When Climate and Credit Collide in Barbados' Economy

Petr Jakubik and Saida Teleu[1]

1. Introduction

Small island economies face unique financial and economic challenges that distinguish them from larger, more diversified economies. Climate shocks, financial frictions, and systemic risk transmission are particularly pronounced in these settings, given their limited economic diversification, high dependence on external financial flows, and vulnerability to extreme weather events. The financial system in Barbados, a highly bank-centric economy, is exposed to these risks through credit constraints, rising non-performing loans (NPLs), and capital adequacy pressures. The interplay between financial frictions and climate-induced capital destruction has critical implications for economic stability and long-term growth. Understanding these dynamics is essential for designing policies that enhance financial resilience and mitigate systemic vulnerabilities.

Despite growing interest in climate-related financial risks, much of the existing literature has focused on advanced economies with deep financial markets and well-developed regulatory frameworks. Studies such as Vermeulen et al. (2021) and Battiston et al. (2017) highlight the role of financial networks in amplifying systemic risk transmission from climate shocks. However, little is known about how these risks interact with the structural limitations of small economies, where credit supply is often constrained, financial intermediation is path-dependent, and regulatory buffers may be insufficient to absorb external shocks. This research seeks to fill this gap by analyzing the relationship between climate shocks, financial intermediation, and systemic financial stability in Barbados.

This study addresses three central research questions: (i) What are the transmission mechanisms through which climate shocks affect capital accumulation and financial stability in Barbados? (ii) How do persistent credit supply constraints influence economic stagnation and financial stress? (iii) What role do macroprudential and regulatory policies play in mitigating climate-induced financial vulnerabilities in small economies?

To explore these questions, the research integrates insights from financial stability theory, credit market frictions, and climate finance. The study employs empirical methodologies that include macro-financial stress testing, sectoral credit risk assessment, and a dynamic analysis of capital adequacy deterioration due to climate-induced asset losses. By doing so, it provides a

[1] Petr Jakubik, Charles University in Prague, Faculty of Social Sciences, Institute of Economic Studies, Opletalova 26, 110 00 Prague, Czech Republic; e-mail: jakubik@fsv.cuni.cz; petrjakubik@seznam.cz

Saida Teleu, Central Bank of Barbados; Anglo-American University in Prague; Charles University in Prague, Faculty of Social Sciences, Institute of Economic Studies; e-mail: Saida.Teleu@centralbank.org.bb; saida.teleu@fsv.cuni.cz; teleusaida@gmail.com

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comprehensive evaluation of how systemic risks evolve in a small island economy facing climate stressors.

This research makes several contributions to the literature. First, it empirically validates the capital destruction-financial fragility hypothesis, demonstrating that climate-induced capital losses directly impact NPLs and financial stability in small economies. Second, it challenges traditional credit cycle models by showing that supply-side constraints, rather than cyclical demand factors, dominate financial intermediation in Barbados. This finding aligns with recent discussions on credit market imperfections in developing economies but introduces a novel dimension by linking these constraints to climate shocks. Third, the study offers policy insights into how macroprudential regulations can enhance financial stability in climate-vulnerable economies. By evaluating the role of capital adequacy, provisioning requirements, and stress-testing methodologies, it provides a roadmap for strengthening financial sector resilience against systemic risks.

The remainder of this paper is structured as follows. Section 2 reviews the relevant literature on climate finance, financial frictions, and banking sector resilience. Section 3 outlines the methodological approach, including data sources, stress testing techniques, and empirical strategies. Section 4 presents the main findings on credit constraints, financial stress transmission, and systemic risk dynamics. Section 5 discusses policy implications, including regulatory strategies for mitigating financial fragility. Finally, Section 6 concludes with recommendations for future research and financial sector reform.

2. Literature review

This study builds on multiple strands of literature in climate finance, financial intermediation and macroeconomic productivity. It engages with key discussions on systemic risk transmission, credit market frictions, and the economic consequences of climate shocks, while introducing new insights specific to small island economies.

The research closely relates to the literature on climate-induced financial risk transmission, particularly the works of Vermeulen et al. (2021) and Battiston et al. (2017), who examine systemic risk amplification through financial networks. These studies highlight how physical and transition risks contribute to asset devaluations and rising non-performing loans (NPLs). In the case of Barbados, with its concentrated banking sector, the mechanisms described in these studies have significant implications for financial stability. Unlike the assumption that financial institutions internalize climate risks into their lending strategies (Bolton et al., 2020), the findings in Barbados indicate that risk aversion and credit constraints exacerbate financial vulnerabilities rather than mitigating them.

The study also contributes to the literature on credit market imperfections and bank lending behavior, as explored in Bernanke and Gertler (1989) and Holmstrom and Tirole (1997). It provides empirical evidence of high credit supply persistence, where historical lending behavior plays a more significant role in shaping future credit availability than macroeconomic fluctuations. This aligns with theories of path-dependent credit markets but challenges conventional credit cycle models, such as those proposed by Minsky (1986), which assume a more dynamic relationship between GDP growth and credit expansion. In contrast to classical financial intermediation theories (Diamond, 1984), which posit that banks efficiently allocate resources to support economic growth, the findings in Barbados suggest that financial institutions prioritize stability over efficiency. This results in credit rationing and structural financial frictions that hinder investment and economic expansion.

Another key contribution of this study lies in its engagement with the literature on climate shocks and macroeconomic productivity. Existing research by Dell et all (2012) and Hsiang and Jina (2014) examines the long-term macroeconomic effects of climate shocks, particularly in terms of output and productivity losses. This study extends these discussions by showing that post-shock recovery efforts in Barbados have led to capital accumulation without corresponding gains in total factor productivity (TFP). Conventional economic growth models suggest that increased investment should drive productivity improvements, but in Barbados, financial frictions and inefficiencies in capital allocation prevent this outcome. The findings challenge the predictions of neoclassical growth models, such as Solow (1956), which assume that capital deepening inherently enhances productivity.

By integrating these discussions, this study makes three broad contributions to the literature. First, it strengthens theoretical models on climate risk and financial stability by empirically validating the nonlinear transmission of climate shocks through the financial system. Second, it challenges conventional demand-driven credit cycle theories by demonstrating that in small economies, supply-side constraints dominate financial intermediation. Third, it calls for a reevaluation of post-shock recovery models, emphasizing the need for efficiency-oriented capital allocation rather than mere capital expansion.

These findings underscore the importance of developing climate-adjusted financial regulations, targeted credit policies, and alternative financial intermediation mechanisms to address the unique challenges faced by small, climate-vulnerable economies. Future research should further explore the interplay between sectoral vulnerabilities, financial risk transmission, and macroeconomic resilience in similar economic contexts.

3. Empirical Methodology

3.1 Estimation of Climate-Related Damage Rates

Damage rates quantify potential economic losses due to climate-related hazards. The methodology consists of several steps. Data collection and hazard mapping are based on high-resolution spatial projections of damages caused by storm surges, floods, and high winds. These projections are provided for different return periods, such as 1-in-50-year and 1-in-100-year events. The study applies damage functions calibrated using an adaptation of the FEMA HAZUS methodology, relating hazard severity, such as wind speed or flood depth, to expected asset damage. These functions are applied to asset exposures to estimate the expected economic losses. The estimated damage rates are further adjusted to incorporate projections of rising sea levels and increased storm intensity, ensuring that forward-looking climate risk is accurately captured.

3.2 Integration into the Production Function

The estimated damage rates are incorporated into a macroeconomic framework using a Cobb-Douglas production function:

$$Y = A \times K^{\alpha} \times L^{\beta}$$

where output (Y) is determined by total factor productivity (A), capital (K), and labour (L). Climate-induced capital destruction is incorporated by modifying the capital stock as follows:

$$K' = K \times (1 - D)$$

where K' represents the adjusted capital stock and D denotes the estimated damage rate. By substituting this into the production function, the study derives scenario-based GDP projections under varying levels of climate-related capital destruction. Elasticity parameters (α, β) are estimated using historical economic data, allowing for a dynamic assessment of capital accumulation and economic productivity under climate risk scenarios.

3.3 Stress Testing Methodology

Given the bank-centric nature of Barbados's financial system, climate shocks have the potential to generate systemic financial frictions that disrupt economic stability. This study enhances conventional stress-testing methodologies by integrating a framework that accounts for the propagation of climate-induced credit risk through the banking sector, the feedback effects between capital adequacy and credit supply.

We use the stress testing methodological framework to analyze the transmission of Non-Performing Loans (NPLs) to Risk-Weighted Assets (RWA) and Capital Adequacy Ratio (CAR). The process follows a sequential approach where increases in NPLs affect provisioning, risk-weighted asset calculations, and ultimately the capital adequacy of financial institutions.

3.3.1 Credit Risk Model

To evaluate financial resilience, this study employs a climate stress testing framework that integrates sectoral non-performing loan (NPL) dynamics as a function of GDP and tourist arrivals (TA), incorporating Bayesian Model Averaging (BMA) to account for model uncertainty.

$$\Delta NPL_t = \sum_{i=1}^{N} P(M_i|D)(\gamma_{i1} GDP\ growth_t + \gamma_{i2} TA_t + \varepsilon_{it})$$

Where M_i represents different model specifications, $P(M_i|D)$ is the posterior probability of model i given the data D, γ_{i1}, γ_{i1} are model-specific estimated coefficients, ε_{it} is the error term.

3.3.2 Non-Performing Loans and Loan Loss Provisions

NPLs impact capital through provisioning, which reduces retained earnings and consequently affects Tier 1 capital. The relationship between provisions and NPLs is formalized as follows:

$$Provisions = NPLs \times Loss\ Given\ Default\ (LGD)$$

where NPLs represent total non-performing loans and LGD is the expected percentage loss in the event of default.

Provisions directly impact net income, which affects Tier 1 capital as follows:

$$Net\ Income\ (after\ provisions) = Operating\ Profit - Provisions - Other\ Costs$$

If net income becomes negative, Tier 1 capital is eroded, reducing the bank's regulatory capital.

3.3.3 Non-Performing Loans and Risk-Weighted Assets (RWA)

Risk-weighted assets (RWA) depend on the composition of loans. As NPLs increase, RWA can either:

- Decrease, if banks provision/write off NPLs reduce their asset base.
- Increase, if high-risk loans remain on the balance sheet, attracting higher risk weights.

The RWA for credit risk is computed as:

$$RWA_{credit\ risk} = \sum_i Loan\ Exposure_i \times Risk\ Weight_i$$

If NPLs remain on the balance sheet, they contribute to RWA at a high-risk weight (typically 100%-150% under Basel regulations). If they are written off, RWA may decrease, but at the cost of capital reduction.

3.3.4 Effect of Provisioning on RWA

Provisioning reduces net loans:

$$Net\ Loans = Gross\ Loans - Provisions$$

Since credit-risk RWAs are based on net exposure:

$$RWA_{new} = Risk\ Weight\ \times (Net\ Loans - Provisioned\ Loans)$$

Thus, an increase in provisions may reduce RWA slightly, provided risk weights remain constant.

3.3.5 Impact on Capital and Capital Adequacy Ratio (CAR)

Regulatory Capital

Total regulatory capital consists of Tier 1 (T1) and Tier 2 (T2) capital:

$$Tier\ 1\ Capital_t = Tier\ 1\ Capital_{t-1} + Net\ Income_t - Dividends\ Paid_t$$

$$Tier\ 2\ Capital_t = Tier\ 2\ Capital_{t-1} + \min(Generall\ Provisions, 1.25\% \times Credit\ RWA_t)$$

Where Tier 1 Capital includes common equity and retained earnings, and Tier 2 Capital includes subordinated debt and general provisions (capped at 1.25% of RWA).

The Basel formula for CAR is $CAR_t = \frac{Total\ Capital}{RWA_t}$.

Expanding $CAR_t = \frac{Tier\ 1\ Capital_t + Tier\ 2\ Capital_t}{RWA_t}$

CAR Decline due to NPLs

As NPLs rise, provisions increase, leading to a reduction in Tier 1 capital and, potentially, Tier 2 capital. The change in CAR is computed as:

$$\Delta CAR_t = \frac{\Delta Tier\ 1\ Capital_t + \Delta Tier\ 2\ Capital_t}{\Delta RWA_t}$$

If provisioning exceeds net profits, retained earnings become negative, resulting in a sharp decline in Tier 1 capital. This reduction in capital, coupled with increased RWA from non-written-off NPLs, leads to a deterioration in the capital adequacy ratio, potentially breaching regulatory minimum thresholds.

4. Results

4.1 Economic and financial friction in Barbados

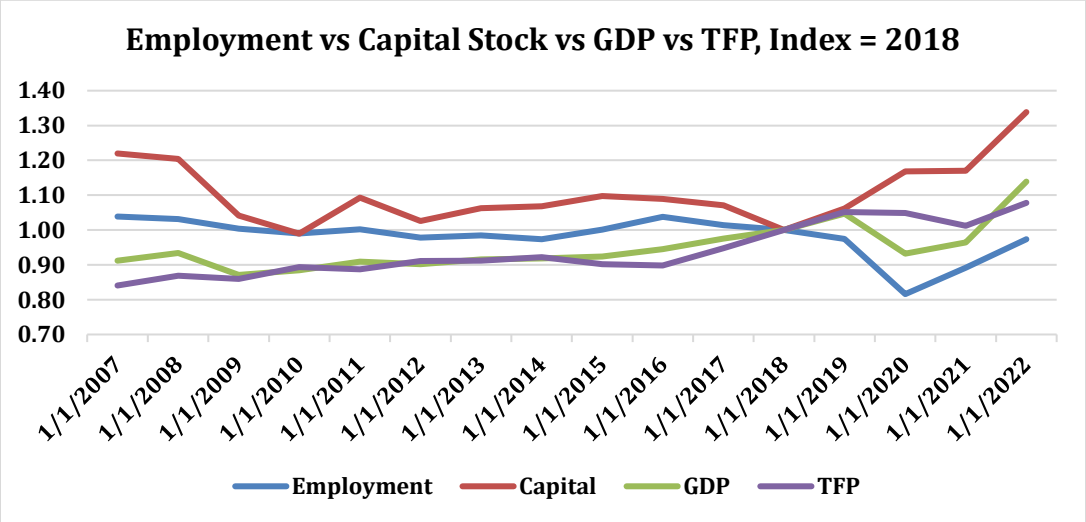
The trends in employment, capital stock, GDP, and TFP from 2007 to 2022 reveal important insights into the structural dynamics of Barbados's economy. Over most of the period, GDP and capital stock exhibited moderate fluctuations, while employment and TFP remained relatively stable. However, a notable divergence emerges after 2020, characterized by a sharp increase in capital stock alongside a decline in TFP. This pattern suggests a shift in the underlying growth dynamics, potentially reflecting adjustments in investment patterns, economic recovery initiatives, or structural changes following adverse shocks.

To reinforce the theoretical mechanism of systemic risk transmission through capital destruction, we explicitly link these trends to financial stability vulnerabilities. Climate-induced capital destruction directly reduces productive capacity, leading to lower GDP growth and increased financial frictions. The deterioration in TFP despite rising capital stock suggests inefficiencies in capital reallocation, confirming the capital destruction-banking fragility link in our theoretical framework.

The increase in capital stock indicates a rise in investment or capital accumulation, which may be linked to public or private recovery efforts in response to economic disruptions, such as climate-related shocks or the COVID-19 pandemic. However, the simultaneous decline in TFP suggests that these investments have not translated into proportional efficiency gains in production. A decline in TFP, despite an expanding capital base, implies a weakening in the economy's ability to convert inputs into higher output, pointing to potential inefficiencies in capital allocation, diminishing returns to capital, or structural constraints in productive capacity.

The results align with the systemic risk transmission mechanisms described by Vermeulen et al. (2021) and Battiston et al. (2017), reinforcing that climate-related financial frictions — manifested through credit contractions and heightened non-performing loans — exacerbate financial instability.

Figure 1: Trends in Employment, Capital Stock, GDP, and TFP (2007-2022)



Source: Authors' calculations

4.2 Credit Supply Persistence, Financial Frictions, and the Macroeconomic Disconnect in Barbados

The findings suggest that credit supply in Barbados exhibits a high degree of persistence, where past lending behavior plays a dominant role in determining future credit availability. This pattern is consistent with path-dependent credit dynamics, where banks rely on historical lending patterns rather than responding dynamically to changes in macroeconomic conditions. Theories of credit market frictions and financial constraints suggest that such persistence may arise from risk-averse lending behavior, particularly in markets where banks face information asymmetries and limited diversification opportunities. This persistence is further reinforced by structural economic constraints, including low productivity growth and a lack of bankable projects, which limit investment demand and constrain the potential for credit expansion.

This observed persistence also implies that credit rationing mechanisms may be in effect, wherein banks prioritize liquidity management over expansionary lending, particularly in environments with heightened economic uncertainty. While capital adequacy remains stable, this stability reflects conservative capital management strategies rather than an inherent strength in credit intermediation. Banks' preference for maintaining buffers over expanding credit suggests that financial intermediation in Barbados operates with structural rigidities that limit the responsiveness of lending to real economic conditions.

Table 1: Credit supply model for Barbados

Variable	Model 1	Model 2
Constant	-0.2867	
	(0.6128)	
Lagged Credit Supply	0.8297	N/A
	(0.0000)	
Lagged Capital Adequacy Change	1.6541	1.6728
	(0.0592)	(0.0575)
Lagged Non-Performing Loans Change	-1.4817	-1.0969
	(0.0811)	(0.1987)
Lagged GDP Growth	N/A	0.2260
		(0.0495)
R-squared	0.7250	0.7200
Adjusted R-squared	0.6900	0.6850
S.E. of Regression	3.2500	3.2600
Sum Squared Residuals	395.5000	398.2000
Log Likelihood	-106.5000	-106.8000
F-statistic	23.0000	22.8000
Prob(F-statistic)	0.0000	0.0000

Note: The dependent variable in both models is Credit Supply. The equations analyze how past financial conditions, such as changes in capital adequacy, non-performing loans (NPLs), and GDP growth, affect the availability of credit. Model 1 includes Lagged Credit Supply, whereas Model 2 replaces it with Lagged GDP Growth to assess the macroeconomic influence.

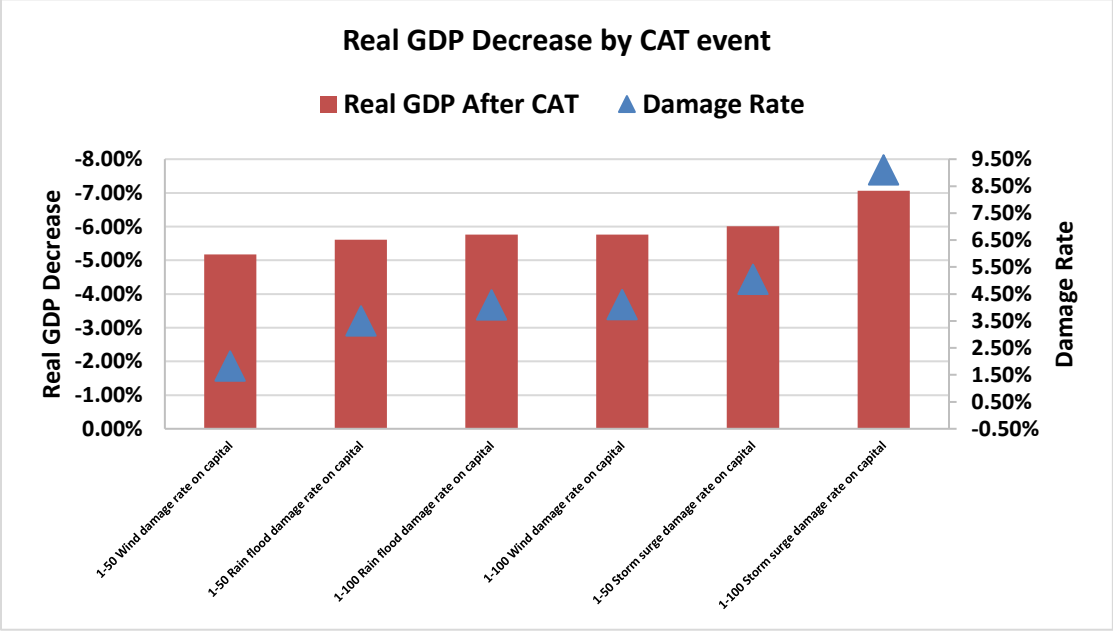
A notable finding is the relatively weak relationship between GDP growth and credit supply, which aligns with the structural limitations of the economy. While in many economies, higher economic growth stimulates credit expansion through increased investment demand, in Barbados, financial intermediation appears to be shaped more by long-term supply-side constraints

than by cyclical demand-side factors. Even in periods of economic expansion, banks may limit credit growth due to concerns about borrower creditworthiness and investment feasibility. The lack of high-productivity investment opportunities and the prevalence of financial frictions, such as high collateral requirements, further restrict access to credit, reinforcing the notion that lending decisions are not primarily driven by immediate macroeconomic conditions.

The observed stability of capital adequacy amid financial shocks highlights the importance of historical capital management strategies in shaping financial stability outcomes. The buffer-stock theory of capital adequacy suggests that banks in Barbados maintain precautionary capital reserves to absorb potential shocks, rather than adjusting their capital positions in response to short-term credit risk fluctuations. This ensures resilience during periods of financial stress but also indicates a lack of flexibility in capital allocation, which could hinder credit expansion in times of economic recovery.

The relationship between capital damage and economic contraction demonstrates the non-linearity of climate shock impacts (Figure 2). While moderate damage rates result in smaller GDP contractions, extreme events such as 1-in-100-year storm surges lead to disproportionately larger output losses. This pattern highlights the heightened vulnerability of economies with concentrated exposure to climate-sensitive industries. Capital destruction not only disrupts short-term economic output but also creates long-term inefficiencies if recovery efforts focus solely on rebuilding lost assets rather than improving productivity. Without targeted adaptation strategies, climate shocks can lead to economic stagnation by reinforcing inefficiencies in capital allocation and sectoral rigidities.

Figure 2: Real GDP Impact from Catastrophic (CAT) Events

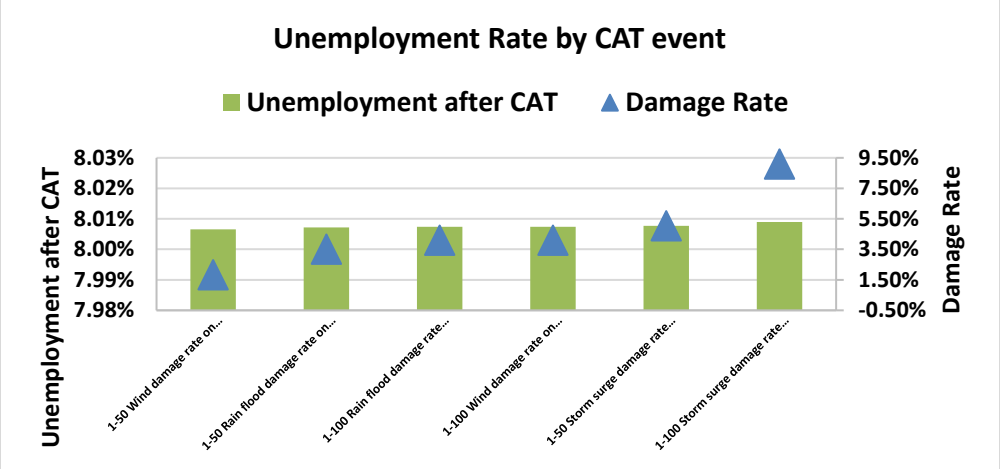


Source: Authors' calculations

The relatively muted unemployment response following catastrophic events suggests that the labor market does not fully reflect the economic distress caused by capital destruction and GDP contractions (Figure 3). This may be due to the way official labor market statistics are collected, as they primarily capture stable employment while potentially underrepresenting fluctuations in

tourism-related jobs, which are inherently cyclical. Given the significance of the tourism sector in Barbados, the true labor market impact of climate shocks could manifest through increased informal employment, underemployment, or wage pressures rather than outright job losses.

Figure 3: Unemployment Rate Response to CAT Events



Source: Authors' calculations

The relationship between capital damage rates and non-performing loan (NPL) increases across different catastrophic (CAT) event scenarios (Figure 4). As capital damage rates rise, NPLs experience a corresponding increase, reflecting heightened credit risk in the financial system. For moderate events, such as 1-in-50-year wind and rain flood damage, NPLs increase slightly from 6.38% to 6.43%, with damage rates between 4.0% and 4.5%. However, as events become more severe, particularly 1-in-100-year storm surges and combined wind + storm surge events, the NPL increase becomes more pronounced, reaching 6.50% and 6.55%, respectively, with damage rates peaking at 9.5%.

This confirms the hypothesis that financial frictions are amplified under extreme climate shocks, validating the role of capital destruction in amplifying systemic risk transmission. While moderate damage leads to small increases in NPLs, extreme climate shocks have a disproportionate impact, suggesting that financial vulnerabilities escalate as damage rates exceed critical thresholds. The results emphasize the sensitivity of the financial system to climate-induced asset losses, reinforcing the link between capital damage and rising credit risk exposure.

The aggregate stress test results for banks, finance companies, and credit unions indicate a moderate decline in the Capital Adequacy Ratio (CAR) from 18.5% to 17.0%, reflecting increasing financial stress (Figure 5). While the calculations were performed at an aggregate level, the underlying structure of the financial system suggests that credit unions are likely the primary driver of the observed negative trends. The capital deterioration is primarily attributed to rising loan losses and increasing non-interest expenses, which more than offset the positive contributions from net interest income, non-interest income, and risk-weighted asset (RWA) adjustments.

The rise in loan losses is a key contributor to capital erosion, signaling increased credit risk and deteriorating asset quality. Unlike banks, which tend to have larger, diversified loan portfolios and greater collateralization of assets, credit unions often extend credit to segments with higher default probabilities, which could explain why loan losses exert significant pressure on capital adequacy at the aggregate level. However, because credit unions are not the dominant financial

institutions in the system, their impact on overall capital erosion remains moderate in absolute terms.

The contained decline in capital adequacy suggests that while the financial system remains above regulatory minimums, prolonged stress or continued credit deterioration could exacerbate capital erosion over time. Although credit unions are not as large as commercial banks, they play an important role in financial intermediation, particularly by providing credit access to underserved segments. Their response to rising NPLs — whether through tightening lending conditions, adjusting risk assessments, or increasing provisioning levels — will be crucial in determining broader financial system resilience.

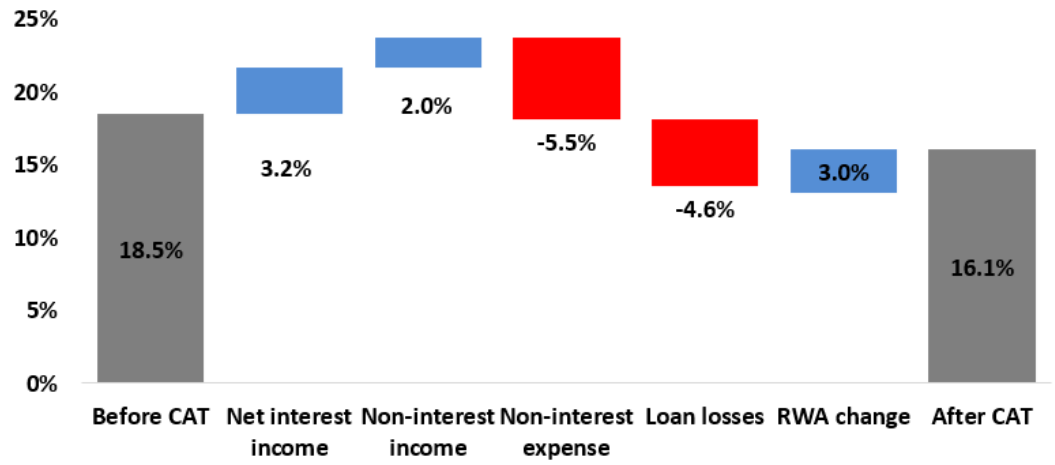
Figure 4: Effects of CAT Events on Non-Performing Loans (NPLs)

	1:50 Wind damage rate on capital	1:100 Wind damage rate on capital	1:50 Rain flood damage rate on capital	1:100 Rain flood damage rate on capital	1:50 Storm surge damage rate on capital	1:100 Wind + Storm surge damage rate on capital
NPL Increase (%)	6.08	6.3	7.13	7.56	7.9	9.15
Damage Rate (%)	4	4.2	4.5	4.8	9	9.5

Source: Authors' calculations

Given these trends, regulatory oversight may need to focus on reinforcing capital adequacy requirements, enhancing climate-adjusted stress testing methodologies, and strengthening provisioning frameworks to ensure that financial institutions, especially those with high-risk exposure, remain sufficiently resilient to systemic shocks. Future analyses may benefit from a sectoral breakdown of financial stress transmission, which would provide a more granular understanding of where vulnerabilities are concentrated and help policymakers design targeted interventions.

Figure 5: Impact of Catastrophic Event on CAR and Loan Losses: One-Year Stress Test



Source: Author's Calculations

5. Policy and Theoretical Discussion

The findings of this study contribute to the broader literature on financial stability by reinforcing the theoretical linkages between systemic risk transmission, financial frictions, and capital destruction in a small open economy. The persistence of credit supply, despite fluctuations in macroeconomic conditions, highlights a key rigidity in financial intermediation that aligns with theories of path-dependent lending and credit market imperfections (Holmstrom and Tirole, 1997; Bernanke and Gertler, 1989). The weak relationship between GDP growth and credit expansion suggests that traditional demand-driven credit mechanisms may not fully explain financial intermediation in economies with structural constraints.

In the case of Barbados, these structural constraints are further compounded by its status as a fiscally driven economy, where public sector activity and government spending play a central role in shaping macroeconomic outcomes. Fiscal policy often acts as the primary stabilizer in the face of external shocks, including climate-related events, leading to a financial system that is highly sensitive to government-led investment cycles. As a result, the dynamics of financial intermediation are closely intertwined with fiscal priorities, which can either support or constrain private credit flows depending on the fiscal stance and public debt trajectory.

The observed inefficiencies in capital allocation, as evidenced by the post-2020 divergence between rising capital stock and declining TFP, provide empirical support for models emphasizing capital misallocation and diminishing returns to investment (Hsieh and Klenow, 2009). In the context of Barbados, this dynamic suggests that financial frictions — such as collateral constraints, risk aversion, and credit rationing — play a central role in shaping capital accumulation without necessarily improving productive efficiency. This finding extends the literature on financial constraints and economic development by illustrating how misallocated capital investment, rather than capital shortages per se, may drive long-term productivity stagnation (Banerjee and Duflo, 2005).

The systemic risk posed by climate shocks to the financial sector aligns with the climate-finance nexus explored in recent literature (Battiston et al., 2017; Vermeulen et al., 2021). The nonlinear response of Non-Performing Loans (NPLs) to capital damage rates suggests that financial vulnerabilities are not linearly proportional to climate shocks but instead exhibit threshold effects, where extreme events disproportionately impact financial stability. These results

substantiate theories of climate-related financial risks that argue for scenario-based stress testing and forward-looking risk management approaches in financial regulation (NGFS, 2021).

5.1 Policy Relevance: Implications for Financial Stability and Economic Resilience

5.1.1 Strengthening Climate-Related Stress Testing and Financial Regulation

The findings suggest that conventional risk assessment frameworks may underestimate the systemic implications of climate shocks on financial stability. Policymakers should consider integrating climate-adjusted stress testing methodologies that capture nonlinearities in capital destruction and credit risk transmission. The demonstrated increase in NPLs following catastrophic events underscores the necessity for dynamic provisioning mechanisms that proactively account for climate-induced credit deterioration. Regulatory authorities, including central banks and financial supervisory bodies, should enhance macroprudential policies to incorporate climate-adjusted capital adequacy requirements, ensuring resilience against climate-related tail risks.

5.1.2 Addressing Credit Market Frictions and Enhancing Financial Intermediation

The persistence of credit supply in Barbados, despite macroeconomic fluctuations, reflects a broader issue of structural financial frictions that impede responsive credit allocation. Policy measures aimed at improving credit market efficiency should prioritize reducing information asymmetries, enhancing credit risk assessments, and fostering alternative financing mechanisms such as credit guarantees and fintech-based lending platforms. Given that capital adequacy remains stable due to conservative risk management, financial authorities should explore the potential for targeted credit expansion initiatives that balance financial stability concerns with the need to stimulate productive investment.

5.1.3 Improving Capital Allocation for Long-Term Productivity Growth

The divergence between capital accumulation and declining TFP suggests that investment efforts may not be translating into efficiency gains. To address this, policymakers should focus on improving capital allocation by incentivizing investments in high-productivity sectors through targeted fiscal policies, investment tax credits, and enhanced public-private partnerships. Additionally, reforms that facilitate technological adoption and innovation-led growth could help mitigate the productivity stagnation associated with misallocated capital.

5.1.4 Enhancing Financial Resilience of Credit Unions and Non-Bank Financial Institutions

The role of credit unions in financial stress transmission highlights their importance in financial inclusion but also underscores their vulnerability to systemic shocks. Given their exposure to high-risk borrowers and limited capital buffers, regulators should consider differentiated capital adequacy requirements for non-bank financial institutions (NBFIs) to enhance their shock-absorbing capacity. Strengthening prudential oversight and encouraging the development of risk-sharing mechanisms within the credit union sector could help mitigate systemic financial vulnerabilities.

2.5 Labor Market Considerations: Addressing Hidden Unemployment Effects

The muted labor market response following catastrophic events suggests that standard employment indicators may not fully capture economic distress. Policymakers should enhance labor market surveillance by incorporating alternative indicators such as informal employment rates, underemployment measures, and sector-specific wage trends. Given the tourism sector's cyclicality, targeted support mechanisms, such as wage subsidies or workforce reskilling programs, may help mitigate hidden employment effects following climate and economic shocks.

5.2 Limitations of the Study

While this study provides valuable insights into the financial and economic dynamics of Barbados, several limitations should be acknowledged. First, the study relies on aggregate macroeconomic and financial data, which may obscure sector-specific variations in credit constraints, capital efficiency, and climate risk exposure. A more granular analysis at the firm or industry level could provide deeper insights into the transmission mechanisms of financial frictions.

Second, the study does not explicitly incorporate behavioral responses of financial institutions and firms to climate and financial shocks. The role of adaptive strategies, such as credit reallocation, financial innovation, or risk-sharing mechanisms, remains an area for further research.

Third, the empirical framework, while robust, is subject to data constraints, particularly regarding informal financial activities and off-balance-sheet risks. Given the significance of the informal sector in Barbados, future research could benefit from incorporating alternative data sources, such as firm surveys or high-frequency financial indicators, to capture the full extent of economic and financial frictions.

Finally, the study focuses on Barbados as a case study of a small open economy with high climate risk exposure. While the findings may have broader implications for other small island developing states, further comparative analyses are needed to generalize the results to different institutional and economic contexts.

5.3. Conclusion: Toward a Resilient Financial System in Barbados

This study underscores the complex interplay between systemic financial risk, climate shocks, and structural economic frictions in a small open economy. The theoretical insights contribute to the broader discourse on financial intermediation inefficiencies, while the policy implications highlight the need for a multi-pronged approach to strengthening financial resilience. Moving forward, a combination of enhanced regulatory frameworks, targeted economic policies, and climate risk mitigation strategies will be essential to fostering a more robust and adaptive financial system in Barbados.

Future research should explore sectoral breakdowns of financial stress transmission, assess the effectiveness of existing climate resilience policies, and investigate potential spillover effects of financial frictions on broader economic stability in other small island economies. Such analyses would further contribute to designing tailored policy interventions that promote long-term financial stability and economic growth.

6. Conclusion

This study provides a comprehensive analysis of the relationship between climate shocks, financial frictions, and systemic risk transmission in Barbados. By integrating empirical evidence with financial stability theory, it demonstrates that climate-induced capital destruction exacerbates financial vulnerabilities through rising non-performing loans (NPLs) and persistent credit constraints. The findings confirm that supply-side credit frictions, rather than cyclical demand-driven dynamics, play a dominant role in shaping financial intermediation in Barbados. This challenges conventional credit cycle theories and highlights the structural rigidities that constrain economic recovery following climate-related shocks.

From a financial stability perspective, the study emphasizes the nonlinear transmission of climate shocks through the financial system. The results suggest that while moderate climate-induced damages have a limited financial impact, extreme shocks trigger a disproportionate amplification of systemic risk. This supports the argument that traditional risk assessment models may underestimate the financial stress associated with climate-related shocks, necessitating the development of climate-adjusted stress testing frameworks.

The research also underscores the importance of capital allocation efficiency in post-shock recovery. The divergence between capital accumulation and declining TFP signals inefficiencies in investment strategies, where financial frictions prevent productive reallocation of capital. This finding calls for a reevaluation of post-disaster investment frameworks to ensure that financial resources are channeled into sectors that maximize economic resilience and long-term productivity.

The policy implications of these findings are significant. Regulatory authorities should strengthen macroprudential policies that integrate climate risk assessments, ensuring that capital adequacy frameworks account for the long-term financial effects of climate shocks. Credit market inefficiencies must be addressed through targeted financial reforms that improve credit access, enhance risk-sharing mechanisms, and promote alternative financing instruments to mitigate systemic credit constraints. Additionally, improving financial resilience among credit unions and non-bank financial institutions will be critical to maintaining financial stability, particularly in economies where these institutions play a key role in financial intermediation.

While this study contributes to the growing literature on climate-induced financial risk, it has certain limitations. The reliance on aggregate financial data may obscure sectoral variations in credit risk exposure, and further research could benefit from firm-level or high-frequency financial data to refine the understanding of financial frictions. Additionally, the behavioral responses of financial institutions to climate and financial shocks remain an area for further investigation, as adaptive strategies such as credit reallocation and financial innovation may influence systemic risk outcomes.

Future research should extend the findings of this study by examining cross-country comparisons to determine the extent to which the financial frictions observed in Barbados are generalizable to other small island developing states. Further exploration of sectoral vulnerabilities and the effectiveness of existing financial resilience policies would also provide valuable insights into the design of targeted policy interventions. Ultimately, addressing climate-induced financial instability requires a multifaceted regulatory approach that enhances financial sector resilience while fostering sustainable economic growth.

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