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# **Managing Climate Change Risk: The Policy Options for Central Banks**

Peterson K. Ozili

## **Abstract**

This article discusses some policy options that central banks may find useful in dealing with climate change risk in the financial sector. The effect of climate change on the financial sector are indirect but severe when they occur. Central banks play an important role in regulating the financial sector and in managing its inherent risks, yet there are no studies that suggest policy solutions to help central banks and other financial sector regulators deal with the risk that climate change pose to the financial sector. Five policy options are proposed in the paper, which includes: imposing a climate change capital surcharge; impose a fixed-rate risk capital - based on Tier 2 capital; a reduction in lending to industries whose activities destroy the environment and climate; creating a climate bank; and, requiring financial institutions to relocate their important assets to areas less prone to climate change events. Several policy experiments are needed to identify the best policy option that works best for each country while taking into account the unique financial sector, financial system and climate change history of each country.

Keyword: climate change, financial risk, financial institutions, central bank, financial system, financial sector, banks, capital surcharge, climate change risk, climate bank, bank regulation.

JEL Code: G21, G28.

## 1. Introduction

The paper discusses the policy options that central banks may find useful in dealing with the risk of climate change. There is a general consensus that climate change events have a disastrous effect on human life and on businesses (Ramanathan et al, 2019; Kellogg, 2019). This has led many individuals, organizations and governments to seek ways to deal with the increasing climate change risk in the World.<sup>1</sup> Before now, the financial sector was considered to be immune from climate change events. But given the possible reduction in banks' profit and the potential loss suffered by banks following the destruction of the assets of banks' clients and customers during hurricanes, thunderstorms and typhoons, central banks are now being pressured to assess and evaluate the impact of climate change events on the financial sector as a whole.

In the financial sector, climate change events have an indirect effect on financial institutions, at least in theory, for instance, climate change events can lead to: loss or damage of physical collateral, disruption to the operations of financial institutions, disruption to the business of banks' customers, increase in insurance claims and liabilities due to climate-related damages, increase in insurance premiums, harsh working conditions for employees in the financial sector, and the potential loss of office branch networks (Ozili, 2020a). Businesses affected by climate change events may not be able to meet their loan obligations to financial institutions which may affect the profitability and stability of the financial institutions that lend money to the affected businesses. For this reason, central banks and bank supervisors have been under pressure to formulate policies to reduce the effect of climate change on financial institution in the financial sector.

So far, only few Central banks have issued policy statements on climate change such as the Bank of England<sup>2</sup> and the Bank of Canada<sup>3</sup>, and most of the policy statements issued by these two central banks are narratives or descriptive caution to financial institutions under their supervision. Other central banks have been reluctant or slow in fighting the risk that climate change pose to the financial sector (Brunnermeier and Landau, 2020; Ozili, 2020b), for two reasons: one, most Central banks think that the risk that climate change pose to the financial sector are non-systemic in nature, and therefore, do not require significant supervisory response and action; and two, some Central bankers believe that climate change risk cannot be accurately measured or quantified, and risk that cannot be measured or quantified cannot be managed.

This study is important because climate change risk has the potential to become systemic, and managing systemic risk in the financial sector is important to central banks. Central banks are the only institution with the authority to require financial institutions to proactively conduct risk

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<sup>1</sup> A consensus was reached in the 2016 Paris Agreement. The 2016 Paris Agreement within the United Nations Framework Convention on Climate Change deals with greenhouse-gas-emissions mitigation, adaptation, and finance.

<sup>2</sup> <https://www.bankofengland.co.uk/knowledgebank/climate-change-why-it-matters-to-the-bank-of-england>

<sup>3</sup> <https://www.bankofcanada.ca/2019/05/opening-statement-160519/>

assessment on the impact of climate change risk on financial institutions' activities and operations. The authority (and discretion) that Central banks have in regulating financial institutions puts them in the best position to set up policies aimed at mitigating climate change risk.

In this article, I present some policy solutions on how Central banks can mitigate climate change risk. The policy solutions expressed in this article makes two contributions to the literature. First, the discussion in this article contributes to ongoing policy debates on how to reduce the risk that climate change pose to corporations including financial institutions (see Battiston et al, 2017; Campiglio et al, 2018; Furrer et al, 2012, etc). Secondly, the viewpoints expressed in the article contribute to the literature that examine the effect of financial regulation and supervision on regulated financial institutions (see Goodhart et al, 2013; Demirguc-Kunt et al, 2003). Extending the debate to climate change, I explore the kind of policies that will help financial institutions remain safe during climate change events. Finally, the policy ideas expressed in this paper are important and relevant to financial sector regulators, bank supervisors, banking academics, climate change academics and climate change scientists.

The rest of the article is organized as follows. Section 2 presents the literature review. Section 3 discuss the policy options and Section 4 concludes.

## **2. Literature Review**

### **2.1. Climate change: origins**

On the origin of climate change, Ramanathan et al (2019) argue that human activity has made modifications to the land, the oceans, and the atmosphere, and those changes have damaged the environment and disrupted the planet's climate. Kellogg (2019) argue that human activity, particularly the use of fossil fuel, has induced a significant change in the climate, leading to a significant warming of the Earth's surface for the next fifty years. Korell et al (2019) show that there is need to conduct experiments that alter the local climate, and measure community-level response and ecosystem-level response to climate change, to help us understand how future ecosystems will respond to climate change. In their study, they synthesized data from 76 studies that manipulated the climate and measured plant community responses. They find that most climate change experiments do not correspond to model-projected climate scenarios for their respective regions, which implies that it may be difficult to predict the response of plant biodiversity and ecosystem functions to climate change. Altieri and Gedan (2015) analyzed the severity of climate change, and found that 94% of dead zones are in regions that will experience at least a 2 °C temperature increase by the end of the century. Poole et al (2019) examine how air pollution affects the weather and climate change. They show that air pollution from fossil fuel burning and traffic-related emissions can alter respiratory defense mechanisms and work synergistically with specific allergens to worsen asthma in susceptible people. They suggest that

community efforts can help to reduce air pollution, thereby reducing greenhouse gas emission and improving air quality.

## **2.2. Climate change in the financial sector**

Carney (2015) analyses the effect of climate change on the financial sector, and show that climate change will expose the financial sector to three main risks. One, physical risks - the impact today on insurance liabilities and the value of financial assets that arise from climate- and weather-related events, such as floods and storms that damage property or disrupt trade. Two, liability risks - the impact that could arise tomorrow if parties who have suffered loss or damage from climate change events seek compensation from those they hold responsible. Three, transition risks - the financial risks which could result from the process of adjustment towards a lower-carbon economy (Carney, 2015).

Doran and Quinn (2008) analyse nearly 6400 10-K filings by S&P 500 companies, to determine whether there are climate change-related disclosures by corporations in the stock market. They find that there was high level of non-disclosure of climate change risks by corporations. Only about half of the executives believe climate change is a social issue that affects shareholder value in the next five years. 76.3% of surveyed corporations failed to even mention climate change in the required SEC filings which investors relied on. Doran and Quinn (2008) further argue that the fact that the large majority of S&P 500 companies neglect to even mention climate risk demonstrates the fundamental failure to implement securities law and protect investors in capital markets. They suggest that the SEC should provide standardized guidance to corporations on reporting requirements for climate risk disclosure.

Dafermos et al (2018) use a stock-flow-fund ecological macroeconomic model to analyse the effects of climate change on financial stability. They place emphasis on the impact of climate change damages on the price of financial assets and the financial position of firms and banks. They find that, climate-induced financial instability can adversely affect credit expansion and reduce the level of economic activity. They also find that climate change damages can lead to portfolio reallocation that can cause a gradual decline in the price of corporate bonds. Finally, they observe that, by destroying the capital of firms and reducing their profitability, climate change is likely to gradually deteriorate the liquidity of firms, leading to a high default rates that could negatively affect the financial and non-financial sector. Battiston et al (2017) find that the direct and indirect exposures to climate-policy-relevant sectors represent a large portion of investors' equity portfolios, especially for investment and pension funds. They suggest that an early and stable climate policy framework would allow for smooth asset value adjustments.

Campiglio et al (2018) argue that the primary responsibility for managing the transition to a low-carbon economy rests with governments, and that even though the government may seek collaboration with Central banks, such cooperation will not require a modification of Central banks' mandate. On the other hand, Monti (2009) argue that the impact of extreme weather events, including climate change and global warming, can be reduced through a proactive role of

governments in direct and continuous collaboration with the private sector especially insurance companies, reinsurance companies and other financial sector participants. Zobia (2005) argue that climate change does not only affect communities and societies but also companies in the financial sector, and that the insurance industry and other institutional investors have begun to take climate and CO2 emission risks into consideration in their insurance premium and investment decisions.

### **2.3. The Central bank and risk in the financial sector**

There are many risks in the financial sector. Most risks are correlated with each other, and the correlation among risks require an integrated approach in managing risk rather than managing risk in silos or separately (Cornett and Saunders, 2003). Depending on the type of financial institution, some risk will be more important than others (Hull, 2012). For banks, the important risks are credit risk, operational risk, liquidity risk and market risk, while Fintech businesses tend to worry more about operational risk and liquidity risk. Regulators require banks to identify and manage their risk effectively because poor risk management may lead to poor performance (Brunnermeier et al, 2009).

Central banks are most often the regulator of all financial institutions in the financial sector in most countries (Goodhart, 2011), and as a result, achieving financial system stability is one of its main mandates as well as maintaining price stability (Ferguson, 2003). Central banks manage risks in the financial sector by issuing out regulations that sets the licensing requirements for a company to engage in financial services business, set the minimum regulatory capital requirements, imposing activity restriction on financial institutions when necessary, demand higher levels of regulatory capital when necessary, imposing severe penalties to discourage financial institutions from breaking the rules, and conducting risk-based supervision of the activities of financial institutions. In addition to these, the role of central banks is expected to change as new risks emerge in the financial sector (Goodhart, 2011). One of such risk is climate change risk.

## **3. The Policy Options**

### **#1. Impose a climate change capital (CCC) surcharge**

Central banks should impose a climate change capital (CCC) surcharge on all financial institutions under its supervision. The climate change capital (CCC) surcharge is the amount of risk capital that financial institutions should set aside for their exposure to businesses whose activities pollute the environment and the atmosphere or climate. The climate change capital (CCC) surcharge should be kept with the central bank or the financial regulator in a country, and the expectation is that the CCC surcharge will be used to minimize the damage to financial institutions caused by unfavourable climate change events when they occur, and to help the affected financial institutions recover from unexpected and unfavourable climate change event.

To adopt this policy approach, supervisors will need to measure the climate change risk assets (CCRA), the climate change impact (CCI) ratio and the climate change capital (CCC) surcharge of a financial institution. The CCRA is the weighted average of the sum of the climate change risk assets under at least four (4) scenarios or determinants. The climate change capital (CCC) surcharge of a financial institution, which is a percentage of the CCRA, is the amount of capital a financial institution should set aside to mitigate climate change risk. The climate change impact (CCI) ratio is simply the ratio of the asset-at-risk if a climate change event occurs as a proportion of the financial institution's total risk assets in the geographical area.

The CCI ratio is expressed as:

$$\text{CCI ratio} = \text{climate change risk assets} / \text{total risk assets}$$

Under this policy approach, a financial institution will be required to assign a climate change risk-weight to all its physical and tangible assets using a specified methodology. To determine the risk weight, four major factors should be taken into consideration alongside other national considerations, (i) the history of climate change events that have occurred in the geographical area where the financial institution's assets are located, (ii) the current number of industrial activities in the geographical area that are environmentally destructive, (iii) the availability of, and number of, emergency response agencies in the geographical area, and (iv) the amount of free funds (excluding cash reserve ratio) owned by the financial institution.

Let's take a hypothetical example. Consider a small bank, Rohm Bank, located in California in the United States. Rohm Bank operates under a regional banking license which means that all the assets of Rohm Bank are located in a specific region - California. Assume that the collateral owned or kept by Rohm Bank are also located in the same geographical area where the bank's assets are located, therefore, the valuation of Rohm Bank's assets will also include the value of all collateral assets in Rohm Bank's possession in the geographical location. Also, assume that the total value of the Rohm Bank's assets is \$14million. The climate change risk weights are derived from assessing the bank's exposure to climate change events using four scenarios or determinants using the methodology shown in Table 1.

[Insert Table 1 here]

## **#2. Impose a fixed-rate risk capital**

Secondly, Central banks can use a fixed-rate risk-capital policy. Central banks may impose a fixed-rate risk capital (for example, as a percentage of Tier 2 capital) on all financial institutions under its supervision. The risk capital will act as capital to mitigate climate change risk when it materializes. The fixed rate may be 2.5% of Tier 2 capital or 1% of Tier 2 capital depending on a rate determined by the bank supervisor or Central bank. Let's take a practical example.

Consider a bank that has a Tier 1 capital of \$50,000,000. Assume that Tier 2 capital is 33.3% of Tier 1 capital and a climate change fixed rate charge of 12.5 is imposed on banks by the national supervisor or the Central Bank. The fixed-rate risk capital of the bank will be:

$$\text{Tier 2} = 0.333 \times \$50,000,000 = \$16,650,000$$

$$\text{Fixed-rate risk capital} = 12.5\% \times \text{tier 2 capital}$$

$$\text{Then, the fixed-rate risk capital} = 0.125 \times \$16,650,000 = \$2,081,250$$

Whichever fixed-rate charge is adopted, the fixed rate charge should be kept with the financial institution not the regulator. This allows the financial institution to internalize the cost and risk of climate change events. The Tier 2 fixed rate charge may be used by financial institutions to meet their minimum regulatory capital requirement when a climate change event has not yet occurred. But when a climate change event occurs, the fixed-rate risk capital cannot be used in the computation of minimum regulatory capital ratio but must be used to minimise losses or damages to the assets of financial institutions after climate change events have occurred. Central banks should monitor financial institutions to ensure that the fixed-rate risk capital is set aside by financial institutions under its supervision.

## **#3. Reduce lending to industries whose activities destroy the environment and climate**

The third approach is to use lending restriction to businesses in industries whose activities hurt the environment and the climate. The Central bank may require financial institutions to reduce lending to industries whose activities degrade the immediate environment they operate in - such as the mining industry, petroleum industry, etc. This can be achieved in two ways (i) one, by lending to such businesses at a higher interest rate, or (ii) by deducting a climate penalty charge (CPC) from the total loan value before disbursing the loan to the customer.

Lending to businesses in such industries can be reduced to a minimum to pressure them to put in measures to protect the environment they operate in. Any bank that fail to reduce their loan exposure to companies in these industries may be sanctioned by the supervisor. Also, an outright loan ban may be placed on companies whose activity degrade the environment in a significant way, and the company has failed to put in place measures to minimize harm to the immediate environment which could affect members of the community. Such ban can pressure businesses in



these industries to design internal mechanisms and policies to reduce harm to the environment and the climate.

#### **#4. Create a climate bank**

Another policy option for Central banks is to set up a climate bank. A climate bank is a bankruptcy-remote entity and a special purpose entity jointly owned by all financial institutions including the Central bank. Each participating financial institution will contribute an agreed amount of capital to the climate bank, which will be used to help a financial institution recover from damages to the financial institution's assets when unfavorable climate change events occur. As a bankruptcy remote entity, the failure of all participating financial institutions will not lead to the failure of the climate bank because the payout to each financial institution is limited to the capital contributed by each participating financial institution. Also, a certain amount of capital can be given as loan to affected financial institutions at the discretion of other participating owners who may require interest on the premium capital (a form of loan) subject to the payment of interest. Finally, each participating owner may be required to review their capital contribution to the climate bank from time to time, and may be required to replenish any deficit in their capital contribution from time to time.

A climate bank structure is a superior model compared to the insurance contract arrangement. This is because, in an insurance company setting, climate change is likely to increase costs for companies in the insurance industry because of increased claims related to extreme weather events, which are intermittent and unpredictable. Moreover, if the payout costs are deemed to be too costly and unprofitable for insurance companies, insurance companies can stop offering policy cover for climate change events, preferring to offer only traditional insurance policies. In contrast, the climate bank model is similar to a mutual fund model in which every owner (financial institutions) contribute their own funds to the climate bank. The major difference is that a distressed financial institution can use their funds (which comes at no cost to them) and can also use the funds or capital of other owners subject to the payment of interest on the borrowed capital.

#### **#5. Relocate important assets to areas less prone to climate change events**

Finally, Central banks can require financial institutions to have an emergency asset relocation policy. Central banks can ensure that financial institutions relocate their important assets away from cities that are prone to unfavourable climate change events such as mudslides, earthquake, typhoon, landslides, etc. The downside of this approach is that moving a financial institution's assets away from climate change prone areas to safer areas may reduce the level of economic activity in communities that suffer from climate change events, and could trigger a recession in such communities. For this reason, the emphasis here is that all financial institutions can relocate their "important assets", not "all assets", to cities that are less prone to unfavourable climate change

event. Only the important assets should be relocated to a safer location. For example, small bank branches and customer service centers should not be relocated while the Headquarters of a financial institution and its information system infrastructure warehouse may be relocated to areas that are less prone to unfavourable climate change events.

#### **4. Conclusion**

This article discussed some policy options that central banks may find useful in dealing with the risk of climate change in the financial sector. The paper suggests five policy options which includes: imposing a climate change capital surcharge; impose a fixed-rate risk capital - based on Tier 2 capital; a reduction in lending to industries whose activities destroy the environment and climate; creating a climate bank; and, requiring financial institutions to relocate their important assets to areas less prone to climate change events.

It is important to ensure that financial institutions remain safe during climate change events and Central banks have a role to play in ensuring the safety and soundness of the financial institutions under their supervision, and for this to happen, new banking regulations will increase in the coming years, and climate change regulation is one of them. In the future, bank supervisors may impose stricter or lighter rules based on the peculiarities of the financial sector and the climate change history in each country. After formulating a climate change policy, implementation should follow. When implementing a climate change policy in the financial sector, Central banks may speed-up or delay the implementation of climate change policies, and there should be enough time to adjust to new and existing climate change policies.

The implication of these policy options is that it will compel financial institutions to exercise a great deal of caution in lending to businesses that harm the environment in a significant way. Such policies will also help in making businesses accountable for the environment they operate in. Through such policies, financial institutions will be able to pressure their customers to design internal mechanisms and policies to reduce the harm their activities cause to the environment and the climate.

Future research can investigate, empirically, the effect of specific climate change events on the stability of major financial institutions. Future research is also needed to explore the possibility for self-regulation of climate change risk by financial institutions in the financial sector. Should financial institutions develop their own internal policies to tackle climate change risk (i.e. micro or self-regulation) or should the Central bank develop a one-size-fits-all policy on climate change risk for all financial institutions? This is a worth-while puzzle to solve.

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## List of Tables

Table 1: Measuring climate change capital (CCC) surcharge for Rohm Bank				
Scenario (or determinant)	Methodology	Number (rating)	Risk weight (0.1 to 0.9 i.e. low to high)	Climate change risk assets
Extent of, or number of, environmentally destructive activities by businesses in the geographical area	(i) Low risk (0-5), (ii) Moderate risk (6-20), (iii) High risk (above 20).	7	0.5	\$7,000,000
10-year history of climate event (i.e. number of recorded climate change events) in the area.	(i) Low risk (0-5), (ii) Moderate risk (6-10), (iii) High risk (above 10).	2	0.2	\$2,800,000
Free funds owned by the Rohm Bank	(i) Low risk (rated “0.5” if current free fund is significantly greater than that of previous year). (ii) Moderate risk (rated “4.5” if current free funds are materially the same as that of previous year) (iii) High risk (rated “8.5” if current free funds is materially lower than that of previous year)	8.5	0.8	\$11,200,000
Number of emergency response team in the area	(i) Low risk (above 5) (ii) Moderate risk (3 to 4) (iii) High risk (0-2)	1	0.9	\$12,600,000
Total climate change risk assets divided by number of scenarios	-	-	-	\$33,600,000/4
Average climate change risk asset (CCRA)	-	-	-	\$8,400,000
Total risk asset	-	-	-	\$14,000,000
CCI ratio	-	-	-	0.6 or 60%
Climate change capital surcharge (CCC) = 10% of CCRA	-	-	-	\$840,000
Climate change risk asset = risk weight multiplied by total risk asset value. Climate change risk weight is derived using a set of quantitative and subjective criteria based on knowledge of the geographical area and knowledge of Rohm bank’s balance sheet.				