

SMART UNCONVENTIONAL MONETARY (SUMO) POLICIES: GIVING IMPETUS TO GREEN INVESTMENT

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Today, given the amount of investment needed to reach a 2-degree emissions reduction target and the tight budgetary constraints of governments worldwide, public spending alone will not be sufficient alone. Therefore, there is a double need to not only shift private financial flows from “brown” sectors to “green” sectors, but also to leverage new sources of financing.

Addressing the second challenge, this study reviews three families of proposed funding mechanisms based on unconventional monetary policies targeting “green” or “climate” investments. These “Smart Unconventional Monetary” (or SUMO) policies include: (i) the use of Special Drawing Rights (SDRs) issued by the International Monetary Fund (IMF), (ii) green quantitative easing and (iii) the issuance of Carbon Certificates.

Proponents of these mechanisms assert that they have a strong potential to provide substantial low-cost financing for green projects and reduce the risks linked to green investments for private investors. Furthermore, they could have further macro-economic co-benefits in specific circumstances. For example, implemented jointly with appropriate “demand-side” mechanisms, a SUMO policy mechanism, even if short-term, could help trigger investment, bank lending and growth in Europe and pave the way for a longer-term green policies’ framework.

Nevertheless, this analysis has identified that the implementation of such mechanisms has a number of challenges to overcome. The first challenge is to convince policy makers that these mechanisms, even if they resort to unconventional monetary policies, will not lead to inflation. The second challenge is the difficulty to reach multilateral agreements in the short run, because of geopolitical and institutional barriers. The third challenge is the necessity to involve the private sector.

Furthermore, to facilitate their contribution to low-carbon investment, this analysis suggests that ensuring the environmental integrity, both ex-ante – during the selection of eligible projects – and ex-post – will be key. This can be done through the implementation of Monitoring, Reporting and Verification (MRV) mechanisms. Initial lessons are drawn from the Clean Development Mechanism as well as other existing schemes (white certificates, etc.).

If these proposals are to be seen as credible, it appears that further research is necessary on the potential volume - both environmental (GHG reduction) and financial - of these unconventional mechanisms, as well as on their ecological and economic consequences and their adaptability to emerging and developing economies.

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EXECUTIVE SUMMARY

Around two trillion dollars per year are estimated to be necessary worldwide by 2035 to build the needed low-carbon and resilient infrastructure to reach global emission reduction objectives. Even if this amount represent an additional need of only about four hundred billion dollars per year compared with business-as-usual scenarios (IEA, 2014), the necessary shift of investment is massive. It is even more true since solving the climate-change finance equation involves not only increasing flows to low-carbon projects, but equally capping – and reducing – investments in carbon-intensive activities. However, the recent economic crisis has toughened the budgetary constraints of governments in developed countries, rendering it more difficult to cover domestic needs. Further, governments are equally constrained to respect the international pledges made at COP 15 in Copenhagen to mobilize \$100 billion per year by 2020 to finance low-carbon development in developing countries. Consequently, it is broadly recognized that given the enormity of the challenge, public budget spending by developed countries will be insufficient to reach the 2° target. As such, diversifying and expanding sources of funding and incentives for private investors is a priority.

There is a double need to not only shift private financial flows from “brown” sectors to “green” sectors, but also to leverage new sources of financing. However, the creation of new sources of finance may also be necessary – a gap that could be filled by innovative or nonconventional financial mechanisms. This study reviews three families of proposed funding mechanisms based on unconventional monetary policies targeting “green” or “climate” investments.

Leveraging International and Currency-Zone Monetary Policy

Unconventional monetary policy appears to be an option with significant potential that has received little attention to date. This kind of policy is worth considering as it seems compatible with the current economic environment and has been or is about to be implemented in a several OECD countries. Indeed, on June 5th, 2014, the President of the European Central Bank (ECB) Mario Draghi announced that the ECB would launch a policy of targeted longer-term refinancing operations (TLTROs) (Draghi, 2014). Given that in many cases unconventional monetary policies are slated to be implemented in the coming years, there may be an opportunity to introduce a green component in addition to other policy objectives.

Three main families of “green” unconventional monetary policy proposals are currently under discussion:

- The use of Special Drawing Rights (SDRs) issued by the International Monetary Fund (IMF) to capitalize an international green investment fund.
- Green quantitative easing (Green QE), which allows central banks to redeem bonds, the proceeds of which will be used to fund low-carbon projects.
- The creation of “Carbon Certificates” (CC) issued by a central bank that would allow green projects developers to repay a portion of their loans to commercial banks using these certificates gained through emission reductions.

Proponents of these “Smart Unconventional Monetary” (or SUMO) mechanisms have identified a strong potential in terms of providing substantial low-cost funds to green projects and reducing the risks linked to green investments for private investors. Indeed, Green QE and Carbon Certificates mechanisms are estimated by different proponents to generate hundreds of billions of dollars per year while staying in the proportions of QE policies that have been conducted in the United Kingdom and the United States. Regarding SDRs, the proposed scale of funding of most proposals is based on \$100 billion per year as it is the amount developed countries have committed to devote to low carbon development in developing countries.

Furthermore, addressing climate finance through SUMO policies could have further macro-economic co-benefits in specific circumstances. Firstly, they have a lower impact on public budgets compared to incentive policies such as feed-in tariffs or subsidies. Secondly, two of these mechanisms offer the

opportunity to complete global foreign exchange reserves, which would allow developing countries to be less dependent on the U.S. dollar and U.S. monetary policy and decrease the level of systemic risk in the global economy.

Overcoming barriers: agreeing multilaterally and dissuading fears of inflation

This study, nevertheless, identifies that the implementation of such mechanisms has to overcome three main challenges. Firstly, policy makers shall have to be convinced that resorting to these mechanisms will not lead to inflation, even if they resort to unconventional monetary policies. Initial analyses suggest that less money will be created through green monetary policies than when QE was implemented in the United Kingdom and in the United States where inflation was not experienced. Furthermore, the current close-to-zero level of inflation in developed countries should further reassure policy makers³. Moreover; - and contrary to traditional unconventional monetary policies - the liquidity provided by the central bank in these mechanisms is required to be invested in low-carbon projects. Consequently, these mechanisms limit the risks of banks and investors resorting to financial markets purely for speculative reasons, thus encouraging green productive investments and limiting inflation or speculative bubbles. Indeed, in theory, new liquidities do not result in inflation if they are reflected in wealth creation, i.e. growth (see **Box 1** and Appendix IV - Taylor's rule).

The second challenge, which is closely linked to the first, concerns the need for multilateral agreements. While national governments with direct control over their currency can act unilaterally within certain limits⁴, there is typically a need for multilateral agreements, either international or at the scale of a currency union – e.g. in the case of the Eurozone. Such agreements may be difficult to reach in the short run and thus limit short-term roll out, due to geopolitical or institutional barriers. Furthermore, one of these mechanisms – the use of SDRs – can only be implemented on a global scale whereas the two others can also function at the scale of a currency area. In the case of an international implementation, agreeing on a number of the definitional issues could require significant negotiation. For instance, the specific case of CCs requires a definition of a value – not a price – per ton CO₂eq, which could be global or region-specific. The governance of these mechanisms – should it be unilateral or multilateral and in particular their link to the multilateral processes such as the UNFCCC - is also a core issue.

Beyond governmental and political concerns, the third challenge is the necessity to involve the private sector, and in particular private banks and investors. These programs will need to take into consideration the needs of these actors and their investment cycle. The access to large quantities of low-cost capital may need to be paired with incentives and capacity-building programs to provoke widespread redirection of investments from “brown” sectors towards “green” sectors.

Ensuring a successful channeling of funds: a robust, yet operable, MRV framework

Furthermore, to facilitate their contribution to low-carbon investment, this analysis suggests that ensuring the environmental integrity, both ex-ante – during the selection of eligible projects – and ex-post – will be key. Defining what types of investments would be eligible could be based on existing debates and modeled on existing monitoring, reporting and verification (MRV) frameworks. However, it is important to note that there is currently no agreement on a single definition or approach.

The environmental integrity and efficiency of any climate-finance mechanism is directly linked with its ability to ensure that created flows are used to finance best low-carbon projects. As such, it is essential to pay close attention to the definition of the perimeter of eligible projects and to the implementation of a

³ If inflation was close or superior to 2%, the risk of creating more inflation would have to be taken seriously, even with only small amounts of liquidities, as it would be against central banks' main role to keep inflation below 2%.

⁴ Three main limits are: (i) many countries, e.g. Ecuador, have adopted dollarization or pegged their currency to another currency (ii) unilateral action on monetary policy may lead to capital flight and (iii) the central bank is often independent from the government.

robust – but economically feasible and easily adoptable by financial sector actors – monitoring, reporting and verification framework. This will likely require a trade-off between reducing complexity and transaction costs and decreasing acceptable levels of uncertainty in terms of GHG emission reductions as well as long-term lock-in of emission pathways. In any case, it seems necessary to make sure that GHG-intensive projects are excluded from the mechanism – potentially using a basic positive-list approach. While the MRV requirements may in turn be less restrictive, lessons can be drawn from existing systems such as the Kyoto Protocol's Flexibility Mechanisms and some national policies such as White or Green Certificates and emission trading schemes.

As these mechanisms move forward, a tradeoff must be made between a robust – but potentially slow implementation and up-take – and a rapid deployment that would require a simpler scheme and a lighter MRV procedure in the beginning.

To ensure that a maximum proportion of the amounts of liquidity created are used to finance green projects, it is necessary minimize the costs of MRV without sacrificing its efficiency.

Limited estimates of potential impact: a clear need for further analysis

While the different instruments proposed may be increasingly complex in terms of their technical details and attention to feasibility, little analysis has been conducted to clearly estimate their potential. There is a need for further research on the potential volume, both environmental and financial, of these unconventional mechanisms, as well as on their ecological and economic consequences and their adaptability in developing and emerging economies. This will be an important step in informing policy makers and financial-sector actors whose acceptance and adoption will be crucial for future development and implementation.

Next steps: testing of these mechanisms in Europe?

SUMO policies could first be implemented in countries monetarily independent where no multilateral agreement is needed. Countries that are keen to implement domestic climate policies, such as Norway, Switzerland or the United Kingdom, seem to be good candidates. Furthermore, the European Central Bank is currently pondering the use of unconventional monetary tools to resolve a number of macroeconomic issues. This may present the needed window of opportunity to use a part of the liquidity freed for much-needed low-carbon projects. The EU has in the past been a pioneer of ambitious climate action, as epitomized by the implementation of the EU ETS and the Climate and Energy Package. This may be an opportunity to do so again. As such, an initial experimentation phase will most likely be necessary to adapt the created financial flows to the evolving capacity and demand of project developers and commercial financial institutions.

As the discussion on these types of mechanisms moves forward, it is important to think about the implementation of appropriate and complementary policies to foster the funding demand for low-carbon projects and hence make these funding supply policies succeed. If they are implemented jointly with appropriate “demand-side” policies, these monetary policies could help boost investments, bank lending and growth in Europe and pave the way for a longer-term coherent framework of green policies.

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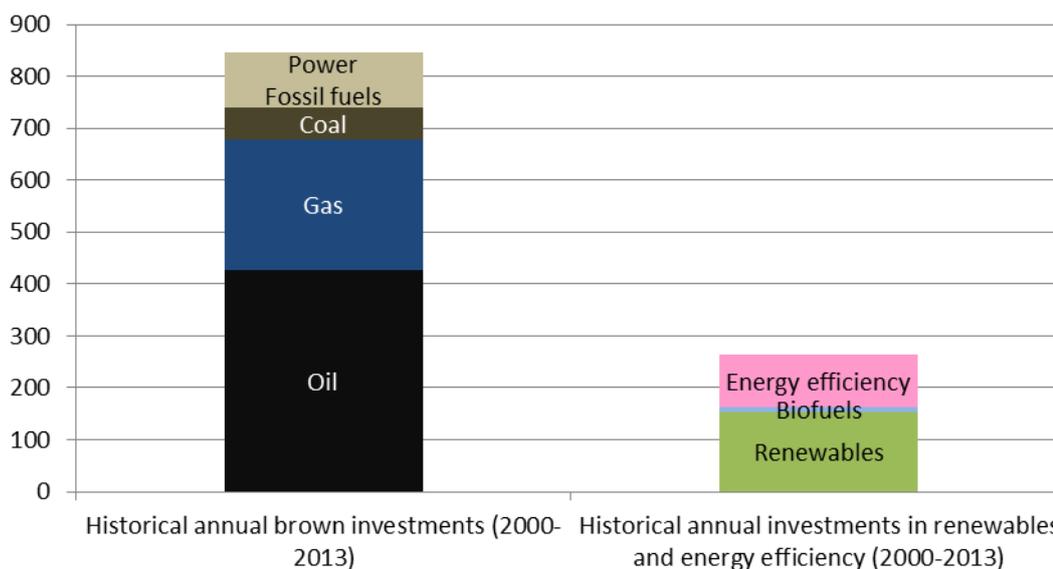
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INTRODUCTION: A WINDOW TO USE MONETARY POLICIES TO REACH CLIMATE INVESTMENT NEEDS

According to the International Energy Agency (IEA), annual investments in energy efficiency and low-carbon technologies need to reach \$790 billion by 2020 and \$2.3 trillion by 2035 in order to limit climate change to 2°C. In other words, cumulative investments in those sectors from 2014 to 2035 should reach \$28.3 trillion in the IEA low-carbon transition scenario (IEA, 2014). At the European level, the IEA reports that in terms of cumulative investment, around \$4.6 trillion are necessary from 2014 to 2035 for renewables, biofuels and energy efficiency, which represents approximately \$220 billion per year (IEA, 2014). Regarding of additional funding needed compared to a business as usual (BAU) scenario, the estimation amounts to \$59.6 billion per year on a European scale and around \$432 billion per year on a global scale (IEA 2014). Thus, the order of magnitude of low-carbon investment needs represents from hundreds of billions to several trillions of dollars⁵. Furthermore, solving the climate-change finance equation involves not only increasing flows to low-carbon projects, but equally capping – and eventually reducing – investment in carbon-intensive activities. Indeed, the IEA estimates “brown” investments – here gas, oil, coal and fossil-fuel generated power – at \$846 billion per year between 2000 and 2013, while annual investments in renewables over the same period only reach \$153 billion (see Figure 1). Thus, reducing and redirecting funds is a key part of achieving long-term climate objectives.

Figure 1 : Historical annual investments in “brown” and “green” sectors (billions of dollars)



Source: authors, data from IEA (2014)

On the other hand, the recent economic crisis has tightened the budget constraints of governments in developed countries, rendering it more difficult to fulfill both domestic needs as well as the pledge made at COP 15 in Copenhagen to mobilize \$100 billion per year by 2020 to finance low-carbon development in developing countries. Today, it is broadly recognized that given the enormity of the challenge, public budget spending of developed countries alone will be insufficient to reach the 2° target. As such, it is more than ever necessary to implement public policies as well as diversify and expand sources of funding – by involving private savings or resorting to monetary policy for instance.

There are two complementary key elements to solve the low-carbon finance equation: in addressing the “demand side” of funding to improve the profile of “green” projects⁶ to better fit the current investment

⁵ Other reports, like the one from the World Economic Forum (2013), try to assess necessary investments for agriculture, water or adaptation but the amounts needed are unclear because they are much more difficult to evaluate.

⁶ Defining what types of projects are “green” or low-carbon is a key issue and will be addressed in further detail below.

logic of the existing funding supply; or in modifying the criteria or logic of the “supply side” of low-carbon finance to encourage the allocation of capital to green projects⁷. Currently, the majority of policies targeting low-carbon investment focus on the “demand side”. To put it differently, they seek to adapt the demand for financing – i.e. financially viable low-carbon projects – to the funding supply’s rules of investment ; for instance by improving risk/yield ratios – through grants, taxes, feed-in tariffs, etc. This paper focuses on the less-used supply-side mechanisms, and more specifically on those based on unconventional monetary policies, to increase the funding supply.

This paper reviews three families of existing propositions of funding mechanisms based on unconventional monetary policies targeting green or climate investments. These SUMO policies are: (i) the use of Special Drawing Rights (SDRs) issued by the International Monetary Fund (IMF), (ii) green quantitative easing (Green QE) and (iii) the issuance of Carbon Certificates.

Special Drawing Rights are international reserve assets, the original role of which was to supplement the foreign exchange reserves of the IMF’s member countries. They are issued by the IMF and granted to the member countries according to their quota-share, which depends on their wealth. The idea here is to use existing or newly issued SDRs to capitalize an international climate fund that would provide grants and low-interest rate loans to fund low-carbon projects in developing countries.

Green quantitative easing is an unconventional monetary policy where the central bank enlarges its balance sheet to buy great quantities of assets, thus releasing great quantities of cash. The idea here is that those liquid assets could be used to finance low-carbon projects, thus triggering a green recovery that would result in job creations and the transition to a low-carbon economy.

Finally, the Carbon Certificates mechanism consists of the central bank issuing new liquid assets providing low-carbon projects with low-cost debt through commercial banks. This debt can then be repaid using certificates attesting emission reductions in addition to traditional monetary servicing of the contracting debt.

Since the 2008 economic crisis, developed economies, and the Eurozone in particular, have been concerned with a stagnant growth and threatened by low inflation and even deflation. Unconventional monetary policies have been implemented, including QE in the United States and in the United Kingdom and similar policies – “Long-Term Refinancing Operations” (LTRO) and “Securities Market Program” (SMP) – in Europe. However, in the Eurozone, proper QE has not yet been officially implemented, although some economists have suggested its potential value, (Krugman 2013a, Timbeau, Xavier (dir.) 2014). On June 5th, 2014, the President of the European Central Bank (ECB) Mario Draghi announced that the ECB would launch a policy of targeted longer-term refinancing operations (TLTROs) aiming at stimulating investment in companies (Draghi 2014).

This kind of macroeconomic policy could have further co-benefits in terms of environment and low-carbon projects funding if policy makers decide to add a green component to it. Implemented jointly with appropriate “demand-side” mechanisms, a SUMO mechanism, even if short-term, could help revive investments, bank lending and growth in Europe. Green monetary policies could be in that sense short term boosters to the implementation of a framework of green policies coherent in the long run.

All in all, this kind of policy is worth considering as it seems compatible with the current economic environment (Giraud 2012). Nevertheless, an analysis is needed to fully understand both their micro and macroeconomic impacts as well as means to ensure their environmental integrity, both ex-ante – during the selection of eligible projects – and ex-post – by the implementation of a Monitoring, Reporting and Verification (MRV) mechanism.

⁷ On one hand, existing amounts of savings are far away sufficient to provide needed climate finance. On the other hand, theories such as the “secular stagnation” express the idea of a “saving glut”, expressing the lack of investment opportunities for savings. A supply-side policy could therefore be a change in the existing incentive for savings’ management.

I. THREE MAIN FAMILIES OF SUMO POLICIES TO STIMULATE CLIMATE INVESTMENTS

The three kinds of mechanisms discussed in this note are based on monetary creation, either through the creation of a new kind of asset – “Carbon Certificates”, or via the additional issuance of an existing asset. These mechanisms can also fall into two large categories depending of their perimeter of implementation: the SDRs proposition can only be implemented internationally whereas the other two can also be implemented at the scale of a currency area. Below is a short presentation of these mechanisms. Further information is given in the respective appendices and a table summarizing the characteristics of each proposal is available at the end of part II (p. 21). All the presented mechanisms are based on existing proposals.

A. An international tool: the use of IMF Special Drawing Rights (SDRs)⁸

According to the International Monetary Fund (IMF), “the SDR is an international reserve asset, created by the IMF in 1969 to supplement its member countries' official reserves. Its value is based on a basket of four key international currencies, and SDRs can be exchanged for freely usable currencies. With a general SDR allocation that took effect on August 28, 2009 and a special allocation on September 9, 2009, the amount of SDRs increased from SDR 21.4 billion to around SDR 204 billion (equivalent to about \$316 billion, converted using the rate of March 12, 2014)” (IMF 2014a).

According to the IMF's Articles of Agreement, an allocation of SDRs can only be decided if it corresponds to a “long-term global need to supplement existing reserve assets” (IMF 2014a), which theoretically excludes an allocation aimed at financing low-carbon projects in developing countries. However, SDRs have already been used to finance concessional loans intended for least developed countries (LDCs). Accordingly, France and the United Kingdom transferred their unused allocations to the IMF in 2009 after converting them into currencies, in order to enable the IMF to grant concessional loans to LDCs. This precedent opened the way for a potential new use of SDRs (Revkin 2009).

SDRs are allocated to IMF member countries in accordance with their quota-share, which reflects their weighting in the global economy. The IMF pays the member countries interest on the SDRs that they hold – their SDR assets –, and receives fees on the SDRs that it has allocated – the SDR allocations. Accordingly, if a country has more SDRs than its initial allocation, it receives net interest from the IMF. Conversely, if a country has fewer SDRs than its initial allocation, it must pay net interest to the IMF.

Table 1: SDRs proposals - summary table

	Emission of new SDRs	Nature of the fund's equity	Value of the fund's equity (billion dollars)	Dividends	Funding per year (billion dollars)	Percentage of grants	Budgetary costs linked to the capitalization of the fund (dollars)	Annual budgetary costs of interest paid on the SDRs (dollars)	Other budgetary costs (dollars)
ECF	NO	Dollars	100	YES	7	80%		2,4B/year	
IMF	NO	SDRs	120	YES (\$2,4B/year)	100	60%		2,4B/year	60B/year
Action Aid	YES	Dollars	165	NO	100?	100%	165B (SDRs)	2,4B/year + interests of DC's SDRs	
WFC	YES	Dollars	100	NO	100	100%	100B (SDRs)	2,4B/year	
Giraud	YES	SDRs	120	NO	100	60%	Up to 194,5B (SDRs)	2,4B/year	Guarantee (880B)

In this case, we estimate that the average interest paid by developed countries to the IMF amounts to \$2.4 billion per year, according to the estimates of IMF economists and G. Giraud. This figure should be considered as a minimum amount, since the interest paid to the IMF by developed countries will increase as the number of SDRs entrusted to the fund rises.

Source: authors

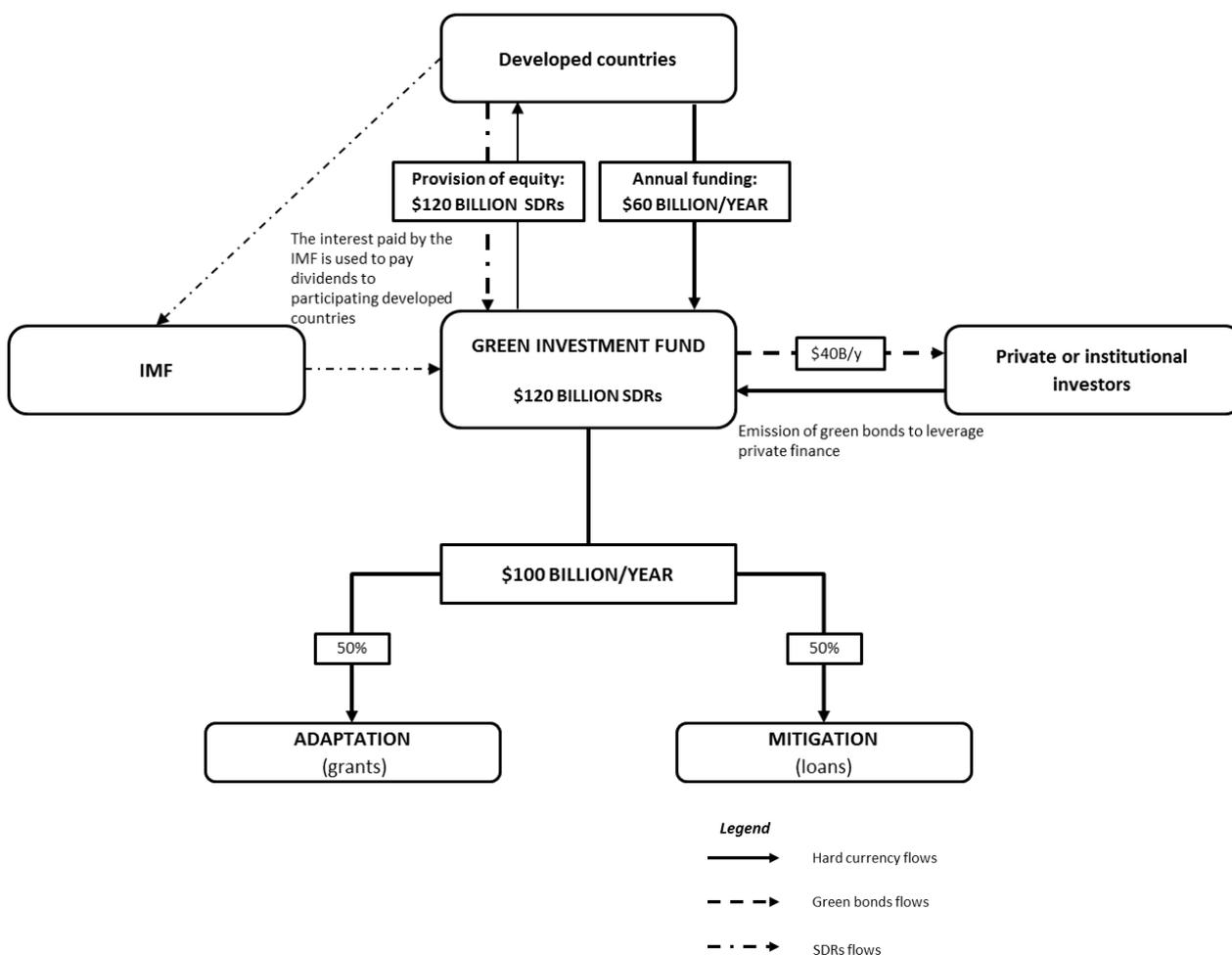
⁸ For more details, please see Appendix I – Special Drawing Rights.

The studied proposals fall into two categories:

- In proposals by the European Climate Foundation (ECF) (2009), and Bredenkamp and Pattillo (IMF) (2010), the mechanism can function without new SDR issuance.
- In the proposals by Action Aid (2010), the World Future Council (WFC) (2009) and Giraud (forthcoming), new allocations of SDRs are required.

In all these proposals, developed countries entrust part of their SDRs to an international fund, which could be for instance the Green Climate Fund⁹ (see Figure 2 which gives an example of proposal).

Figure 2: The IMF proposed scheme



Source: authors, inspired from (Bredenkamp and Pattillo 2010)

The participation to the fund can be made on the basis of the countries' IMF quota share, which would imply that the richest countries would pay the most. Moreover, in most proposals, developing countries do not participate to the provision of the fund's equity. According to this principle, for an amount of equity capital of \$100 billion and if only OECD countries participate, the United States would have to provide around \$28.5 billion, France around \$8.2 billion and Austria around \$1,4 billion. However, alternative allocation processes are also possible¹⁰. For instance, Giraud (forthcoming) proposes that developed

⁹ Most of the proposals were made before the settlement of the current form of the Green Climate Fund (GCF). Therefore, some propositions made by the authors, like the fact that the fund could emit green bonds, are not possible yet with the current structure of the GCF.

¹⁰ Calculated by the authors using data from the IMF.

countries participate according to their historical amount of CO2 emissions. Participation on a voluntary basis could also be possible.

In some proposals, participating countries perceive interests whereas in others, the SDRs entrusted to the fund are a grant and do not give right to any dividend (see Table 1).

In some proposals, the fund would use the SDRs as paid-in capitalization and subsequently issue green bonds in order to leverage private finance from international capital markets. In such proposals, developed countries would have to guarantee the bonds issued in order to provide them with an AAA/AA rating. In other cases, the SDRs would be converted into hard currency by the countries or by the fund itself. In most proposals, developed countries would also participate annually in projects funding through budgetary subsidies.

The money will then be used to finance mitigation and adaptation projects in developing countries. To disburse annually \$100 billion, the amount of SDRs required to establish the initial capitalization ranges from \$120 billion with dividends for the donors to \$165 billion without dividends, depending on the architecture of the mechanism.

B. Green Quantitative Easing¹¹

This mechanism is proposed by several economists, among which Alain Grandjean in France and Richard Murphy and Colin Hines in the United Kingdom. This mechanism is modeled on the unconventional monetary policies that have been implemented during the economic crisis. It consists of a central bank buying debt from green or low-carbon investments – such as “green bonds”¹² – on the primary or the secondary market, depending on the identity of the bond issuer, the environmental impact of the company or project funded by the bond, and the central bank rules (Figure 3). Such green bonds could be issued by public or private entities.

For example, one can look more closely at the case of the Eurozone, to see how such a mechanism could work in practice. There is no restriction for the European Central Bank (ECB) to buy private bonds during the refinancing operations of commercial banks. However, currently, article 123 of the Lisbon Treaty forbids the ECB to buy public debt on the primary market. Nevertheless, the central bank can buy public securities, such as government issued bonds, on the secondary market. In practice, in order to bypass article 123, governments can issue a green bond which is bought by a commercial bank and then redeemed by the ECB during the refinancing operations of the bank, under certain fiscal or monetary policy conditions as for “Outright Monetary Transactions” (OMT) program and (OMT) and “Securities Market Programme” (SMP). However, in this financing circuit, there is a loss of efficiency for the government due to the addition of an intermediary. Indeed, the interest rate of the loan from the commercial bank will necessarily be higher than the ECB’s interest rate. Another option for making public policies and investments take benefit of a SUMO policy could be that the green bond be issued by a public investment bank or by the European Investment Bank (EIB). In the latter case, the ECB has the right to buy the bond directly on the primary market¹³ (see Figure 3).

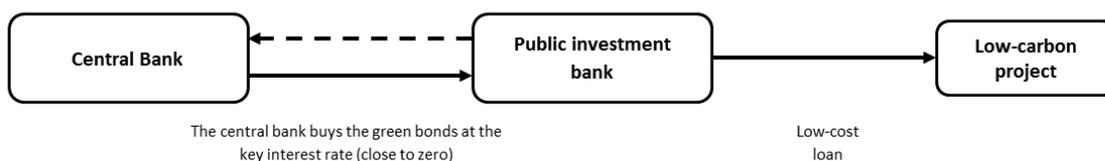
¹¹ For more details, please see Appendix II – Green Quantitative Easing

¹² See (Morel and Bordier 2012)

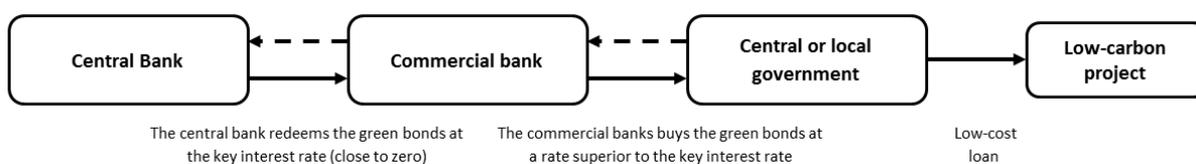
¹³ See (ECB 2009b)

Figure 3: Two options for Green Quantitative Easing

Option 1: purchase of green bonds when they are issued on the primary market



Option 2: purchase of green bonds on the secondary market



Legend

- Hard currency flows
- - - → Green bonds flows

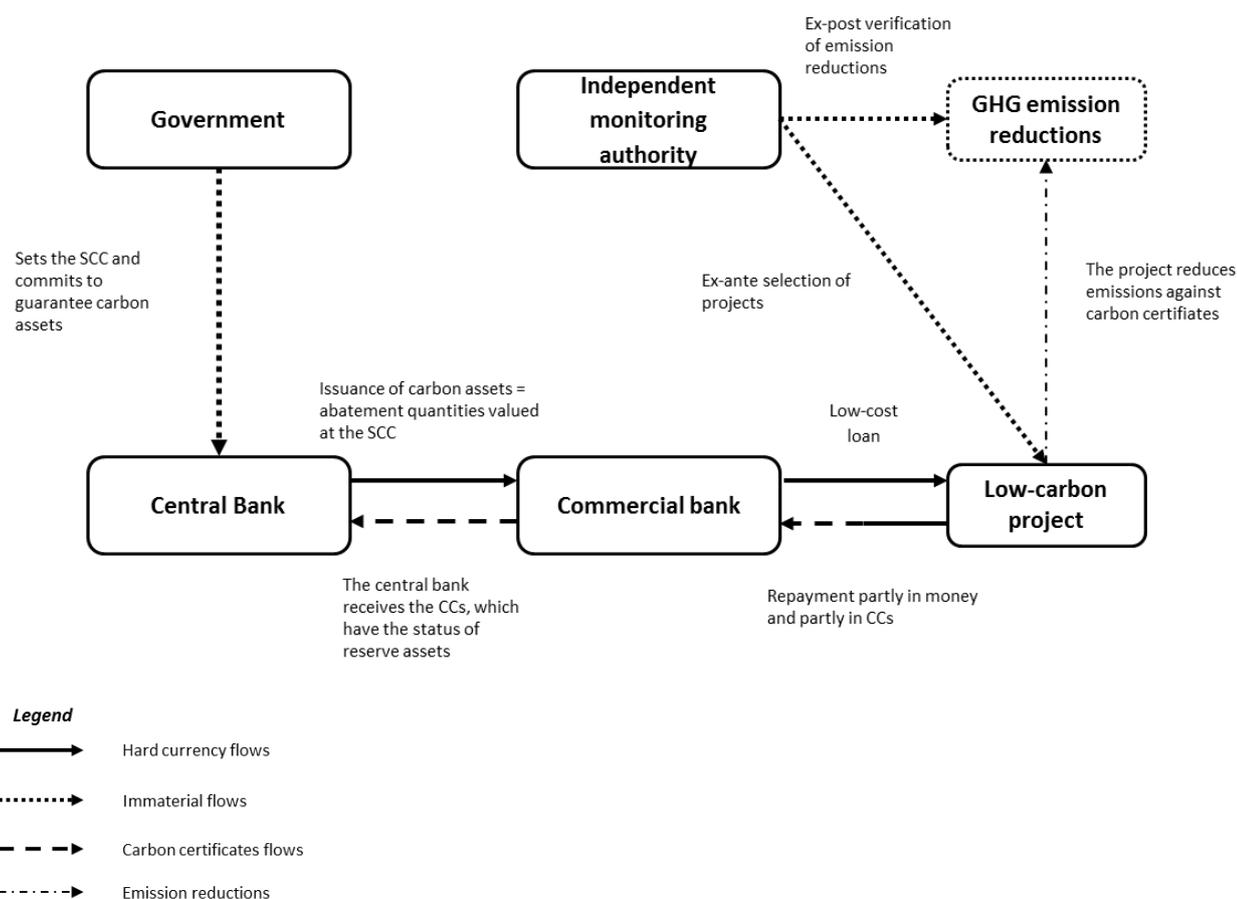
Source: authors.

C. Issuance of Carbon Certificates (CC)¹⁴

The aim of this mechanism, proposed for instance by Jean-Charles Hourcade and Michel Aglietta, is both to stimulate green funding by issuing a new kind of monetary asset and to enhance the solvability of low-carbon projects by authorizing project developers to reimburse loans with “Carbon Certificates” (CCs) representing avoided emissions (see Figure 4). These CCs could then be used as collateral by commercial banks during their refinancing operations with the central bank. The carbon assets created would be valued at the social cost of carbon (SCC), upon which the participating governments would have agreed beforehand. These assets would also be guaranteed by the participating governments; so that commercial banks can create reliable green financial products in order to leverage private finance.

¹⁴ For more details, please see Appendix III – Carbon Certificates

Figure 4: The Carbon Certificates mechanism



Source: authors, inspired from Hourcade, Perrissin Fabert, and Rozenberg (2012).

II. GREEN MONETARY POLICIES HAVE THE POTENTIAL TO BE ECONOMICALLY PROFITABLE FOR INVESTORS, PROJECT DEVELOPERS AND PUBLIC BUDGETS BUT FACE POLITICAL BARRIERS FOR THEIR IMPLEMENTATION

Green monetary policies require low budgetary spending for governments while stimulating green investment. As recovery policies, they also impact the macroeconomic context through giving incentives to investors and project developers and rebalancing international reserves. On the other hand their impact on inflation – and more broadly on the economy – must be assessed. In that perspective past unconventional monetary policies implemented in OECD countries can provide useful inputs. However, these policies are threatened by perverse effects, such as moral hazard and rent-seeking activities, which can be reduced by the implementation of efficient MRV procedures. Above all, green monetary policies will have to overcome institutional and political barriers. In any case, the greening of unconventional monetary policies can under certain conditions enhance the short term positive economic effects of such policies and pave the way for future phases of green investment.

A. A breath of fresh air for public budgets and new economic incentives for investors and project developers

Stimulating climate investment with limited public budgetary impacts

The main advantage of these mechanisms is their lower impact on public budgets compared to incentive policies such as feed-in tariffs or subsidies. Moreover, by definition, a monetary policy can effect several sectors or clean technologies at a time whereas existing policies tend to focus on a specific sector or technology. In that way, it may be the sole kind of public policy stimulating investment in clean projects enough to rapidly reach investment needs. In some instances, SUMO mechanisms could overlap with the other supply-side implemented investment incentive schemes such as tax rebates for green investors. On the other hand, policies addressing supply of funding and policies addressing demand of funding may be needed at the same time. None of the proposed schemes studied in this paper has addressed the overlap between policies in detail.

Even if they are focused on funding supply, monetary policies also have a positive impact on the green funding demand. Indeed, by providing low-cost debt to green projects, they can increase financial return on investment. Moreover, the Carbon Certificates proposal goes even further by raising the economic profitability of low-carbon projects, as part of the loan is not repaid in money but in emission reduction credits.

Regarding commercial banks, the mechanisms studied decrease the risk associated with holding illiquid assets such as long-term bonds. Indeed, the central bank's purchase program increases the demand and decreases the illiquidity of these bonds. This effect will be stronger if the SUMO policy is led over a long period of time. Consequently, granting low-carbon loans and issuing green bonds can become more attractive to private investors and banks thanks to these mechanisms.

Foreign exchange reserves: bringing emerging economies on board

Two of these mechanisms offer the opportunity to complete global foreign exchange reserves in the long run, either through new allocations of existing assets – SDRs –, or through the emission of new reserve assets – Carbon Certificates.

The diversification of reserve assets would allow developing countries to be less dependent a single foreign country – such as the U.S. dollar and the monetary policy of the United States. Indeed, following the 1997-98 Asian crisis, developing countries have accumulated dollar reserves, including US Treasury Bonds, to guard against a possible leakage of foreign investment (Aryeetey 2004). This phenomenon, known as South-North capital flows, represents a significant cost to developing countries. It is often called "reverse aid"¹⁵. Currently, about 50% of the principal foreign holders of U.S. debt are UNFCCC non-Annex I countries¹⁶. China, in particular, holds \$1,272.9 billion of US Treasury Bonds, that is to say 21.6% of the bonds held by foreign countries¹⁷. In 2009, Governor Zhou of the People's Bank of China issued a report advocating the development of a new international reserve asset that would not also be a national currency. According to him, this would solve the "Triffin dilemma", according to which an issuing country of reserve currency cannot simultaneously maintain the value of its currency and meet the global demand for liquidity (Zhou 2009). The advent of SDRs as a common global reserve asset could decrease the level of systemic risk and partly solve the structural imbalances in the global economy by providing countries with additional and permanent low-cost reserves (Aryeetey 2004). Carbon assets could potentially play a similar role in the long-run.

¹⁵ For a general summary about reverse aid, see (Rosenberg 2007) . For more details, see for example (Stiglitz 2003)

¹⁶ Data from US Treasury website, "Major Foreign Holders of US Treasury Securities", February 2014

¹⁷ Data from US Treasury website, "Major Foreign Holders of US Treasury Securities", February 2014

B. The global economic impact of unconventional monetary policies

Green unconventional monetary policies are confronted with lower macroeconomic risks than colorless unconventional monetary policies

A low risk of inflation principally due to comparatively small amounts of liquid assets required for the energy transition

According to the monetarist theory of money, in most cases, an increase in the amount of money in the economy implies inflation. However, Keynesians consider money creation as a monetary policy tool which can boost growth and reduce unemployment¹⁸. Before going further, it is important to note that the large majority of money is created by commercial banks making loans (McLeay, Radia, and Ryland 2014).

Box 1: The Taylor Rule

In practice, the Taylor Rule (J. B. Taylor 1993) (see Appendix IV - Taylor's rule) is a good model to describe the policies of the central banks such the Federal Reserve and the ECB. The Taylor rule expresses the level of the key interest rate mainly dependent on the difference between the inflation target and the inflation rate and the gap between potential GDP¹⁹ and observed GDP (output gap). Currently, the Eurozone faces a risk of low-inflation and even deflation²⁰ and GDP is below its potential level (ECB 2013). According to Taylor's rule, the ECB should fix a very low interest rate²¹. If this rate is close or equal to zero, it reaches the "zero lower bound", which means that the central bank cannot decrease it anymore. This situation is consistent with an unconventional monetary policy. Therefore new monetary policies are considered in Europe (Draghi 2014) and have already been implemented in the USA and the UK without being included in a "climate strategy".

The literature suggests that the inflation risk of a SUMO policy would be limited by the fact that (i) only small amounts of money are at stake compared to traditional unconventional monetary policy interventions and (ii) the money created will be directed towards the production of wealth (see Box 1). For instance, the allocation of \$250 billion SDRs in 2009 accounted for only 1/3 of 1% of global GDP, less than 1% of world trade and only 3% of world reserves (IMF 2013). By comparison, the Fed's QE policy resulted in an increase in its balance sheet of \$3.32 trillion from September 2008 to September 2013, which is equivalent to about 20% of US GDP. As for the Bank of England, its balance sheet increased by £375 billion from March 2009 to July 2012, which is equivalent to about 25% of UK GDP²².

These monetary policy interventions did not lead to inflation (Krugman 2014). By comparison, a climate monetary policy at the European level could create about €190 billion per year during 10 years or €90 billion per year during 20 years²³ to reach the same levels, i.e. 20% of the Eurozone GDP. The ECB announced that the combined initial entitlements of its TLTROs, which will mature in four years, will amount to around €400 billion (Draghi 2014). It could be hoped that at least part of this program will be directed towards the low-carbon transition. Furthermore, concerning the Eurozone or any other currency area, the amount of money created could be capped: a total budget could be decided by the European Council or its equivalent depending on the needs of each country, the inflation risk and the margin of

¹⁸ To know more about the current issues in monetary economics, see (Le Merrer 2007).

¹⁹ The potential GDP or potential output is the GDP obtained with full employment of labor and capital.

²⁰ See the recent declarations of ECB President Mario Draghi (E. Taylor 2014) (Draghi 2014) or Nobel Prize Winner Paul Krugman's columns in *The New York Times* (Krugman 2009)(Krugman 2014).

²¹ In June 2014, the ECB announced a decrease in interest rates.

²² Calculated by the authors using data from the Fed, the Bank of England and the World Bank.

²³ This estimate must be considered as a high estimate because it seems unlikely that energy transition will be financed exclusively by the monetary policy or that the monetary policy will only fund environmental projects. The data used are from the World Bank and the Banque de France.

money creation that the central bank wants to leave to private banks (Hourcade, Perrissin Fabert, and Rozenberg 2012).

The risk of inflation is most of all limited because of the current economic situation in Europe or Japan for instance, where inflation is close to zero and the key interest rates have reached their zero lower bound. If inflation were close or superior to the inflation target – usually close to 2% –, the risk of creating more inflation would have to be taken seriously, even with small amounts of liquid assets.

New liquid assets will be directed towards the production of wealth

Moreover, green unconventional monetary policies could better drive money towards productive investments. On one hand, it could help to solve the output gap issue (see Box 1) and better stimulate growth than “classic” unconventional policies ; on the other hand, questions are arising about the link between low-inflation under existing QE and its inability to drive money to productive investment (Ryan-Collins et al. 2013).

What is more, in the case of green QE, CCs and SDRs, the liquidity provided by the central bank is bound to be invested in low-carbon projects. Consequently, these mechanisms limit the risks of banks and investors resorting to financial markets purely for speculative reasons, thus encouraging green productive investments and limiting inflation or speculative bubbles (Grandjean 2012). With regard to the case of CCs, Hourcade, Perrissin Fabert, and Rozenberg (2012) explain that as the social cost of carbon (SCC) will be fixed by convention, the market price of CCs should revolve around the SCC, which should be enough to significantly reduce the risk of a bubble.

Nevertheless, the principal risk of bubble in this case is to create excessive tension in some areas, which would result in a “green bubble”, where the value of assets created would be over-evaluated. This is especially true for climate projects where several years may elapse before the operational start of a project – the case of large-scale renewable energy plants for example (Grandjean 2012). As a consequence, the pace of the monetary policy must not be too fast so that the funding demand has time to adapt. In other word, if the monetary mass grows much faster than the observed GDP, in particular in green sectors, there is a risk that the excess liquidity results in speculation or inflation. In order to limit the scale of the monetary policy, the central bank could implement tapering²⁴ when positive effects on the real economy are observed. Moreover, adequate public policies should be implemented to help project developers implementing enough green projects.

Proponents assert that concern of depreciation should be disregarded

An inordinate increase in the money supply - green or not - could also lead to a loss of value of the euro and thus its depreciation. Thus, developing countries holding reserves in euros or exporting to the euro area could be negatively affected. Grandjean (2012) argues that from the perspective of Europe, a depreciation of the euro would lead to competitiveness gains that would be welcome in the current crisis. However, the first sector in deficit in the trade balance in France and in the euro area is energy. A depreciation of the euro would then increase the cost of imports. The environmental consequences of this increase in the cost of energy are uncertain. Indeed, on the one hand the price effect should lead to reduce the consumption of massively imported fossil fuels: oil and gas. On the other hand, there is a risk of increasing the use of coal, whose share of domestic production is greater. Nevertheless, the transition to a low carbon economy, made possible by the creation of “green” money, should reduce fossil fuel use, and therefore reduce this concern.

Finding means of involving developing countries

Finally, for now, green monetary policies do not seem adapted to emerging economies. The two currency zone mechanisms – Carbon Certificates and Green Quantitative Easing – cannot meet the needs of major

²⁴ “Tapering” refers to a gradual reduction of the range of a policy.

emerging economies such as BRICS²⁵ and Indonesia for instance. Indeed, these countries – except for China – are currently raising their key interest rates. They are thus more exposed to a risk of inflation than OECD countries²⁶. Nevertheless, there is no reason that low-carbon projects in developing countries should not enjoy the benefits of green monetary policies. Private investors benefiting from those policies could invest in projects in developing or emerging countries and the Green Climate Fund, which could be supplied with SDRs or carbon assets, is entirely dedicated to them. Moreover, further research is needed to determine what kind of green monetary policies could be implemented in developing countries.

A risk of perverse effects that can be reduced by implementing efficient selection and monitoring procedures

Windfall profits

The positive effects of these mechanisms could be limited by a windfall effect, in other words, by the fact that some “new” money will be used to fund projects that would have received funding anyway. The release of new liquidity could also induce rent-seeking activities. In other words, industrial lobbies could capture part of the funds to finance some of their activities that could have been financed without public aid. This loss of efficiency can become problematic if the “freed” money is invested in activities harming the climate. Indeed, solving the climate-change finance equation involves not only increasing flows to low-carbon projects, but equally capping – and eventually reducing – investment in carbon-intensive activities. In that perspective, on the contrary of carbon pricing mechanisms – tax or cap-and-trade –, green unconventional monetary policies only have an impact on future investments and not existing ones.

In the event that private banks would be involved, the additional liquidity obtained by these banks could be used to serve four main objectives: (i) to complete their reserves, (ii) to stimulate their speculative activity, (iii) to increase their investment in carbon-intensive projects and (iv) to increase their investment in low-carbon projects. This would be true in any kind of monetary policy, but stands to reduce the effectiveness of the climate objective of a green monetary policy.

The share of different options will be dependent on each bank’s context but also on the availability of different business opportunities. Therefore, in order to decrease the risks of freeing money for carbon-intensive projects, the implementation of complementary demand-based policies to stimulate low-carbon projects (and/or penalize carbon-intensive investment) will be necessary.

Moral hazard

There is also an issue of “green” moral hazard linked to the definition of eligible investments. Private banks and entrepreneurs could gain by applying as loose definitions as possible to expand the range of eligible projects. The banks involved in the mechanisms have an incentive to consider as “green” as many projects as possible because these projects provide them with better refinancing conditions. Similarly, entrepreneurs have an incentive to overstate their emissions reductions in order to get easier access to a loan.

In case of a public guarantee, the problem of moral hazard could lead to situations of default because the bank knows that in any case it will receive at least a part of the repayment of the loan, which is an incentive to grant loans without carefully checking the solvency of the borrower. Therefore, if there is a public guarantee, it should be limited to a certain portion of the loan – such as 50% -, so that the default risk is shared between the bank and the government.

Defaulting can equally be linked to the GHG emissions reductions. In the case of the Carbon Certificates mechanism, the default can be environmental if the project does not meet its GHG mitigation goals, or

²⁵ Brazil, Russia, India, China and South Africa.

²⁶ Direction Générale du Trésor, fiches pays.

financial if it turns out not to be financially solvent ex-post²⁷. Indeed, by overestimating the “green” component of a project, a bank could neglect potential solvency problems.

In these cases the question of the repayment of the loan and, more generally, the credibility and attractiveness of the mechanisms are at stake. It must therefore be ensured that in all cases, an efficient MRV procedure, is implemented (described in more detail below).

A major challenge: convincing private banks to take part in the mechanism

It is likely that private banks will be reluctant to finance projects that do not have standard risk profiles. One alternative option could be to use dedicated public or green investment banks or funds, like what is done in the United Kingdom with the Green Investment Bank. However, in the particular case where the great majority of the policy would be assumed by public institutions, there is a risk of crowding-out of private investors in some low-carbon sectors, which could have long term consequences in term of private climate finance, as a loss of expertise is possible. Therefore, it is important that public intervention focuses on involving the private sector and private finance to the greatest extent possible.

Another option could be to make Long Term Investors (LTI) privileged intermediaries between the ECB and green businesses or projects funded. The new monetary policy of the ECB undermines the economic model of several Long-Term Investors (LTI) of the euro area by annihilating either their profitability – because of its low interest rates – or their market – since commercial banks can offer competitive financing. Consequently, the LTI are engaged in research to develop new skills and the mechanisms proposed could be part of their approach.

Much promised, but further assessment of potential is needed

The efficiency of the mechanisms described here must be assessed from four angles:

- Their ability to raise capital: to date the only estimations available are for the SDRs model. In those proposals the investment fund that would receive the SDRs is modeled on the Green Climate Fund. Consequently, it is estimated that the fund could deliver \$100 billion per year (Bredenkamp and Pattillo 2010).
- Their ability to reduce the cost of capital for projects developers. The potential gain is important because interest rates that will be offered to project developers through these mechanisms are much lower than those charged by private banks and could therefore improve the financial profitability. This could result in an overlap with other existing incentive policies and a rationalization of the mix of policies may be needed to improve efficiency.
- Their potential to reduce GHG emissions, which has not yet been assessed quantitatively. While a precise estimate may be impossible to estimate, an idea of the order of magnitude of emission reduction potential would be an important part of weighing these tools against other instruments.
- Their adaptability to emerging and developing countries which face specific risks such as immature financial markets and banking systems and weak institutions²⁸.

²⁷ In the Carbon Certificates proposal, a project that fails to meet its abatement objective can repay its loan in money to replace the missing CCs. The bank must thus always make sure that a project is financially solvent before granting a loan (Hourcade, Perrissin Fabert, and Rozenberg 2012).

²⁸ See the *Doing Business Project's* rankings (<http://www.doingbusiness.org/rankings>) and reports, in particular (Doing Business 2012) and (Anderson and Gonzalez 2013)

C. Institutional and political barriers

A serious challenge to these mechanisms is that they are limited by political and institutional barriers that could be difficult to overcome.

First, they fall within major economic debates such as the independence of the central bank and the neutrality of money. They imply a necessary politicization of money and question its political control. Therefore, they necessitate a paradigm shift in mainstream economics.

Concerning the issuance of new SDRs, the United States – which has a blocking power in the Executive Board of the IMF – may not agree to their issuance due to the complexity of the institutional management of American SDRs by the Exchange Stabilization Fund (see Appendix I – Special Drawing Rights). Thus, the use of American SDRs to finance low-carbon development will certainly require approval by the U.S. Congress. This could be further complicated as – as discussed above - an increase in the number of outstanding SDRs could result in the reduction of dollar reserves in developing countries. In turn, it could lead to a decrease in demand for U.S. Treasury Bonds, an increase in the weight of the U.S. debt, and ultimately to the weakening of the U.S. financial influence internationally (see section “Foreign exchange reserves: bringing emerging economies on board” p. 15). As a consequence, a favorable vote by the U.S. Congress seems unlikely given its current positions. More generally, this proposed mechanism faces a risk of opposition from developed countries because of its incompatibility with the initial purpose of SDRs as defined in the IMF status²⁹.

Apart from financing projects, green monetary policies could help fund low-cost green public policies. In this case, the financial structure may depend on the central bank's status. Thus, it seems unlikely to see green treasury bonds issues by an EU country purchased in the primary market by the ECB. Germany, in particular, is likely to oppose it given that the granting of direct loans to the government by the central bank is prohibited in its constitution. Nevertheless, solutions exist to bypass these constraints, even if they can add intermediary costs.

The Carbon Certificates (CCs) proposed scheme would also require agreements at minimum at a monetary zone level, especially on the social cost of carbon and on the way of assessing emission reductions. Moreover, a broader agreement may be needed to consider CCs as reserve assets. In any case, these political barriers show that the decision of using new monetary policies for economic reasons is probably a prerequisite to implement green new monetary policies.

Moreover, if the impact of OECD countries' monetary policies on developing countries may seem of low importance, it is not necessarily the case in the context of international climate negotiations. Negotiations around "response measures" and the inclusion of international aviation in the EU ETS illustrate the vigilance of developing countries on the impact on their development of developed countries' domestic policies.

Finally, in the case of an international implementation, agreeing on a number of the definitional issues could require significant negotiation. For instance, the specific case of CCs requires a definition of a value per ton CO₂eq either unique or regional-specific. The governance of these mechanisms and in particular their link to international processes such as the UNFCCC is also a key issue.

More generally, the core issue concerning international negotiations, as stressed by Guesnerie (2006), is that there is no international governance, but only multilateral international cooperation that crystallizes around international organizations (WTO, IMF) or protocols (Kyoto) that are certainly imperfect but, to date, the only feasible form of global governance.

²⁹ For example, the Bundesbank seems to have opposed the use of SDRs for a European rescue plan because it was not the first purpose of SDRs. See Spiegel P., “How the euro was saved”, *The Financial Times*, 11 May 2014.

D. Summary table

Table 2: Specific characteristics of each mechanism

	SDRs	Green QE	CCs
Description	<ul style="list-style-type: none"> Use of SDRs to capitalize an international green fund 	<ul style="list-style-type: none"> QE policy targeting green projects 	<ul style="list-style-type: none"> Issue of a new asset repayable through emission reductions
Former unconventional use	<ul style="list-style-type: none"> Used to finance development aid Used to help countries during the 2008 crisis 	<ul style="list-style-type: none"> By Japan in the 1990s By the US and UK after the 2008 economic crisis 	
Geographical scale	<ul style="list-style-type: none"> International 	<ul style="list-style-type: none"> Currency area 	<ul style="list-style-type: none"> Currency area
Strong points	<ul style="list-style-type: none"> Adapted to a fairness strategy based on economic power 	<ul style="list-style-type: none"> Speed and ease of implementation 	<ul style="list-style-type: none"> Improve the economic situation of green project by giving a economic value to emission reductions
Co-benefits	<ul style="list-style-type: none"> Funding of a majority of projects in developing countries Completing international reserves 	<ul style="list-style-type: none"> Funding some projects in developing countries Reducing the output gap 	<ul style="list-style-type: none"> Funding some projects in developing countries Completing international reserves Reducing the output gap
Need for MRV	<ul style="list-style-type: none"> Monitoring of projects 	<ul style="list-style-type: none"> Monitoring of projects 	<ul style="list-style-type: none"> Monitoring of projects + assessment of emission reductions
Economic limits	<ul style="list-style-type: none"> Lack of efficiency and transparency due to the necessary intermediation of national institutions Need to pay perpetual interests to the IMF 	<ul style="list-style-type: none"> Inflation and carbon bubble Loss of credibility of the central bank Uncertain consequences on the behavior of private financial operators 	<ul style="list-style-type: none"> Same as Green QE Plurality of carbon prices Illiquidity of carbon certificates that could lower their attractiveness
Institutional limits	<ul style="list-style-type: none"> Need for the agreement of the US Congress Need to make the structure of the Green Climate Fund evolve Need to find a way to circumvent the initial role of SDRs 	<ul style="list-style-type: none"> In Europe : need for the agreement of Germany and risk to have to modify the Treaties Need to convince private banks to participate 	<ul style="list-style-type: none"> In Europe : need for the agreement of Germany Need to convince private banks to participate Need for an agreement on the Social Cost of Carbon Need for an agreement on the methodology of emission reductions computation

Source: authors

III. DEFINITION OF ELIGIBILITY AND A ROBUST – BUT OPERABLE – MRV PROCESS

As mentioned above, these funding mechanisms are exposed to a significant risk of moral hazard. The selection of the projects financed through these instruments is a key issue in these three mechanisms, but there is currently no consensus on the way to define the “greenness” of projects. There is also a need for Monitoring, Reporting and Verification (MRV), which is even stronger in the CCs mechanism, as emission reductions have to be assessed.

A. Assessing which projects are “green”

Determining the eligibility of projects is a key issue – both in political and operational terms. If mechanisms are used to finance projects with a limited low-carbon transition value, then the credibility and the efficiency of the mechanism will be put into question. Furthermore, investors and those involved in

the implementation of the mechanisms will need clear and easily-applied definitions to facilitate the investment process if the scale of investment necessary to achieve GHG objectives is to be met.

Currently, there is no single definition in use in terms of a “green”, “low-carbon” or “transition-coherent” project (2 Degrees Investing Initiative 2013). In a working paper issued in 2012, the OECD tried to define green investments. The conclusion is that it is “unlikely that an agreement can be found on an all-encompassing and exact operational definition of ‘green investment’” (Inderst, Kaminker, and Stewart 2012).

Illman et al. (2014) identified 10 different methodologies to determine the climate specificity of an investment. Some organizations, like the Climate Policy Initiative (CPI) (Buchner, Hervé-Mignucci, and Trabacchi 2011), only give qualitative approaches and leave room for interpretation whereas others, such as the Joint Multilateral Development Banks Group, rely on categories and positive lists. The 2013 green finance mapping of the International Development Finance Club provides us with a classification of projects types according to their domain. They start by defining three broad categories – climate change mitigation, climate change adaptation and “other” environment – and criteria for eligibility for the two latter categories. In a second step, eligible projects’ sub-categories are defined and classified within the broad categories. For each eligible project type, several examples are given. For instance, in the broad category “adaptation to climate change”, one of the eligible projects is “coastal protection”, and the examples associated are “building of dykes to protect infrastructure” and “mangrove planting” (IDFC 2013).

Furthermore, some financial-sector-specific initiatives to define “green bonds” or “climate bonds” have emerged in the past decade. The “Green Bonds Principles”, for instance are “guidelines that recommend transparency and disclosure and promote integrity in the development of the green bond market by clarifying the approach for issuance of a green bond”³⁰. However, these principles focus on issues related to transparency, reporting or governance, and do not address in details the definition of the projects’ “greenness” even if the Green Bond Principles raise this issue.

The Climate Bonds Initiative, an investor-focused NGO, has started to draft a taxonomy of projects that could be funded through green bonds (see Appendix V – Climate bonds taxonomy), in order to “provide guidelines for prospective climate bond and green bond issuers and investors about goods and services essential to that rapid transition to a low-carbon and climate resilient economy”³¹. In 2011, the Climate Bonds Initiative also launched the Climate Bond International Standards and Certification Scheme, which aim is to make a list of requirements applying to Climate Bonds. It includes mechanisms for verification and monitoring of standards compliance. For the moment, standards only exist for projects related to wind and solar energy generation and direct grid connections. Standards are in the process of being completed for energy efficient buildings, low-carbon transport, biofuels and water³². Furthermore, as of publication of this note no bonds had yet been issued using these definitions.

As regards the financial sector, sustainability or green indexes have also been created in the past few years. For instance, the Nasdaq OMX Green Economy Index tracks the performance of companies which activity is related to sustainable development. Apart from financial eligibility criteria, the securities must also meet a sustainable development criterion to be included in the index. Indeed, they must be involved in the reduction of fossil-sourced products, services, fuels and lifestyles in particular sub-sectors such as energy efficiency, pollution mitigation or renewable energy generation, among others³³.

Currently, multiple methodologies or principles trying to define what is green already exist, and communication efforts are made between the different public institutions and public banks. Today, the question is more on the harmonization of these various definitions and methodologies.

³⁰ « Green Bond Principles », January 13, 2014

³¹ <http://www.climatebonds.net/taxonomy>

³² To learn more about the Climate Bonds Standards, please see <http://standards.climatebonds.net/>

³³ See “NASDAQ OMX Green Economy Index® Family Methodology”
(https://indexes.nasdaqomx.com/docs/methodology_QGREEN.pdf)

Finally, the determination of what is green is a normative, political choice based on a tradeoff between efficiency and difficulty of implementation.

- In a first step, there is the possibility of advancing gradually, with positive lists and typologies involving projects which greenness is widely admitted, like wind or solar power for instance.
- The second important thing is to make sure that these mechanisms will not be used to fund environmentally harmful projects. Indeed, although the financing of environmentally neutral projects will only decrease the efficiency of the mechanism, the financing of “dirty” projects could have counterproductive consequences. The exclusion of dirty projects can be done through multiple ways, including a minimum emission reductions threshold, a baseline setting or an exclusion list of certain categories of projects for instance.
- Finally, the selection criteria could be sector-adjusted. For example tougher criteria could be implemented in sectors exposed to a risk of over-investment, in order to select only the most efficient projects.

B. Implementing a Monitoring, Reporting and Verification procedure and, for Carbon Certificates, assessing emission reductions

Although all mechanisms need a MRV procedure, the Carbon Certificates mechanisms is the only one requiring an assessment of emission reductions. Indeed, the two other mechanisms only need to define the eligibility of projects and potentially to ensure that they have been implemented as planned.

To date, assessing avoided GHG emissions of a project has focused on using baseline scenarios and GHG emission estimates for projects. Furthermore, the concept of “additionality” – or the idea that the added financing from a climate finance mechanisms was responsible for the project occurring – has been widely applied and has raised multiple issues and debates. While currently in use in a number of mechanisms, the main problem faced by the implementation of an efficient MRV procedure is its cost and often-intensive data needs.

Lessons from the Clean Development Mechanism (CDM): common agreed rules but expensive mechanism

The Clean Development Mechanism (CDM), implemented with the Kyoto Protocol, provides some examples of the difficulty to grant carbon credits against emission reductions. This mechanism is subject to a stringent MRV process given that it creates fungible offsets credits used internationally. While the monetary mechanisms studied here do not include an offsetting component, the existing framework can nevertheless demonstrate the broad areas that will need to be addressed. Although the CDM MRV mechanism is especially suitable for mitigation projects, adaptation projects can also be financed by unconventional monetary policies provided that an appropriate methodology is developed³⁴. In the CDM framework, seven quality criteria are essential in order to guarantee that each carbon credit is equal to one ton of avoided CO₂ emissions. These criteria are: baseline setting, additionality, monitoring, verification, transparency, timeline and permanence (Shishlov and Bellassen 2012).

- *Baseline setting*: a scenario that reasonably represents anthropogenic GHG emissions that would most likely have occurred in the absence of the project has to be established. Projects participants can chose between three baseline methodologies: (i) historical or existing actual emissions, (ii) “emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment”, and (iii) “average emissions of similar project activities undertaken in the previous five years, in similar social, economic, environmental and technological circumstances, and whose performance is among the top 20% of their category”(Shishlov and Bellassen 2012).

³⁴ Nevertheless, the CCs mechanism seems less adapted to adaptation projects as it rewards emission reductions.

Thus, a potential problem stems from the fact that one of the three alternatives requires assuming a hypothetical scenario that could never be verified in the real world. Moreover, the baselines are set on a project-by-project basis, which further aggravates inconsistencies. In order to address this issue, the development of country-wide standardized baselines has been discussed since CMP1³⁵ in Montreal in 2005.

- *Additionality*: unless it is described in a positive list, a CDM project must prove that it is different from the baseline, i.e. that it would not have taken place without being certified under the CDM scheme. Most demonstrations use the “additionality tool”, created by the CDM Executive Board. This tool is composed of three or four steps: identification of alternatives to the project activity, investment analysis and/or barrier analysis and common practices analysis.

The problem of the additionality evaluation is that it requires the assessment of alternative hypothetical scenarios, which will never materialize if the project is implemented. This means that additionality can never be established with a 100% certainty.

- *Monitoring*: a monitoring plan to identify and regularly estimate anthropogenic GHG emissions from sources within the boundaries of a project must be implemented.
- *Verification*: the monitoring plan, the consistency between project description and the relevant methodology to compute emissions reductions and the correct implementation of the project have to be verified periodically by an independent third party.
- *Transparency*: all the documents related to the project are public and available on the UNFCCC website. All carbon credits get issued on a registry, with a serial number that allows tracking down the project and period to which they correspond.
- *Timeline*: carbon credits are issued for the emissions reductions achieved, i.e. ex-post.
- *Permanence*: emissions reductions have to be permanent, which may not be the case for reforestation projects, for instance.

Furthermore, the CDM is governed internationally within the framework of the UNFCCC and the CDM Executive Board. Each participating country established a Designated National Authority (DNA) to oversee projects domestically. This raises the question of how mechanisms operate both at international and national levels.

These issues have been and keep being addressed in numerous reforms since the implementation of the CDM. In particular, the gradual introduction of standardized baselines and positive lists simplifies and speeds up the registration of projects.

The example of energy saving certificates in France³⁶

White certificates schemes can also demonstrate lessons concerning MRV. The Energy Savings Certificate (ESC) scheme was implemented in France in 2005. It aims to require energy suppliers to take action to reduce greenhouse gas emissions. In most cases, ESCs are delivered against the implementation of actions referenced in an official list of “standardized action worksheets”. Each action corresponds to a certain number of ESCs, which is determined by the average energy savings between the solution implemented and a baseline situation. Therefore, the attribution is done using a topology of projects ex-ante, without verifying if the measures actually implemented are of quality. This process is cheaper for the banks and the projects developers although it is costly upfront for the regulator. It is also

³⁵ First Conference of the Parties serving as the Meeting of the Parties to the Protocol

³⁶ To know more about the ESCs, consult the website of French Ministry of Environment (<http://www.developpement-durable.gouv.fr/-Certificats-d-economies-d-energie,188-.html>) or this presentation by the ADEME (http://www.eceee.org/events/eceee_events/energy-efficiency-obligations/2_ademe)

simpler to use than the CDM MRV procedure, but there is a greater uncertainty about the actual emission reductions.

Transaction costs

The difficulties of implementation and the costs of MRV could jeopardize the use of the Carbon Certificates mechanism. Therefore, a balance must be struck between the monitoring costs and its benefits.

The administrative process of the CDM resulted in MRV costs that were estimated on average at €55 thousand but may be as high as €200 thousand per project per year. The baseline determination and the demonstration of additionality represent half of the costs involved (Guigon, Bellassen, and Ambrosi 2009). Consequently, main reforms were made in this area, which include a consolidation of methodologies, the implementation of several standards and of a project cycle procedure.

Yet, according to Hourcade, Perrissin Fabert, and Rozenberg (2012), a way to mitigate MRV costs would be to use a “statistical additionality” instead of a “project-based additionality”. This means that it is the pool of identical projects, and not each individual project, that must yield a total abatement greater than what would have occurred otherwise. This implies verification processes based on taxonomy of projects that may result in lower administrative cost than project-based verification.

As to the actual monitoring costs, a way to mitigate them may be providing agents with an incentive to reduce uncertainty. This may be done through discounting based on the overall monitoring uncertainty, as it is practiced in some types of carbon offset projects. Such an approach offers a certain degree of flexibility, whereby agents with low monitoring cost are encouraged to provide higher quality information and be rewarded with more CCs. Conversely, agents with high monitoring costs are not excluded from the scheme, but the lower quality of information is penalized with fewer CCs being awarded (Shishlov 2014).

All in all, the core issue in all this procedures – projects selection and MRV –, is to strike a balance between an efficient but costly procedure and a less expensive mechanism that would be less precise, but sufficient. A cost-benefit calculation is needed to assess from what degree of MRV and selectivity, transaction costs become higher than the costs of inefficiency.

CONCLUSION

Green monetary policies have a strong potential in terms of providing low-cost funds to green projects and reducing the risks linked to green investments for private investors, notwithstanding the institutional or political barriers that may exist. Furthermore, they can also address more global macroeconomic issues, such as the diversification of reserve assets asked by developing countries.

The review of the existing proposals indicates that the implementation of such mechanisms has to overcome three main challenges.

- The first one is the need for multilateral agreements, either international or at the scale of a monetary zone – such as the Eurozone –, which may be difficult to reach in the short run.
- The second challenge, which is closely linked to the first, is to convince policy makers that those mechanisms, even if they resort to unconventional monetary policies, will not create inflation. Indeed, it appears that the amounts of money involved will stay in the proportions of QE policies that have been conducted in the United Kingdom and the United States. However, if inflation was already close or superior to the inflation target of the central banks, the risk of creating more inflation would have to be taken seriously, even with small amounts of liquid assets.
- The third challenge is the necessity to involve the private sector, and in particular private banks and investors, and to give them incentives in order to redirect investments from “brown” sectors towards “green” sectors.

What is more, there is a need to pay close attention to the definition of the perimeter of eligible projects and to the implementation of a performant but economical MRV system in order that a maximum proportion of the new liquid assets are used to finance green projects. It seems important to find a system that would efficiently reduce free-riding while limiting the transaction costs.

Further research should be conducted on the potential volume, both environmental and financial, of these unconventional mechanisms, as well as on their ecological and economic consequences and their adaptability to emerging and developing economies.

Regarding this last point, another monetary instrument which could be used by central banks in developing countries, is their collateral framework. It can consist for instance in providing preferential treatment to green assets or excluding high-carbon assets as collaterals during financial actors' refinancing operations, hence improving the liquidity for climate-friendly assets. This instrument was not addressed as such in this study³⁷ but its issues – e.g. eligibility of projects, risk of a “green bubble”, institutional difficulties – are nearly the same as the other policies described.

The issue of the practical details of implementation of green monetary policies must also be addressed. In addition, popularization work should be conducted with policy makers so that these mechanisms become increasingly known and accepted by all.

Currently, the ECB is about to resort to unconventional monetary tools. Indeed, on June 5th, 2014, Mario Draghi announced that the ECB would launch a policy of targeted longer-term refinancing operations (TLTROs) (Draghi 2014). This could be an opportunity to seize, as a part of the liquidity freed could be directed towards low-carbon projects. As a consequence, a tradeoff has to be found between a robust but slow implementation and a rapid action that would require a simpler scheme and a lighter MRV procedure. In any case, a transition phase will be necessary to adapt the flows of money created to the evolution of the funding need. During this phase and after, a key of success for these funding supply policies is the joint implementation of appropriate demand policies to foster the funding demand for low-carbon projects. Assuming that this joint implementation takes place, green monetary policies could give a kick start to a green recovery, and pave the way for a longer-term green policies framework.

³⁷ However, it is used in Green QE and Carbon Certificates mechanism.

APPENDIX I – SPECIAL DRAWING RIGHTS

See separate appendix.

APPENDIX II – GREEN QUANTITATIVE EASING

See separate appendix.

APPENDIX III – CARBON CERTIFICATES

See separate appendix.

APPENDIX IV - TAYLOR'S RULE

In practice, the Taylor Rule (J. B. Taylor 1993) is a good tool to describe the policies of the Fed and the ECB. This rule is:

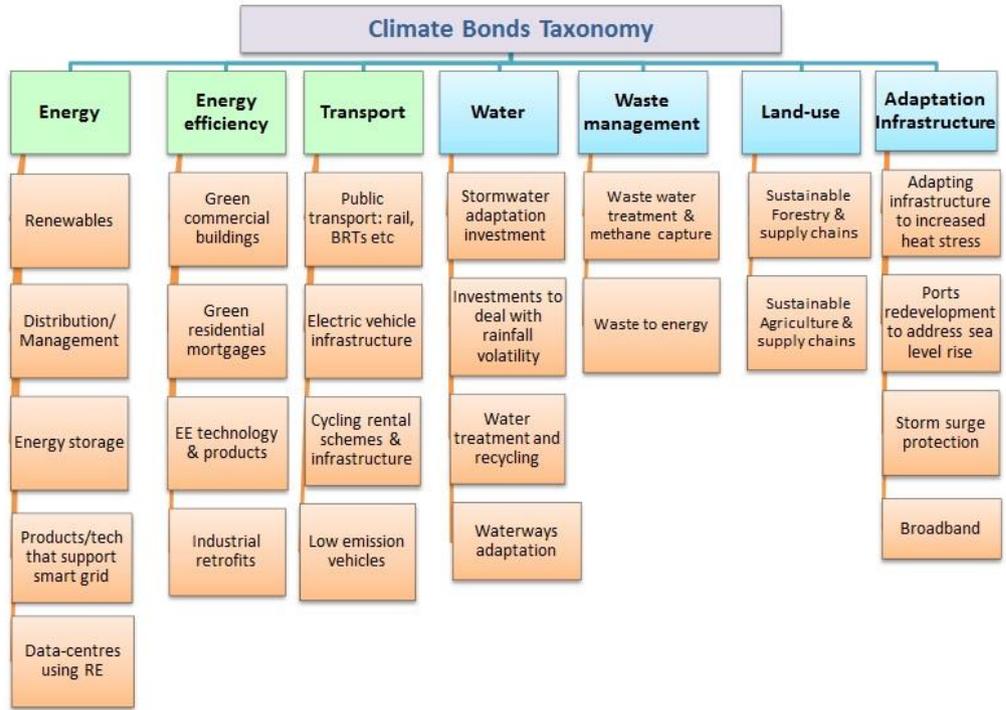
$$i_t = r + \pi_t + \alpha(\pi_t - \pi^0) + \beta(y_t - y^0)$$

where i_t is the intervention rate of the central bank on the interbank market, $r + \pi_t$ is the long term nominal interest rate, π_t is the inflation rate, π^0 is the inflation target, y_t is the observed Gross Domestic Product (GDP) and y^0 is the potential GDP³⁸. α and β are the respective weights of the inflation and output objectives. $\pi_t - \pi^0$ is the inflation gap and $y_t - y^0$ is the output gap.

³⁸ The potential GDP is the GDP obtained with full employment of labor and capital.

APPENDIX V – CLIMATE BONDS TAXONOMY

Figure 5: The Climate Bonds Initiative’s taxonomy



Source: Climate Bonds Initiative - <http://www.climatebonds.net/taxonomy>

REFERENCES

- 2 Degrees Investing Initiative. 2013. "From Financed Emissions to Long-Term Investing Metrics. State-of-the-Art Review of GHG Emissions Accounting for the Financial Sector". 2°II.
- Action Aid. 2010. "Using Special Drawing Rights for Climate Finance". Discussion Paper.
- Aglietta, Michel, and Jean-Charles Hourcade. 2012. "Can Indebted Europe Afford Climate Policy? Can It Bail Out Its Debt Without Climate Policy?" *Intereconomics 2012*. ZBW-Leibniz Information Center for Economics, 159–64.
- Anderson, John, and Adrian Gonzalez. 2013. "Does Doing Business Matter for Foreign Direct Investment?" Case Study. Doing Business.
- Aryeetey, Ernest. 2004. "A Development-Focused Allocation of the Special Drawing Rights." *Discussion Paper*, no. 2003/3. UNU-WIDER.
- Bernanke, Ben, Vincent Reinhart, and Brian Sack. 2004. "Monetary Policy Alternatives at the Zero Bound: An Empirical Assessment". Working Paper. Fed.
- Blanchard, Olivier, and Daniel Cohen. 2010. *Macroéconomie*. 5ème édition. Pearson Education. Pearson.
- Bredenkamp, Hugh, and Catherine Pattillo. 2010. "Financing the Response to Climate Change". IMF Staff Position Note. IMF.
- Buchner, B, M Hervé-Mignucci, and C Trabacchi. 2011. "The Landscape of Climate Finance 2011". CPI Report. CPI.
- Clark, Pilita, and Chris Giles. 2014. "Mark Carney Boosts Green Investment Hopes." *Financial Times*, March 18. <http://www.ft.com/intl/cms/s/0/812f3388-aeaf-11e3-8e41-00144feab7de.html?siteedition=intl#axzz33aojqSGm>.
- Doing Business. 2012. "Doing Business in OHADA 2012". Doing Business, World Bank.
- Draghi, Mario. 2014. "Introductory Statement to the Press Conference" presented at the ECB, June 5, Frankfurt am Main.
- ECB. 2009a. "EIB Becomes an Eligible Counterparty in the Eurosystem's Monetary Policy Operations."
- ———. 2009b. "Governing Council Decisions on Non-Standard Measures." *Monthly Bulletin*, June.
- ———. 2013. "Potential Output, Economic Slack and the Link to Nominal Developments since the Start of the Crisis". *Monthly Bulletin November 2013*. ECB.
- European Climate Foundation. 2009. "Climate Finance: Using SDRs to Finance Climate Change Mitigation and Adaptation". Briefing paper. European Climate Foundation.
- Gagnon, Joseph, Matthew Raskin, Julie Remache, and Brian Sack. 2010. "Large-Scale Asset Purchases by the Federal Reserve: Did They Work?" Staff Reports No. 441. Federal Reserve Bank of New York.
- Giraud, Gaël. forthcoming. "COP21 À Paris En 2015: Une Proposition de Financement International de La Transition Énergétique Dans Les Pays Émergents"
- ———. 2012. *L'illusion Financière*. Ed. de l'Atelier.
- Grandjean, Alain. 2012. "La Monnaie, Une Affaire d'Etat." *Projet*, no. n°329 (April): pp 81–87.
- Guesnerie, Roger. 2006. *L'économie de Marché*. Ed. du Pommier.
- Guigon, Pierre, Valentin Bellassen, and Philippe Ambrosi. 2009. "Voluntary Carbon Markets: What the Standards Say". Working Paper. Mission Climat. Caisse des Dépôts.

- Hourcade, Jean-Charles. forthcoming. “Document de Travail-EPE.”
- ———. 2014. “Europe : Le Défi Climatique Pour Horizon.” *Revue-Projet.com*, February 26. <http://www.revue-projet.com/articles/2014-03-hourcade-europe-le-defi-climatique-pour-horizon/>.
- Hourcade, Jean-Charles, Christophe Cassen, and Priyadarshi Shukla. Forthcoming. “Climate Policy Architecture for the Cancun’s Paradigm Shift: Building upon the Lessons from History.” *Proposed for Publication in a Special Issue of International Environmental Agreements*
- Hourcade, Jean-Charles, and Baptiste Perrissin Fabert. 2013. “Triggering the Funding of the Low-Carbon Transition: A Monetary Plan.” *CIREL*, July.
- Hourcade, Jean-Charles, Baptiste Perrissin Fabert, and Julie Rozenberg. 2012. “Venturing into Uncharted Financial Waters: An Essay on Climate-Friendly Finance.” *International Environmental Agreements*, March, 165–86.
- IDFC. 2013. “Mapping of Green Finance Delivered by IDFC Members in 2012”. International development finance club. https://www.idfc.org/Downloads/Publications/01_green_finance_mappings/IDFC_Green_Finance_Mapping_Report_2013_11-01-13.pdf.
- IEA. 2014. “World Energy Investment Outlook”. Special Report. OECD/IEA.
- Illman, Julia, Mikko Halonen, Shelagh Whitley, and Nella Canales Trujillo. 2014. “Practical Methods for Assessing Private Climate Finance Flows”. ODI, Gaia, OECD Research Collaborative.
- IMF. 2013. “Special Drawing Right (SDR) Allocations: Questions and Answers.” *IMF.org*. August 5. <https://www.imf.org/external/np/exr/faq/sdrallocaqs.htm>.
- ———. 2014a. “Special Drawing Rights (SDRs): Factsheet.” *IMF.org*. March 25. <https://www.imf.org/external/np/exr/facts/sdr.HTM>.
- ———. 2014b. “Gold in the IMF.” *IMF.org*. March 25. <https://www.imf.org/external/np/exr/facts/gold.htm>.
- Inderst, G, Christopher Kaminker, and Fiona Stewart. 2012. “Defining and Measuring Green Investments: Implications for Institutional Investors’ Asset Allocations”. OECD Working Papers on Finance, Insurance and Private Pensions No. 24. OECD Publishing. OECD.
- Kroll, Matthias. 2011a. “The Lack of \$100 Billion for Climate Finance and the Possibility to Create New Global Reserve Money in the Form of Special Drawing Rights from the IMF.” In Poznan.
- ———. 2011b. “Rethinking Environmental Protection: IMF Special Drawing Rights Could Finance the Energy Transition.” In .
- Krugman, Paul. 2000. “Thinking about the Liquidity Trap.” *Journal of the Japanese and International Economies*, no. No.14: pp 221–237.
- ———. 2009. “A History Lesson for Alan Meltzer.” *The New York Times*, May 4.
- ———. 2013a. “The ECB and the Austerity Trap.” *The New York Times*, March 31.
- ———. 2013b. “Monetary Policy in a Liquidity Trap.” *The New York Times*, April 11. http://krugman.blogs.nytimes.com/2013/04/11/monetary-policy-in-a-liquidity-trap/?_php=true&_type=blogs&_php=true&_type=blogs&_r=2.
- ———. 2014. “The Inflation Obsession.” *The New York Times*, March 2. http://www.nytimes.com/2014/03/03/opinion/krugman-the-inflation-obsession.html?_r=0.
- Le Merrer, Pascal. 2007. “Les Débats Actuels En Économie Monétaire.” *Idées*, no. n°48.
- Markowitz, Harry. 1952. “Portfolio Selection.” *The Journal of Finance* Vol.7 (No.1): pp 77–91.
- McLeay, Michael, Amar Radia, and Thomas Ryland. 2014. “Money Creation in the Modern Economy”. Quarterly Bulletin 2014 Q1. Bank of England.

- Morel, Romain, and Cécile Bordier. 2012. "Financing the Transition to a Green Economy: Their Word Is Their (green) Bond?" *CDC Climat Research Climate Brief*, no. n°14 (May).
- Murphy, Richard, and Colin Hines. 2010. "Green Quantitative Easing: Paying for the Economy We Need". Finance for the Future.
- Novethic. 2013. "Les Obligations Environnementales et Sociales : Un Instrument Financier Prometteur". Novethic.
- Perrissin Fabert, Baptiste, and Jean-Charles Hourcade. 2013. "Des 'Certificats Carbone' Pour Soutenir L'investissement Bas Carbone : Étude Du Circuit Financier", June.
- Revkin, Andrew. 2009. "Soros Hatches Climate Finance Scheme." *The New York Times*, December 10, sec. Green. http://green.blogs.nytimes.com/2009/12/10/soros-hatches-climate-finance-scheme/?_php=true&_type=blogs&_r=0.
- Rosenberg, Tina. 2007. "Reverse Foreign Aid." *New York Times*, March 25.
- Ryan-Collins, Josh, Richard Werner, Tony Greenham, and Giovanni Bernardo. 2013. "Strategic Quantitative Easing: Stimulating Investment to Rebalance the Economy". London: new economics foundation.
- Shishlov, Igor. 2014. "MRV Incentives: Theory and Peactice (the CDM Experience)". PDF file presented at the Bonn MRV Workshop, May, Bonn. http://www.cdclimat.com/IMG/pdf/2-_shishlov_-_mrv_incentives_and_cdm-_cdc_climat.pdf.
- Shishlov, Igor, and Valentin Bellassen. 2012. "10 Lessons from 10 Years of the CDM." *CDC Climat Research Climate Report*, no. n°37 (October). CDC Climat Research.
- Spratt, Stephen, and Christina Ashford. 2011. "Climate Finance: A Tool-Kit for Assessing Climate Mitigation and Adaptation Funding Mechanisms". Institute of Development Studies, Stamp Out Poverty.
- Stiglitz, Joseph. 2003. "Dealing with Debt: How to Reform the Global Financial System." *Harvard Relations Council International Review*, no. n°25.
- Taylor, Eva. 2014. "Draghi: ECB Aware of Risks from Persistently Low Inflation." *Reuters*, May 27. <http://www.reuters.com/article/2014/05/27/us-ecb-draghi-idUSKBN0E71QH20140527>.
- Taylor, John Bryan. 1993. "Discretion Versus Policy Rules in Practice." *Carnegie-Rochester Conference Series on Public Policy*, no. 39: pp 195–214.
- Timbeau, Xavier (dir.). 2014. "Banques Cantrales, Dernier Rempart Contre La Déflation. Perspectives 2014-2015 Pour L'économie Mondiale." *Revue de l'OFCE*, no. No. 135 (May).
- Ugai, Hiroshi. 2007. "Effects of the Quantitative Easing Policy: A Survey of Empirical Analyses." *Monetary and Economic Studies* Vol.25 (No.1).
- World Economic Forum. 2013. "The Green Investment Report: The Ways and Means to Unlock Private Finance for Green Growth."
- World Future Council. 2009. "Breaking the Climate Finance Funding Deadlock."
- Zhou, Xiaochuan. 2009. "Reform the International Monetary System."

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