banks away from brown lending, and Green Credit allocation and Green QE policies to positively support a significant expansion of green financing.

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