

IV. MACRO STRESS TESTING DURING CLIMATE RISKS: REEXPLORING THE TRADITIONAL MECHANISM

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ABSTRACT

Global financial system stability is severely threatened by climate change, and conventional methods for managing financial risk may not be sufficient to handle the problems this presents. Macro stress testing can be used to analyse the possible effects of climate change on financial stability as well as to determine how resilient financial institutions are to major shocks. The report makes the case that macro stress testing should be expanded to evaluate risks associated with climate change, such as liability risks, transition risks, and physical risks. Macro stress testing can shed light on the repercussions of climate change on financial markets and institutions. Regulators and financial institutions can more accurately assess their resilience to climate-related disruptions and take the required steps to mitigate these risks by including climate hazards into stress testing scenarios. The paper also makes the case that green finance legislation can be crucial in enabling the use of macro stress testing to evaluate risks associated with climate change. The paper examines several distinct green finance regulations that enable macro stress testing incorporate climate change risks. The paper has lastly demonstrated that macro stress testing is a crucial instrument for evaluating the threats to financial stability posed by climate change. Green finance regulations must be created to make it easier to incorporate climate risks into macro stress testing in order to do this. To strengthen financial stability and resilience in the face of climate change, governments and financial regulators must collaborate to establish and execute such regulations.

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I. INTRODUCTION

India has begun its journey toward carbon neutrality, proposing a "Green Deal" to be completed by 2070. The financial sector, in particular, has been scrutinized for its ability to contribute to environmental sustainability. In this context, 'green finance' has emerged as a hot topic among global corporations. Green finance refers to all public and private organizations that provide financial support for sustainable development initiatives. Green finance emphasizes the importance of increased capital flow from the national government and private entities to establish green infrastructure. The RBI Governor recently stated that it is important to focus on the climate related risks that shall impact the business model of banks and ultimately disrupt the Indian economy. To assess the associated risks, regulators must formulate a forward-thinking, comprehensive, and strategic approach to address climate risks.¹

The key issue presently appearing in bank management is that the traditional risk management approaches are not sufficient for the measurement of climate change risks. The ability to predict either short-term costs or long-term effects of weather events is difficult, even though effective policymaking frequently necessitates a precise assessment of economic harms. Since the global financial crisis of 2008, stress tests have been used more frequently. Regulators use them to evaluate how well-prepared Regulated Entities ("REs") are for a given set of risks. It is suggested that the solution to this conundrum may lie in a macro-stress test for system-wide analysis with supervisory objectives. Through this paper, the authors attempt to showcase,

¹ Shaktikanta Das, Governor, Reserve Bank of India, 'Banking Beyond and Tomorrow' (Speech at Bank of Baroda's Annual Banking Conference, Mumbai, 22 July 2022) <<https://rbidocs.rbi.org.in/rdocs/Speeches/PDFs/BOBBBT22NDJULYEF5ED5285B7143F3BBDD451D32BD9296.PDF>> accessed 29 March 2023.

the significance of green finance regulations in implementing macro stress testing for better risk management. The present article is divided into four parts. *Firstly*, the article describes the risks imposed by climate risks. *Secondly*, it shall delve into explaining the traditional risk management approach undertaken by the financial institutions in India and then signifies the macro stress testing approach. *Thirdly*, it elaborately defines the definition of green finance and its importance in attracting green investment. *Fourthly*, it concerns the development of green finance regulations for implementing macro stress testing. The authors also attempt to provide policy recommendations in this subsection.

II. CLIMATE CHANGE RISKS – AN ECONOMIC NIGHTMARE

Climate change is what can be termed the doomsday clock of the 21st century, with its effects overreaching towards posing major economic difficulties across the world. While the immediate effects of climate change are pretty obvious and extremely talked about, the need has arisen to investigate a more significant, indirect effect – the potential for a significant financial meltdown. For instance, a large insurer could go bankrupt due to climate-related catastrophes, which could quickly spread to the mortgage and other financial sectors, increasing expenses and delaying recovery.

Climate change has triggered extreme weather events such as floods, storms and heatwaves. By 2030, India, which is anticipated to rank third in terms of carbon dioxide emissions after the US and China shall experience a 0.5°C increase in temperature.² According to average taken over a period of 30-years, the sub-Himalayan region of eastern India often sees a monthly

² *ibid.*

mean temperature of 15.5 C in the month of June.³ However, recently 3.1 °C higher than average temperature has been noted.⁴ In 2021 climate change induced natural calamities have accounted for over 343 billion USD in economic damages, across the globe.⁵ India has been ranked 7th amongst countries that are most frequently impacted by extreme weather conditions according to the Global Climate Risk Index 2021.⁶ 19 million hectares of land were burned during the 2019–20 wildfire season in Australia, at a cost to the economy of AUD 20 billion.⁷ Notably, the report – the State of Climate in Asia 2021 has found that India suffered the second-highest loss due to extreme climate events in 2021, incurring nearly \$7.6 Billion in damages as a result of flooding and storms.⁸ The study by the European Environment Agency estimated that its members suffered cumulative economic losses of between EUR 450 billion and EUR 520 billion as a result of weather- and climate-related catastrophes during 1980 to 2020.⁹

³ S. Thapa, ‘Comfort zone calculation and climatic condition for a typical building located in the darjeeling hills’ (2011) 29(1) Salesian Journal of Humanities and Social Science II (2) 123.

⁴ Disha Shetty, ‘Hottest July ever! 65% Indians were exposed to heatwaves in May-June 2019’ (*Business Standard* 10 August 2019) <https://www.business-standard.com/article/current-affairs/hottest-july-ever-65-indians-were-exposed-to-heatwaves-in-may-june-2019-119081000202_1.html> accessed 25 March 2023.

⁵ ‘Weather, Climate and Catastrophe Insight’ (*AON* 2023) <<https://www.aon.com/getmedia/f34ec133-3175-406c-9e0b-25cea768c5cf/20230125-weather-climate-catastrophe-insight.pdf>> accessed 26 March 2023 [“AON”].

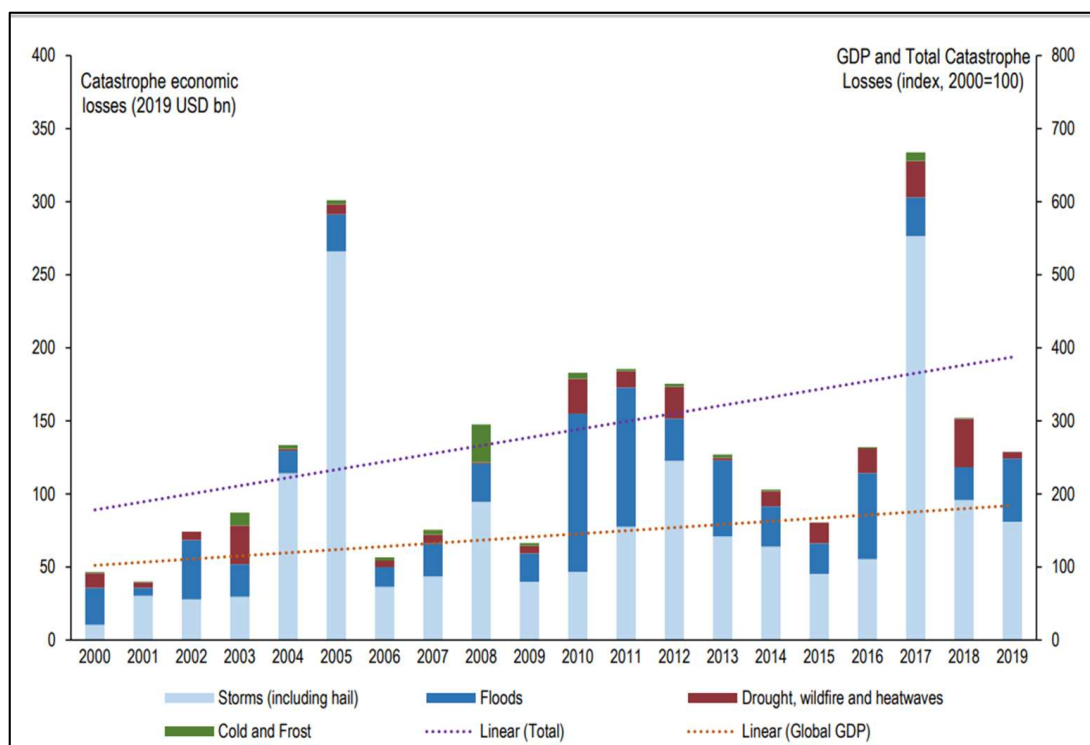
⁶ Diya Trivedi, ‘India among countries worst affected by climate change: Global Climate Risk Index 2021’ (*Frontline* 25 January 2021) <<https://frontline.thehindu.com/dispatches/india-among-countries-worst-affected-by-climate-change-according-to-global-climate-risk-index-2021/article33659497.ece>> accessed 26 March 2023.

⁷ Filkov, et al., ‘Impact of Australia’s catastrophic 2019/20 bushfire season on communities and environment. Retrospective analysis and current trends’, (2020) 1(1) *Journal of Safety Science and Resilience* 44.

⁸ World Meteorological Organization, *State of the Climate in Asia 2021* (WMO-No. 1303, 2021).

⁹ European Environment Agency, ‘Economic losses and fatalities from weather- and climate-related events in Europe’ (03 February 2022) <<https://www.eea.europa.eu/publications/economic-losses-and-fatalities-from/economic-losses-and-fatalities-from>> accessed 29 March 2023.

The following chart indicates the economic damage that climate change induced calamities impose –



Source: OECD calculations based on data on economic losses provided by Swiss Re sigma and data on gross domestic product from World Economic Outlook (database) (April 2021)

Given the far-reaching effects of climate change on the financial well-being of the country and the global market, it becomes imperative that the banking sector internalize such risks via their business models. Global markets and the market players in light of the climate related risk management would be in a need for finance. Additionally, banks as a response to this are integrating the global climate sustainability agenda into their operational aspects, including the evaluation of financing assets. This would however, require an appropriate regulatory framework for; a) identifying significant drivers of climate risk and the channels through which they are transmitted; b)

mapping and measure climate-related exposures and any areas of risk concentration; and c) assessing the overall risk.

In such a context, we shall now examine whether the efforts of India's banking regulation towards climate resilience could benefit by beginning with a macro stress test for climate risks.

III. UNDERSTANDING THE METHODS OF RISK MANAGEMENT.

A. Traditional Methodology

An effective risk governance framework includes a risk management process that enables the institutions to recognize new risks as well as create and put into action effective risk mitigation plans. When identifying and reducing all types of risk, the management should take climate-related financial risks into account. These risk assessment principles outline the various risk categories in which climate-related financial risks can be addressed.¹⁰ There are several approaches that have been undertaken by the Indian government for the calculation of impacts and risk assessment. These methods include 1) Informational impact focused study 2) Backward-looking climate risk analysis and 3) Forward-looking climate risk analysis.¹¹ These risk analysis are primarily based on the available data. For example, the informational study is mostly a generalized study that provides a broad overview of hazards, impacts and damages. In order to take the analysis

¹⁰ Office of the Comptroller of the Currency, Principles for climate-related financial risk management for large <<https://www.occ.gov/news-issuances/bulletins/2021/bulletin-2021-62a.pdf>> accessed 29 March 2023.

¹¹ Dr Reinhard Mecheler, et. Al, *Climate Risk Management Framework for India: Addressing Loss and Damage* (National Institute of Disaster Management and Deutsche Gesellschaft Fur Internationale Zusammenarbeit Giz 2019).

forward into a risk assessment, two approaches can be applied.¹² The first approach being a backward looking assessment wherein the past record of the damages can be utilized for the understanding of risks and damages, and the second being a forward looking scenario bases manner, a risk analytical method to comprehend risk, vulnerability, and exposure, generate scenarios, evaluate attribution, and reap the rewards of risk mitigation.

Traditional risk management approaches are based primarily on subjectivity and individual perceptions, which may not be the optimal way of dealing with the emerging risk landscape.¹³ While a number of approaches already exist in the field of short-term risk assessment and management, mainly in the field of extreme events, existing approaches do often not sufficiently address long-term, slow onset changes due to climate change. Also, risk and vulnerability assessments often do not meet the information needs of policymakers and local governments in order to manage the risks of climate change and associated losses and damages effectively.¹⁴

Pertinently, the ability to predict either short-term costs or long-term effects for weather events is difficult, even though effective policy making frequently necessitates a precise assessment of economic harms. This is due to the fact that current models frequently rely on historical data, which in this case means examining data that was influenced by a climate that no longer exists given that CO2 levels are higher than ever and are continuing to rise exponentially. Therefore, it seems that one of the main obstacles to

¹² *ibid.*

¹³ Vishal Ruia, 'Role of Data Analytics in risk management' (*Ernst & Young*, 22 February 2021) <https://www.ey.com/en_in/risk/role-of-data-analytics-in-risk-management> accessed 25 March 2023.

¹⁴ Dr Reinhard Mecheler, et. Al, *Climate Risk Management Framework for India: Addressing Loss and Damage* (National Institute of Disaster Management and Deutsche Gesellschaft Fur Internationale Zusammenarbeit Giz 2019).

implementing successful supervisory reforms is the lack of adequate data and analytical capacity in relation to climate risks.¹⁵ Hence, it is concluded that the traditional risk management approaches are not sufficient for the measurement of climate change risks.

B. Macro Stress Testing

Macro stress testing has received a lot of attention in many countries since the financial crisis of 2008 as a way to assess potential risks to the financial system. Stress testing is a type of scenario-based analysis used to gauge a system's resistance to potential stresses.¹⁶ Stress testing became a crucial part of crisis management during the 2007–2009 global financial crisis, especially for the FRB and the Committee of European Banking Supervisors.¹⁷ Analysis of climate-related scenarios is becoming a significant method for determining, quantifying, and managing climate-related risks. The term "climate-related scenario analysis" refers, for the purposes of this guidance, “to exercises used to conduct a forward-looking assessment of the potential impact on a bank of changes in the economy, financial system, or the distribution of physical hazards resulting from climate-related risks”.¹⁸ These tests are different from conventional stress tests, which usually evaluate the potential effects of brief shocks on current economic and financial conditions.

In order to assess how well a bank's strategy and risk management are prepared for structural changes brought on by climate-related risks, banks can

¹⁵ Basel Committee on Banking Supervision, *Climate-related financial risks-measurement methodologies* (Bank for International Settlements, April 2021).

¹⁶ Marcelo, A., A. Rodríguez, and C. Trucharte, ‘Stress Tests and Their Contribution to Financial Stability’ (2008) 9 65-81 *Journal of Banking Regulation* <<https://doi.org/10.1057/jbr.2008.1>>.

¹⁷ M Goldstein, ‘Banking’s Final Exam: Stress Testing and Bank-Capital Reform’ (Peterson Institute for International Economics Press 2017).

¹⁸ K Dent and Ben Westwood, *Stress Testing of Banks: An Introduction* (Bank of England, 2016).

apply an efficient framework for climate-related scenario analysis alongside their current risk management procedures.¹⁹ Macro-prudential stress tests are intended to evaluate the financial sector's overall resilience to shocks, which may include second-round effects resulting from connections with the larger financial system or the economy.²⁰ Even though data is gathered at the firm level, the analysis reveals risks and weaknesses that could jeopardize the stability of the financial system as a whole.²¹ It would be helpful for banks to incorporate macro-stress testing for the identification and assessment of the risk which will subsequently enable it to estimate the financial stability analysis of the climate change risks.²²

Macro stress testing has been devised in various countries like The Netherlands, China, United Kingdom, European Union, France and Australia. These countries are the frontrunners in implementing climate stress testing and pertaining regulations. For instance, People's Bank of China (“PBC”) has standardized green disclosures and green credit ratings since 2018. In the UK, the Prudential Regulation Authority and the Bank of England had incorporated climate stress testing as part of their yearly Concurrent Stress Testing process. Although modelling climate-related scenarios and evaluating the impact of associated second-order effects are complex challenges, climate stress tests still offer crucial data. Greater expertise will be developed through more

¹⁹ Office of the Comptroller of the Currency, Principles for climate-related financial risk management for large banks <<https://www.occ.gov/news-issuances/bulletins/2021/bulletin-2021-62a.pdf>> accessed 29 March 2023.

¹⁹ Patrizia Baudino and Jean-Phillippe Svoronos, *Stress-testing banks for climate change – a comparison of practices* (Bank for International Settlements 2021).

²⁰ Ibid.

²¹ Patrizia Baudino, R. Goetschmann, J. Henry, K. Taniguchi, and W. Zhu, *Stress-Testing Banks – A Comparative Analysis* (Bank for International Settlements 2018).

²² Manal Shah, ‘Macro-Stress Testing for Climate Risks and Green Finance Regulations’ (*IndiaCorpLaw*, 19 November 2022) <<https://indiacorplaw.in/2022/11/macro-stress-testing-for-climate-risks-and-green-finance-regulation.html>> accessed 29 March 2023.

practice and need once climate stress scenarios are on the agenda and considered legitimate by regulatory bodies and the businesses they regulate.²³

C. The Case Study of Bank of Japan

Macro stress testing is carried out by the Bank of Japan using various scenarios that reflects the financial and economic conditions at different points in time. The results were then published in the semi-annual Financial System Report. Macro stress testing is done every six months, and the Financial System Report (“FSR”) has published the results. In the FSR, macro stress testing has two goals.²⁴ First, it describes the potential risk factors that Japan's financial institutions may encounter and assesses how resilient the Japanese financial system is as a whole to these risks. In order to ensure the stability of the financial system, the Bank also uses it to facilitate communication with pertinent domestic and international parties.²⁵ The Bank's macro stress testing currently includes the following noteworthy components.²⁶ First, it uses the FMM, a medium-sized structural macromodel with two sectors—financial and macroeconomic—to reflect the feedback loop between the financial and economic sectors. Second, it can analyze data for specific financial institutions as well as overall metrics like capital adequacy ratios and net interest income.

²³ Aziz Durrani, Ulrich Volz and Masyitah Rosmin, ‘The Role of Central Banks in Scaling up Sustainable Finance: What do Monetary Authorities in Asia and the Pacific Think?’ (2020) ADBI Working Paper Series, Asian Development Bank <<https://www.adb.org/sites/default/files/publication/575571/adb-wp1099.pdf>> accessed 30 March 2023.

²⁴ Financial System and Bank Examination Department, ‘Macro Stress Testing at the Bank of Japan’ (2014) Bank of Japan 1.

²⁵ *ibid.*

²⁶ *ibid.*

IV. IMPACT OF GREEN FINANCE & ITS REGULATION

Green Finance as a term has gained traction among policymakers, regulators, and institutional bodies around the world in recent years. There is no clear definition of green finance and its components in any academic/scientific literature for India. In the absence, terms like ESG Investment, sustainable finance, and climate finance are used interchangeably or in conjunction with it.¹ Without a defined term, there is high probability that attribution can be arbitrary and may cause confusion if actions are not perceived as being in line with pollution reduction, climate change adaptation, and mitigation.² However, the United Nations Environment Program (“UNEP”) have attempted to define green finance. Green finance refers to national or global finance funded by private, public or alternative funds that seeks to support risks imposed by climate change and support sustainability, particularly aspects such as biodiversity and resource conservation.³ This definition has been a guiding light for various governments and inter-governmental agencies for the development of policies.

Markets can be shaped around important policy agendas using a variety of potent interventions from policy actors.⁴ Recently, the Reserve Bank of India announced regulatory policy initiatives for combating climate risks and sustainable finance. These guidelines include guidelines on 1) wide

¹ Inderst, G., Kaminker, Ch., and Stewart, F., 'Defining and measuring green investments: implications for institutional investors' asset allocations' (2012) OECD Publishing.

² Labanya Prakash Jena & Dhruva Purkayastha, 'Accelerating Green Finance in India: Definitions and Beyond' (June 2020) CPI Discussion Brief, Climate Policy Initiative.

³ Maya Forstater and Naurin Nuohan Zhang, 'Definitions and Concepts: Background Note' (2016) UNEP <https://unepinquiry.org/wp-content/uploads/2016/09/1_Definitions_and_Concepts.pdf> accessed 20 March 2023.

⁴ Alex Nichols, 'Policies, Initiatives, and Regulations Related to Sustainable Finance' (Asian Development Bank 1 2021).

framework on green deposits 2) disclosure framework on climate related risks 3) climate scenario analysis and stress testing.⁵ This embarks India's landmark step towards the formulation of green finance regulations. Green finance regulations refer to policies developed by a state regarding all public and private organizations that provide financial support for sustainable development initiatives. The objective of Indian Government here could be tweaking the Indian financial market by increasing market participants' alleged interest in financial instruments with a "green" outlook.⁶

Globally, in order to address climate change and environmental degradation, national governments, financial institutions, and international organizations are increasingly realizing the significance of green finance policies (Table 1).

Table 1: Policies/Initiatives undertaken across the globe by 2021

Policy Level	Developing Authority/Country	Policy/Initiative
Transnational	N/A	Paris Agreement
Transnational	United Nations	UNEP Environment Fund
Transnational	United Kingdom	Social Investment Task Force

⁵ ET Online, 'RBI announces regulatory guidelines on climate risk and sustainable finance' (*The Economic Times*, 8 February 2023) <<https://economictimes.indiatimes.com/news/economy/policy/rbi-announces-regulatory-guidelines-on-climate-risk-and-sustainable-finance-for-res/articleshow/97718777.cms?from=mdr>> accessed 30 March 2023.

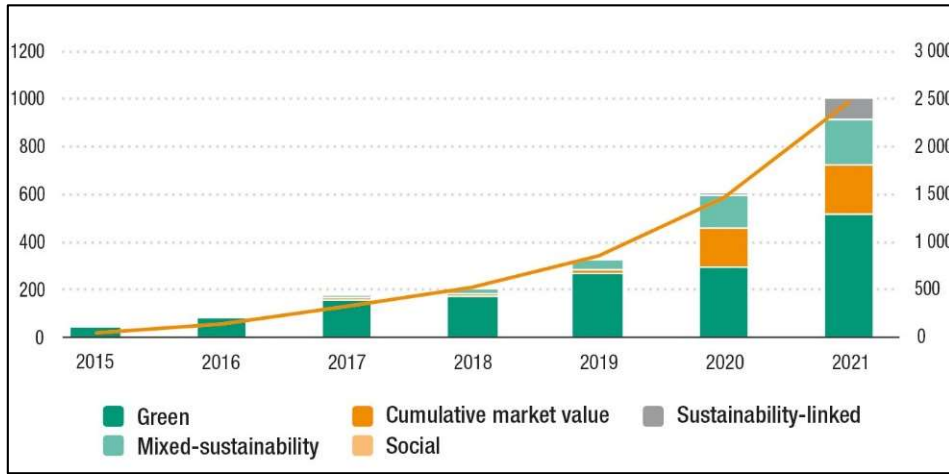
⁶ Department of Regulation, 'Discussion Paper on Climate Risk and Sustainable Finance' (2022) Reserve Bank of India <<https://rbidocs.rbi.org.in/rdocs/Publications/PDFs/CLIMATERISK46CEE62999A4424BB731066765009961.PDF>> accessed 30 March 2023 ["RBI Discussion Paper"].

Regional	European Union	European Green Deal
Regional	Asian Development Bank	ASEAN Catalytic Green Finance Facility
National	United Kingdom	Green Finance Taskforce
National	United States	Green New Deal
National	Netherlands	Donut Economy
National	India	Green Bonds
National	India	Green Debt Securities (Reporting & Disclosures)
National	India	ESG & Sustainability Regulation

These international initiatives are crucial for advancing green financial practices and aiding the shift to a low-carbon economy. These regulations can assist in reducing the effects of climate change and promoting environmental sustainability by encouraging financial institutions to invest in sustainable projects. As estimated by UNCTAD, the value of sustainable financial products is to be \$5.2 trillion, up 63% from 2020. In addition, there are \$2.5 trillion in sustainable bonds (including green, social, and mixed-sustainability bonds) (Figure 1) and \$2.7 trillion in sustainable funds (Figure 2).⁷

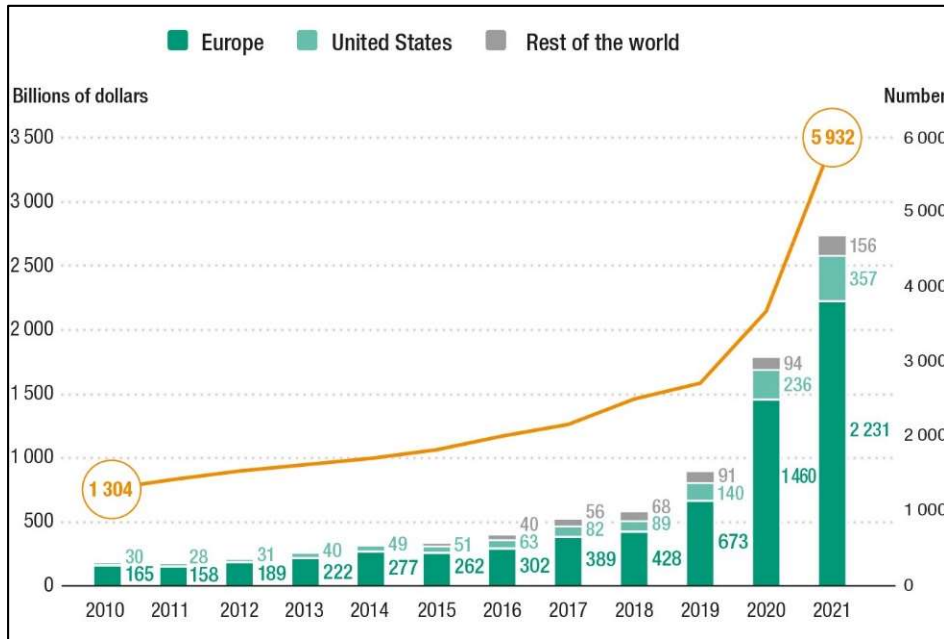
⁷ UNCTAD, 'Regulation rising as financial markets tackle climate risks' (*UNCTAD*, 09 June 2022) <<https://unctad.org/news/regulation-rising-financial-markets-tackle-climate-risks>> accessed 29 March 2023.

Figure 1: Sustainable Bonds Market, 2015-2021 (Billions of Dollars)



Source: United Nations Conference on Trade and Development

Figure 2: Sustainable funds and assets, 2010-2021 (Number of funds, r/h axis, and billions of dollars, l/h axis)



Source: United Nations Conference on Trade and Development

The authors hereby establish the analysis of the policies and regulations development by the authorities. In United Kingdom, the

government rolled out a green finance task force for the purpose of developing proposals on how the public and commercial sectors should cooperate to make green financing a crucial component of the UK financial services sector, such as increasing investment into cutting-edge clean technology and improving demand and supply for green lending, etc.⁸ Whereas in India, the Securities Exchange Board of India (“SEBI”) mandated disclosure requirements for issuers of green debt securities by regulation called SEBI (Issue and Listing of Debt Securities), 2008. This policy aimed at

- *“Continuous review and assessment of identified green project(s) and/or asset(s);*
- *Continuous disclosure of utilized and unutilized proceeds;*
- *Ensuring that all project(s) and/or asset(s) funded by the proceeds of green debt securities, meet their documented objectives; and*
- *Offering qualitative and quantitative indicators on the environmental impact of the project(s) and/or asset(s); and*

V. VERIFYING PROCEEDS AND INTERNAL TRACKING MECHANISMS, THROUGH EXTERNAL AUDITORS.”

However, the correlation of green finance with the green finance regulations and green technology innovation creates positive as well negative impact on the market. According to some studies, the mechanism of disparate environmental regulations on the development of green technologies is negatively regulated by green finance. The "command and control" environmental regulations' detrimental effects on green technological innovation are lessened by green finance, while the "market incentive"

⁸ Green Finance Taskforce, *Accelerating green Finance* (Government of United Kingdom, 2018).

environmental regulations' beneficial effects are lessened. On the other hand, through space overflow, green finance can effectively support the development of green technology innovation in nearby areas while also significantly enhancing the level of local green technology innovation.⁹

VI. THE DAWN OF A NEW AGE – ENFORCING MACRO STRESS TESTING VIA GREEN FINANCE REGULATIONS

India is amongst the countries who yet do not have any codified sustainability or green policies in particular for the banking sector, however, there have been several attempts from the regulatory bodies for promoting an overarching policy that covers the financial sector in terms of green financing. RBI has recently released a press-note stating that it will soon be coming up with a Policy to regulate Green Finance and to prevent the harms associated with climate risks.¹⁰ This is in addition to the Discussion Paper that RBI released on Climate Risk and Sustainable Finance, wherein RBI has tried to examine the risks attributable to climate change, and the need for appropriate governance, strategies to overcome such risks, and devise micro-prudential risk management structure for the same.¹¹ The question that arises is how do Green Finance Regulations help in enforcing macro stress test? The answer is two-limbed –

⁹ Fang Y and Shao Z, 'Whether Green Finance Can Effectively Moderate the Green Technology Innovation Effect of Heterogeneous Environmental Regulation' (2022) IJERPH.

¹⁰ Reuters, 'RBI to issue norms to boost green finance, mitigate climate risks' (*Times of India* 08 February 2023) <http://timesofindia.indiatimes.com/articleshow/97721100.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst> accessed 29 March 2023.

¹¹ RBI Discussion Paper (n 39).

A. Creation of a Robust Framework

Green Finance regulations have to stand-up to their responsibility of regulating and supervising sustainable financing by formulating rules, governing REs and empowering the Regulators. Incorporating provisions on macro-stress testing is key step towards this responsibility.

Climate risks have been broadly categorized into; a. physical risks and b. transition risks.¹² The physical risks include ones that are a resultant of extreme weather events, such as heatwaves, floods, storms, ecosystem pollution, chronic sea-level rise or water scarcity, and deforestation/desertification.¹³ Interestingly, the transition risk has its genesis in the policy movement towards low carbon economy, for instance, public policy change, technological changes, etc.¹⁴ While these transitioning policies bring forth opportunities for sustainable development, it also imposes the governments, REs, investors, and borrowers with high transition costs. Creation of a robust framework in form of Green Finance Regulation entails internalizing these risks via Macro stress testing. For this purpose:

- Mandating mapping of risks and disclosure: Macro-stress testing requires data of REs on their exposure to climate-related hazards. These regulations can mandate the REs to map the exposure and disclose the same, for instance, concentration in CO₂/GHG-intensive assets, carbon emission footprint of portfolio, liabilities (including borrowings and credit lines) provided to entities exposed to climate

¹² Prashant Vaze, Neha Kumar, Sarah Colenbrander, Lily Burge and Nandini Sharma, “Identifying, managing and disclosing climate-related financial risks: options for the Reserve Bank of India” (2022) ODI Report.

¹³ *ibid.*

¹⁴ *ibid.*

risks, collateral positioned in higher-risk flood prone areas, coastal areas, etc. Thus, regulators can better comprehend the possible effects of these risks on the entire financial system. Further, this will lead to REs providing green financial products to de-risk their portfolio.

- Mandating top-down macro stress tests for the REs & providing guidelines on bottom-up technique: A top-down technique, as it's typically defined in stress testing, reflects the fact that the exercise is nearly totally directed by a single authority, which also supplies the scenario and the major premises.¹⁵ In contrast, a bottom-up method is one in which businesses use their own modelling and occasionally add assumptions to obtain the results to the extent to which these may better reflect their individual circumstances.¹⁶

The authors advocate that the top-down approach should be made compulsory by the Regulations, and even a separate authority supervised by the RBI could be created to carry out these functions. The Regulation should mandate that RBI should carried out the macros stress test at a regular interval by including in its pool REs from various sectors. The rationale behind this exercise is to gain access to a holistic examination of data and to increase the exposure of data. For instance, RBI can undertake the top-down test by ascertaining credit risk, sectoral risk, interest risk, and liquidity risk.

Similarly, guidelines of a bottom-up approach, will be dealt in the subsequent part of the article.

- Regulating customers to the REs: Tenor restrictions may be made applicable to clients in industries that are particularly susceptible to

¹⁵ Basel Committee on Banking Supervision, *Stress testing principles* (Bank for International Settlements, October 2018).

¹⁶ *ibid.*

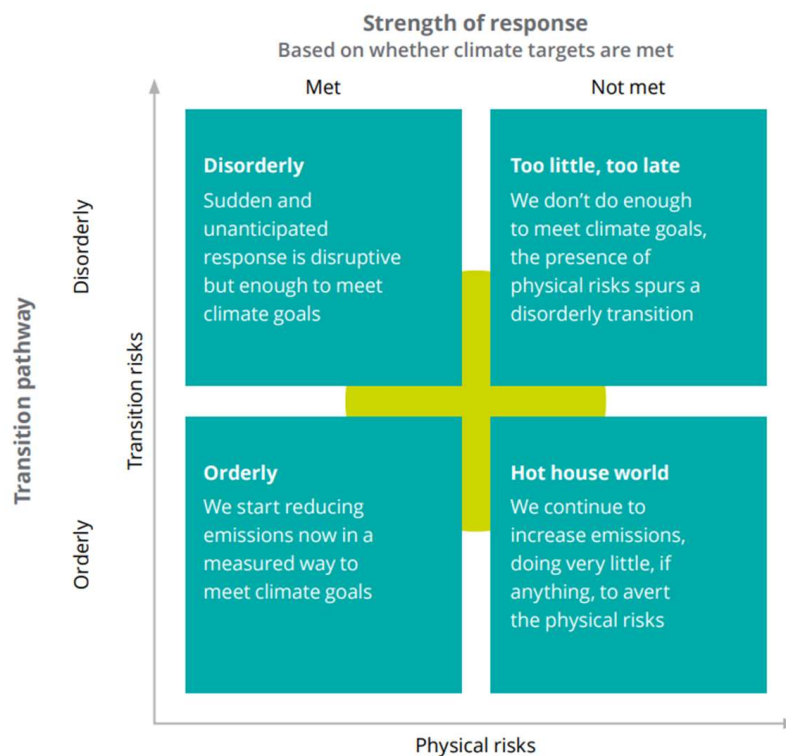
climate risks. Moreover, customers with real estate as collateral to be provided with a reduced loan-to-value cap if they don't meet the minimum sustainability requirements. Customers whose productivity is directly impacted by weather conditions should be directed to get insurance against extreme weather occurrences (such as seasonal floods and droughts). Further, customers in CO₂ and GHG-intensive businesses should be subjected to a sustainable energy transition plan.

- Rules on Insurance Companies: Insurance companies form the backbone of risk mitigation response when a climate disaster hits. Hence, the Green Finance Regulation can provide specific rules on insurance companies, for instance, based on previous data of the losses incurred due to climate disaster, the prices of the insurances to be adjusted and at the same time kept affordable to the consumer so that insurance protection vacuum is not created.
- Incorporating penalty for violation: For non-disclosure of REs' data and non-compliance with the guidelines of macro stress testing, the Regulation can impose penalties.
- Mandating the publication of results: The Regulation can mandate the publication of the results of the stress test on the websites of the REs or via Reports similar to financial statements that are made available to all stakeholders. An explanatory note can be added after the concluding report that whether or not the RE has sufficient capital buffers to withstand the potential impact of the climate risks.

B. Providing guidelines on conducting Macro stress testing

The Green Finance Regulations can provide for guidelines on formulation and implementation of macro stress test by the REs individually.

The public sector banks, insurance companies, pension funds, non-banking financial companies, and other REs can be promoted to develop their own procedures and standards for such stress testing. The Regulation can stipulate the requirement of ‘portfolio analysis’ (where the REs can identify the assets and liabilities they want to test), followed by modelling stress test according to sector specificity (where the REs can identify their primary sector that is likely to be affected more, such as coal-intensive industries, followed by the sub-sectors). Accordingly, the impact assessment should be done by tailoring the stress test as per the following graph:



Source: Deloitte – Centre for Regulatory Strategy, Asia Pacific (Report on Climate-related risk stress testing)

Based on the graph various scenarios can be created such as; an economic recession, a sharp increase in interest rates, and a decline in asset prices, floods due to melting of glacier caused to continuous carbon emission,

orderly implementation of sustainability policies, disorderly transition to a low-carbon economy, which included a sharp decline in oil and gas prices, a sudden rise in carbon prices, etc. Therefore, the Green Finance Regulation can provide for a general framework of a macro stress test, based on which the REs can develop their own methodology.

C. Issues in the enforcement of macro stress testing via Green Finance Regulations

The mechanism of macro stress testing establishes various opportunities to the industry but also brings certain challenges in the enforcement of the same. The authors have identified various challenges that shall be addressed by the regulators for the formulation of the policy:

- Disclosure of data: Many jurisdictions currently experience deficiencies in the availability, quality, and granularity of the data used for climate scenario evaluations, especially for transition hazards but also frequently for physical threats. Another potential problem is the speed at which datasets can be updated; financial companies, who are used to updating data on a quarterly or semi-annual basis, may have different needs from regulators, who can only update databases every five years. With respect to the Indian context, Data on physical and transitional risk factors is scarce. Because existing data-gathering practices do not meet international standards, the already available data is insufficient and unreliable.¹⁷
- Data Privacy concerns: Data privacy remains a big concern in the enforcement of disclosure requirement, especially in the absence of

¹⁷ Neha Khanna et. Al, 'Climate Risks and Opportunities' Climate Policy Initiative 10.

any data protection laws in India. Companies and institutions may be required to divulge sensitive information, such as confidential information about their business operations, investments, and strategy, as a result of climate-related stress testing. This information has a likelihood of being abused or obtained by unauthorized individuals, posing threats to finances, reputation, or competition.¹⁸ Further, for the stress testing, data retention is possible, thus it's important to follow the right disposal and retention procedures to ensure privacy. Data breaches and unauthorized access are made more likely when data is kept around longer than necessary or is not properly disposed away.

- Climate and modelling expertise: The help of experts in climate and science when creating or customizing data sets to match the context of the financial institution will be necessary. In any disclosures made, financial institutions will also need to be able to show that they comprehend the information and presumptions underlying the climate risk scenarios for the regulator and the general public.¹⁹

Therefore, the enforcement of macro stress testing via green finance regulations marks a positive yet murky step towards sustainable financing. India could formulate these regulations through the aid of numerous governments and think-tanks across the globe.

VII. CONCLUDING REMARKS

Green Finance Regulations thereby in the context of macro-stress testing satisfy the twin overarching purposes: first, introducing the macro-

¹⁸ Centre for Regulatory Strategy, 'Climate related risks and stress testing' (2020) Deloitte 28.

¹⁹ Neha Khanna et. Al, 'Climate Risks and Opportunities' Climate Policy Initiative 10.

stress test as a mandate for internalizing climate change induced risks, and second providing for guiding rules for the implementation of such stress tests. Global financial system stability is severely threatened by climate change, and conventional methods for managing financial risk may not be sufficient to handle the problems this presents. Macro-stress test offers priceless remedy to the plight of Regulators and REs to such possible shocks and to reduce the risk.

The authors make the case that macro-stress testing should be expanded to evaluate risks associated with climate change, such as liability risks, transition risks, and physical risks. Regulators and financial institutions can more accurately assess their resilience to climate-related disruptions and take the required steps to mitigate these risks by including climate hazards into stress testing scenarios. The authors also make the case that green finance legislation can be crucial in enabling the use of macro stress testing to evaluate risks associated with climate change. Thus, macro-stress testing along-side hands in glove with green finance regulations is a crucial instrument for evaluating the threats to financial stability posed by climate change. Therefore, to strengthen financial stability and resilience in the face of climate change, governments and financial regulators must collaborate to establish and execute such regulations.