

Impact of Climate Change on Financial Stability of Banking Sector in Pakistan

Memoona Yaseen¹, Maaz Ud Din², Robina Shaheen³ and Sher Khan⁴

<https://doi.org/10.62345/jads.2024.13.3.100>

Abstract

The study underscores the critical role of climate change as a growing risk to the financial stability of the banking sector in Pakistan. Empirical findings reveal a significant negative impact of climate change, evidenced by rising temperatures and CO2 emissions, on financial stability metrics such as ROA, ROE, and Z-score. These results highlight the urgent need for green financial instruments and government collaboration to mitigate such risks. Climate change is an active research topic given its economic, social and environmental repercussions. However, this research is fundamentally conducted to empirically analyse the impact of climate change on the financial stability of banking sector. GMM technique has been applied to test the proposed hypothesis. Findings, of the study reveals that climate change negatively impact the financial stability of the Banks. Climate change-induced natural disasters transfer losses to the financial sector in various ways. These include direct damage to banking and payment service facilities, heightened uncertainty for investors, limited availability of finance for reconstruction efforts following physical damage and decline in asset prices.

Keywords: Climate Change, Financial Stability, Financial Sector.

Introduction

Climate change and its economic consequences have been a growing field for research and primarily explored in developed countries; still there exists paucity of research on climate change and its impacts on financial stability in developing countries. Undoubtedly, climate change has caused frequent natural disasters like droughts, floods, rise in temperature and sea level which has increased financial instability and threats for economies (Dafermos, 2018). The Federal Reserve, in 2021, enlightened that climate change exacerbate the financial risk, affects the cost and availability of credit and amplify the risk to economic activities. Besides another study depicts climate change is a serious threat and adversely affecting the business and economies globally (Brunetti, 2021).

Financial system is facing a new potential risk in shape of climate change (Battiston, 2021). Financial system risk due to climate change has been categorized into two broad dimensions known as physical and transition risk. Climate change relevant physical risk is defined as decrease of financial assets and increase in financial liabilities whereas transition risk is defined as decrease in value of assets while making necessary adjustment in shifting economies towards low carbon country (Wan, 2022). Climate risk posed severe financial stability threats to banks

¹Lecturer, Institute of Management Sciences, University of Haripur, KP-Pakistan.

Corresponding Author Email: yaseenmemoona794@gmail.com

²Lecturer, Department of Business Administration, ILMA University Karachi, Pakistan.

Email: maazyousafzai12@gmail.com

³Lecturer, Department of Linguistics and Literature, University of Haripur KP-Pakistan.

Email: robina.shaheen@uoh.edu.pk

⁴Researcher at Comenius University Bratislava, Slovakia. Email: sherkhan4477@gmail.com



which overall disrupt the businesses and economies of countries (Shabbir, 2023). The banking sector is highly vulnerable to climate related risk and experiencing significant decline in profitability (Zhang, 2022). Another study in this regard shows climate change increases the systematic risk for banks and put stress on risk managements strategies to curb the effects of climate change (Song, 2023). Furthermore, Paris Climate Agreement has considered climate change and financial stability as a central policy debate (Shabir, 2024).

Climate change transmit risk to financial stability via three broad ways. Physical risk which refers to damage in property, disruption in trade and decrease in the value of assets due to extreme weather conditions like floods and storms. Secondly, liability risk that individual or groups seek compensation from those they held accountable for climate change. Lastly, transition risk which refers to the financial risk while convergence to low carbon economy, shifts in technologies and policies reevaluate worth of many assets as cost and opportunities become apparent (Carney, 2015). Climate change natural disaster transmit losses to financial sector in shape of direct damage to banking and payment service facility, amplified uncertainty for investors, inadequate finances for reconstruction due to physical destruction, reduce in lending for affected areas, deteriorating in household and corporate balance sheet, drop in insurance in affected areas and decrease in prices of assets (Batten, 2016).

This research aims to add in the literature on the climate change from developing countries perspective. This study is addressing the theoretical and empirical gap in literature as few studies are conducted in developing countries. Developing countries like Pakistan are more prone to climate relevant Risk. Therefore, the objective of this research is to identify the impacts of climate change on financial performance of banking sector in Pakistan. This paper will also provide some insights about which green financial instruments can be useful in mitigating the impact of climate change while addressing the phenomenon of climate change. The organisation of the study is stated as follows. After introduction the second section reviews literature from past studies. Third part of the study describes the formulation of hypothesis in light of literature. Fourth section deals with data sets and explain the model of the study. Fifth part of this study discusses the empirical results. The last section of the study presents conclusion drawn from results, policy implications, limitations and future research directions.

Literature Review

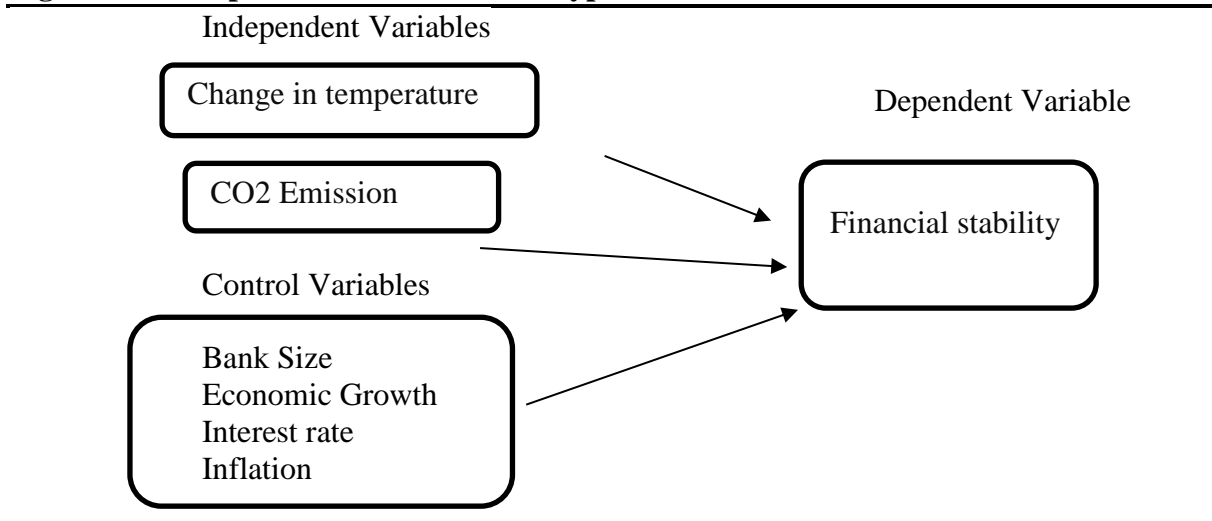
A recent study conducted in the China reports climate risk awareness is imperative to strengthen the banking sector as findings of the study reveal that climate change adversely effects the efficiency of banking sector and deteriorate the loan supply and decreases the deposits (Shouwei Li, How does climate risk affect bank loan supply? Empirical evidence from China, 2023). Moreover, another study reports countries which are facing extreme weather conditions; firms in all those countries experience substantial decrease in earnings and also observed higher volatility in earnings and cash flows of the firms (Huang, 2018).

Climate change is a serious threat to financial markets; fluctuations have been observed in the prices of stocks and bonds, banking and investing activities declined significantly which can disrupt the entire financial system (Griffin, 2015). Likewise, a study explored empirically the impacts of climate related variables (temperature and Rainfall) on index that measure the financial distress in commodity prices and their findings depict that climate related variables influence the Financial stability (Flori, 2021). Climate change exacerbate financial stress which fuels financial instability in the economy (Diallo, 2023).

Climate change not only causes economics losses but also influence the sentiments of investors and create a whole chain effect for interrelated financial sectors which leads to financial crisis (Wang, 2021). Moreover, when a temperature increases above from a certain threshold it negatively impacts the financial stability (Liu, 2021).

In Pakistan climate change is a serious policy concern as climate change enhance the risk of floods and droughts which decline the productivity of agriculture sector, high temperature also affects the water resources; shortage of water resources enhance risk to energy sector. (Chandio, 2020). Climate change hinder the developmental goals of least developed countries and negatively impact the education, energy, health and sustainable production (Wright, 2015). In a facet of new risk posed by climate change many financial institutions and national banks are considering climate change as financial risk for the investors and economic sector (Sun, 2022). Another study in which impact of high temperature on performance of firms in 93 countries has been studied and findings of the research demonstrates that climate change (high temperature) reduces the performance of firms and it also decrease the revenue and operating income of all those firms exposed to high temperatures. The firm's performance is negatively influence by greater heat exposure, it also effect the expenses of the firm as electricity consumption for cooling increases and firms have to bear additional charges in shape of increased wages for heat related hazards (Pankratz, 2023). It is crucial for business to investigate climate risk and incorporate climate risk into investment decision making in order to strengthen the value of the firm while mitigating the climate risk (Li, 2024). In a recent study relationship between strategies to reduce (GHG) emission and performance of firm has been explored, findings of the study indicate that investment in green technologies are helpful in enhancing the environmental and financial performance of the firm and also ensure reduction in (GHG) emission. (Letmathe, 2024).

Figure 1: Conceptual Frame work and Hypothesis



H1: Climate change (temperature change) is negatively associated with Financial Stability of banking sector.

Change in temperature damages the capacity of assets, it also increases the credit risk for institutions and insurance companies experience financial losses (Sun, 2022). In a similar manner in a recent research relationship between climate change (temperature deviation) on financial stability of financial markets have been studied and findings reports that the higher the temperature lower the level of financial stability. In other words, climate change negatively effects financial stability (Wu, 2023).

H2: Climate change (Co2 emission) is negatively associated with the Financial Stability of banking sector.

The findings of research conducted in Pakistan reveals that climate volatility is detrimental to the economic growth of the economy in that rise in temperature and C02 emission negatively

affects GDP (Khurshid, 2022). In a similar manner a recent study conducted in China reveals that climate risk negatively affects the financial stability of the countries (Liu, 2024).

Methodology

The Generalized Method of Moments (GMM) was chosen due to its effectiveness in dealing with endogeneity issues in panel data, ensuring more robust results. The study focuses on the period from 2010-2021, representing a critical decade where the banking sector faced escalating climate risks, justifying the chosen sample period. This part of paper delineates the methodology for gathering data, including the dataset and specifies concerning variable measurement and techniques employed to test the proposed hypotheses. The study is structured to examine the correlation between climate change financial stability and bank loan supply of banking, while also exploring the potential effects of temperature change and Co2 emission on financial stability of banking sector of Pakistan. It seeks to analyse how both the measures of climate change effects financial stability of banking sector in Pakistan, necessitating a quantitative research approach.

Sample and Dataset

The sample of this study comprises of 15 banks including some private and public sector banks of Pakistan. Study period of this research is consisted on 12 years from 2010 to 2021. A comprehensive panel dataset comprising 180 observations has been meticulously assembled for the purpose of final estimation. However, data financial stability of financial sector has been fetched through the financial statement analysis of financial sector done by State bank of Pakistan. Data for climate change indicators (change in temperature and Co2 emission) has been obtained from International Monetary Fund (IMF) and World Development Indicators WDI. The data of macroeconomic variables involved in this research and Bank Z-Score has been obtained from WDI.

Table 1: Operational Definition of variables

Variables(acronyms)	Measurement
Return on Asset (ROA)	Net income/Total Assets
Return on Equity (ROE)	Net income/Shareholders Equity
Bank Z-Score (Z-score)	Z-score compares the resilience of commercial banking system denoted by its capitalization and returns, against the variability observed in those returns, figures are obtained from WDI.
Change in Temperature (tem-chng)	Annual surface temperature change
Carbon dioxide emission (Co2 emission)	“CO2 emissions from manufacturing industries and construction (% of total fuel combustion)”
Bank size	LN of Total Assets
Economic growth(GDP)	GDP growth annual (%)
Interest rate (Interest)	Real interest rate (%)
Consumer price Index(CPI)	Inflation, consumer prices (annual %)

Dependent Variable (Financial stability)

In literature different measures are offered to cater the financial stability of banking sector. However, this study utilized the financial stability indicators for banking sector suggested by (IMF). In line with past literature this study is using Return on Asset, Return on Equity as strong measures of financial stability. Moreover, to check the robustness of the model this study

also implied Z-score which is statistical tool to measure the financial stability of banking sector (Abrar, 2018).

Independent Variables (CO₂ Emission and change in temperature)

In recent researches numerous measures have been used for climate change. However, literature strongly advocates CO₂ emission and change in temperature are good measures for climate change. Harmful gases emitted due to industrial activities and burning of fossil fuels are known as CO₂. (WDI). Whereas change in temperature refers to average rise in temperature of earth and higher temperature has been associated with the decline in the financial stability (Wu, 2023).

Control Variables

There are multiple factors which contributes in the fluctuations of financial stability of banks. In order to better analyse the impact of climate change on financial stability of banks some control variables are also included in this research in line with the past literature. Bank size which is defined as total assets of a bank is taken as control. Bank size effects the financial stability or performance of a bank (Shah, 2014). GDP which is used as measure of economic growth. Interest rate which is defined as lending interest rate. Both GDP and interest are taken as control variables following the literature (Li, 2023). Consumer Price index serves as a crucial tool for understanding the dynamics of consumer spending, inflation, and overall economic health, making it a vital component of financial market analysis and policy making. It also effects performance and financial stability of banks (Lu, 2023).

Model Specifications

Initially, the dataset undergoes scrutiny for multicollinearity to mitigate the risk of spurious outcomes, employing Variance Inflation Factor (VIF) analysis. The findings of this assessment indicate an absence of multicollinearity. Following this, descriptive statistics of the variables are presented, encompassing mean, minimum, and maximum values along with standard deviations, spanning the study period from 2010 to 2021. For quantitative analysis, a statistical correlation is conducted to ascertain the interrelationships among financial stability indicators (ROA, ROE, and Z-score) and climate change variables such as temperature change and CO₂ emission within the sample under investigation. Moreover, 2 step GMM dynamic panel estimation formulated by Arellano and Bond (1991) has been applied to evaluate the result of climate change on financial stability of banking sector. Equation 1 and 2 has been applied to measure the impact of climate change (Temperature change and Co₂ emission) on Return on Asset. Nevertheless, estimation has been done in STATA to test the proposed hypothesis.

$$ROA_{it} = \beta_0 + \beta_1 ROA_{i,t-1} + \beta_2 Tempchng_{it} + \sum W_{it} + \epsilon_{it} \quad (1)$$

$$ROA_{it} = \beta_0 + \beta_1 ROA_{i,t-1} + \beta_2 Co2_{it} + \sum W_{it} + \epsilon_{it} \quad (2)$$

Equation 3 and 4 has been estimated to measure the impact of climate change (Temperature change and Co₂) emission on ROE. In order to measure the result effortlessly, strong indicators of financial performance suggested by IMF have been applied. Subsequently, both ROA and ROE are used individually with the climate change indicators.

$$ROE_{it} = \beta_0 + \beta_1 ROE_{i,t-1} + \beta_2 Tempchng_{it} + \sum W_{it} + \epsilon_{it} \quad (3)$$

$$ROE_{it} = \beta_0 + \beta_1 ROE_{i,t-1} + \beta_2 Co2_{it} + \sum W_{it} + \epsilon_{it} \quad (4)$$

Finally, equation 5 and 6 are also estimated to find the impact of climate change on financial stability of the banks. In order to check climate change significant impact on financial stability of the banks this study also applied Z-score which is another strong measure of financial stability suggested in the literature. Furthermore, individual equations have been estimated with both the indicators of climate change (tempchng and Co₂ emission).

$$Z - score_{it} = \beta_0 + \beta_1 Z - score_{i,t-1} + \beta_2 Temp_{chn}_{git} + \sum W_{it} + \varepsilon_{it} \quad (5)$$

$$Z - score_{it} = \beta_0 + \beta_1 Z - score_{i,t-1} + \beta_2 CO2_{it} + \sum W_{it} + \varepsilon_{it} \quad (6)$$

ROA, ROE and Z- score indicates the financial stability of the banks *i* at period *t*; β_0 is constant whereas (Temp. change and Co2) represent temperature change and Co2 emission taken as independent variable of the study. *W* in the equation is vector of control variable (Bank size, GDP, interest rate, CPI) and ε_{it} is the error term.

Results and Discussion

Descriptive Analysis

The table given below explains the descriptive statistics of the all variables. The table represent the mean value, minimum, maximum and standard deviation of the variables incorporated in this particular research.

The dependent variable of the study is financial stability. However, different measures are used in the study. The mean value of ROA is 0.0086 and minimum value of the ROA is -0.0177 and maximum value is 0.0296. Which means ROA of the banks is showing quite fluctuations over years. In the similar manner mean value of ROE 0.1396 and maximum value is -0.3192 and minimum value is -0.3192. This explain that most of the company has better ROE. In the similar manner mean value of Z-score is 10.5403 while maximum value is 13.2916 and minimum value is 7.4399. The independent variable of the study is climate change and (temperature change and Co2 emission) are used as measure of Climate change. The mean value of temperature is 0.8313, minimum value of temperature is 0.2630 and maximum value of temperature change 1.3590 which depicts that average surface temperature increased over the years. In the table Co2 mean value is reported 0.7927 and minimum 0.7109 and maximum value of Co2 is 0.9185. The high value of Co2 in table explains that industrial activities and fossil fuels contribution has increased Co2 concentration the atmosphere. Rest of all are controls in line with the past studies.

Table 2: Descriptive analysis

Variables	N	Minimum	Mean	Maximum	Standard deviation
ROA	180	-0.0177	0.0086	0.0296	0.0069
ROE	180	-0.3192	0.1396	2.3471	0.1954
Z-score	180	7.4399	10.5403	13.2916	1.7785
Temp change	180	0.263	0.8313	1.359	0.3898
Co2	180	0.7109	0.7927	0.9185	0.0706
Bsize	180	17.2336	19.9899	22.128	1.1061
GDP	180	-1.2741	3.7339	6.5738	2.1684
Interest rate	180	-1.7109	3.0979	7.7613	2.6269
CPI	180	2.5293	7.8909	12.9388	3.2598

Notes: ROA represents Return on Asset which is measured as net income divided by total asset, ROE here depicts Return on Equity which is calculated as net income divide by equity, Z-score is measure of financial stability from

WDI. Temp change represents change in annual surface temperature from IMF. Co2 is carbon emission due to industrial activities and fossil fuels from WDI, Bank size is log natural of Total asset. GDP is annual growth figures obtained from WDI, Interest rate is taken from WDI, CPI is consumer price index obtained from WDI.

Correlation Matrix

Table 3 explains the correlation among different variables incorporated in the study. The correlation between the independent variables (temperature change and Co2) with dependent variable is in line with the past literature. Both (temp change and co2) are strongly negatively correlated with ROA. In the similar manner both the measures of climate change (temp change and Co2) are negatively correlated with ROE as expected. Again (temp change and Co2) are negatively correlated with Z-score. All the controls of the study are also correlated with each other.

Table 3: Correlation results

Variables	ROA	ROE	Z-score	Tem chng	Co2	Bsize	GDP	Interest	CPI
ROA	1								
ROE	0.2647	1							
Z-score	0.1217	0.0622	1						
Tem chng	-0.1395	-0.0298	-0.6585	1					
Co2	-0.1270	-0.0423	-0.3189	0.4967	1				
Bsize	0.3881	0.2328	-0.0577	0.0284	0.3516	1			
GDP	-0.0356	0.0233	0.1570	0.5004	0.4007	0.0796	1		
Interest	-0.0390	0.0273	0.4812	0.1111	0.0764	-0.0458	0.3515	1	
CPI	0.0152	-0.0384	-0.4483	-0.1669	-0.4724	-0.1352	-0.5816	-0.6997	1

Notes: ROA represents Return on Asset which is measured as net income divided by total asset, ROE here depicts Return on Equity which is calculated as net income divide by equity, Z-score is measure of financial stability from WDI. Temp change represents change in annual surface temperature from IMF. Co2 is carbon emission due to industrial activities and burning of fossil fuels from WDI, Bank size is log natural of total Asset. GDP is annual growth figures obtained from WDI, Interest rate is taken from WDI, CPI is consumer price index obtained from WDI.

Regression Analysis

This study has employed GMM technique to test hypothesis empirically. However, this study used 2 steps GMM regression in STATA to empirically test the hypothesis. The result of the study significantly supports the proposed hypothesis that climate change (temperature change and CO2 emission) negatively impacts the financial stability of the banks. Moreover, impact of both the measures of climate change has been measured individually.

Table 4: Regression Analysis

Dependent Variable (Financial Stability)	ROA	ROA	ROE	ROE	Z-score	Z-score
Variable	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Temp change	-.003424*** (0.000)	–	-.07848*** (0.000)	–	-4.0944*** (0.000)	–
Co2 emission	–	-0.0173*** (0.001)		-.9335*** (0.000)		-22.4631*** (0.000)
Bank size	.0004812*** (0.000)	.001099*** (0.000)	0.1867*** (0.000)	0.5839*** (0.000)	.4907*** (0.000)	1.2800*** (0.000)
GDP	.0001959*** (0.009)	-0.0000756 (.246)	.00757*** (0.000)	.0038*** (0.002)	.3597*** (0.000)	0.2914*** (0.000)
Interest rate	.0000787** (0.035)	0.000096*** (0.008)	.0159*** (0.000)	.0056*** (0.000)	.3597*** (0.000)	.2469*** (0.000)
CPI	-.000463 (0.493)	-0.000634 (.334)	.00450** (0.020)	-.0055*** (0.000)	.0214*** (0.000)	.0029 (0.685)
Sargan	1.000	0.9957	1.000	1.000	0.2508	0.2546
No.of obs	180	180	180	180	180	180

Dependent variable is financial stability which has been measured through ROA, ROE and Z-Score. Independent variables of the study are Temp change and Co2 emission. P value is provided in Paranthesis ***, **, * at 1%, 5% and 10%. Sargan test which provides the validity of Instruments. The null Hypothesis of Sargan should be insignificant which depicts Instruments are valid and not correlated with error term. Sargan test is valid for all the models.

The result of model 1 and model 2 shown in table strongly advocates that both temperature change and Co2 emission negatively influence the ROA of the banks. Similarly model 3 and Model 4 of the study depict the result of Temperature change and Co2 emission on the ROE of the banks. Again, the result of both the indicators of climate change provide evidence that Temperature change and Co2 has significant negative impact on the ROE of the banks. Finally, the study has also employed Z- score as a measure of financial stability. Model 5 and model 6 of the study in the table illustrate that both (temperature change and Co2) negatively influence the Z- score of the banks. Climate change is detrimental to the financial stability of the financial sector which is consistent with the recent studies (Wu, 2023).

Conclusion

Climate change is a huge potential research area. However, phenomenon of climate change is still under explored in developing countries. Subsequently, an effort has been made in this study to add in the literature from developing countries perspective. The findings of the study reveal that rise in temperature and Co2 emission disturb the financial stability of the banks in Pakistan. This research substantiated the notion that climate change impact the financial stability of financial sector. Therefore, climate change is a new form of risk which financial sector is facing. The findings of the research bear immense practical importance for banking sector. Regulatory authorities and Government should pay special attention to control climate relevant risk through introducing (climate related financial derivatives). Government should introduce the green financial instruments to mitigate the negative influence of climate change on financial sector. Investment in green financial instruments (green bonds, green loans and green investment funds) will not only decrease the natural disaster but also prove helpful in mitigating the economic and financial instability due to climate change. Policy makers should

advance their efforts to attract climate finance to support green financing schemes as developing countries are facing insufficient climate finances to deal with the risk posed by severe weather condition. Economy should be shifted to low carbon economy in order to decrease physical, environmental and financial damage. Policy makers should make collaborative efforts with all the regulatory authorities and financial sectors for the attainment of sustainable financial and economic growth of the country.

Limitations and Future Research Directions

This research work contributes in the literature and has great practical importance but there are some limitations of the research which are highlighted as follows:

Firstly, this research has used small sample for study purpose, in future this research should be extended to both financial and non- financial sector of Pakistan.

Secondly, this research has highlighted some of the green financial instruments. However, in future research should use some of the green financial instruments in the model to further explore the impact of those green financial instruments in mitigating the impact of climate change. The findings of this study underscore the detrimental effects of climate change on Pakistan's banking sector. To mitigate these risks, it is essential for regulatory bodies to introduce green financial instruments and enhance climate-related financial disclosures. Collaboration between government bodies, financial institutions, and international organizations is necessary to ensure a sustainable transition to a low-carbon economy.

References

- Battiston, S., & Yao, D. (2021). Climate risks and financial stability. *Journal of Financial Stability*.
- Batten, S., Sowerbutts, R., & Tanaka, M. (2016). *Let's talk about the weather: The impact of climate change on central banks*. Bank of England Working Papers.
- Brunetti, C., Dennis, B., & Jansen, R. (2021, March 19). *Climate change and financial stability*. FEDS Notes. Retrieved from <https://www.federalreserve.gov/econres/notes/feds-notes/climate-change-and-financial-stability-20210319.html>
- Carney, M. (2015). *Breaking the tragedy of the horizon – climate change and financial stability*. Bank of England.
- Chandio, A. A., Jiang, Y., Rehman, A., & Ahmed, F. (2020). Assessment of formal credit and climate change: Empirical evidence from the agricultural sector. *Sustainability*, 12(1), 1-19.
- Diallo, M. N., & N'Diaye, S. (2023). Climate risk and financial stress in ECOWAS. *Journal of Climate Finance*.
- Flori, A. (2021). Commodity prices co-movements and financial stability: A multidimensional visibility nexus with climate conditions. *Journal of Financial Stability*.
- Griffin, P. A., & Myers Jaffe, A. (2015). Science and the stock market: Investors' recognition of unburnable carbon. *Energy Economics*, 51, 1-12.
- Huang, H. H., & Karolyi, G. A. (2018). The impact of climate risk on firm performance and financing choices: An international comparison. *Journal of International Business Studies*, 49(6), 633-656.
- Khurshid, N., Ahmad, F., & Rehman, A. (2022). Impact of climate change shocks on economic growth: A new insight from non-linear analysis. *Frontiers in Environmental Science*, 1-15.
- Letmathe, P., & Chun, A. (2024). The productivity paradox in carbon-intensive companies: How technological advances can affect environmental outcomes. *Business Strategy and the Environment*.

- Li, S., & Wu, X. (2023). How does climate risk affect bank loan supply? Empirical evidence from China. *Economic Change and Restructuring*, 56(4), 2169-2204.
- Liu, Z., & Shi, H. (2021). Assessing the impacts of climate change on financial stability: Evidence from China. *International Journal of Climate Change Strategies and Management*.
- Liu, Z., & Shi, H. (2024). Impact of climate risk on financial stability: Cross-country evidence. *International Review of Financial Analysis*.
- Pankratz, N., & Bauer, R. (2023). Climate change, firm performance, and investor surprises. *Management Science*, 69(5), 7352-7398.
- Shabir, M., Jan, P., & Iqbal, Z. (2023). COVID-19 pandemic impact on banking sector: A cross-country analysis. *Journal of Multinational Financial Management*, 67, 100784.
- Shabir, M., Jan, P., & Iqbal, Z. (2024). Diversification and bank stability: Role of political instability and climate risk. *International Review of Economics and Finance*, 84, 63-92.
- Shah, S. Q., & Javid, R. (2014). Analysis of financial performance of private banks in Pakistan. *Procedia - Social and Behavioral Sciences*, 102, 1021-1025.
- Song, X., & Feng, T. (2023). Temperature shocks and bank systemic risk: Evidence from China. *Finance Research Letters*, 55, 103548.
- Sun, L., & Fan, S. (2022). Financial stability role on climate risks, and climate change mitigation: Implications for green economic recovery. *Environmental Science and Pollution Research*, 29(44), 33063-33074.
- Wu, L., & Li, X. (2023). The impact of climate change on financial stability. *Sustainability*, 15(1), 1-18.
- Wright, H., & Urmee, T. (2015). *Impact of climate change on least developed countries: Are the SDGs possible?* IIED Briefing Papers.
- Zhang, X., & Zheng, S. (2022). The banking instability and climate change: Evidence from China. *Energy Economics*, 110, 105648.