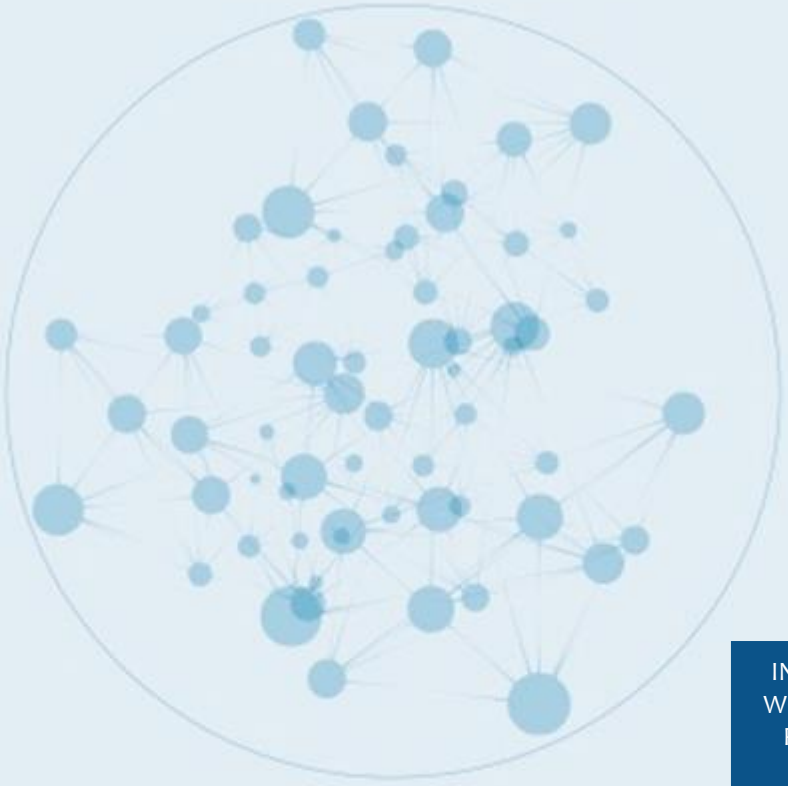
Inquiry: Design of a
Sustainable Financial System

UN environment

ON THE ROLE OF CENTRAL BANKS IN ENHANCING GREEN FINANCE



INQUIRY WORKING PAPER

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The UN Environment Inquiry

The Inquiry into the Design of a Sustainable Financial System has been initiated by the United Nations Environment Programme to advance policy options to improve the financial system's effectiveness in mobilizing capital towards a green and inclusive economy—in other words, sustainable development. Established in January 2014, it published the first edition of 'The Financial System We Need' in October 2015, with the second edition launched in October 2016. The Inquiry's mandate currently extends to the end of 2017, with work focused on deepening and taking forward its findings.

More information on the Inquiry is at: *www.unep.org/inquiry* or from: Ms. Mahenau Agha, Director of Outreach *mahenau.agha@unep.org*.

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About this report

This working paper results from a workshop the UN Environment Inquiry and CIGI held on 2-3 December 2014 in Waterloo, Canada to discuss options for a sustainable global financial system. The workshop included participants from a range of academic and research institutions from the Waterloo region and abroad, including the University of Waterloo, the University of London, Harvard University, and the University of Gothenburg.

Comments are welcome and should be sent to *simon.zadek@unep.org*.

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Contents

Abstract

The paper examines the role of central banks in 'greening' financial systems. Given the enormous investments needed to bring about a green transformation, the financial sector will have to play a central role in allocating resources towards a sustainable and green economy – and stop financing activities that harm the environment. Against this backdrop, the paper examines the extent to which environmental factors impinge on central banks' conventional goals and provides a theoretical analysis of the cases for and against central banks to respond to environmental and sustainability challenges. Moreover, the paper explores the ways in which central banks (as well as financial regulatory authorities) can impact investment decisions and the creation and allocation of credit through monetary as well as micro- and macroprudential policies, including disclosure requirements, climate-related stress testing and differentiation of reserve or capital requirements according to environmental impact. Although theoretical in nature, the paper is enriched by real-world examples. While making the case for a pro-active, 'sustainable development role' of central banks, the paper also discusses the risks of overstretching central banks' mandates and vesting too much power in unaccountable institutions as well as the division of labour between central banks and other institutions.

1 Introduction

Given the enormous investments needed to bring about a 'green transformation' towards sustainable, low-carbon development, the financial sector will have to play a central role in allocating resources to sustainable investments – and stop financing activities that harm the environment. Awareness has been rising that the financial system needs to take account of environmental and climate risks facing the real economy, and a large and growing number of central banks and regulators in developing and developed economies alike have already started dealing with this challenge in practice.[1]

And yet, the academic literature on central banking has largely ignored this topic thus far. The years since the outbreak of the Global Financial Crisis have seen an intensive discourse on the changing mandate of central banks and their role in safeguarding financial stability (e.g., Goodhart 2010; Eichengreen 2011; Buiter 2012; G30 2015). As pointed out in a recent G30 (2015: xi) report on the fundamentals of central banking, "important questions have arisen as to the proper roles, duties, and obligations of central banks in the years ahead." However, little attention has been dedicated to the role for central banks in addressing environmental and climate challenges despite the material risks they pose for real economies and financial stability.

Against this backdrop, this paper examines the extent to which environmental factors impinge on central banks' conventional goals and provides a theoretical analysis of the arguments for and against mandating central banks with environmental objectives. The paper also explores the ways in which central banks (as well as financial regulatory authorities if financial stability has been delegated to them) can impact on investment decisions and the creation and allocation of credit through monetary as well as micro- and macroprudential policies. Possible instruments include disclosure requirements, climate-related stress testing, differentiation of interest rate setting and variation of reserve or capital requirements according to environmental impact, or limits to certain types of investment or lending. Although theoretical in nature, the paper is enriched by real-world examples. While making the case for a pro-active role of central banks, the paper at the same time cautions against overburdening central banks' mandates. Central banks and financial regulators can make important contributions towards greening finance, but as will be discussed later they are not always the institutions best placed to do so.

The paper is structured as follows. Section 2 briefly reviews recent discussions about the roles and responsibilities of central banks. As a consequence of the Global Financial Crisis, the previously dominant consensus that central banks should essentially target inflation has been questioned, and a discussion has developed about other targets, especially financial stability, that central banks need to focus on and the tools needed to achieve them. In this context, the paper extends the discussion about central banks' responsibilities to include sustainability targets and the extent to which they may conflict with or complement other goals. Subsequently, Section 3 analyses the case for central banks to respond to sustainability challenges, and the relationship between possible sustainability objectives and financial stability and growth targets. Section 4 then discusses the range of policy instruments that may be employed by the central bank and financial regulation to achieve sustainability targets. This is followed by a discussion of the risks of overstretching central banks' mandates and undermining their institutional independence in Section 5. Section 6 concludes with some thoughts on the optimal division of labour between central banks and other public institutions.

2 The Changing Role of Central Banks

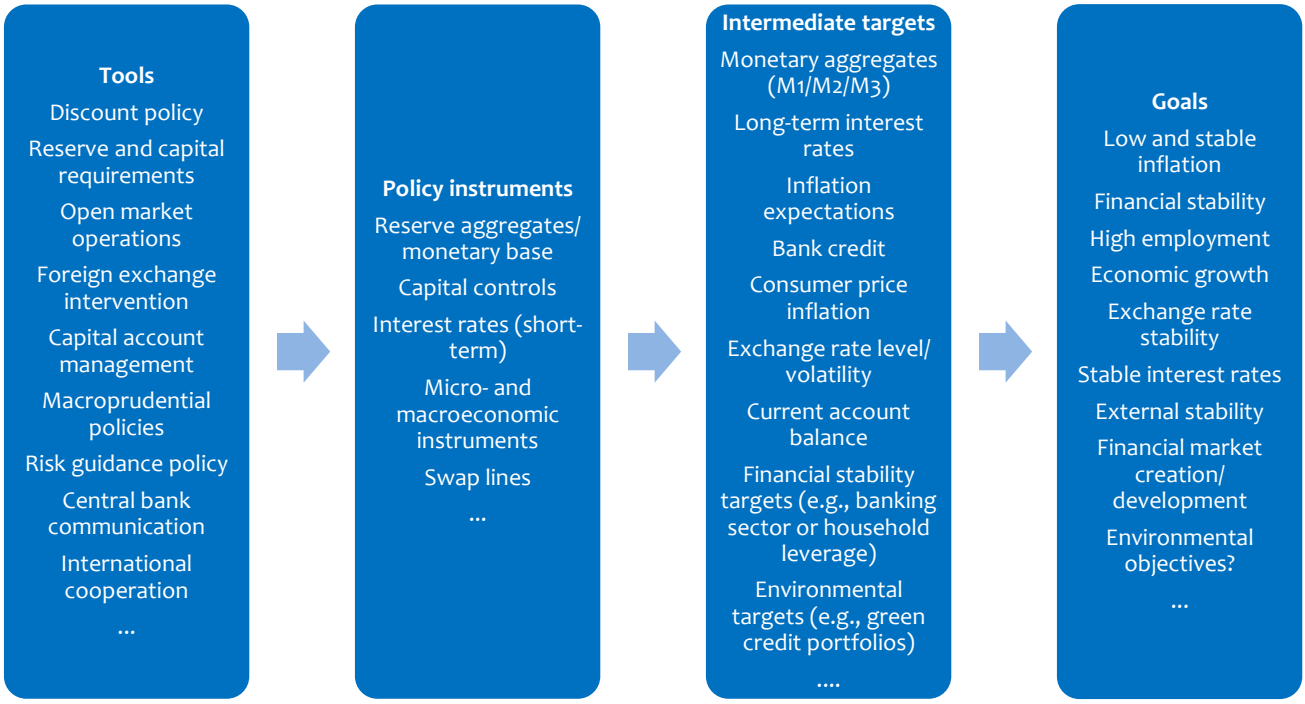
Milton Friedman (1968: 1) once remarked that "[t]here is wide agreement about the major goals of economic policy: high employment, stable prices, and rapid growth. There is less agreement that these goals are mutually compatible or, among those who regard them as incompatible, about the terms at which they can and should be substituted for one another. There is least agreement about the role that various instruments of policy can and should play in achieving the several goals." Today, most would agree that environmental and social sustainability should be added to Friedman's list of major goals of economic policy, but disagreements persist regarding the appropriate policies that should be adopted to reach these goals, their compatibility and who should be in charge.

Until recently, a relatively broad consensus existed regarding the role of central banks and monetary policy. The best contribution that central banks could make to societal prosperity, most economists believed, was to secure low and stable inflation rates. This conviction was epitomized by the so-called inflation targeting framework that dominated mainstream economic thinking since the early 1990s. Although maintaining financial stability had been historically one of the three main objectives of central banking (Goodhart 2010),[2] the rise of inflation targeting went along with a trend to delegate financial supervisory functions from central banks to dedicated financial regulatory authorities. Though appealing in its simplicity and clear rules-based approach, the inflation targeting concept has been severely criticized since the outbreak of the Global Financial Crisis for failing to address concerns other than price stability, and most importantly for its disregard of financial stability. Unsurprisingly, financial stability has again become a focal concern for central banks since the outbreak of the crisis. As Buiter (2012: 1) puts it, "there can be little doubt that, for any central bank faced with a potential conflict between price stability (or macroeconomic stability) on the one hand and systemic financial stability on the other, the primary of financial stability has been rediscovered with a vengeance. Systemic financial stability trumps price stability or macroeconomic stability every time – anywhere." This has serious implications for central banks with an inflation targeting framework as it questions the tenets of this approach. Frankel (2012) even went as far as to declare "the death of inflation targeting". In the same vein, Blanchard (2011: 8) debunked the simplistic pre-crisis orthodoxy which he described as "a one target, one instrument world" as follows: "Before the crisis, mainstream economists and policymakers had converged on a beautiful construction for monetary policy. To caricature just a bit: we had convinced ourselves that there was one target, inflation. There was one instrument, the policy rate. And that was basically enough to get things done. If there is one lesson to be drawn from this crisis, it is that this construction wasn't right, that beauty is unfortunately not always synonymous with truth. The fact is that there are many targets and there are many instruments. How you map the instruments onto the targets, and how you use these instruments best is a very complicated problem. This is the problem we have to solve. Future monetary policy is likely to be much messier than the simple construction we had developed earlier." (Blanchard 2011: 1)

Indeed, as Blanchard points out, there are numerous potential targets for the central bank and also a number of instruments that could be used to achieved them. Figure 1 provides an overview of potential tools, policy instruments, intermediate targets and policy goals. The policy goals of central banks can be broadly grouped into three main functional roles: maintaining price stability, maintaining financial stability, and supporting wider economic policy objectives. The latter may include objectives such as high employment, economic growth, exchange rate stability, stable interest rates, external stability, financial market creation/development, and possibly also sustainable development. The objectives will not

necessarily be of equal ranking. Price stability is specified as a primary objective in most central bank legislation, either as "an explicit legislative mandate or because more general objectives have been interpreted to require it" (BIS 2009: 3). Price stability is widely regarded as the sine qua non for achieving high and sustainable real growth. Price stability, however, need not be a singular or the only primary objective.[3] As discussed, since the Global Financial Crisis, financial stability has been rediscovered as a primary objective, even in cases where it is not specified as a dominant policy objective in a central bank's legislation. It is in the context of the demise of the inflation targeting framework and the discussion on a wider central bank mandate that the following analysis of a potential environmental role of central banks needs to be placed. Indeed, as will be argued in the next section, the renewed emphasis on the role of central banks in safeguarding financial stability can be directly linked to the case for responding to environmental and sustainability challenges. Arguably, even when environmental and sustainability objectives are not part of a central bank's explicit mandate, the instrumental incorporation of sustainability factors may be relevant in order to achieve price stability or safeguard financial stability.

Figure 1: Tools, Policy Instruments, Intermediate Targets and Policy Goals



Source: Compiled by author.

While multiple potential instruments exist, it is important that the Tinbergen rule, according to which the number of policy goals cannot exceed the number of policy instruments, is adhered to (Tinbergen 1952). This is no trivial matter, as highlighted by Mundell (1963: 262):"To achieve a given target there must be an effective instrument and to achieve various independent targets there must be at least an equal number of effective instruments. If a program includes more targets than instruments at least one target cannot be fully attained; whereas if it contains more instruments than targets, there will be more than one way of achieving the combination of targets. Just as a mathematical system will be "overdetermined" or "underdetermined" if the number of variables differs from the number of equations, so a policy system will not generally have a unique attainable solution if the number of targets differs from the number of instruments."

Hence, when discussing whether central banks ought to incorporate sustainability goals, it will be important to analyse the extent to which these can be included in a consistent and effective policy system. While central banks with more targets than instruments need to discuss how to recover more instruments, there is also a danger of overstretching central banks' mandates, as will be discussed in Section 5. But before this, however, the next section discusses whether there is a case for the central bank to include sustainability goals in their policy functions.

3 The Case for Central Banks to Respond to Environmental and Sustainability Challenges

We distinguish three broad types of arguments justifying why central banks should respond to environmental and sustainability challenges: (i) the financial and macroeconomic risk argument, (ii) the market failure argument, and (iii) an argument relating to the role of central banks as credible and powerful actors, especially in developing countries.

3.1 The Financial and Macroeconomic Risk Argument

The first set of arguments relates to the role of central banks as guardians of financial and macroeconomic stability. To start with, climate change and environmental damages may have very direct consequences for price stability through their impact on food and energy prices. Floods and droughts related to climate change may affect agricultural output, which in turn influences food prices.[4] At the same time, the need for climate change mitigation impacts patterns of energy production and energy prices. Monetary policy has to take into account changes to food and energy prices, and while the central bank may not be able to directly influence them, these changes can have indirect and second-round effects on core inflation. Factors driving food and energy prices thus need to be included in central banks' long-term inflation outlook analysis.

But there may be also risks to financial stability from environmental damage and climate change. As discussed, safeguarding financial stability has traditionally been considered a core responsibility of central banks, and the post-crisis deliberations have produced a relatively broad consensus that central banks need to move away from narrow price stability-focused mandates and take charge again of financial stability. Furthermore, the crisis experience has shown that financial regulation and supervision needs to extend beyond its traditional microprudential focus and develop macroprudential policy frameworks aimed at limiting systemic risk in the financial sector. As put by Macklem (2011: 1), "central banks have a pivotal role to play in mitigating systemic risk by identifying system-wide vulnerabilities and using their panoramic view of the financial system to connect the dots."

Although few central bankers and regulators will think of environmental risk when considering forms of systemic risk,[5] there should be little doubt that environmental risk – and risk arising from climate change in particular – constitutes a significant systemic risk for the financial sector. While "[u]ncertainties about future vulnerability, exposure, and responses of interlinked human and natural systems are large" (IPCC 2014: 11), there is a broad consensus that climate change will have a significant impact on the functioning of our economies and therefore also on financial systems. However, as pointed out by Leaton et al. (2013: 23), "the banking system and regulators are not yet watching for the warning signals [of climate change] – leaving a financial system that is still not fit for purpose. The rules that guide and govern the operation of financial markets need to evolve to address this systemic risk."

At least three types of financial sector risk are associated with climate change.[6] First is what is commonly referred to as 'transitional risk'. Climate change and the need for mitigating it will require drastic policy action and adjustments by firms and households. While policymakers thus far have been reluctant to take action and the private sector by and large continues with business as usual, the pressure for taking tougher action on climate change and reducing carbon emissions will inevitably rise. The costs of adjustment will rise the longer mitigating action is delayed. New environmental regulation and changes to carbon pricing will significantly affect carbon-intensive businesses and may even threaten their very survival. As an example, because of new environmental regulations, "a large share of the fossil-fuel

reserves of oil, gas and coal companies would be at risk of becoming "stranded assets" – and left undeveloped – in the event of global policy action to limit warming to 2°C" (Kiernan 2014). Risks, however, extend not only to fossil fuel companies but to the economy at large. And although "[g]lobal climate-change policy action may advance [only] incrementally, ... the overall trend is unlikely to be reversed. If anything, the pace of implementation will accelerate as the risks posed by climate change become clearer, even if efforts to reach a sweeping agreement [on the global level] fail" (Kiernan 2014). Moreover, the development of new technologies in response to climate change mitigation and adaption pressures may render some established technologies and business practices redundant, causing a reassessment of asset valuations. If the re-pricing of risk happens in a gradual manner, the risks to financial stability will be limited, but financial authorities may have a role in safeguarding that these risks are addressed. As pointed out by Carney (2015), "[t]here have already been a few high profile examples of jump-to-distress pricing because of shifts in environmental policy or performance." It should be added that high carbon and resource intensity have a long-term impact on the viability of individual businesses and the competitiveness of economies at large, which implies also risks for macroeconomic sustainability and stability.

Second, economies face a physical risk, which the Bank of England (2015b: 4) defines as "the first-order risks which arise from weather-related events, such as floods and storms", comprising "impacts directly resulting from such events, such as damage to property, and also those that may arise indirectly through subsequent events, such as disruption of global supply chains or resource scarcity." Irrespective of any prospective environmental regulation aimed at mitigating climate change or any adaption measures undertaken, the risks of pervasive disruptions to individual businesses and entire industries or even economies stemming from climate change may be significant. This, again, can have systemic impact at a regional or national level and could even affect sovereign credit risk.[7] However, apparently neither business nor finance is sufficiently factoring in these risks at the moment. Although general awareness of risk from extreme weather and climate change is rising, the Center for Climate and Energy Solutions concluded in an assessment of business resilience to climate change that the vast majority of businesses are not prepared for the effects of climate change: "Broadly speaking, the research reveals that while the vast majority of companies recognize risks from extreme weather and climate change, and many see these risks in the present or near term, uncertainty about the precise nature, timing and severity of climate impacts often inhibits investment in resilience beyond "business as usual." A few leading companies are taking steps to address climate risks where they see significant opportunities to become more efficient, reduce costs, or provide greater value to customers – in other words, where there is a clear business case to do so. By and large, however, the business response thus far is largely a continuation of existing practices based on a historical picture of past risks, and often fails to adequately consider changing climate and weather conditions. Thus, the most common strategy for addressing climate-related risks leaves most companies without the resilience they need to weather future physical impacts of climate change." (CCES 2013: 9)

These effects, however, may be considerable. For instance, a study by the Risky Business Project (2014: 2) on the economic risk of climate in the US concluded: "The U.S. faces significant and diverse economic risks from climate change. The signature effects of human-induced climate change—rising seas, increased damage from storm surge, more frequent bouts of extreme heat—all have specific, measurable impacts on our nation's current assets and ongoing economic activity. ... Damage to coastal property and infrastructure from rising sea levels and increased storm surge, climate-driven changes in

agricultural production and energy demand, and the impact of higher temperatures on labor productivity and public health."

As recognized by the Bank of England (2015a: 35), such "[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, one would expect banks and other financial institutions to price in these risks. Indeed, some evidence indicates that financial markets start doing so. Based on the data of 582 publicly listed corporations in the US, Bauer and Hann (2010) find that legal, reputational and regulatory risks related to environmental incidents impact borrowing conditions. Bauer and Hann also find that firms' proactive environmental practices lower their cost of debt financing. However, as pointed out by Alexander (2014: 12), "the history of financial crises demonstrates that financial markets suffer from serious over and underestimation of risks because of asymmetric information and moral hazard" and that "[t]hese risks translate into large externalities for the economy and society". Especially regarding long-term investments, financial institutions need to get serious about climate risk, and financial supervisors ought to ensure that the systemic risk stemming from climate change is incorporated into financial institutions' risk models since a failure to do so is associated with an increased risk of economic and financial calamity. Against this backdrop, Alexander (2014) recommends that "[t]he Basel Committee should explicitly acknowledge environmental risks and their increasing impact on the stability and sustainability of the economy as an emerging source of systemic risk for banks and banking stability. On this basis it should encourage and support bank regulators to work with banks to adopt current best practice in the management of environmental issues, and to collect the necessary data and conduct analysis to refine the banking sectors' understanding of, and ability to address, systemic environmental risk in the future."

Disclosure is central to addressing climate and environmental risk. In its first report, the Financial Stability Board's *Task Force on Climate-related Financial Disclosures* notes that "inadequate information on risk exposures can lead to a mispricing of assets and/or misallocation of investment and can potentially give rise to concerns about financial stability, since markets can be vulnerable to abrupt corrections" (TCFD 2016a: 8).[8] To date, however, only a small fraction of companies disclose sustainability risk.[9]

Thirdly, firms – financial as well as non-financial – may face climate- or environment-related liability risks (Carney 2015; Bank of England 2015b). These are risks that could arise if agents suffering losses related to climate change or environmental damages seek compensation from those they hold responsible for their damage, including carbon extractors or emitters and environmental polluters more generally. By providing third party liability insurance, liability risk could thus also become a major problem for the insurance sector (Bank of England 2015b). Moreover, financial firms could be held responsible for breach of fiduciary duty for "[f]ailing to consider long-term investment value drivers, which include environmental, social and governance issues, in investment practice is a failure of fiduciary duty" (UN Global Compact *et al.* 2015: 9).

To the extent that central banks are tasked with guarding financial stability, these risks need to be considered in central banks' financial stability and macroprudential policy frameworks. Importantly, financial regulators need to address the "tragedy of the horizons" problem (Carney 2015). Thus far, a fundamental problem of financial stability tests is time horizons, which typically extend out to only three to five years, or a decade at most. Yet, it is problematic to restrict the analysis to the duration of a credit cycle when one knows that actions over that period will almost certainly create instability beyond that time horizon.

3.2 The Market Failure Argument

The provision of credit by banks to socially undesirable activities – such as carbon-intensive or polluting businesses – can be characterized as a credit market failure. As pointed out by Campiglio (2016: 224), "[t]his 'credit market failure' lies in the misalignment between the legitimate pursuit of private interests by commercial banks – which create the majority of the money supply – and the development objectives that a society sets to itself, the achievement of which is conditional to the availability of financial resources and a certain degree of monetary stability." In the presence of externalities, the allocation of credit by commercial banks may hence be suboptimal from a societal perspective, with too much being allocated to carbon-intensive, polluting activities.

Environmental regulation and carbon pricing should be the preferred policy tools to correct this market failure and prevent or disincentivize such investments, but as long as carbon pricing markets are not functioning and environmental policies are not in place or not effectively enforced, the central bank may have a case to use its powers to affect credit creation and allocation. In this sense, the credit market failure argument for green financial regulation is an application of the theory of the second best (Lipsey and Lancaster 1956): if first best policies for fixing the credit market failure cannot be implemented, then the government may resort to a second best policy and mandate the central bank or financial supervisor to address negative environmental externalities by using the tools they have at their disposal.

A further form of market failure are missing markets, i.e., situations where efficient, free markets which would enable a Pareto efficient distribution of resources fail to exist because set-up costs, such as administration or gathering of information, prevent private profits (Heller 1999) or because such markets need to reach a certain scale to function. As explained by Maroni (1978), under certain conditions central banks may have a role to play in the development of securities markets, for instance by establishing procedures to promote the disclosure of information or the development of a secondary market.[10] Along these lines, the case can be made for central banks to support the build-up of missing market segments to promote green finance, such as a green bond market. Helping to create new green markets may also ensure that traditional tools of monetary policy are made environmentally consistent.

3.3 Central Banks as Credible and Powerful Actors in Developing Countries

In developing countries, the case for an environmental role of central banks can also be derived from the typically strong institutional standing that central banks have in the policy frameworks of these countries. While, as just discussed, the case for incorporating environmental sustainability in their analytical frameworks in principle applies to all central banks and financial regulators, the case for assigning an environmental mandate to central banks and financial regulators may be even stronger in developing and emerging economies, where environmental regulation is often not or only weakly implemented or even ignored because weak public institutions lack clout. In developing economies, central banks and financial regulators are typically among the most sophisticated and powerful public institutions. Through their command over the banking sector, they can effectively exert influence over private investment decisions. Moreover, central banks' financial market expertise and their transnational networks can help them to promote "best practice" reforms in the financial sector. To some extent, this argument is an extension of the market failure argument discussed above, and hence an application of the theory of the second best. The relevance of this argument for developing country central banks may be larger than for those in developed countries because market failures, especially missing or underdeveloped markets (such as local currency bond markets), tend to be a more prevalent problem in the former.

The argument for central banks as promoters of sustainable development relates to the literature on the developmental role of central banks – a role central banks have assumed not only in developing countries.[11] In fact, historically, the central banks of most countries – including European central banks as well as the US Federal Reserve – have played a crucial role in economic development by supporting targeted sectors, be it in industry or finance.[12] As Epstein (2007: 2) points out, "virtually all central banks have [at some point] engaged in 'industrial policy' or 'selective targeting'." This was still widespread practice until the central banking revolution of the 1980s.[13] Even today, despite their rhetoric to the contrary, many central banks, including many across the OECD, are effectively directing lending and investment.[14]

The fact that central banks could do all sorts of things does not imply that they should necessarily do so. Important questions arise regarding the mandate and accountability of central banks, potential conflicts between goals, as well as their institutional independence. Central banks' credibility may suffer when they take on and fail to achieve additional goals. These points will be discussed in Section 5. Before this, however, the following section will review potential policy tools that could be used by central banks to impact lending and investment decisions and the creation and allocation of credit.

4 Potential Policy Tools to Impact on Investment Decisions and the Creation and Allocation of Credit

Central banks can employ a number of policy tools to impact investment decisions and the creation and allocation of credit into green investments and away from environmentally harmful activities. Some are variations of traditional monetary policy tools that can be used to enhance green investments, including differentiated rediscount rates and capital or reserve requirements that affect the money multiplier and can be used to incentivize green lending, while others could be classified as unconventional policy tools. Central banks can also use their convening power to encourage financial institutions to consider climate and environmental risks in their operations and develop capacities to tackle them. Moreover, central banks – or other financial authorities in case responsibility for financial regulation lies outside the central bank – can request financial institutions to disclose climate-related risks and carry out climate-related stress tests.

4.1 Disclosure Requirements

Without effective disclosure of climate-related financial risks, the impacts of climate change may not be correctly priced in by financial markets. The Financial Stability Board's *Task Force on Climate-related Financial Disclosures* therefore recommends mandatory disclosure requirements for all financial organizations – including banks, insurance companies, asset managers and asset owners – in their public financial filings (TCFD 2016b). Improved transparency of climate-related risks helps a more appropriate pricing of risks and allocation of capital, and provides the basis for green macro-prudential regulation and climate-related stress testing.

4.2 Green Macroprudential Regulation and Climate-related Stress Testing

Schoenmaker et al. (2015) argue that macroprudential supervision ought to take into account externalities that may give rise to financial instability and identify the ecological imbalances that may cause material financial risks. A straightforward way of addressing environmental systemic risk would be to introduce ceilings on credit extension to certain carbon-intensive or polluting activities. Credit ceilings have fallen out of fashion since they are regarded as non-market instruments, but in the past they were commonly used by central banks to limit credit expansion without increasing interest rates (Zysman 1987). Exemptions from credit ceilings can be used also to channel investments into priority sectors.

Schoenmaker et al. (2015) discuss a number of more sophisticated macroprudential instruments to address climate risk, including countercyclical capital buffers; higher risk weights for either carbon-intensive and dependent sectors (such as transport, mining and energy) or for particularly carbon-intensive and dependent companies within these sectors; restrictions on exposure concentration to carbon intensive and dependent assets; and climate-related stress tests.

A climate-related stress test scrutinizes the likely impact of hypothetical climate scenarios on the health of individual financial institutions and the financial system as a whole in order to assess the resilience of individual institutions and the system to adverse shocks. Developing a robust stress test is a challenge that involves the complex modelling of climate shock scenarios and transmission mechanisms of these shocks across the financial system (Batten et al. 2016).

4.3 Directed Green Credit Policy Instruments

Fry (1995: 306) classifies six main categories of directed credit policy instruments, namely, subsidized loan rates for priority sectors, differential rediscount rates, direct budgetary subsidies, credit floors,

credit ceilings and proliferation of specialized financial institutions. Out of these, the most commonly used instrument is subsidized loan rates for priority sectors. To incentivize commercial banks to lend to priority green sectors at lower loan rates, a central bank can use differential rediscount rates where banks extending credit to green investment can rediscount bills at lower rates. That is, "[f]inancial institutions are compensated partially, fully or even overcompensated for lending at subsidised rates of interest to priority borrowers when they rediscount priority loans at the central bank on concessional terms" (Fry 1995: 306). While "[t]his method can and often does jeopardise the control over the cash base ... [i]t is the only technique that can be used without direct interest or credit allocation controls" (ibid.).

4.4 Green Differentiated Reserve Requirements

Another way for the central bank to influence credit allocation is the use of differentiated reserve requirements, for instance linked to the composition of commercial bank portfolios or the geographical location of credit (Chandavarkar 1988). As pointed out by Epstein (2007: 12), "[v]ariable 'asset based reserve requirements' were [historically] widely used ... to promote lending to desired sectors." The reserve requirement ratio is the share of deposits that banks and other depository institutions such as savings institutions and credit unions must hold in reserve and not lend out. Reserve requirements have a significant impact on banks' ability to create credit and thereby also an economy's money stock. If the central bank lowers the reserve requirement, banks can increase their lending. Allowing lower required reserve rates on privileged green assets would be a way of favouring green investments over conventional investments (Rozenberg et al. 2013; Campiglio 2016).

Such a policy where banks with a higher share of green lending are subject to lower reserve requirements has been introduced in 2010 by the Banque du Liban, the central bank of Lebanon (BDL 2010). The stated target of Banque du Liban is to "facilitate financing investments in specific economic sectors by exempting banks from part of the required reserve requirement to finance these projects at low cost" (BDL 2009). Together with the central bank, the Lebanese Center for Energy Conservation (LCEC), an agency affiliated to the Lebanese Ministry of Energy and Water, implemented a National Energy Efficiency and Renewable Energy Action (NEEREA) scheme aimed "at providing cheap credit to the private sector for projects related to renewable energy production and energy efficiency in buildings" (Campiglio 2016: 226). In essence, the Banque du Liban supports green credits by lowering the reserve requirements of commercial banks by an amount of 100-150% of the loan value if the bank's customer can provide a certificate from the LCEC that confirms the energy savings potential of the financed project.

4.5 Differentiated Capital Requirements

Like reserve requirements, capital requirements can be differentiated according to the type of bank and their lending. Adjusting capital adequacy ratio minimum requirements (i.e., the ratio of a bank's capital over its risk-weighted credit exposures required by the regulator) or the risk weightings of different assets directly affects banks' ability to create credit. For instance, the capital requirements regulation under Basel III foresees a capital reduction factor for loans to small and medium enterprises (SMEs), which means that SMEs typically receive a differentiated treatment for their loans compared to large enterprises. In the same spirit, Campiglio (2016: 226) proposes "calibrating the computation of Basel III risk-weighted capital ratios in a way that low-carbon activities would exert a lower pressure than alternative investments."[15]

4.6 Accepting Carbon Certificates as Part of Commercial Banks' Legal Reserves

Rozenberg et al. (2011) propose to enhance the market for carbon certificates by making carbon certificates acceptable as part of commercial banks' legal reserves. The idea is to distribute carbon certificates to low-carbon projects and make them exchangeable for concessional loans. This would reduce the capital costs for low-carbon projects. Low-carbon projects would hence become relatively more attractive than 'regular' investments.

4.7 Green Quantitative Easing and Reserve Management

Quantitative easing (QE) is an unconventional monetary policy that was first employed by the Bank of Japan in the early 2000s to fight deflation when nominal interest rates already were at the zero lower bound. It essentially consists of large-scale asset purchases from banks and other financial institutions via open market operations. These asset purchases include mainly government bonds, even though some central banks have also bought corporate bonds and equities. While there are conflicting views regarding the efficacy of QE in general, the argument has been made that asset purchases under QE could be directed toward the purchase of green financial assets such as green bonds.

In the UK, where the Bank of England has pursued QE since January 2009, a discussion of green quantitative easing has unfolded (cf. Lucas 2011; Harvey 2012; Clark and Giles 2014). For instance, David King, a former chief scientific adviser to the British government, demanded that QE should be aimed at the green economy: "By placing conditions on quantitative easing (QE), which give preference to lending that promotes more environmentally responsible development, the government could help to ensure that the economic recovery does not simply return the UK to its former high-carbon and resource-intensive path of economic growth. ... QE could provide a major spur to the greening of the UK's infrastructure, not just for renewable and nuclear energy but also a more efficient use of all resources, which would cut the environmental impact of the economy. "Quantitative easing has been relatively passive – why not use it in a way that can be directed?" King said. "Why not use it to take us to a sustainable economy and manage the release of private sector money? You could have a quite selective series of tests [to determine where the money should go]." He said this was a much better option than the current approach of using subsidies to favour low-carbon growth, which he said was not working well." (Harvey 2012)

At a more general level, central banks could manage their assets according to social impact investment standards. As pointed out by Sheng (2014: 17), "[i]f central banks were to join the UN Principles on Responsible Investing, then another US$24 trillion worth of funds would be added to the US$45 trillion already pledged, equivalent to one quarter of global financial assets. 4% of central bank assets allocated to such funding would amount to US$1 trillion alone."

4.8 Green Finance Guidelines and Frameworks

A further option is the release of green credit guidelines aimed at guiding banks towards greener lending. As of January 2017, 37 countries are represented in the Sustainable Banking Network (SBN), a knowledge-sharing network of banking regulators and banking associations established in 2012 to support the development of environmental and social risk management by financial institutions and promote green and inclusive lending. Thirteen SBN member countries have already introduced green finance guidelines, while the other countries are currently working on such guidelines.[16] The various green finance guidelines differ across countries but usually comprise frameworks for environmental risk assessment as well as incentive schemes for enhancing green finance.[17]

One of the countries that has been in the vanguard in developing green banking policies is China, where attempts at addressing environmental risks through financial regulation date back to 1995. In 2012, the China Banking Regulatory Commission (CBRC) issued Green Credit Guidelines "for the purpose of encouraging banking institutions to, by focusing on green credit, actively adjust credit structure, effectively fend off environmental and social risks, better serve the real economy, and boost the transformation of economic growth mode and adjustment of economic structure" (CBRC 2012).[18] However, while the CBRC's Green Credit Guidelines have received much praise, the Chinese experience has shown that such non-binding guidelines are not enough to affect banks' lending practices in any meaningful way, suggesting that it may be necessary to go further and introduce compulsory elements in a more comprehensive green finance framework (Volz et al. 2015). In 2014, CBRC complemented the Green Credit Guidelines by introducing a Green Credit Monitoring and Evaluation mechanism and a key Performance Indicators Checklist. China's green credit policies have therefore "evolved from an initial principle based approach in 2007 to a standardized, metrics-driven performance assessment of all licensed banks" (UN Environment Inquiry 2015: 27). In 2015, the People's Bank of China also introduced green financial bond rules.

Other countries where comprehensive green banking frameworks have been introduced include Bangladesh and Indonesia. In 2011, Bangladesh Bank, the central bank, published 'Policy Guidelines for Green Banking' and 'Guidelines on Environmental Risk Management' to encourage banks to conduct systematic environmental risk analysis as part of the credit appraisal process. Bangladesh Bank has implemented two further policies to develop green finance: a green refinancing scheme and a mandatory credit quota for loans.[19] A roadmap for a green banking framework aimed at developing capacities for environmental risk assessment and green lending with compulsory elements has been recently developed for Indonesia (Volz 2015).

4.9 Soft Power

Last but not least, the convening role and soft power of central banks can matter a lot for promoting the development of new green market segments or products and the nurturing of sustainable financial market practices. As emphasized by Chandavarkar (1988: 4), "[m]ore than statutes and formal powers it is the central bank's status, expertise, and influence, in relation to the government, developmental agencies and the financial community, which defines its promotional opportunity-set as a regulator, innovator, participant, guarantor, and catalyst of financial development." By including climate and other environmental challenges on the agenda, the central bank can signal the importance of this topic to market actors and encourage them to take it seriously. To this end, central banks can also rely on their international networks and joint international action, whether on standards, methods or policy engagement such as the G20.

This brief overview has shown that central banks have a fairly large set of tools at their disposal to impact on investment decisions and the creation and allocation of credit. It is not possible to make general statements which tools and policy instruments are most effective or appropriate, as this will depend on the specific country circumstances and the specific mandate that central banks have received.

5 The Limits to a Sustainable Development Role of Central Banks

While the paper has argued thus far that there may be a case for a pro-active, 'sustainable development role' of central banks, one needs to be clear about the risks of overstretching central banks' mandates. The risks are at least threefold.

5.1 Conflicting Objectives

First, on a functional level, central banks will encounter problems if they are supposed to achieve too many objectives and have too few tools, as discussed in Section 2. In principle, if central banks were tasked with environmental goals, they would need to be equipped with effective instruments in order to achieve these goals without compromising other goals. It should be noted though that the financial and macroeconomic risk challenges stemming from climate change discussed above are issues central banks have to deal with in any case. That is, as far as the traditional core responsibilities of central banks – safeguarding macroeconomic and financial stability – are affected, there is no need to add environmental goals to central banks' mandates as these are implicitly already part of the mandate. Yet, it will be critical to analyse in detail how environmental and climate change risks can be adequately incorporated into existing frameworks. Recent years have seen considerable efforts by central banks and academics to develop macroprudential frameworks and instruments (e.g., Mendoza 2016). The understanding of how to best incorporate climate risk into macroprudential analysis is still at an early stage,[20] but a consensus seems to be slowly emerging that climate and environmental risks need to be addressed in financial supervision and regulation to the extent that they pose material risk to the financial sector. At the same time, the extent to which central banks should use tools at their disposal to play a pro-active sustainable development role to promote green investment and dis-incentivize dirty investments is still heavily disputed, and there are indeed concerns that promoting specific sectors such as the green economy may cause conflict with other central bank goals, including financial stability.

5.2 Vesting Too Much Power in Unaccountable Institutions

Second, there is a danger that too much power may be vested in unaccountable institutions.[21] Over the past decades, a relatively broad consensus has developed that central banks should be granted institutional independence, i.e., the conduct of monetary policy in pursuit of goals set by the government should be free from political influence. As central bank policies have stretched their powers in the post 2008-crisis era beyond what used to be the accepted norm, central banks have faced increased criticism for taking policy decisions that critics say go beyond their mandate. A quasi-fiscal role of central banks, for instance, is considered problematic as central banks have no political legitimacy for taking decisions about the allocation of public spending. At the same time, it is important to realize that monetary policy has always distributional consequences and that it is impossible to reduce central banking to a purely technical exercise.[22]One possible way to address this issue is by improving central bank accountability, for instance by enhancing reporting requirements.

Whether central banks go beyond their mandates depends on the formal mandate but also its interpretation, which can be ambiguous. In the case of the Eurozone, for instance, Article 127 (1) of the Treaty on the Functioning of the European Union clearly defines price stability as the primary objective of the European System of Central Banks (ESCB). However, it also states that "[w]ithout prejudice to the objective of price stability, the ESCB shall support the general economic policies in the Union with a view to contributing to the achievement of the objectives of the Union as laid down in Article 3 of the Treaty on European Union." Article 3 (3) of the Treaty on European Union in turn includes the objective of

"*sustainable* development of Europe based on balanced economic growth and price stability, a highly competitive social market economy, aiming at full employment and social progress, and a high level of protection and *improvement of the quality of the environment*" (emphasis added). This means that the ESCB's mandate does indeed include, inter alia and without prejudice to the objective of price stability, supporting the European Union's *environmental objectives*. This brings us back to the question of potentially conflicting goals, but it also opens up the question to what extent the political authorities and the public at large want the ESCB to play an active role in supporting environmental objectives. As the current discussions in the Eurozone show, it is not solely up to the central bank to interpret its mandate – ultimately, central bank policies need to be based on public and political support.

Central banks need to establish the legitimacy of their actions through clearly communicating their assessment of the risks and the rationale for their policy actions. Otherwise, they may risk losing their independence (Eichengreen et al. 2011).[23] As Groepe (2016: 1) points out, "the biggest risk to central bank independence is the possible backlash from being unable to deliver on unreasonable expectations. Central bank mandates have expanded – perhaps appropriately so – but there are limits to what monetary policy was designed to achieve. Central banks cannot be, and should not be regarded as, "the only game in town"." Indeed, there is a danger that "governments, parliaments, public authorities, and the private sector assume central bank policies can substitute for the structural and other policies they should take themselves" (G30 2015: xii).

5.3 Resistance to Change from within the Central Banking Community

The current generation of central bankers has been trained to think in a framework that gives little room to objectives other than macroeconomic and maybe financial stability. It may therefore be counterproductive to overwhelm the central banking community with demands and expectations that central banks should now become a jack of all trades and also solve the world's environmental problems. While central banks have a potentially large number of instruments at hand to affect the allocation of capital towards green investment, they should not necessarily be asked to do everything they possibly could. Starting with existing central bank mandates – which differ across countries/monetary areas – and also taking into account different central banking traditions, a discussion is needed about the extent to which central banks should support their respective government's sustainability policies. The outcomes of such discussions are likely to differ across countries and will depend also on institutional legacies (Johnson 2001; North 1990). The path-dependent nature of institutional change, which includes also cultural patterns, requires that institutional traditions are taken care of so that resistance to change does not undermine attempts at institutional redesign. To paraphrase Jeffrey Frankel, no single monetary policy regime is right for all countries or at all times, and no one-size-fits-all solutions exist for incorporating sustainability considerations into existing frameworks.

6 Conclusions

To achieve a green transformation towards low-carbon, sustainable growth and development, it will be crucial to involve the financial sector and the authorities that oversee it. This paper discussed the role that central banks and other financial authorities may play in ensuring that environmental and climate risks are accounted for by financial actors and that credit and capital are allocated towards sustainable investments (and that investments that do not comply with sustainability standards will not get financed). The paper also discussed the ways in which monetary and financial authorities can impact investment decisions and the creation and allocation of credit through monetary as well as micro- and macroprudential policies. While making the case for a pro-active, sustainable development role of central banks, the paper also pointed to the risks of overstretching central banks' mandates and endangering their institutional independence.

To the extent that central banks are responsible for financial and macroprudential stability, incorporating climate change risk considerations into existing monetary and macroprudential frameworks is already part of existing core mandates. Whether central banks should also play a promotional role to support green investment is fundamentally a political question that requires careful consideration.

The functions the central bank should perform depend on various factors, including the structure and level of sophistication of the financial system and the existence of other institutions – public or private – that may or may not be capable of correcting market failures and supporting green finance and investment (Groepe 2016). Central banks have quite a number of powerful policy instruments at their disposal to foster green finance. Yet, the paper also argued that it is important not to overburden central banks. In this context, a central issue is the division of labour among public institutions. After all, the central bank is only one among a set of public institutions that can affect green investment outcomes, and in many countries it is not necessarily the one best positioned to achieve these. Other important actors include the finance ministry (which can use the tax code and subsidies to redirect investment), environment ministries (which can prohibit investments that harm the environment) and public banks with a developmental or environmental mandate. Moreover, there is arguably also a role for financial industry bodies to provide guidance to market participants and develop standards for sustainable lending, disclosure, etc.[24]

The case for central banks to pursue sustainability objectives beyond their traditional core mandates of maintaining monetary and financial stability can be seen as an application of the theory of the second best. If first best policies for fixing the misallocation of capital cannot be implemented, then the government may resort to a second best policy and mandate the central bank or financial supervisor to address negative environmental externalities by using the tools they have at their disposal. Thus, it is important to initially consider if other actors can adopt first best policies that make a policy engagement of the central bank redundant. If first best policies are impossible because of political deadlock or the weakness of the institutions that should pursue them, possible second best policies by other agents – including the central bank – and their potential distortions need to be considered.

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Endnotes

[1] See UN Environment Inquiry (2015, 2016) for an overview of initiatives taken by monetary and financial authorities and private sector participants aimed at aligning the financial system with sustainable development. In January 2016, the Chinese G20 presidency launched the G20 Green Finance Study Group (GFSG) in which all G20 central banks are members. The GFSG is co-chaired by the People's Bank of China and the Bank of England.

[2] Goodhart names maintaining price stability and supporting the state's financing needs at times of crisis as the other two main objectives central banks have pursued throughout history.

[3] The Federal Reserve Act (Section 2A), for instance, defines three statutory objectives for monetary policy: "maximum employment, stable prices, and moderate long-term interest rates."

[4] The effects on food price inflation resulting from extreme weather events may be particularly significant for developing countries. See Heinen et al. (2016) for an analysis for the inflationary costs of extreme weather in developing countries.

[5] The ECB (2009: 135), for instance, defines "three main "forms" of systemic risk: the contagion risk, the risk of macro shocks causing simultaneous problems and the risk of the unravelling of imbalances that have built up over time. These three forms of risk are not mutually exclusive and may materialise independently or in conjunction with each other."

[6] See also IFC (2010) and Ceres (2014).

[7] On the effects of climate change on sovereign risk, see Kraemer (2014).

[8] The Task Force was established by the Financial Stability Board in December 2015 at the request of the G20.

[9] According to Corporate Knights Capital (2014: 5), "[o]nly 128 of the world's 4,609 large listed companies (2.8%) currently disclose all of the seven "first-generation" sustainability indicators: employee turnover, energy, greenhouse gas emissions (GHGs), injury rate, payroll, waste and water."

[10] See also Saxena (2007).

[11] See for instance Brimmer (1971), Chandavarkar (1987), Epstein (2007, 2009) and Dafe (2014). The argument for a developmental role of central banks was recently expressed by the then Governor of the Central Bank of Kenya, Ndung'u (2015), who said: "As a central bank, we take the view that we need to go beyond our traditional mandate of price and financial stability. In emerging economies such as Kenya, it is imperative that Central Banks also act as market development agents. In this role, Central Banks support development of financial infrastructure, strong institutions and a conducive policy environment."

[12] See Hodgman (1973), Zysman (1983) and Epstein (2007).

[13] In a survey of credit controls in Western Europe carried out in the early 1970s, Hodgman (1973: 147) pointed out that in France, Italy and Belgium "methods to control and to allocate credit in the service of national economic objectives are fully accepted as desirable and ... the authorities have been granted substantial explicit powers to this end."

[14] Current examples of OECD central banks promoting specific sectors include the Bank of England's Funding for Lending Scheme, which was launched in 2012 together with the HM Treasury to incentivize banks and building societies to boost their lending (Bank of England 2012); the Bank of Korea's Bank Intermediated Lending Support Facility, a credit policy operations tool aimed at increasing bank lending to small and medium enterprises (SMEs) and decreasing their borrowing rates (Jung and Lim 2014); and the Bank of Japan's Loan Support Program, which provide loans to "support strengthening the foundation for economic growth" through loans funding 19 different areas including research and development; new business development; development and upgrading of social infrastructure; environment and energy business; business for securing and developing natural resources; medical, nursing care, and other health-related business; and childcare services business (BOJ 2016). In 2009 and 2010, the Federal Reserve lent a total of US$71.1 billion through its 'Term Asset-Backed Securities (ABS) Loan Facility' in order "to increase credit availability and support economic activity by facilitating renewed issuance of consumer and small business ABS at more-normal interest rate spreads" (Federal Reserve 2012: 50). For an overview of SME lending schemes across developing Asia, see ADB (2015).

[15] See also Schoenmaker et al. (2015) discussing using capital instruments to address carbon risk.

[16] The 13 SNB countries that have already introduced green finance guidelines are Bangladesh, Brazil, China, Colombia, Indonesia, Kenya, Mexico, Mongolia, Nigeria, Peru, South Africa, Turkey and Vietnam. For details see: *http://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability+and+disclosure/environmental-social-governance/sbn_guidancefrommembers*

[17] See UN Environment Inquiry (2015, 2016) for an overview of developing green finance frameworks around the world. Volz (2016) provides a more detailed review of green finance frameworks in Asia.

[18] For an overview of China's efforts to boost green finance, see Zadek and Zhang (2014) and PBOC and UN Environment Inquiry (2015).

[19] For an overview of Bangladesh's green finance policies, see Bangladesh Bank (2011), Islam and Das (2013) and Barkawi and Monin (2015).

[20] Cf. the discussion by Schoenmaker et al. (2015) and Batten et al. (2016).

[21] The issue is further complicated in countries where central banks are privately owned. Examples include the Swiss National Bank in Switzerland, which is 45% owned by private shareholders, and the US Federal Reserve System, which comprises the 12 Federal Reserve Banks that are chartered as private corporations.

[22] On the distributional effects of monetary policy, see for instance Doepke et al. (2015) and Adam and Zhu (2016).

[23] As made clear by Eichengreen et al. (2011: 31): "Better communication and greater clarity on how the central bank will be held accountable for its broader mandate are necessary to defend central bank independence. Independence is politically viable only with accountability, and the best way to enhance accountability is for central banks to become more transparent and forthright about their objectives and tactics."

[24] For an overview of recent industry-led initiatives and standards, see UN Environment Inquiry (2015, 2016).

Inquiry: Design of a Sustainable Financial System
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