2023

FINANCIAL STABILITY REPORT

Central Bank of Barbados
Financial Services Commission

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Preface

The Central Bank of Barbados (the Bank), the Financial Services Commission (FSC), and the Barbados Deposit Insurance Corporation (BDIC) share oversight of the financial system in the form of a Financial Oversight Management Committee (FOMC). The Bank regulates commercial banks and finance companies, the FSC regulates credit unions, insurance companies, mutual funds, and occupational pension plans, while the BDIC provides a safety net for depositors at commercial banks and finance companies. The FOMC mandate is to maintain financial stability by overseeing the financial system, identifying and assessing vulnerabilities, and prescribing policies to bolster the system's resilience to possible adverse events.

Financial stability refers to the condition where a country's financial system operates effectively, efficiently, and resiliently, facilitating economic processes, mitigating risks, and absorbing shocks. This stability is characterised by solvent, well-capitalised, and well-managed financial institutions, efficient and reliable financial markets, and a robust financial infrastructure. Ensuring financial stability is crucial for promoting confidence among consumers, investors, and financial institutions, which in turn supports economic growth and development. Central banks and other financial regulators play a pivotal role in maintaining financial stability through various policy tools, regulations, and supervisory practices. As such, the Central Bank Act passed in December 2020 explicitly establishes financial stability as a core mandate of the Bank and recognises the need for macroprudential considerations in policymaking. The Act notes that "*where there is a perceived threat to the financial system, the Bank shall manage and control that risk by taking any steps it deems necessary.*"

This thirteenth issue of Barbados' Financial Stability Report (FSR) is a collaboration between the Bank and the FSC and provides an assessment of the risk exposures of domestic deposit-taking institutions (commercial banks, finance companies, and credit unions), insurance companies, mutual funds, and pension funds. The FSR serves as an instrument to hold the financial sector regulators accountable for the surveillance, risk management, and the smooth functioning of the financial system. The current report analyses the trends in financial stability indicators for financial institutions, as well as their balance sheets and income statements, with emphasis on the year 2023.

Abbreviations

ACH	Automated Clearing House
AFSI	Aggregate Financial Stability Index
ATM	Automated Teller Machine
BACHSI	Barbados Automated Clearing House Services Incorporated
BDIC	Barbados Deposit Insurance Corporation
BSI	Banking Stability Index
CAR	Capital Adequacy Ratio
CARTAC	Caribbean Regional Technical Assistance Centre
CBOE	Chicago Board Options Exchange
CRE	Commercial Real Estate
DIF	Deposit Insurance Fund
DSR	Debt Service Ratio
DTI	Deposit Taking Institution
FAO	Food and Agriculture Organisation
FOMC	Financial Oversight Management Committee
FSC	Financial Services Commission
FSI	Financial Soundness Indicators
GDP	Gross Domestic Product
GPW	Gross Premiums Written
IMF	International Monetary Fund
LTD	Loan-to-Deposit
LTV	Loan-to-Value
NFC	Non-Financial Corporation
NFPS	Non-Financial Private Sector
NIR	Net International Reserves
NOP	Net Open Position
NPL	Non-Performing Loan
POS	Point of Sale
ROA	Return on Assets
ROAA	Return on Average Assets
ROE	Return on Equity
RRE	Residential Real Estate
RSA	Interest Rate Sensitive Assets
RSL	Interest Rate Sensitive Liabilities
RTGS	Real-Time Gross Settlement
RWA	Risk-Weighted Assets
SIDS	Small Island Developing States
ST	Stress Testing
TCRM	Technology and Cyber Risk Management Guideline
YOY	Year-On-Year

Foreword

by the Governor of the Central Bank of Barbados and Chief Executive Officer of the Financial Services Commission

Dr. Kevin Greenidge
Governor
Central Bank of Barbados

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The FSR has been a crucial guide, providing invaluable insights on risk assessments specific to the Barbadian financial sector. This document has been instrumental in benefitting both local and global stakeholders. In a world characterised by dynamic economic landscapes and evolving financial ecosystems, the FSR's role in maintaining vigilance and foresight to safeguard financial stability cannot be overstated. Like many other countries, Barbados faces numerous challenges and opportunities in the realm of financial and economic stability. Our journey towards sustainable growth and resilience necessitates a deep understanding of domestic and global forces shaping our financial sector. As we navigate through these complexities, the Financial Stability Report serves as a beacon, illuminating the path forward with insights and analysis from dedicated experts at the Bank and FSC. The 2023 FSR continues to uphold this essential function, and we are pleased to declare the sustained health and stability of our financial ecosystem.

The financial year of 2023 was marked by a complex macro-financial landscape, including bank failures in the United States and Switzerland early in the year. Despite these challenges, Barbados' financial institutions demonstrated commendable resilience. This resilience, coupled with sustainable economic growth and the robust performance of the tourism sector, has helped to insulate the Barbadian populace and business sector from the impact of the challenging international economic climate, instilling confidence in the stability of our financial sector.

The risk landscape is inherently dynamic, but after extensive discussions, this edition of the report focuses on three main risks: the impact of a greater-than-anticipated global economic slowdown on the local economy and financial system, the impact of climate shocks on financial system stability, and the potential for cyber-attacks to disrupt the financial system.

The persistence of inflation globally has meant that international interest rates remain elevated at rates last seen in 2007. This has implications both for visitors to the island as well as the affordability of private sector investment projects that are crucial for growth.

Climate risk remains an existential threat to humanity, with small island states and their financial systems particularly at risk of catastrophic physical events. Both of our institutions have taken steps to build frameworks for assessing physical risk, and we expect to invest even more in the years ahead as we further develop this capacity.

Globally, all financial institutions have experienced an ever-increasing barrage of cyber-attacks. Participants in our domestic space have had to mitigate cyber-attacks of varying sophistication and scope. Our regulatory bodies have been vigilant in identifying and managing cyber risks within the prevailing regulatory infrastructure via guidelines and their inspection frameworks.

As we confront these challenges, we must remain steadfast in our resolve to mitigate risks, enhance resilience, and promote inclusive prosperity for all Barbadians. Our commitment to these principles is unwavering, and we are dedicated to ensuring the long-term stability and strength of Barbados' financial architecture, providing a strong reassurance for the future.

We commend the authors, contributors, and all those involved in preparing this report for their dedication and expertise. Their tireless efforts underscore our shared commitment to ensuring the stability and strength of Barbados' financial architecture.

The Bank and FSC stand unwaveringly in our dedication to implement prudent measures essential for perpetuating systemic stability. This approach may result in extending regulatory supervision to a broader spectrum of financial entities. Looking ahead, the impending finalisation of regulatory guidelines for the evaluation and licensing of payment service providers, along with the progress towards enabling deposit insurance for credit unions, will fortify our regulatory framework and effectively diminish risks to financial stability.

As we embark on the journey ahead, let us draw inspiration from past lessons, embrace the opportunities of the present, and chart a course towards a future defined by resilience, sustainability, and prosperity for generations to come.

Executive Summary

The robust health of the domestic financial sector was reflected in the domestic economic expansion observed in 2023. Outstanding credit balances experienced moderate growth, while credit quality improved due to greater business activity. The increased profitability in the banking sector led to an enhancement in the sector's capital adequacy ratios, while the profits of finance companies and capital adequacy were on par with the previous year. Credit to the non-financial private sector (NFPS) increased in 2023 building on the post-COVID expansion in 2022. Credit demand primarily originated from the private sector by way of project financing in the manufacturing, real estate, and transport, storage and communication sectors.

A primary concern for the domestic financial stability outlook emanates from the potential slowdown in the global economy and its cascading effects on the tourism sector and the broader macroeconomy. Firstly, there is the risk of a decrease in tourist arrivals and capital inflows from key market sources, which could dampen domestic economic activity. Such a decline in tourist arrivals might adversely affect the revenue of businesses in critical economic sectors, potentially worsening their debt burden, and impairing their ability to repay debts.

If economic activity wanes and businesses weaken, households' financial positions are likely to suffer due to employment losses, leading to an increase in the unemployment rate. This concern encompasses two aspects: *direct* risks with the possibility of individuals defaulting on loans, especially in the face of rising interest rates or declining incomes, while *indirect* risks arise from cuts in household spending dampening overall economic activity and in turn, amplifying credit risk. Despite Barbados' household debt-to-GDP ratio (48.2 percent in 2023) being higher than other Caribbean and emerging economies, the downward trend in this variable post-pandemic, abates household credit risk concerns (Figure J1).

The macroeconomic slowdown is likely to challenge the occupational pension sector. As many occupational pension plans exhibit significant exposure to foreign markets through their mutual fund investments, the potential slowdown will likely present much volatility to investment portfolios. Many defined-benefit pension plans face significant funding shortfalls, which heightened equity risks can exacerbate, thus threatening the stability of many pension plans in the sector.

In the event of a further escalation in geopolitical tensions, there is a potential for adverse consequences concerning the supply of energy and food commodities. Increases in energy and food prices resulting from geopolitical shocks may contribute to higher imported inflation and widened domestic current account deficits, which would negatively impact the most vulnerable segments of the population.

Persistent inflation can present a challenge for the insurance sector. If inflation remains elevated in many global economies, the insurance sector, particularly the non-life industry, will face higher repair and replacement costs when settling claims. Insurers, therefore, may encounter greater pressure to manage their risks and adjust pricing strategies effectively. Consequently, policyholders could see a further rise in premium rates for insurance coverage.

Changes in global interest rates and borrowing conditions can affect the cost of servicing Barbados' external debt, impacting Government's fiscal position and potentially straining financial stability. Despite a decrease in inflation rates across many jurisdictions in 2023, the key policy rates continue to exceed the targets established by the majority of global central banks. Market players anticipate a relaxation of monetary policy in the latter half of 2024 as the cumulative interest rate hikes of the last two years created restrictive monetary conditions to steer inflation back towards central banks' targets. Nonetheless, the persistence of global inflation levels above these targets could disrupt this expectation. Consequently, financing costs in the region could remain elevated.

Fluctuations in global interest rates are unlikely to affect financial institutions significantly. The anticipated monetary policy easing in many global economies is projected to have a limited effect on the balance sheet of financial institutions due to their significant local investment holdings. This is particularly relevant for insurance companies, where a considerable portion of investments are retained domestically. As a result, changes in global interest rates are less likely to impact discount rate assumptions used for actuarial valuations of insurance liabilities.

The domestic financial system remains vulnerable to climate change. Physical climate risks such as rising sea levels, extreme weather events like hurricanes, droughts, flooding, and changing precipitation patterns, threaten the island's capital stock and macroeconomy. The potential adverse impact on tourism and other sectors of the Barbadian economy could place pressure on the financial sector, specifically in the case of a severe climatic event. While the insurance sector plays a critical role in minimising much of the financial impact of catastrophic losses, the country's protection gap remains a concern due to uninsurance and underinsurance, which needs further investigation.

Deposit-taking institutions continue to integrate climate risk assessments within their frameworks. Based on a 2024 survey, commercial banks and finance companies have prioritised Environmental, Social, and Governance (ESG) considerations in their corporate strategies. These institutions have been including climate risk assessments within their credit granting and borrower default frameworks. Also, these institutions have been minimising their carbon footprint by going paperless and using more energy-efficient equipment during their day-to-day operations (see Appendix E: Climate and Environmental Risk Management Survey Report for a more detailed analysis of the survey). Developing strategies to mitigate and adapt to climate risk is imperative for safeguarding the nation's economic and long-term financial stability.

As the threat of cyber-attacks continues to evolve worldwide, it poses a potential risk to the stability of Barbados' financial sector. Cyber-attacks can target financial institutions, disrupting their operations, compromising sensitive data, and undermining the overall trust in the financial system. In Barbados, like in many other countries, financial institutions are increasingly reliant on technology for various operations, including online banking, electronic transactions, and data storage. While these technological advancements bring efficiency, they also create vulnerabilities that malicious persons and/or institutions may exploit. Cyber-attacks, such as phishing, ransomware, and data breaches, can have severe consequences on the integrity and resilience of the domestic financial system. In 2024, the Bank conducted a cyber risk survey involving financial institutions,

including commercial banks and finance companies. The results indicated that these institutions consider cyber risk as a top priority.[1]

The real estate market displayed stability in reported prices, posing no immediate threat to the soundness of the financial sector. While the overall market activity slightly lagged behind the previous year based on the number of new mortgages, DTIs indicate that property prices appear to have either grown or remained on par. Results from a real estate survey issued by the Bank reveal that DTIs have eased borrower-based lending standards on mortgages such as the loan-to-value (LTV), debt-to-income, and debt service ratios (DSR) in an attempt to spur buyer demand. Respondents also indicated a downward trending house-price to income ratio, suggesting improvements in mortgage affordability. One area of concern, however, is constrained supply in the tourism residential market.

The rise in competition within the DTI sector has led to a redistribution of deposits among its members. The maximum interest rate offered on time deposits has increased. As a consequence, finance companies, whose funding is primarily composed of non-transferable deposits, have encountered increased funding pressures, despite the overall system maintaining a high level of liquidity. Commercial banks faced less pressure as transferable deposits represent the majority of their deposit liabilities.

Barbados' payments system and infrastructure remain robust and resilient. A country's payments systems play a crucial role in maintaining financial stability by facilitating the smooth and efficient functioning of the overall financial infrastructure. The payments system contributes to liquidity management, risk mitigation, building consumer and investor confidence, and facilitates the smooth functioning of financial markets and institutions. The Real Time Gross Settlement (RTGS) system witnessed increased activity as domestic economic activity expanded and there was greater participation in the securities market. The launch of the Real Time Processing (RTP) system by the Barbados Automated Clearing House Services (BACHSI)[2] in February 2023 brought about a noticeable transition from traditional direct electronic payments to the real-time processing of payments. Regulatory oversight and ongoing innovation are imperative to adapting payments systems to the dynamic and changing nature of the financial environment, thereby safeguarding their continual role in bolstering financial stability.

The implementation of the IFRS 17 Accounting Standard[3] can enhance risk assessments in the insurance sector. The FSC is currently engaged with the insurance industry and regional regulators regarding the conversion to the new IFRS 17 accounting standard. While significant changes to revenue recognition are expected, the standard will also provide more granular insight to the regulator and other stakeholders for more effective risk assessments.

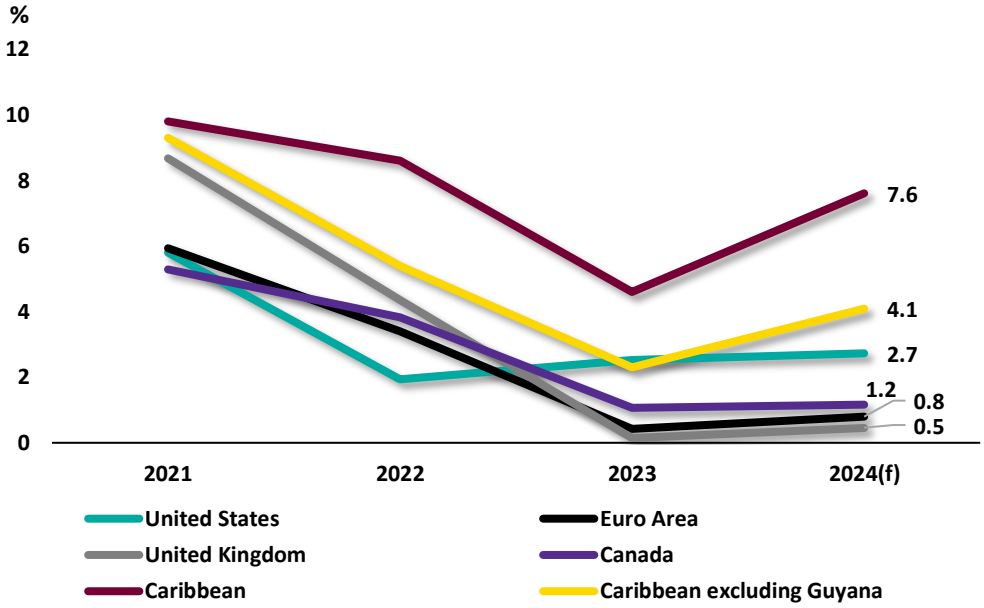
[1] See Appendix F: Cyber Risk Survey Report for further details.
[2] BACHSI facilitates the clearing of cheques, direct payments, and daily bank settlements in real-time.
[3] IFRS 17 is an International Financial Reporting Standard issued by the International Accounting Standards Board (IASB) that establishes principles for the recognition, measurement, presentation, and disclosure of insurance contracts. It aims to provide consistent, transparent, and comparable financial information about insurance contracts to improve financial reporting.

1. Key Risks to Financial Stability

1.1 Global Macroeconomic Slowdown

A key concern for domestic financial stability is the potential for a global economic slowdown, impacting the tourism sector and broader macroeconomy (Figure 1). Despite tensions on the geopolitical front and a stringent monetary policy stance, global economic activity remained resilient in 2023. This resilience primarily stemmed from the gradual resolution of bottlenecks in the global production chain and the decline in energy and food commodity prices. Additionally, robust employment, a rebound in household purchasing power, sustained fiscal support initiatives, and, in some instances, the utilisation of savings accumulated during the pandemic, explained the resilience in global private consumption. In 2024, the global economy is expected to expand at the same pace as it did in 2023 (IMF World Economic Outlook, April 2024). Notably, this growth rate (3.2 percent) is subdued compared to historical norms. Although risks to the global outlook are broadly balanced, some downside risks remain. Among these include, price spikes stemming from geopolitical tensions and persistent core inflation alongside tight labour markets. Moreover, the likely implementation of fiscal consolidation measures aimed at reducing high government debt is anticipated to exert downward pressure on global growth (IMF World Economic Outlook, April 2024).

Figure 1: Real GDP Growth Rates of Barbados' Main Tourist Source Markets[1]



Source: International Monetary Fund (World Economic Outlook, April 2024), World Bank

[1] Guyana experienced a significant increase in its GDP after discovering and subsequently developing its offshore oil reserves. This development led to a surge in oil production and exports. In January 2020, the country started exporting oil, which marked a significant milestone for Guyana as it became a new player in the global oil market.

In 2023, the Barbadian economy experienced positive growth, propelled by tourism and modest enhancements in business sentiment. The financial sector remained stable as evidenced

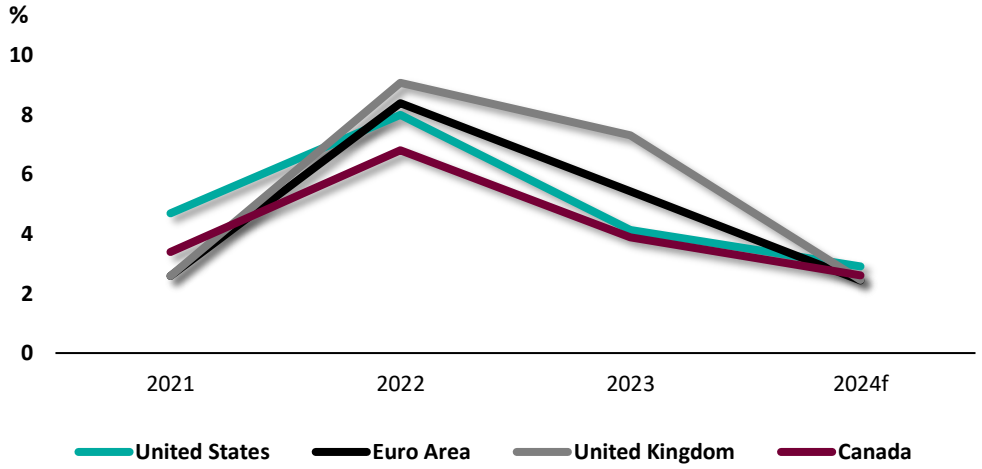
by increases in credit to households and businesses, a reduction in non-performing loans, and improved bank profitability and capital adequacy ratios.

In terms of the macroeconomic outlook for the Barbadian economy, the Central Bank moderated growth expectations for the latter half of 2024. Nonetheless, factors such as the stabilisation of energy markets and anticipated monetary policy easing in advanced economies would reduce the likelihood of a highly adverse scenario unfolding in Barbados.

Financial markets are revising the expected duration of restrictive monetary policies. Even though inflation decreased in many countries during 2023, rates still exceed the targets set by most central banks (Figure 2). In April 2024, the United States (US) Federal Reserve hinted that interest rate cuts may be delayed given the more-than-expected persistence in inflation.[4] Financial markets have noted that US inflation may take longer to recede and the five-year US treasury yield has already started to increase (Figure 3). Additionally, in early 2024, energy markets saw an uptick in prices (Figure 3) due to heightened geopolitical risks in the Red Sea shipping channel as well as elevated tensions in the region and (an extension in) voluntary production cuts from OPEC+. Also, following an ease in world food commodity prices in 2023, the Food and Agricultural Organisation's (FAO) Food Price Index increased for the first time in March 2024, following seven months of consecutive declines. Summarily, although markets expect rate cuts to occur during the latter portion of 2024, uncertainty around the most likely outcomes remains somewhat elevated.

As of mid-2024, both Europe and Canada have cut their respective policy interest rates. The European Central Bank (ECB) reduced its main refinancing rate, marginal lending rate, and deposit rate by 25 basis points, reflecting a response to economic conditions and inflationary pressures within the Eurozone. Similarly, the Bank of Canada also cut its policy interest rate by 25 basis points to address ongoing economic challenges and to help control inflation.

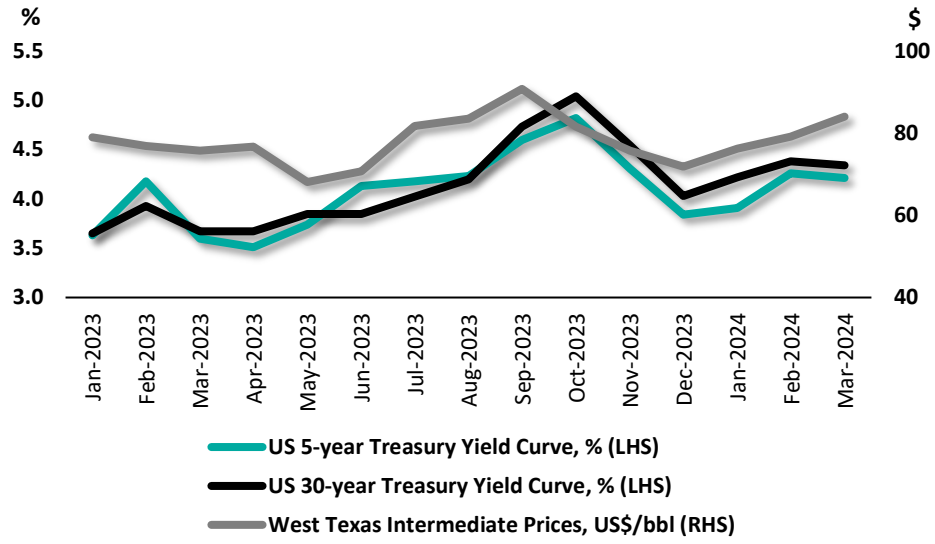
Figure 2: Inflation Rates for Advanced Economies



[4] The March 2024 Consumer Price Index report showed a third consecutive month of elevated inflation after a rapid deceleration in 2023.

Source: International Monetary Fund (World Economic Outlook, April 2024)

Figure 3: US Treasury Yield Curves and Crude Oil Prices

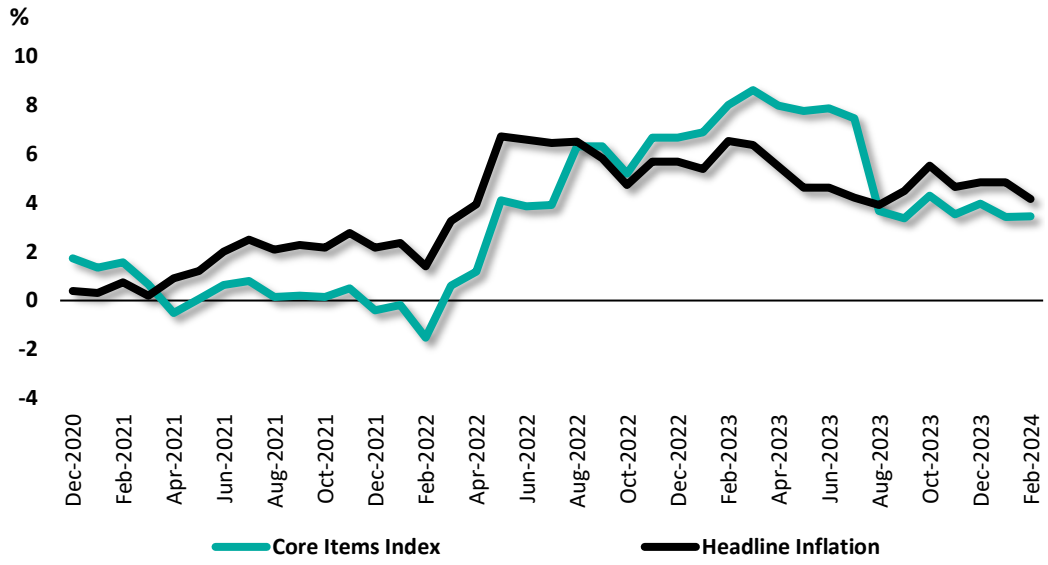


Sources: US Department of the Treasury and US Energy Information Administration

Increased foreign interest payments and variable interest rates related to sovereign debt can pose challenges, but the nature and terms of the debt may moderate the impact on financial stability. Heightened foreign interest payments strain the Government's budget, resulting in increased external debt service payments and potentially leading to cuts in other areas of fiscal spending. However, it is worth noting that most of Barbados' variable-rate debt comprises loans from multilateral financial institutions, which tend to have concessionary terms. Elevated global interest rates pushed up Barbados' expenditure on its external interest expense utilising crucial foreign exchange reserves. The negative impact of higher global interest rates on the fiscal balance was however stymied by increases in Government's revenue (particularly indirect taxes), which improvements in economic activity and rising local prices bolstered. Going forward, as global inflation is anticipated to gradually move downward with longer-term inflation expectations remaining stable, market expectations are that central banks in major advanced economies will lower policy rates in the latter part of 2024.

Domestic headline inflation is expected to steadily decline in 2024 as core inflationary pressures subside (Figure 4), but several downside risks remain. Price increases for energy and food commodities could arise from geopolitical shocks and may contribute to higher imported inflation and widened domestic current account deficits in Barbados, which could negatively impact the balance sheets of households and firms. Apart from geopolitical shocks, extreme weather events have the potential to lead to domestic shortages in certain crops and livestock production, which, in turn, would result in domestic inflationary pressures.

Figure 4: Barbadian Headline Inflation vs Core Inflation[1]



Source: Barbados Statistical Service
[1] Items related to Food, Beverages, and Energy are eliminated from headline inflation to calculate core inflation.

The Bank and the FSC incorporated the above-mentioned downside risks for financial stability into the moderate and severe scenarios of the macroeconomic stress tests for the domestic financial sector.[5]

1.2 Climate Risk

As a Small Island Developing State (SIDS), Barbados must address physical climate risks due to the island nation's susceptibility to the impacts of climate change. As a SIDS, Barbados faces heightened vulnerability to natural, economic, and health-related shocks beyond its domestic control. The growing frequency and intensity of climate shocks directly result from being in climate-sensitive areas or seismic zones, as well as the island's small size. It is expected that by the end of 2050, extreme climatic events could cost the Caribbean region an estimated US$22 billion (Global Americans, 2022).

Despite being a SIDS, Barbados often finds itself in a higher income category due to its relatively high GDP per capita, limiting its access to concessional funds. Many international climate change adaptation and mitigation funding mechanisms are based on income classifications. Given the escalating impacts of climate change, per capita GDP can be deceptive, as it fails to capture the unique challenges SIDS face. As a result, countries similar to Barbados encounter difficulties

[5] See section 2.1.1 Macroeconomic Stress Testing Assumptions.

securing the necessary financial support to effectively address and respond to the specific vulnerabilities they face in adapting to and mitigating the adverse effects of climate change.

Although governments are primarily responsible for combatting climate change, central banks can contribute to this effort. Central banks can assist in ensuring the resilience of the financial system during the transition to a low-carbon economy and in managing physical risks associated with climate change by enhancing the quality and accessibility of information regarding these risks for market participants. Climate stress tests are valuable in this regard, as they have the potential to illuminate climate risks that are currently obscured.

Given SIDS' increased vulnerability to the vagaries of climate change, stress testing becomes a crucial tool in assessing the resilience and vulnerability of financial systems, institutions, or, in this context, economies. By simulating various scenarios, policymakers can develop targeted strategies to enhance resilience, attract international support, and ensure sustainable development in the face of challenges.

Addressing this issue necessitates collaborative efforts, coordinated actions, and utilising expertise from diverse stakeholders who are well versed in the field of climate change.[6] Given the inherent complexity of climate-related challenges, engaging and involving all stakeholders is imperative. An analysis of past damages caused by natural disasters in the Caribbean reveal its detrimental impact on the region's capital stock, underscoring the significance of addressing physical risks effectively.[7]

In 2024, the Coastal Zone Management Unit assisted the Bank with designing relevant physical climate scenarios and estimating the associated damages. The Bank used its macroeconomic framework, credit risk satellite model, and a new stress testing tool to evaluate the economic and financial stability impacts of physical risks.[8] The results of the climate-risk assessment suggest that the financial system remains resilient even in the face of a severe storm surge damaging the financial system. The Bank will continue to enhance its climate assessment capabilities to better inform and equip financial institutions, thereby strengthening the country's financial stability. Additionally, the Bank conducted a survey to gauge the awareness and preparedness of financial institutions in case of a climatic event. Based on the survey results, commercial banks have incorporated climate risk into their risk assessment frameworks.

1.3 Cyber Risk

Cyber risks, with their systemic nature stemming from interconnections and interdependencies within the financial system and its operational systems, present a novel challenge to financial stability. While cyber risk has traditionally been viewed as an idiosyncratic operational risk impacting internal information and communication technology (ICT) infrastructure, it has also been under the purview of micro-prudential supervision. Dedicated regulatory

[6] In July 2024, the Bank will receive IMF CARTAC Technical Assistance training on climate stress testing.
[7] See Box 2: Potential Impact of Climate Change on Caribbean Economies
[8] See thematic article 2: A Climate Risk Assessment of the Barbadian Financial System

frameworks and supervisory policies are in place and are being further developed in Barbados to deal with cyber risk from different angles.

In an effort to limit cyber risks, the Bank and FSC have both been enhancing their cyber risk supervisory frameworks. The Bank issued a Technology and Cyber Risk Management Guideline (TCRM) and a Major Cyber Incident Reporting Template (M-CIRT) and Classification Matrix (Matrix) to the industry in 2023. The Bank developed the TCRM Guideline by adopting international best practices documented by industry standard-setting bodies, and it provides guidance on the governance of cyber risk and the necessary controls needed to strengthen cyber security and resilience. The Bank developed the M-CIRT for licensees to report any major cyber incidents to the Bank in a uniform manner that facilitates the review and study of the root causes and potential problems that may result in a cyber incident. The M-CIRT helps ensure clarity and accuracy in reporting by outlining the specific details and data that are needed, such as the incident's impact, causes, and the licensee's response. The institution classifies a cyber incident as major once it satisfies the criteria for a high or critical incident as defined in the Classification Matrix, for example, an incident that has a material impact on the delivery of services or where critical systems have been extensively compromised. Licensees are required to classify cyber incidents in a timely manner, but no later than within 24 hours of its detection. The initial report should be submitted to the Bank within four hours of the moment the cyber incident has been classified as major.

The FSC undertook a similar process with the launch of its Technology and Cyber Risk Management Guidelines for entities the FSC regulates. These risk-based guidelines establish the FSC's expectations on board involvement, standard operating procedures relating to cyber incidents, staff training, and risk management frameworks for entities regulated by the FSC. Additionally, the FSC has developed cyber security questionnaires to be administered to the insurance, credit union, and security sectors. This initiative forms an integral part of the FSC's continuous efforts to evaluate the scope of its cyber security vulnerabilities. These questionnaires are slated for distribution in 2024.

Micro-prudential policies and vigilant supervision play a crucial role in enhancing overall operational and cyber resilience and mitigating the risk stemming from the collective impact of cyber threats at individual bank levels. The increasing reliance of the financial sector on ICT across various interconnected operational systems, which often perform essential functions, results in numerous dependencies and concentrations. This dependence elevates the likelihood that a cyber event could have significant repercussions for multiple financial institutions, potentially destabilising the entire financial system. Beyond financial implications, a major cyber incident could disrupt critical functions and erode confidence in the financial system's operation. Operational and financial contagion channels and the subsequent loss of confidence could magnify the initial shock and severely disrupt the smooth operation of essential financial services, ultimately impacting the real economy. Consequently, the Bank and FSC recognise cyber risk as a systemic threat and will continue to address this risk within a system-wide framework.

Existing macroprudential tools might not effectively address the systemic nature of cyber risk. While the traditional macroprudential toolbox primarily targets cyclical or structural systemic risks to financial stability, macroprudential tools may not be specifically tailored to counter cyber risk.

Although these tools can serve as relevant backstops and help mitigate the amplification of potential financial shocks resulting from a cyber incident, their capability to act as a systemic cyber risk mitigation tool is limited (IMF Global Financial Stability Report, October 2018). Implementing direct requirements aimed at enhancing cyber resilience, such as enabling the rapid restoration of operational systems, outside the macroprudential toolbox, may be more efficient in mitigating systemic cyber risk.

To calibrate potential systemic risks, the Bank relies on a thorough understanding of vulnerabilities related to systemic cyber risk and potential contagion channels within the financial system. As discussions on systemic cyber risk are evolving, a knowledge gap exists concerning these vulnerabilities, highlighting the necessity to enhance analytical and monitoring capabilities. Given this, the Bank launched a survey in 2024 to: i) obtain a comprehensive understanding of cyber risks faced by local financial institutions and ii) to develop an appropriate approach to mitigate these risks, which necessitates simultaneous efforts from both micro-prudential and macroprudential supervisory perspectives.[9] Notably, close attention should be paid to potential operational concentration risks and contagion channels within the financial system. Identifying systemically important nodes that provide critical financial or operational services offers initial insights into potential contagion channels and aids in comprehending network topology, interdependencies, and risk amplifiers. Moreover, it assists authorities in conducting risk assessments and formulating potential policy actions.

2. Financial Sector Risk Assessment using Stress Testing

In 2023, an IMF CARTAC Technical Assistance initiative aided the Bank and the FSC in formulating a multi-factor and multi-period solvency stress testing (ST) framework. This assistance resulted in the design of two new stress test tools: one for the Bank to stress test banks and finance companies, and another for the FSC to stress test credit unions. Both tools were customised to align seamlessly with the country's existing accounting, tax, and regulatory frameworks for these financial institutions. The team constructed the framework on macroeconomic scenarios that highlight the primary risks to domestic financial stability[10] and a newly developed credit risk satellite model for non-performing loans (NPLs) for all DTIs.[11] The macroeconomic scenarios, comprising baseline, moderate, and severe scenarios, incorporate the results of the credit risk satellite model to forecast credit losses. The stress test tools offer scenario-specific, macroeconomic-consistent projections of institutions' key balance sheet, profit and loss, and capital adequacy components over a period extending up to 12 quarters (March 2024-December 2026).

2.1 Deposit-Taking Institutions

2.1.1 Macroeconomic Stress Testing Assumptions

The Bank recognises stress testing as one of the most complex tools to assess the resilience of the financial sector. For the first time in 2024, the Bank implemented a multi-period (three years), multi-factor stress testing framework to assess the domestic financial sector's resilience against the

[9] See section 4: Emerging Risks: Cyber Risk and Climate Risk and Appendix F: Cyber Risk Survey Report.
[10] Refer to Section 1 Key Risks to Financial Stability.
[11] See thematic article 1: Navigating Credit Risk Uncertainty: A Framework for Financial Stability Stress Testing.

potential adverse effects of a global macroeconomic slowdown. This framework encompasses three distinct scenarios: a baseline derived from the Bank's macro-model projections and two adverse scenarios – labelled as "moderate" and "severe" – to capture varying intensities of an economic recession. The macroeconomic scenarios are also based on the implementation of a newly developed credit risk satellite model.[12]

The baseline scenario aligns with the Bank's macroeconomic forecasts for 2024-2026 and serves as the foundation for the stress tests.[13] The baseline projections foresee economic growth, though at a slower pace, and unemployment is expected to rise slightly, though still remaining low from a historical perspective. Over the three-year period, domestic inflation is projected to ease based on the trajectory of international commodity prices.

On the other hand, the adverse scenarios aim to address potential risks to the baseline projections. In the adverse scenario, the Bank calibrated permanent shocks to key macroeconomic factors in the Bank's macro-model relevant to the scenario narrative. These shocks are statistically based on their respective historical developments and are inputted into to the stress testing tool to generate internally consistent "moderate" and "severe" scenarios. In the severe scenario, the global economic slowdown results in tourist arrivals falling by 50 percent in year one. This results in real GDP contracting by 4.3 percent in 2024, 4 percent in 2025, and 3.7 percent in 2026. These GDP growth rates are 8.3, 6.7, and 6.7 percentage points lower, respectively, compared to the baseline scenario. The moderate scenario captures a milder recession, with GDP growth values set as averages of the baseline and the severe scenario values (Figure 5A).

A key focal point for the adverse scenarios revolves around the subsequent impact of a potential deceleration in the global economy on the tourism sector and the broader economic landscape. Initially, the threat of a reduction in tourist arrivals would negatively impact the revenue of businesses in crucial economic sectors, exacerbating their leverage and impairing their ability to meet financial obligations. The narrative of the adverse scenarios also outlines the consequences which may occur in the event of heightened geopolitical conflicts. An intensification of geopolitical conflicts has unfavourable implications concerning the supply and prices of energy and food commodities, resulting in higher imported inflation (Figure 5B).

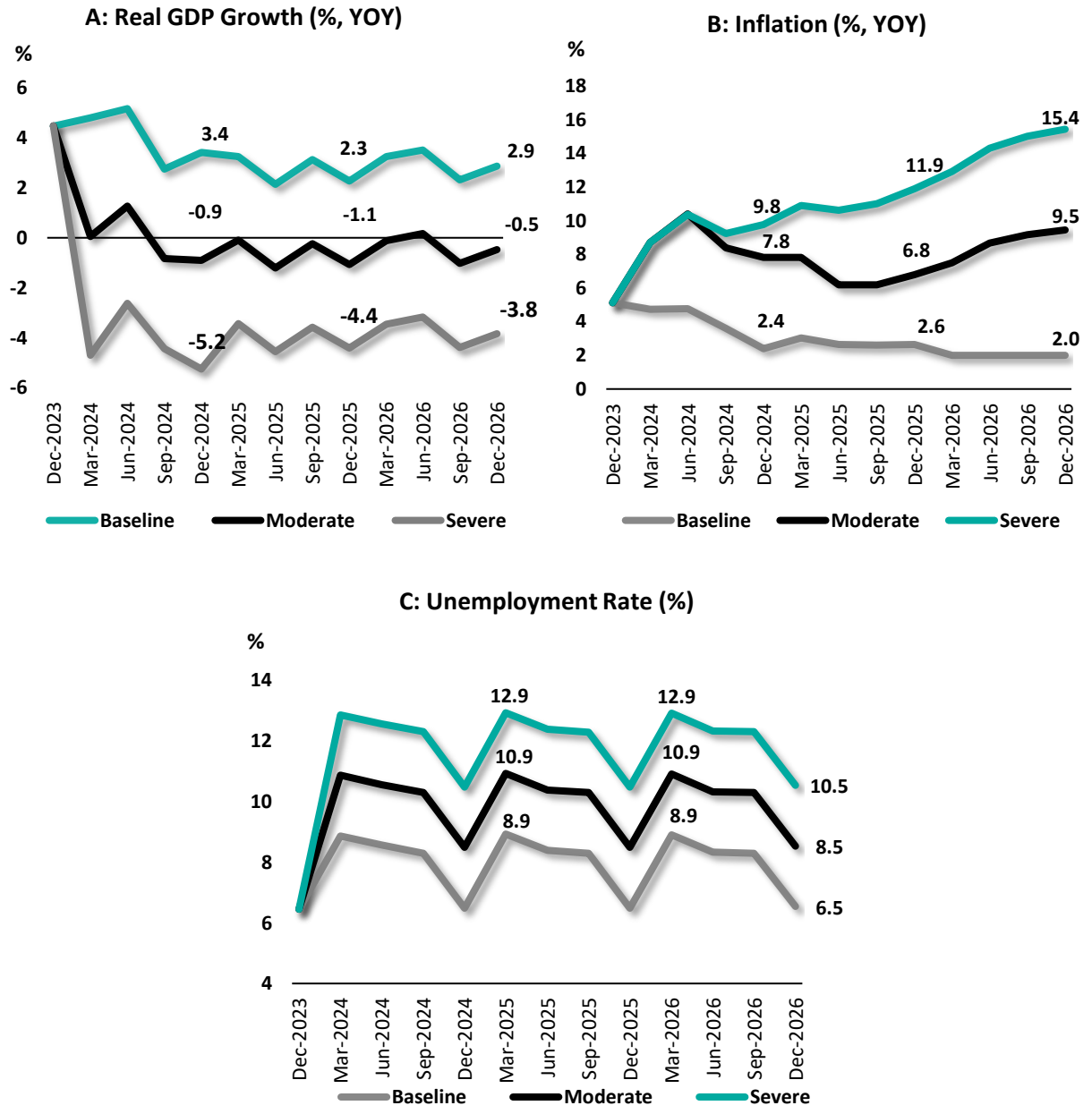
On the domestic front, risks to the baseline projections stem from investment (both private and foreign) falling short of expectations.[14] Should economic activity recede and businesses weaken, households may also face financial strain due to job losses, resulting in an uptick in the unemployment rate (Figure 5C). This, in turn, would affect private consumption. Subdued economic activity alongside higher unemployment will also be reflected in a decline in Government's revenue, especially from consumption and income taxes. The loss of revenue may restrict Government's ability to invest, causing GDP to contract even further.

Additionally, the increased risk premia would negatively affect households' and non-financial corporations' (NFCs) creditworthiness, which in turn would cause an increase in banks' NPLs

[12] See thematic article 1 Navigating Credit Risk Uncertainty: A Framework for Financial Stability Stress Testing.
[13] Forecasts were prepared in February 2024.
[14] See Key Risks to Financial Stability.

coupled with forgone interest income. Commercial banks in this scenario would face an increase in credit risk arising from borrowers' income losses, which would prompt banks to limit new lending to the private sector, both directly via credit rationing, as well as indirectly through an increase in lending rates.

Figure 5: Key Macroeconomic Variables[1]



Sources: Central Bank of Barbados' calculations and Barbados Statistical Service

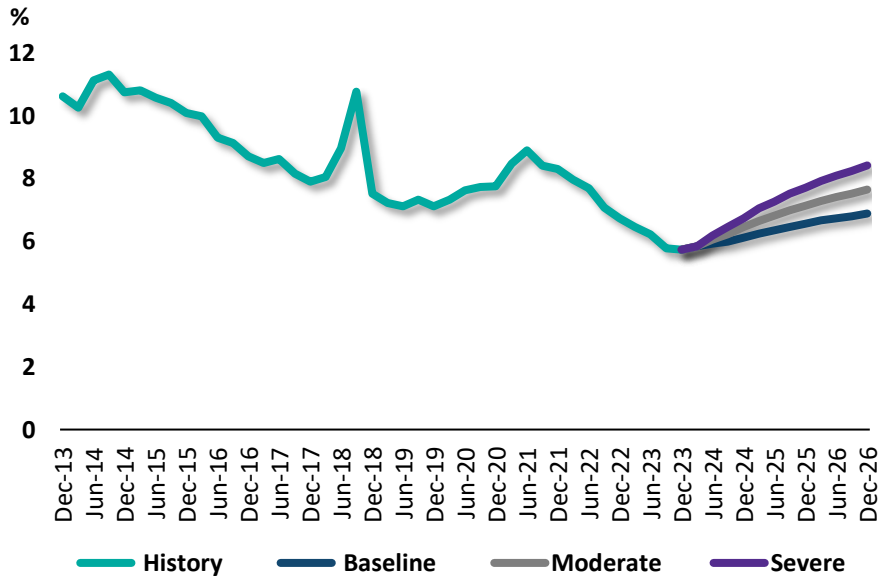
[1] Forecasts were prepared in February 2024.

2.1.2 Macroeconomic Stress Testing Results

The stress tests covered all DTIs, that is, commercial banks, finance companies, and credit unions.

For the stress tests of commercial banks and finance companies, the baseline scenario for NPLs assumes a continuous increase in NPLs amid the cautiously optimistic projection of economic growth in this scenario (Figure 6). For the severe scenario, the projected increase in the NPL ratio gradually reaches 8.4 percent, 1.5 percentage points higher than in the baseline. For the moderate scenario, NPLs are projected to be slightly above the baseline. Considering that the NPL ratio at the sectoral level would react differently to macroeconomic and financial variables, credit risk is estimated separately for mortgages, personal loans, and loans to NFCs.[15]

Figure 6: NPL Ratios Used in the Stress Tests – Commercial Banks and Finance Companies



Source: Central Bank of Barbados' calculations

For commercial banks and finance companies, loan losses would be relatively small in the baseline scenario but would increase dramatically in the severe scenario. In the severe scenario, the stock of loan loss provisions would increase almost five times (4.7) over the three-year horizon, with an average annual credit loss rate[16] of around 3.8 percent per year. This contrasts with the baseline scenario's credit loss rate, which hovers around 1.2 percent per year.

With respect to the minimum Tier 1 ratio, commercial banks and finance companies also appeared to be resilient. In aggregate, the Tier 1 capital adequacy ratio for the sector would grow both in the baseline and the moderate scenarios. In the moderate scenario, one institution with a

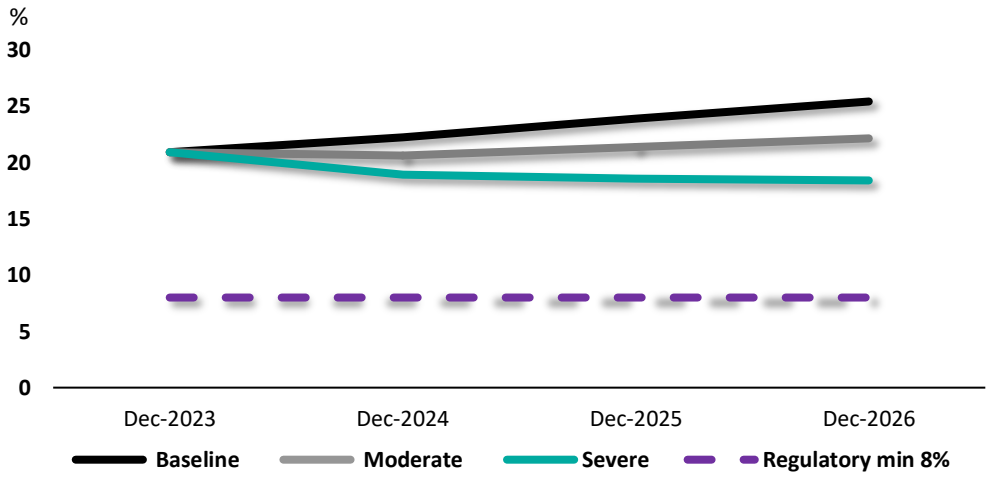
[15] See thematic article 1: Navigating Credit Risk Uncertainty: A Framework for Financial Stability Stress Testing.
[16] Credit loss rate is defined as new provisioning booked in the Profit & Loss (P&L) over the initial stock of net loans.

small share in total assets of the sector would fall below the 4 percent Tier 1 capital adequacy minimum, and would require capital injections of around 0.2 percent of GDP. The sector's Tier 1 capital adequacy ratio (CAR) would only decline in the severe scenario, but still remains above the limit, with two institutions falling below the minimum that would require capital injections of 0.4 percent of GDP.

The results suggest that commercial banks and finance companies are generally resilient to economic stress given their relatively high initial capital adequacy and good pre-provision profitability. Notwithstanding**,** the aggregate CAR of the sector would grow both in the baseline and moderate scenarios due to continuing profitability, with all the earnings retained given no dividend pay-outs (Figure 8). In the moderate scenario, one institution with a small share in total assets of the sector would fall below the 8 percent CAR minimum requirement and would require capital injections of less than 0.2 percent of GDP. The sector's CAR would only decline in the severe scenario, but still remains above the limit, with two institutions below the minimum and requiring capital injections of 0.5 percent of GDP (Figure 7). The contribution of the individual factors in all scenarios over a three-year horizon is shown in Figure 8. A few banks would, on average, become loss making only in the moderate and severe scenarios.

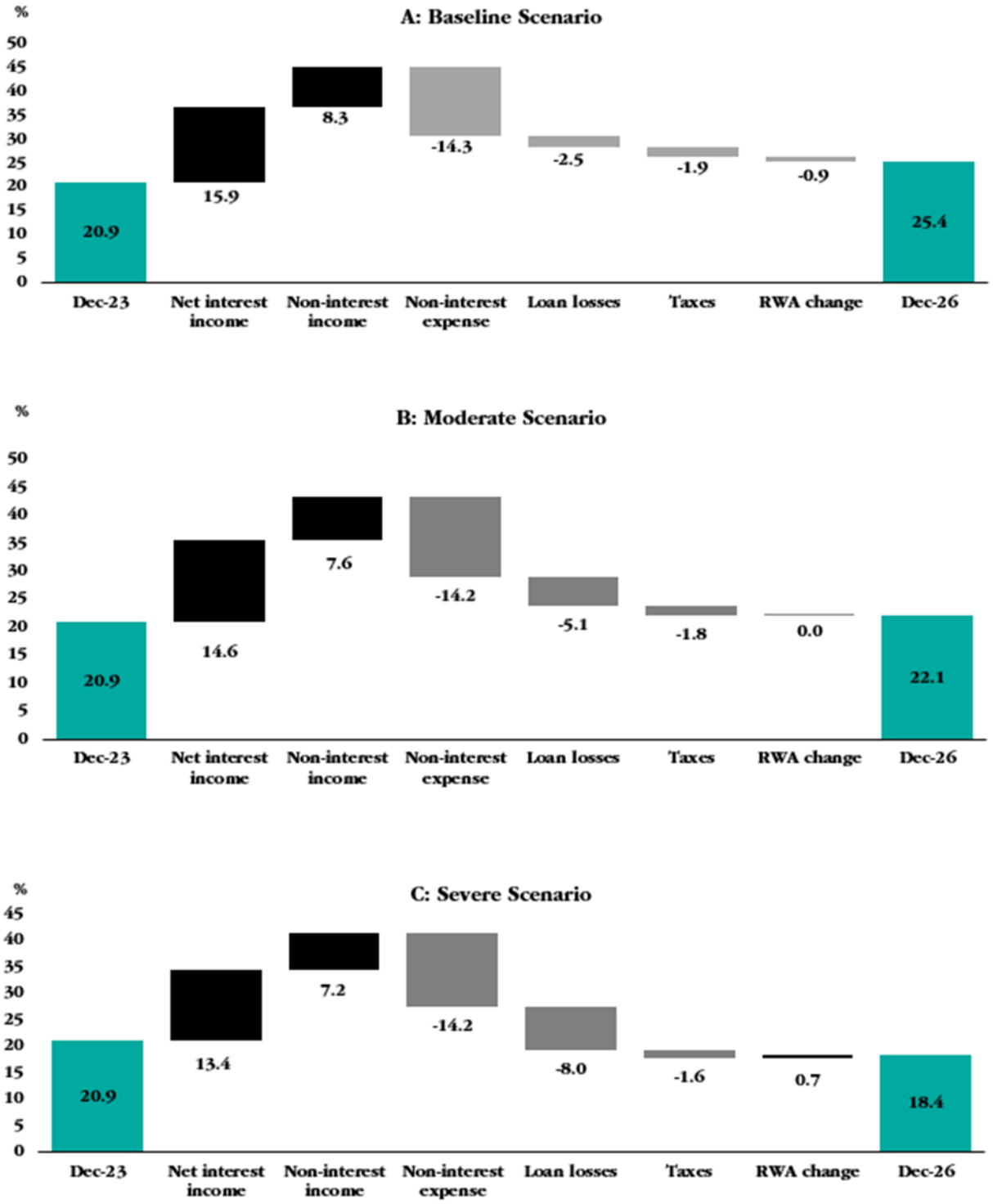
In general, commercial banks and finance companies have sufficient pre-provision buffers and can weather the shocks despite the need to pay the asset-based tax of 0.35 percent of assets and, if profitable, the 5 percent corporate income tax. Among the least five capitalised institutions, two of them fall below the 8 percent CAR limit in the severe scenario. Notably however, the results for all scenarios are contingent on the assumption of no failure by the largest borrowers (concentration risk) and no losses on Government bonds (sovereign risk).

Figure 7: Average Capital Ratios in the Stress Test – Commercial Banks and Finance Companies



Source: Central Bank of Barbados' calculations

Figure 8: Factors Contributing to Changes in Capital Adequacy – Commercial Banks and Finance Companies

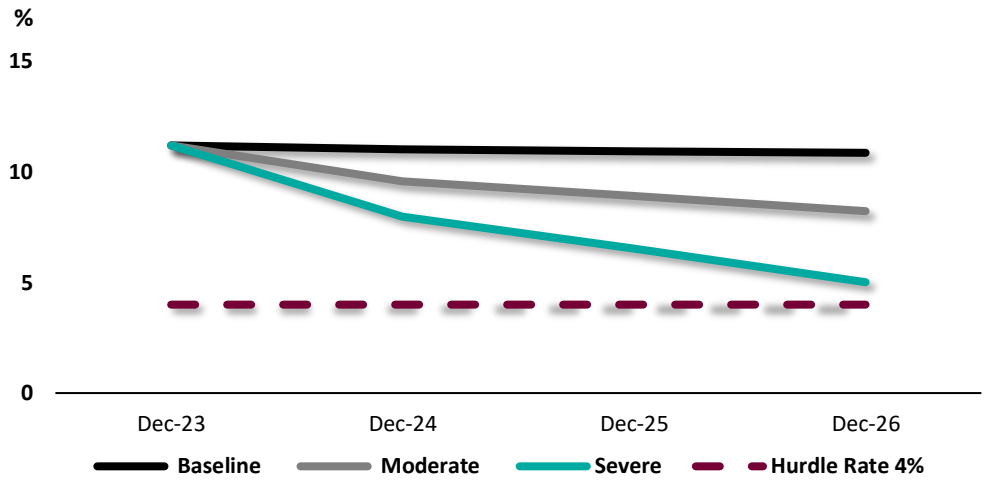


Source: Central Bank of Barbados' calculations

The credit union sector is generally resilient to adverse economic developments as capital levels remained above the hurdle rate.[17] In the baseline scenario, the sector maintained a stable capital position, evidenced by a relatively unchanged capital ratio due to continued profitability (Figure 9). Nonetheless, credit union profitability remained modest compared to banks and finance companies, limiting the amount of surplus retained.

Despite the sector incurring losses under the moderate and severe scenarios, leading to decreased capital levels, the sector's capital ratio remained above the 4 percent hurdle rate. One credit union fell below this threshold in the moderate scenario and would require capital injections of 0.03 percent of GDP by the end of the projected period to reinforce its capital position. In the severe scenario, two credit unions fell short of the hurdle rate and would collectively require capital injections equivalent to 0.4 percent of GDP to align with expected capital requirements.

Figure 9: Average Capital Ratios in the Stress Test – Credit Unions



Source: Financial Services Commission's calculations

2.1.3 Large Exposure Stress Test

According to the results,[18] **the capital adequacy ratio (CAR) of three banks dropped below the prudential requirement from the initial round, resulting in the complete depletion of capital in both instances.** Similar to the previous year, the exercise conducted as of December 2023 includes Government exposure. Additionally, even with 50 percent provisioning, one finance company failed to meet requirements from the first round, a trend that persisted throughout all five rounds. This implies that, with 50 percent provisioning, the remaining two banks and three finance companies can endure the default of their five largest borrowing customers. The same outcome is observed with 100

[17] Capital adequacy in the credit union sector is assessed using the minimum Tier 1 Leverage ratio (total capital as a percentage of non-risk weighted assets) of 4 percent, consistent with the Basel standards.

[18] Large exposure stress tests examine the resilience of financial institutions to losses due to credit and liquidity shocks from large account holders. This test assumes that the five largest borrowers in each institution will sequentially default on their debts, starting with the largest borrower. Each round represents a default by one of the borrowers.

percent provisioning, except in the fifth round, where a fourth bank drops below the 8 percent CAR limit (Table 1).

Under the capital-to-assets method, only one bank and three finance companies are able to withstand the total loss of their five largest credit exposures. With 10 percent provisioning and a 4 percent minimum requirement, no bank or finance company failed in any of the five rounds. With 50 percent provisioning, three banks and one finance company fell below the required 4 percent capital to assets ratio after round two. While at 100 percent provisioning, three banks and one finance company failed from round one, and four banks and the same finance company failed in round five. (Table 1).

The credit unions faired significantly better than the commercial banks with only one of them falling below the 4 percent hurdle rate throughout all of the rounds of the large exposure stress test. Given the nature of their business model, lending more to private individuals instead of large corporate clients, credit unions do not carry the level of large individual credit exposures as do their banking counterparts. Therefore, in times of adversity or shock where their five largest credit customers fail to repay their loans, even with a 100 percent loss, this would result in only one credit union falling below the total capital to total assets ratio benchmark of 4 percent (Table 1).

Table 1: Results of Large Exposure Shocks

Scenario	10% Provisioning			50% Provisioning			100% Provisioning		
	No. of Banks	No. of Finance Companies	No. of Credit Unions	No. of Banks	No. of Finance Companies	No. of Credit Unions	No. of Banks	No. of Finance Companies	No. of Credit Unions
	Capital Adequacy Ratio < 8%								
Round 1	0	0		3	1		3	1	
Round 2	0	0		3	1		3	1	
Round 3	0	0		3	1		3	1	
Round 4	0	0		3	1		3	1	
Round 5	0	0		3	1		4	1	
	Capital-to-Asset Ratio < 4%								
Round 1	0	0	1	2	0	1	3	1	1
Round 2	0	0	1	3	1	1	3	1	1
Round 3	0	0	1	3	1	1	3	1	1
Round 4	0	0	1	3	1	1	3	1	1
Round 5	0	0	1	3	1	1	4	1	1

Source: Central Bank of Barbados' calculations

2.1.4 Liquidity Risk

Low deposit rates have blurred the line between time and demand deposits, reducing the penalty for early withdrawal. With current interest rate dynamics, this liquidity test evenly assesses all deposit categories. Assuming that 95 percent of liquid assets in banks, finance companies, and credit unions could be converted to cash instantly, 5, 10, and 15 percent runs on all domestic-

currency deposit accounts were examined. Additionally, for credit unions, shares, which members can withdraw on demand without notice, were also considered 95 percent convertible to cash.

During daily five percent deposit runs, while banks remained stable without needing liquidity support, there was a slight deterioration observed in finance companies compared to the previous year. One finance company required liquidity support on day one, three on day two, and all four from day three compared to only two requiring liquidity support from day four in 2022's results. Additionally, during daily five percent runs, only one credit union required liquidity support from day three, and three credit unions from day five (Table 2).

The results of the daily 10 and 15 percent deposit runs align with those of the previous year. Using daily 10 percent deposit runs, two banks required liquidity support from day three and three banks from day five, compared to two banks from day four last year; while all four finance companies required support from the first day of this test, compared to two finance companies from day two in the 2022 test. Also, at 10 percent daily runs, two credit unions required liquidity support from day two, four from day three, six from day four, and seven from day five.

With daily 15 percent runs, two banks required liquidity support from day two, three banks from day four, and four banks from day five; while four finance companies required liquidity support from day one and for the rest of the testing period. One credit union needed liquidity assistance from day one, five from day two, seven from day three, and all eight of the largest credit unions from day four. A comparison with 2022's liquidity stress test reveals that the credit unions have performed marginally better in some instances. In 2022, one credit union required liquidity support from day one, six from day two, eight from day three, and nine from day four.

Table 2: Results of Deposit Runs

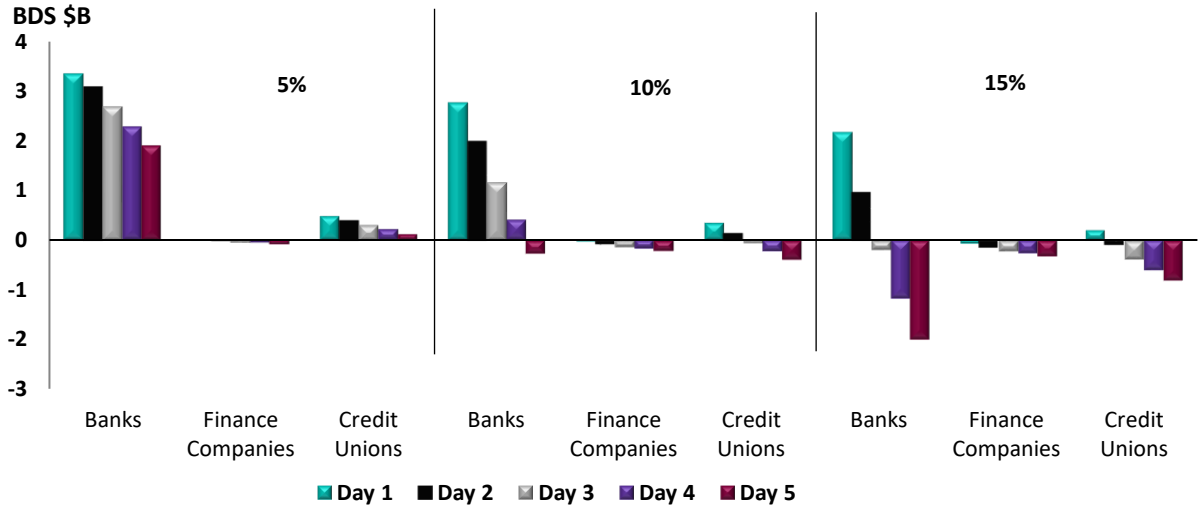
Scenarios	At 5%			At 10%			At 15%		
	No. of Banks	No. of Finance Companies	No. of Credit Unions	No. of Banks	No. of Finance Companies	No. of Credit Unions	No. of Banks	No. of Finance Companies	No. of Credit Unions
Day 1	0	1	0	0	4	0	0	4	1
Day 2	0	3	0	0	4	2	2	4	5
Day 3	0	4	1	2	4	4	2	4	7
Day 4	0	4	1	2	4	6	3	4	8
Day 5	0	4	3	3	4	7	4	4	8

Source: Central Bank of Barbados' calculations

Figure 10 below shows the results of the deposit runs, that is, the net cash flow following each scenario. Each bar represents one day's net cash flow. A positive net cash flow (bars above the zero line) means that liquidity support was not required for that day while the opposite is true for a negative cash flow. Under the five percent daily runs scenarios, the banks and credit unions generally had positive net cash flows and would not require liquidity support. The finance companies experienced marginal negative net cash flows and would require a limited amount of cash support, with five percent daily deposit runs. As the amount of cash extracted in the daily deposit runs increase to 10 percent and then to 15 percent, there is a gradual and consistent deterioration in the

net cash flows of all three groups of financial institutions. Banks would require liquidity support from day five with 10 percent deposit runs and from day three during the 15 percent deposit runs. Meanwhile, finance companies would require more liquidity support. Credit unions would require liquidity support from day three of the 10 percent deposit runs and day two of the 15 percent deposit runs.

Figure 10: Results of Deposit Runs (Net Cash Flow)



Sources: Central Bank of Barbados' calculations

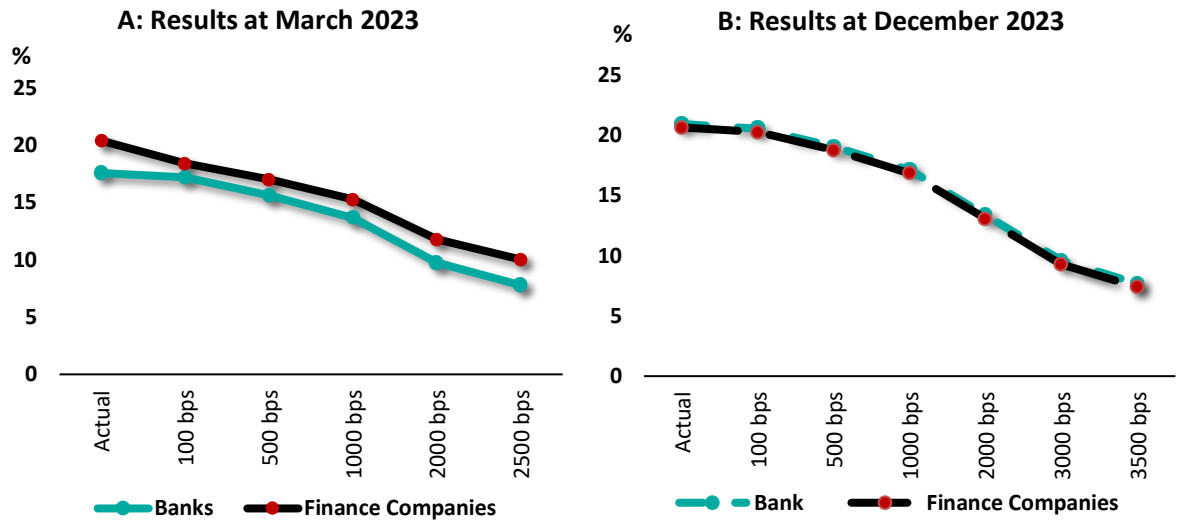
2.1.5 Funding Risk

Based on a review of the short-term maturity gap,[19] banks and finance companies' capital buffers have improved. At December 2023, the aggregate CAR of banks and finance companies had increased to 20.9 percent and 20.6 percent, respectively, compared to 17.6 and 20.4 percent at March 31, 2023 (Figure 11A). Since banks and finance companies started with similar CAR levels, the results of this short-term maturity gap analysis are nearly identical for both groups of institutions and appear as one line in Figure 11B.

This improvement shows that banks and finance companies could withstand interest rate shocks in excess of 30 percent (3000 basis points), before interest rate related losses could lead to capital adequacy breaches. Put simply, assuming all other balance sheet items remain constant, banks and finance companies would need to increase the interest rates paid on deposits by over 30 percent compared to their levels at December 31, 2022. This increase of over 30 percent in deposit interest rates would result in net interest losses, surpassing the interest income from interest-bearing assets. Consequently, these losses would deplete the capital of these institutions below the regulatory benchmark of 8 percent. At the institutional level, it would require a 20 percent (2000 basis points) increase in interest rates on deposits to lead to net interest losses, which would erode the CAR of two banks and one finance company below the 8 percent prudential requirement.

[19] The maturity gap is the difference between the total market values of interest rate sensitive assets (RSA) versus interest rate sensitive liabilities (RSL) that will mature or be repriced over a given range of future dates and is used to assess institutions' vulnerabilities to funding costs and profitability.

Figure 11: Interest Rate Impact on CAR



Source: Central Bank of Barbados' calculations

2.2 Insurance

2.2.1 Underwriting Risks

Increased claims activity amplifies underwriting risks, pressuring liquidity levels throughout the insurance sector.[20] With each rise in claims, insurers face reduced profits and declining cash balances as they look to settle claims. As cash reserves become strained, insurers will likely liquidate investments to address liquidity shortfalls and/or delay claims settlement (Booth, Fulcher, Vosvenieks, & Ward, 2019).[21] While general insurers maintain higher cash reserves to address short-term claims, life insurers' cash reserves are lower due to their long-term obligations. Nonetheless, insurers typically rely on reinsurance arrangements to reduce the potential financial impact of unexpected claims on cash reserves and overall liquidity levels.

Despite higher capital levels this year, insolvency cases remain the same. At the extreme, with a 200 percent increase in claims in the general insurance industry, the average solvency margin fell to 148 percent, and seven insurers were deemed insolvent (Table 3). A 500 percent increase in claims for the life insurance industry caused the average solvency margin to fall to 188 percent, with two insurers falling below the solvency requirement (Table 3).

[20] The test for underwriting risks assesses the sector's sensitivity to a simultaneous increase in claims across all lines of business by incremental amounts. However, it does not account for reinsurance recoveries.
[21] Booth, Claire; Fulcher, Paul; Vosvenieks, Fred; Ward, Russell (2019). Liquidity Risk Management: An Area of Increased Focus for Insurers. Milliman White Paper.

Table 3: Results from Underwriting Risk Test (Claims Increase)

General Insurance			Life Insurance		
Claims Increase	Avg. Solvency Margin	No. Insolvent Insurers	Claims Increase	Avg. Solvency Margin	No. Insolvent Insurers
Baseline	623%	1	Baseline	218%	0
25%	564%	1	100%	212%	1
50%	504%	2	200%	206%	2
100%	396%	3	300%	200%	2
150%	267%	4	400%	194%	2
200%	148%	7	500%	188%	2

Source: Financial Services Commission's calculations

2.2.2 Macroeconomic and Catastrophic Risks

Stress test results demonstrate the insurance sector's ability to withstand adverse economic conditions. The economic downturn scenario assesses the insurance sector's resilience to plausible economic changes, such as a 300-basis point downward shift in the yield curve, a 25 percent loss in real estate and mortgage values, and a 30 percent drop in equity security prices. Following these shocks, the equity securities within the investment portfolios of general insurers were primarily affected. Life insurance companies were, however, more sensitive to the decline in interest rates, which increases the value of the industry's technical reserves (actuarial liabilities) due to their negative duration gap.[22] Nevertheless, all insurers remained solvent in the stressed scenario, except for the lone general insurer deemed insolvent at baseline and prior to economic shocks (Table 4).

The emergence of additional shocks poses heightened risks to the insurance sector. The multiple shock scenario is an extreme scenario considering multiple vulnerabilities to the insurance sector, including an economic downturn, pandemic, and hurricane. It combines the assumptions from the economic downturn scenario with higher technical provisions, increased operating expenses, related-party defaults, and additional claims. Along with the investment losses induced by the adverse economic shifts, general insurers faced significant underwriting losses as claims rose, restricting overall profits and retained earnings. Under this scenario, the average solvency margin for the general insurance industry fell to 180 percent (Table 4), with five insolvent insurers requiring capital injections totalling 0.3 percent of GDP. The most severe impact to the life insurance industry was in the investment portfolio, as related-party investments represent more than half of the industry's invested assets. Like the economic downturn scenario, the test also impacted technical reserves. The life industry's average solvency margin decreased to 143 percent, and two insurers failed to meet the solvency threshold. These insurers would collectively need capital injections equivalent to 0.1 percent of GDP to restore solvency positions.

Table 4: Results from Macroeconomic and Catastrophic Risks

	General Insurance	Life Insurance

[22] Duration measures the sensitivity of the value of assets and liabilities to changes in interest rates. A negative duration gap occurs when the duration of a company's liabilities is longer than the duration of its assets.

	Avg. Solvency Margin	No. Insolvent Insurers	Avg. Solvency Margin	No. Insolvent Insurers
Baseline	623%	1	218%	0
Economic Downturn Scenario	479%	1	175%	0
Multiple Shock Scenario	180%	5	143%	2

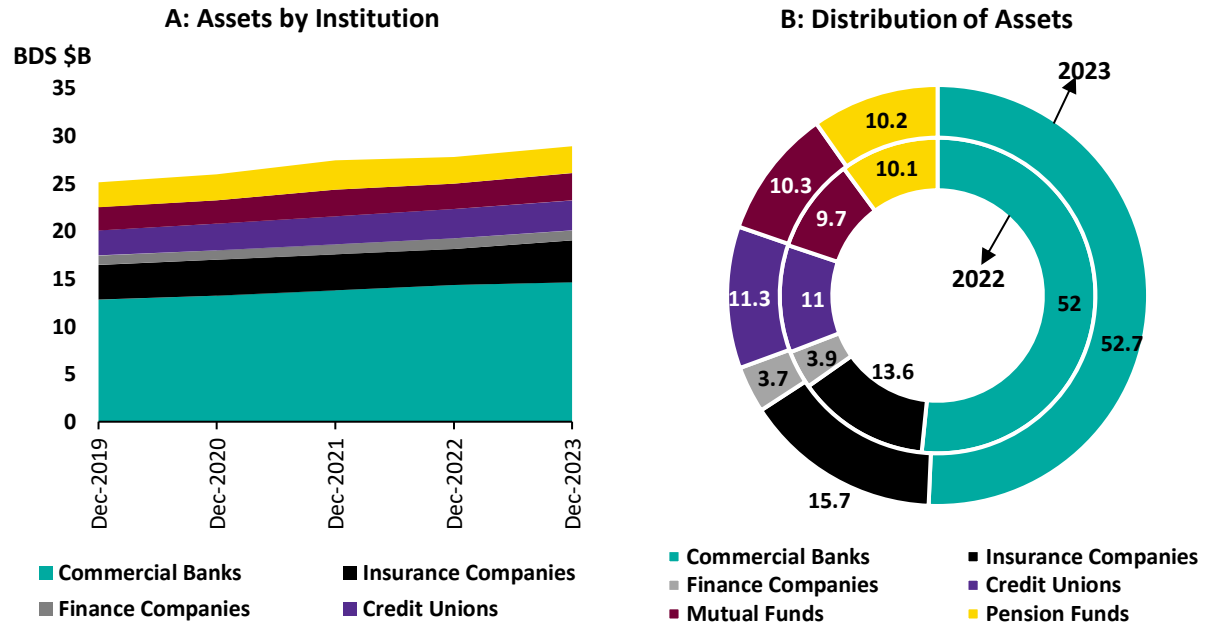
Source: Financial Services Commission's calculations

3. Analysis of the Financial System

3.1 Structure of the Financial System

Given the economy's post-pandemic recovery, total assets of the financial system expanded but asset distribution remained unchanged. At the end of 2023, total assets grew by 4 percent, reaching 226.4 percent of GDP (Figure 12A). Unlike the other financial institutions, finance companies witnessed a decrease. Nonetheless, the distribution of assets in the financial system remained relatively unchanged with banks remaining as the dominant holder of assets in the financial sector (Figure 12B).

Figure 12: Assets of the Financial System



Sources: Central Bank of Barbados and Financial Services Commission

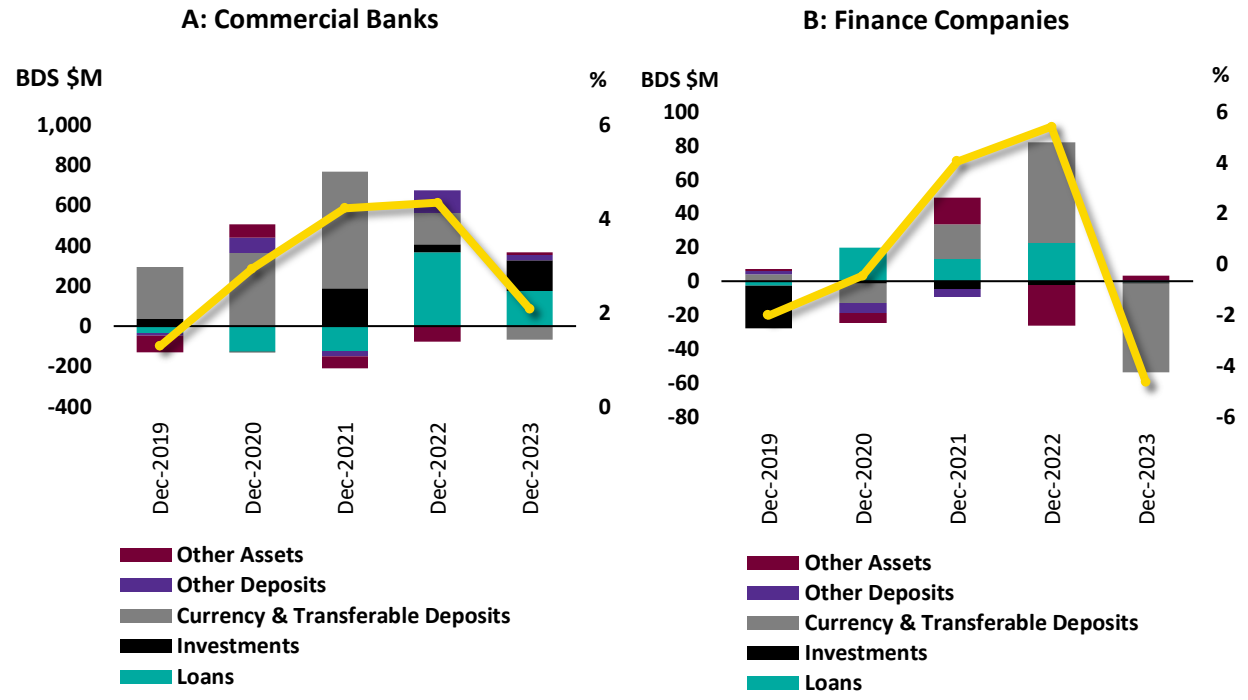
3.2 Deposit-Taking Institutions

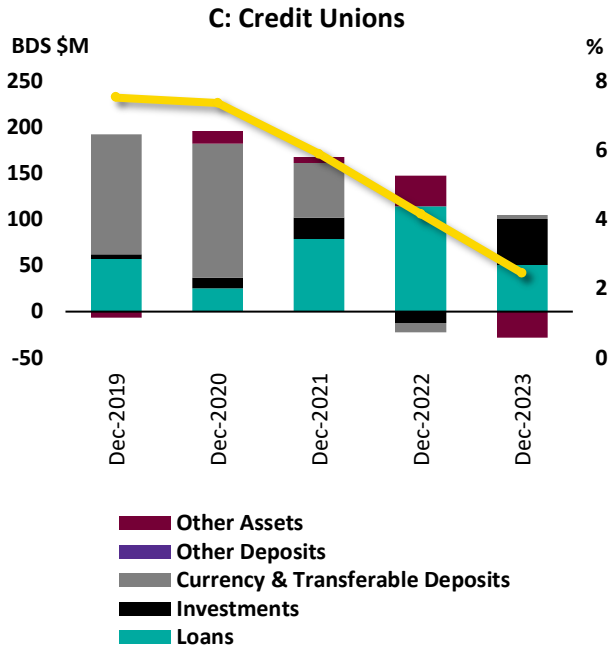
3.2.1 Asset Trends

A potential global macroeconomic slowdown will have implications for DTIs' asset choices as management of these institutions may adopt a low-risk stance and choose to direct funds towards higher-yield assets abroad.

Commercial banks' and credit unions' assets expanded moderately in 2023, while that of finance companies contracted. Banks' and credit unions' assets grew at a more moderate pace relative to 2022, supported by increased lending and investments (Figure 13A and Figure 13C). As a few large non-transferable deposits of finance companies matured, their reserves at the Bank declined while their lending capacity was constrained. Consequently, the assets of finance companies declined (Figure 13B). Notably, the pace of credit growth slowed significantly, but loans continued to dominate DTIs' asset portfolio and represent a significant exposure for DTIs (Figure J2 and Figure 14A).

Figure 13: Asset Growth





Sources: Central Bank of Barbados and Financial Services Commission

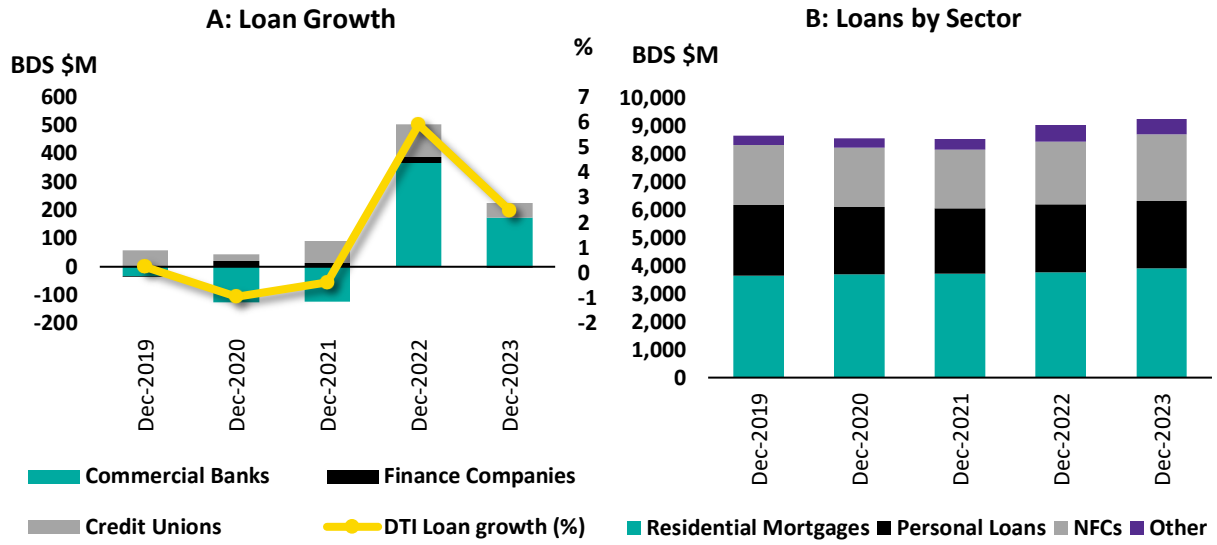
3.2.2 Loans

The risk of a global economic slowdown impacting local activity threatens to stifle loan growth. Notwithstanding, repayment volumes in 2023 remain high and loan delinquency rates declined, suggesting that borrowers will continue meeting their credit obligations in the short to medium term.

Credit growth slowed in 2023. Credit growth peaked in 2022 due to a $146.5 million "blue" loan to the Government and the implementation of business projects as economic activity recovered post-pandemic. However, credit growth in 2023 declined from this peak of 5.9 percent to 2.5 percent as growth across categories normalised (Figure 14A). In 2023, lending to NFCs increased primarily as a result of lending to the manufacturing and real estate sectors. Residential mortgage balances grew by 4.2 percent, while personal loans declined by 1.6 percent (Figure 14B).

Historical data over the last decade suggest that new credit growth has been sluggish (Figure J3). At the end of 2023, the growth in new credit was lower than pre-pandemic and 2022 levels. If new credit growth remains slow, DTIs will face negative implications on their ability to generate interest income, which constitutes a significant proportion of their revenue. However, given the favourable economic projections for the Barbadian economy, it is expected that the confidence demonstrated by the business sector post-pandemic will continue, positively impacting new credit extended.

Figure 14: Loans



Sources: Central Bank of Barbados and Financial Services Commission

Slow to moderate credit growth is expected in the short and medium term. Forecasts predict modest improvements in the macroeconomy, which are expected to result in increased credit to non-financial sector of 2.5 percent for 2024. The main expected drivers of short-term economic growth and the credit expansion are from construction, tourism, and manufacturing sectors which are set to benefit from the hosting of the ICC World Cup matches. The expected increase in economic activity around the ICC World Cup will also see positive spill-overs in the wholesale & retail, transportation, and other ancillary sectors, which are expected to propel the demand for credit. However, a projected global economic slowdown and prolonged geopolitical conflicts present downside risks to the forecast.

3.2.3 Credit Quality

With loans constituting a large majority of DTIs' assets, credit risk is the major source of risk for the financial system. Heightened credit risk can materialise in a global macroeconomic slowdown as lower economic activity dampens the earnings of borrowers, increasing the likelihood of defaults. It is therefore important to continue to monitor the development of NPLs in the economy.

There were broad-based improvements in NPLs during 2023. Heightened economic activity and favourable employment conditions have strengthened borrowers' balance sheets and debt repayment capacity (Figure 15A). The stock of commercial banks' and finance companies' NPLs declined by a similar rate of approximately 13 percent, resulting in improved NPL ratios (Figure 15B). The household and real estate sectors continue to drive the improvement of NPLs.

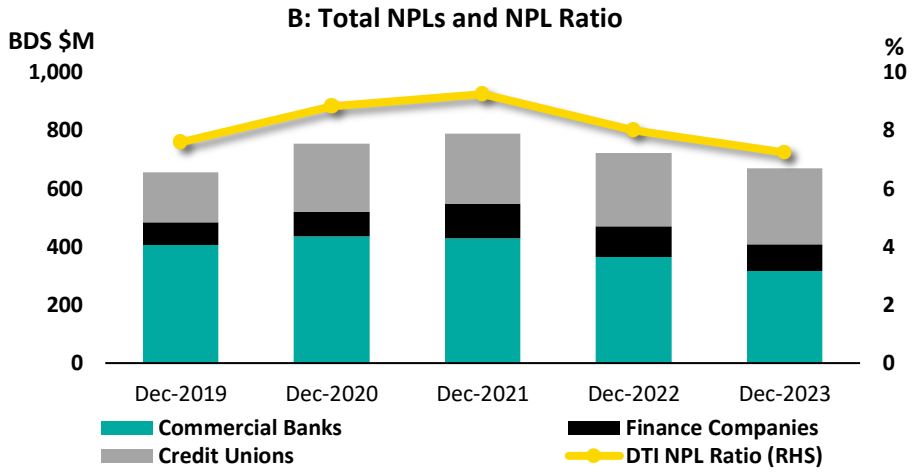
In contrast to NPL improvements in banks and finance companies, credit unions' stock of NPLs increased. Differences in the customer profile of credit unions are a key reason for the contrasting movement in NPLs. The credit union sector is significantly exposed to the lower-to-middle-income demographic, with approximately 70 percent of deposit accounts measuring below $1,000.

Figure 15: Non-Performing Loans

A: NPL Movements by Sector (BDS $M)

	Commercial Banks		Finance Companies	
	Dec 2019- Dec 2023	2023 vs 2022	Dec 2019- Dec 2023	2023 vs 2022
Households		-$30.2		-$5.8
Of Which: Mortgages		-$21		-$3.8
Non-Financial Private Sector		-$14.5		-$7.9
Of which:				
Construction		-$1		-$0.1
Distribution		$5.1		-$0.2
Real Estate & Other Professional Services		-$13.4		-$5
Hospitality		-$2.8		$0
Other		-$2.5		-$0.3

Source: Central Bank of Barbados

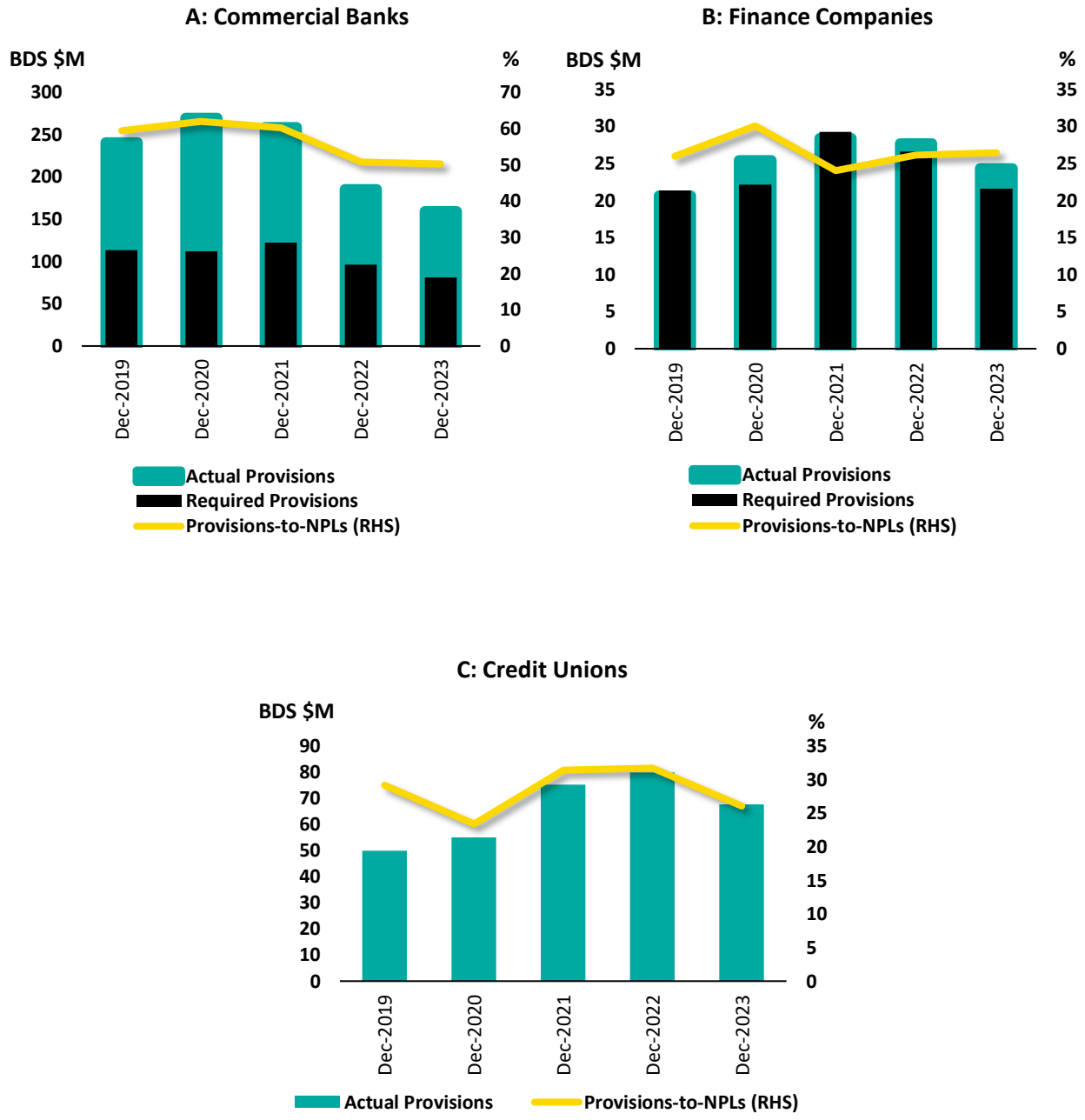


Sources: Central Bank of Barbados and Financial Services Commission

Commercial banks and finance companies hold adequate provisioning. In line with DTIs' positive outlook, provisions accumulated during the pandemic continue to be reduced. Despite this, the commercial banking sector continues to hold almost double the required provisions while finance companies are marginally above the required levels (Figure 16). The stress test results show that

despite lower initial provisioning coverage, credit unions and finance companies are able to withstand a substantial shock.[23]

Figure 16: Provisions-to-NPLs

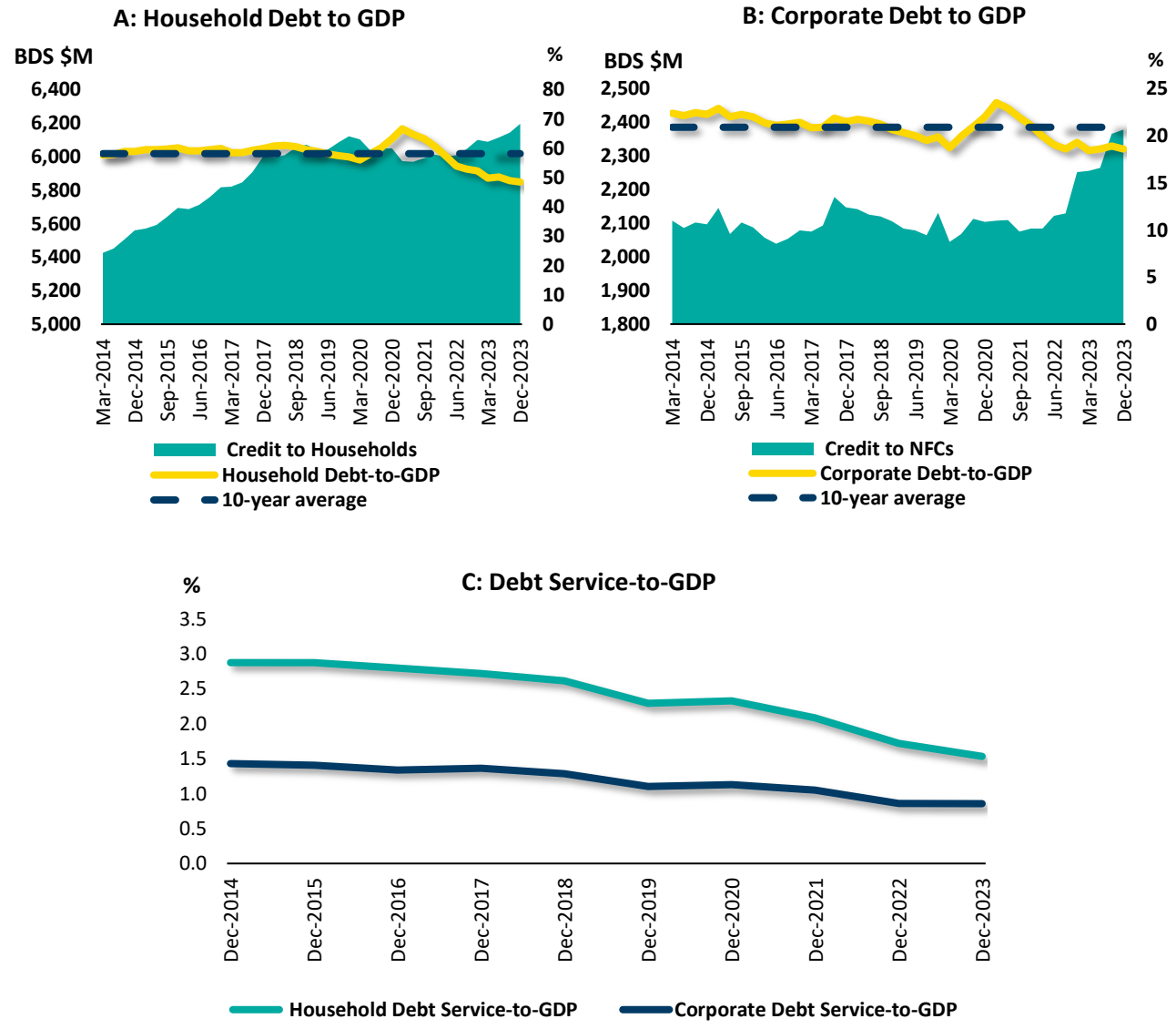


Sources: Central Bank of Barbados and Financial Services Commission

[23] See Macroeconomic Stress Testing Results.

Downward trending indebtedness ratios could dampen the potential severity of an economic downturn on the financial sector. Weaker credit demand, faster repayments, and the expansion of economic activity have resulted in downward trending debt-to-GDP and debt service-to-GDP ratios (Figure 17). The former has fallen below its 10-year average for both households and businesses, with the contraction being greater in the case of households. Households' repayments to banks and finance companies have also been trending upwards, measuring 5.1 percent (or $179.5 million) above its 10-year average by the end of 2023. A combination of lower credit uptake and higher repayments by households potentially signal a weaker debt appetite. Nonetheless, with more robust financial positions, the deterioration of DTIs' asset quality will not be as severe or rapid as it could be if borrowers hold a weak financial position before a downturn.

Figure 17: Indebtedness Ratios of the NFPS



Source: Central Bank of Barbados

Box 1: Real Estate Sector Analysis

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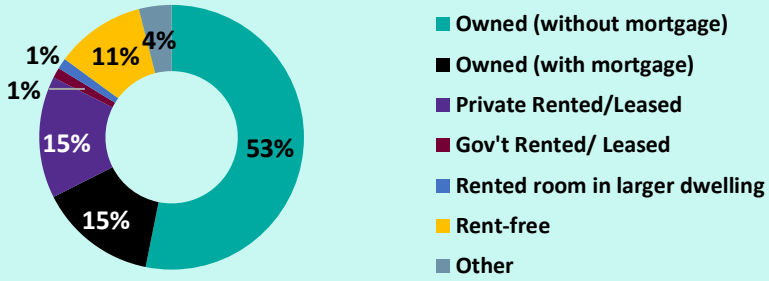
Barbados' real estate market comprises both commercial and residential offerings, including offerings for non-residents. The housing market in Barbados is characterised by outright ownership (53.2 percent) but a substantial proportion of persons (32 percent) are either paying a mortgage or renting (Beuermann, Alvarez, Hoffmann, & Vera, 2021) (Figure 1). The residential real estate (RRE) market can be segmented into a local market and a tourism market. The latter encompasses real estate located in prime tourism areas along the coast, typically commanding higher prices, while the local market encompasses inland real estate properties. House prices in both of those markets tend to move in tandem (Belgrave & Wilson, 2022). Overall, size, location, and the number of bedrooms have been empirically found as key determinants of house prices in Barbados (Belgrave, Grosvenor, & Lowe, 2016).

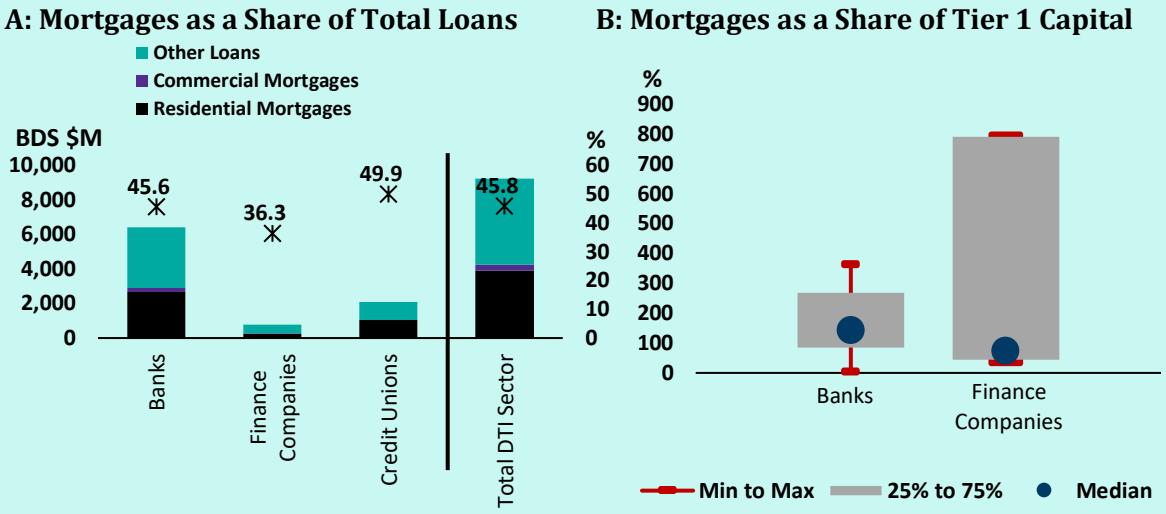
Figure 1: House Ownership in Barbados



Source: Covid-19 Household Survey Round 2 (2021)

Deposit-taking institutions (DTIs) are highly exposed to Barbados' real estate market, especially the RRE market. Mortgages represent nearly half (45.8 percent) of the sector's loan portfolio and the median mortgage to Tier 1 Capital ratio nears 150 percent for banks and 75 percent for finance companies (Figure 2). In line with historical trends, the DTI sector carries greater exposure to the RRE market with the sector carrying $3,824 million of residential mortgage lending. In contrast, DTIs only carry $306 million in commercial real estate (CRE) lending. The credit union sector had the highest exposure, with mortgages representing 49.9 percent of total loans, followed closely by commercial banks (45.6 percent) (Figure 2). With this significant exposure, the potential global macroeconomic slowdown could result in high mortgage defaults as labour market conditions and consumption activity dampen. The CRE market, despite its minor significance in the asset and loan portfolio of DTIs, can act as an amplifying factor in the event of a wider shock as losses in the commercial sector could result in a negative shock to households' income.

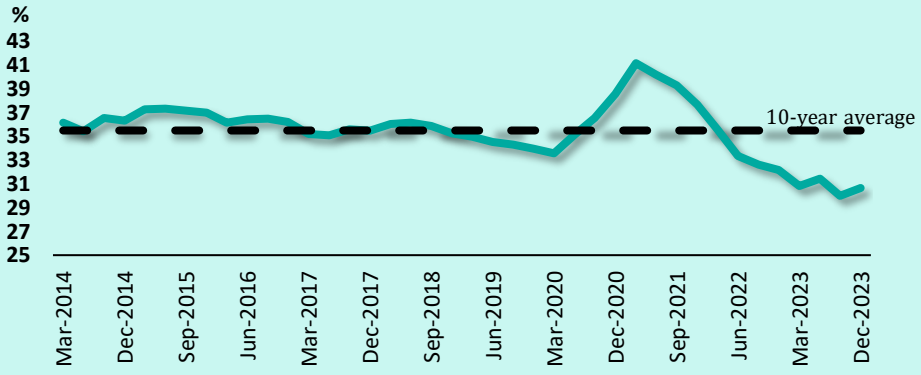
Figure 2: Mortgage Exposure



Sources: Central Bank of Barbados and Financial Services Commission

Activity in the real estate market during 2023 was below 2022 levels. The number of new mortgages extended was approximately 10 percent lower, falling from 2,070 in 2022 to 1,850 in 2023. A sectoral breakdown of new mortgages reveals that the decline was recorded in the RRE market, where new mortgages were 242 fewer. Consequently, mortgage depth (the ratio of residential mortgages to GDP) fell and has remained below its 10-year average since June 2022 (Figure 3). In contrast, the demand for CRE mortgages increased from 42 to 65 mortgages in 2023, signalling private corporate sector confidence in the sustained growth of the economy. With the new demand for CRE, total mortgage balances of DTIs increased by $127.2 million or 3.1 percent relative to 2022.

Figure 3: Mortgage Depth (Residential Mortgages as a % of GDP)

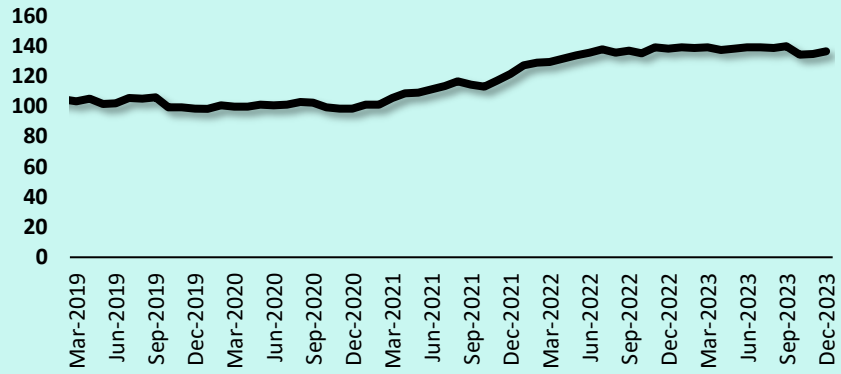


Sources: Central Bank of Barbados and Financial Services Commission

The DTI sector has eased its lending standards on new mortgages in the RRE and CRE markets. Results from a real estate survey issued to banks and finance companies indicate that they have eased their debt-to-income ratio, debt service ratio (DSR), and loan-to-value (LTV) ratio post-pandemic as a means of combatting the relatively lower demand for RRE mortgage. The DSR limit ranges from 40 percent to 45 percent in the RRE market while commercial borrowers' cashflow must be at least 1.25 times their debt- service costs. While most institutions eased lending standards across households and corporates at different income levels, a few institutions indicated that the extended limits depend upon the risk profile of customers. In the face of a global macroeconomic slowdown, mortgage demand can dampen even further, thereby placing pressure on DTIs to ease lending standards even further and increase their risk tolerance.

Heightened costs of building materials could challenge lending standards in the DTI sector and further dampen buyer enthusiasm in the RRE market. The price index of building materials has risen steadily since the second quarter of 2021 as the world grappled with shortages and supply chain issues (Barbados Statistical Service 2023). During 2023, the index was stable but stayed elevated, with prices up more than 20 percent since 2019 (Figure 4). Elevated prices can be reflected in higher construction costs, which means DTIs may face demand for larger mortgages, pushing LTV ratios closer to or above their institutional limits. Additionally, higher costs place further strain on potential borrowers' income, stifling new buyers. If lending conditions do not adjust then the availability of credit tightens and the demand for mortgages will likely remain subdued. This has further negative implications for credit growth and interest income of DTIs.

Figure 4: Building Materials Index



Source: Barbados Statistical Service

Although the majority of mortgages have a variable interest rate, the risk of sudden increases in interest rates is minimal. RRE and CRE mortgages are generally issued with variable interest rates, leaving borrowers exposed to rising interest rates. Nevertheless,

historically, despite fluctuations in global interest rates, the average mortgage interest has been gradually decreasing.

Currently, there is no evidence of a buildup of a real estate bubble, but constrained supply in the tourism residential market could push prices further up in the medium term. One DTI that provides a substantial share of mortgages in the economy, reported that prices of reappraised commercial and residential properties have increased in the last five years. A leading industry player, identified constrained supply of beachfront properties along a prime tourism area (Cathrow & Hutson, 2023), which, according to Belgrave & Wilson (2022), has the potential to exert upward price pressure on the entire RRE market.

The disparity between income and mortgage affordability is narrowing in the RRE market but normalising when CRE is considered. Previous research highlights a mismatch between the supply of and demand for affordable housing and that house prices grew at a faster pace than average wages (Belgrave & Wilson, 2022). However, survey results from commercial banks indicate a downward trending median house price to income ratio in the residential market. The ratio declined from a peak of 6.4 times annual income in 2020 to 5.4 times in 2023, nearing the pre-pandemic ratio of 5.1 times. The trend, however, is different for institutions with both CRE and RRE portfolios. One such institution reported a reduction from 7.7 times annual income in 2019 to a low of 7 times in 2020. This contraction during the initial phase of the pandemic is in line with global trends (Deghi, Natalucci, & Qureshi, 2022) and was underscored by the global lockdowns. Since then, the ratio has been on the mend, increasing to 8 times by the end of 2023. Mortgage affordability is also buoyed by the gradually declining average mortgage interest rates.

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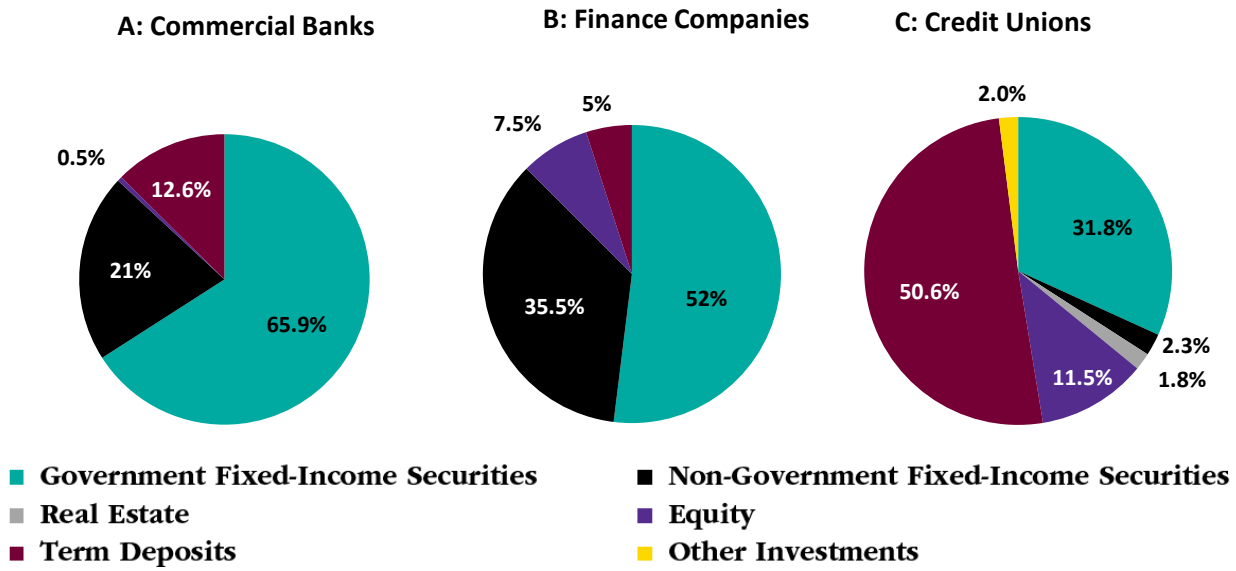
Deghi, A., Natalucci, F., & Qureshi, M. S. (2022). Global Financial Stability Notes: Commercial Real Estate Prices During COVID-19: What is Driving the Divergence? International Monetary

3.2.4 Investments

DTIs' exposure to market risk is quite limited relative to credit risk. Investments account for nearly 20 percent of DTIs' assets, with this proportion below double-digits for finance companies and credit unions. Most of these investments are local-currency denominated. Hence, any interest rate volatility arising from the potential global macroeconomic slowdown is not expected to have a significant effect on the balance sheet of DTIs.

DTIs' investment portfolio remains concentrated in government debt securities. Government debt securities of mainly the Barbadian and United States governments, which are zero-risk-weighted assets under the existing regulatory framework, constitute the principal investment of banks and finance companies. Term deposits account for the largest share of credit unions' portfolio (Figure 18). Notably, the sovereign exposure of banks was lower in the last quarter of 2023 due to maturities of some domestic government bonds and US treasury bills (Figure J4).

Figure 18: Investment Portfolio



Sources: Central Bank of Barbados and Financial Services Commission

The DTI sector's vulnerability to domestic and international fiscal conditions (particularly the United States of America) via their investment portfolio is expected to persist. The upgraded credit rating for Barbados by CariCRIS[24] abates concerns regarding domestic sovereign debt defaults. However, tightening international financial conditions and downgraded credit ratings for the US during 2023 raised fiscal concerns. DTIs are less susceptible to interest rate risk as they hold short-term US investments. Maturity gap analysis[25] at December 2023 reveal that increases in US rates between one to 12 months will boost banks' net interest income but the cost of liabilities will rise faster for finance companies in the three to six months maturity period (Figure J5).

[24] CARICRIS upgraded Barbados' rating by two notches from CariBB in December 2021 to CariBBB- in December, 2023.
[25] See footnote 18 for a definition.

3.2.5 Foreign-Currency Exposure

Foreign-currency exposure is similar to last year, with exchange rate risk remaining low. The proportion of foreign-currency assets to total assets and foreign-currency liabilities to total liabilities remained stable for both commercial banks and finance companies despite the maturity of foreign-currency investments and slower liquidity growth (Figure J6). The net open position (NOP) of both banks and finance companies also remain at similar levels with the largest NOP in USD currency to which the Barbadian dollar is pegged (Figure J7).

3.2.6 Interest Rates

The financial system in Barbados remains largely unaffected by trends in global interest rates. The interest rate spread of commercial banks remained similar to 2022 and shows little signs of changing. Both the weighted average loan rate and deposit rates were virtually unchanged relative to 2022, maintaining the interest rate spread of approximately 5.4 percentage points (Figure J8). Given the persistence of elevated liquidity conditions and subdued credit demand, it is highly unlikely that the interest rate spread will change in the near term.

3.2.7 Liquidity

Deposit growth slowed during 2023. In 2023, deposits at DTIs experienced a slower growth rate of 1.2 percent compared to 5.2 percent recorded in the previous year (Figure J9). This slower growth can be attributed to withdrawals for loan repayments, overseas travel, and the purchase of Government securities. Unlike banks and credit unions, finance companies saw a decline in deposits (Figure J10).

Deposit growth rates were slower across domestic and foreign-currency deposits. Domestic-currency deposits within DTIs increased by 1.3 percent throughout the year (Figure J11). Transferable deposits, which constitute a significant portion of domestic-currency deposits, grew by 2.3 percent, while other long-term deposits decreased by 5.7 percent. This reflects customers' preference for more liquid accounts due to relatively low interest rates. Foreign-currency deposits recorded a marginal decline of 0.2 percent (Figure J12) and amounted to 7.1 percent of total deposits relative to 7.2 percent in the previous year.

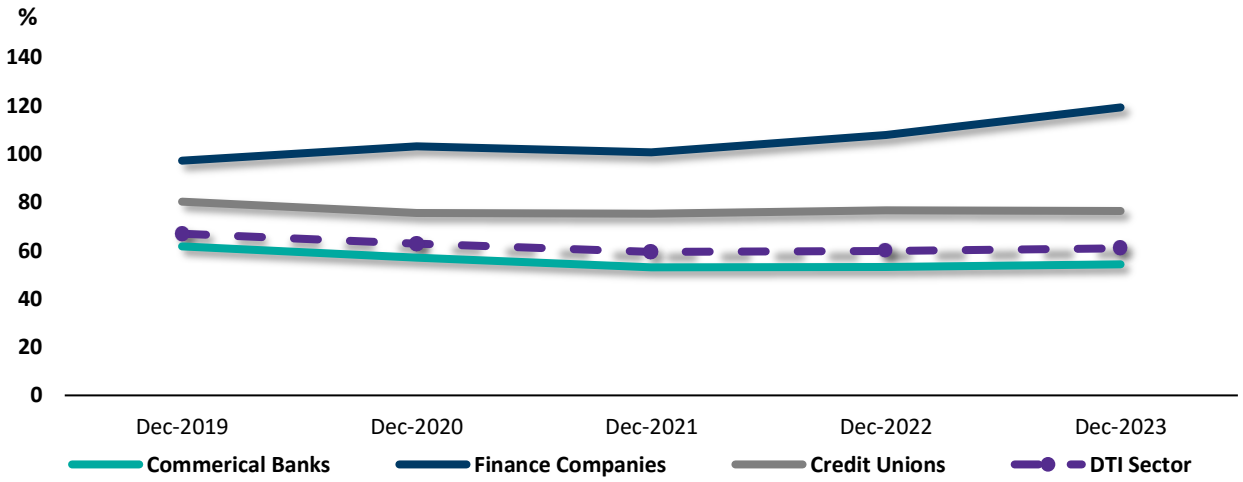
Competitive pressure has surfaced for non-transferable deposits. The maximum weighted time deposit rate rose from 1 percent in 2022 to 2.2 percent in 2023, resulting in a redistribution of deposits among DTIs. The competitive pressure is more concerning for finance companies as their funding is mainly made up of non-transferable deposits. Given the high-liquidity environment, it is not expected that other institutions will be compelled to increase their rates.

Liquid assets trended downward slightly at the end of 2023 (Figure J13). As at December 2023, total cash and transferable deposits of the DTI sector stood at BDS$4,359 million (50 percent of December 2023 GDP). This current level of cash and transferable deposits represent a decline of 2.7 percent from 2022. Both commercial banks and finance companies saw reductions in their balances of cash and transferable deposits year-on-year, while credit unions saw an increase of 0.6 percent. The decline in commercial banks cash and transferable deposits coincided with marginal increases in commercial banks' holdings of foreign and domestic treasury bills. However, these changes had

little impact on the sector's liquid assets to total assets ratios, as this mainly resulted in reclassifications within the class of liquid assets.

The loans-to-deposit ratio signalled no heightened liquidity risk concerns for banks and credit unions, while finance companies face increasing but still immaterial liquidity risk to the sector. The loans to deposit (LTD) ratios moved upwards in banks and finance companies, but declined slightly in credit unions. The increase in commercial banks' LTD ratio was the first since 2015, and was a result of slow deposit growth relative to that of loans in 2023. However, the general eight-year trend in the LTD ratio for banks and credit unions is downward, reflecting strong historical growth in deposit liabilities (Figure 19). The LTD ratio of finance companies remains the highest in the DTI sector as they have lower volumes of deposits relative to the size of their loans when compared to banks and credit unions. Despite the liquidity risks for finance companies being higher, these risks are contained due to the fact that the deposits of finance companies are fixed deposit type instruments, and their loans are mainly small well-collateralised consumer loans.

Figure 19: Loans-to-Deposits Ratio



Sources: Central Bank of Barbados and Financial Services Commission

In 2023, the Deposit Insurance Fund[26] (DIF) experienced significant growth. The total value of the DIF expanded by 11.1 percent, supported by an increase in interest earned on both investments and premiums, which outweighed the fund's operational costs. Additionally, as the level of domestic deposits increased throughout the year, the DIF as a ratio of total eligible deposits rose, further underlying the positive trajectory of the DIF (Figure J14).

The DTI sector continues to operate with high levels of liquidity. Funding risks for financial institutions remain low as they maintain a large stock of cash and transferable deposits relative to

[26] The Barbados Deposit Insurance Corporation (BDIC) guarantees each depositor at commercial banks and finance companies up to $25,000 on domestic currency accounts.

their funding needs. As a result, concerns of liquidity risks materialising in the sector are limited and DTIs are well placed in terms of funding, to further support Barbados' economic growth efforts.

Funding sources of DTIs are mostly domestic, stable, and growing. DTIs main source of funding continues to stem from inflows of domestic deposits, leaving the DTI sector shielded from liquidity shocks stemming from international funding markets. Risks from a slowdown in local funding sources are also limited, as deposits are likely to grow with expected improvements in the tourism sector and the macroeconomic environment in the short to medium term.

3.2.8 Profitability

A slowdown in the global economy could lead to decreased economic activity in Barbados, resulting in lower demand for loans and financial services. DTIs may experience reduced lending volumes, leading to a decline in interest income, which is a key driver of profitability. This reduction in revenue could weaken DTIs' profitability and erode their ability to withstand any potential shocks to their balance sheets and maintain capital adequacy. In 2023, the profitability of commercial banks improved, while profitability waned for finance companies and credit unions.

Despite a decline in credit growth, commercial banks' profitability improved in 2023 due mainly to a $50 million decline in provisions for bad and doubtful debts and a $34.3 million reduction in taxation. After-tax profits of commercial banks increased in 2023 by more than twice the increase in 2022. Return on Average Assets (ROAA) moved to 1.8 percent in 2023, while the Return on Equity (ROE) was 15.7 percent (Figure 20A). The net interest income increased by 8.7 percent compared to the previous year, mainly due to higher interest income on foreign currency loans, deposits, and investments, which more than doubled due to high sustained international interest rates.

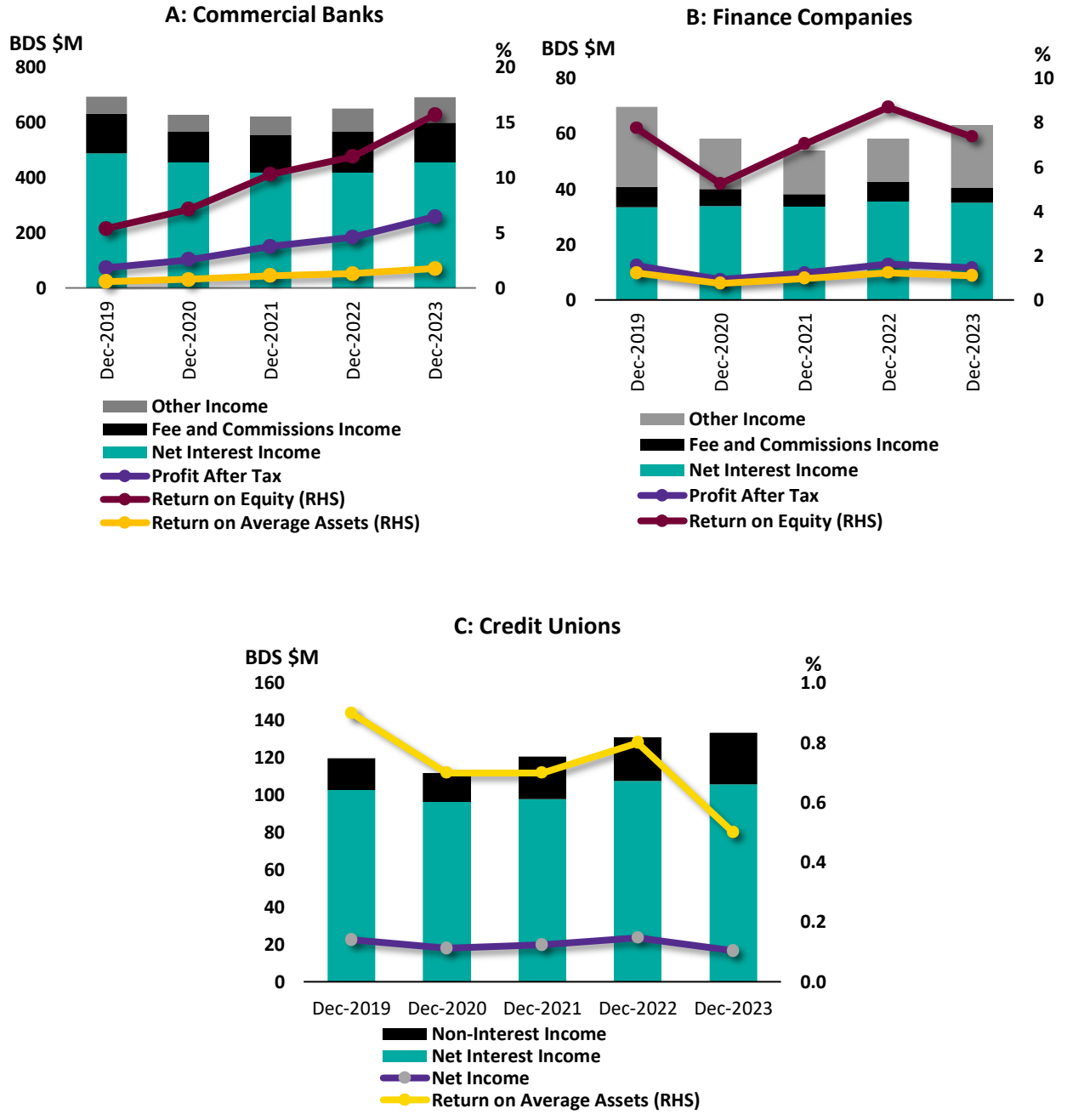
Over the last 10 years, the share of non-interest income to total income grew from 23 percent to 33 percent. This expansion implies that banks are relying more on various types of fee income from across their range of services to increase or maintain their profitability. This increased reliance on fee income, combined with the removal of the minimum deposit rate which eliminated most of their interest expense on deposits, has allowed banks to maintain profitability in an environment with minimal loan growth. The higher fee income has provided banks with a low-risk means of stabilising profitability in the face of weak credit growth.

The profitability of finance companies declined in 2023. The sector's ROAA moved from 1.2 percent in 2022 to 1.1 percent in 2023, while the ROE moved from 8.7 percent in 2022 to 7.4 percent in 2023. The after-tax profits weakened slightly to $11.6 million in 2023 (Figure 20B). This marginal decline in profit was mainly due to uneven declines in total interest income and total interest expenses, coupled with even increases in non-interest income and non-interest expenses of $4.9 million.

Net income of the credit union sector declined by $6.9 million year-on-year due to substantial increases in other expenses and staff costs, despite reductions in provisions for bad and doubtful loans. Following a year of flat loan growth, the credit union sector recorded less than one percent growth in total income. This performance along with increases in other expenses and staff

costs, resulted in a decline in net income to $16.6 million (Figure 20C). The decline in NPLs and the attendant $1.2 million reduction in provisions for bad and doubtful loans lessened the impact of the higher expenditure and flat loan growth. The sector also managed to reduce interest paid on deposits, despite a significant increase in total deposits held by credit union members.

Figure 20: Contribution to Profit by Source



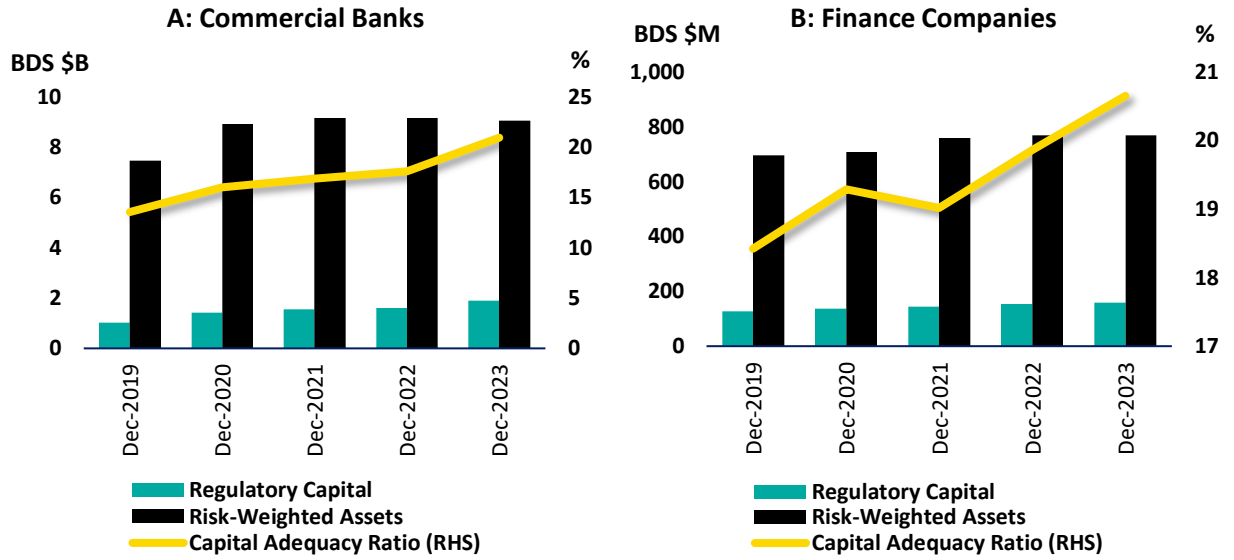
Sources: Central Bank of Barbados and Financial Services Commission

3.2.9 Capital Adequacy

The capital adequacy ratio is an important financial indicator used in assessing the health of DTIs. Considering the main identified financial stability risk related to potential global economic slowdown, the ratio is imperative in determining the ability of these institutions to absorb losses on their balance sheets, along with settling any financial obligations.

The level of capital held by DTIs increased throughout 2023. For banks and finance companies, their level of regulatory capital increased by 17.9 and 5.2 percent, respectively, in 2023 (Figure 21), staying well above the required amount for each type of institution. The substantial increase in Tier 1 Capital was due primarily to higher earnings and profitability during the year, as the economy continued to improve post-pandemic.

Figure 21: Capital Adequacy Ratios

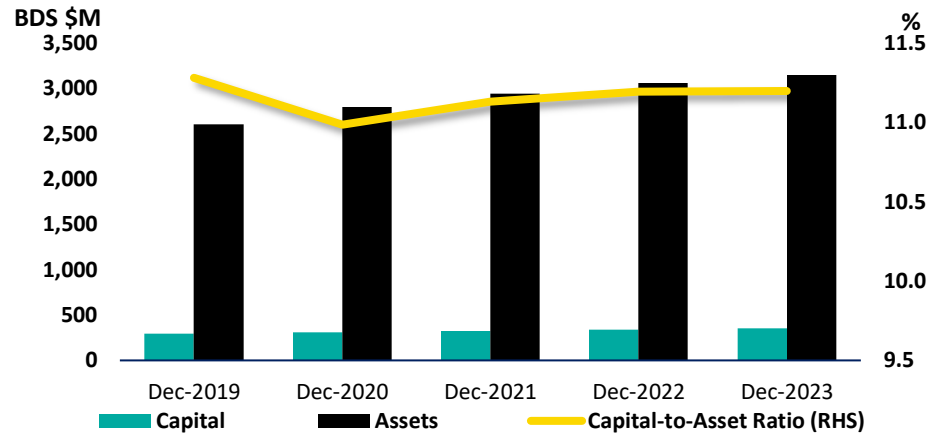


Sources: Central Bank of Barbados and Financial Services Commission

If economic conditions continue to strengthen, there is likely upside risks to the level of capital, but this could be reversed if the economy experiences any economic downturns in the future. The macroeconomic stress test results reveal that deposit-taking institutions remain resilient throughout different levels of adverse scenarios**.** Under the baseline scenario where economic activity is driven by the sustained performance in the tourism sector, it is expected that DTIs would have higher levels of regulatory capital leading to elevated capital adequacy ratios. With moderate and severe scenarios, especially in the cases of geopolitical tensions or severe climatic events, credit growth is expected to decline due to contractions in economic activity. As a result, banks and finance companies would likely increase their loan provisions contributing to further contractions in profitability. As a result, the CAR for both types of scenarios would be lower than in the baseline scenario. Notwithstanding this, the CAR would be still above the minimum rate required.

For credit unions, the capital-to-assets ratio remained relatively unchanged in 2023. Given the small contraction in profitability in 2023 of 0.3 percent, the capital-to-assets ratio stayed on par with the previous year (Figure 22).

Figure 22: Capital-to-Assets Ratio for Credit Unions



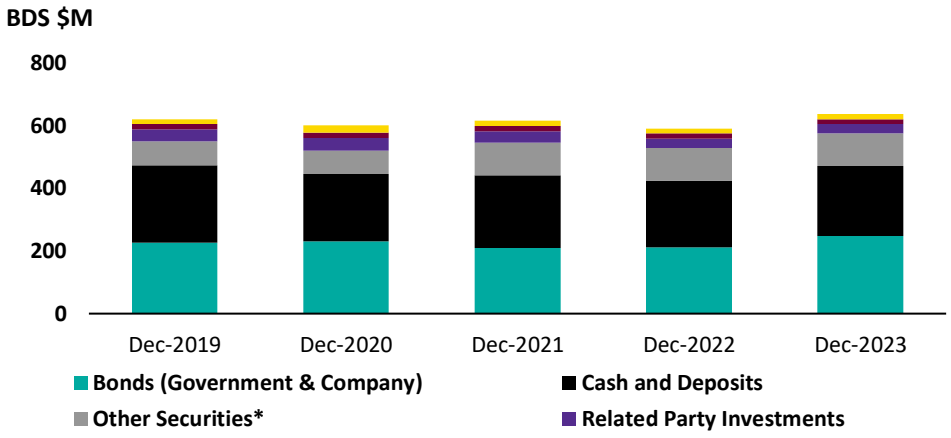
Source: Financial Services Commission

3.3 Insurance Sector

3.3.1 General Insurance Industry

The general insurance industry experienced an increase in the asset base, in contrast to the prior year. Total assets grew by 13.4 percent, as insurers increased their holdings of Government securities following increased premium revenue. The portfolios of general insurers remained concentrated in local Government securities at 29 percent (Figure 23). The industry's penetration rate[27] stood at 9.1 percent, an increase from 8.8 percent in 2022.

Figure 23: General Insurance Classes of Investments



*Mutual Funds, Shares, Unit Trusts

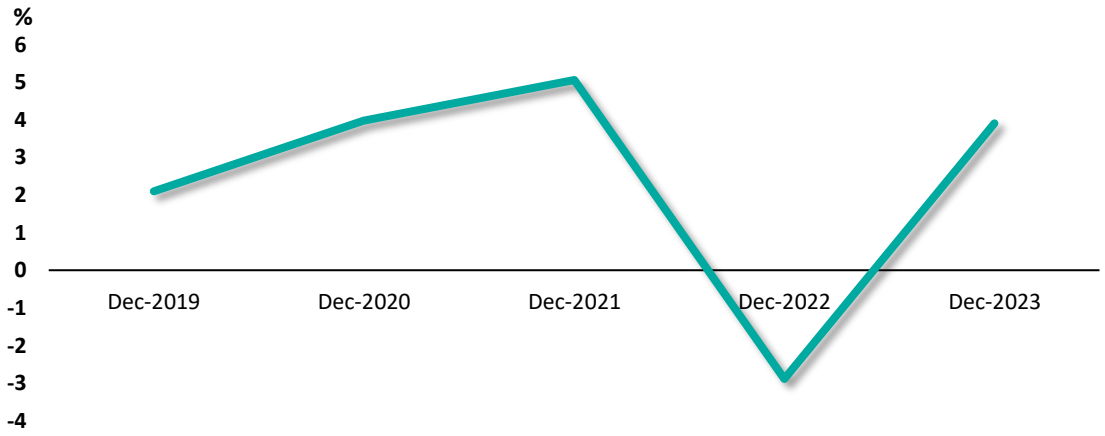
[27] Insurance penetration is defined as total assets compared to Gross Domestic Product (GDP).

Source: Financial Services Commission

Future premium growth could be limited by the potential global macroeconomic slowdown. Premium revenue expanded by 12.7 percent, as many general insurers increased premium rates during the year, which led to improved solvency position across the industry. However, insurance business relative to economic activity remained largely unchanged, maintaining an average penetration rate of 4.8 percent over the past five years. The potential global economic slowdown could limit further growth in the industry, as it could reduce consumer demand for insurance coverage leading to increased levels of underinsurance and uninsurance. At year-end, the industry recorded a return on assets (ROA) of 3.9 percent compared to -2.9 percent in 2022 (Figure 24), resulting primarily from positive gains from underwriting activities and, to a lesser extent, investment performance.

Inflationary pressures and evolving market dynamics have forced the industry to tighten underwriting strategies. Though the industry has maintained an average loss ratio of 63 percent in recent years, many general insurers have consistently struggled with underwriting losses. The persistence of core inflation in global economies has resulted in high operating and claims settlement costs. Additionally, the "hardened" global reinsurance market has brought escalating costs for third-party coverage.[28] These developments have prompted the industry to implement further rate hikes, particularly in the property and motor lines, to enhance financial resilience to the heightened risks.

Figure 24: General Insurance Return on Assets (ROA)



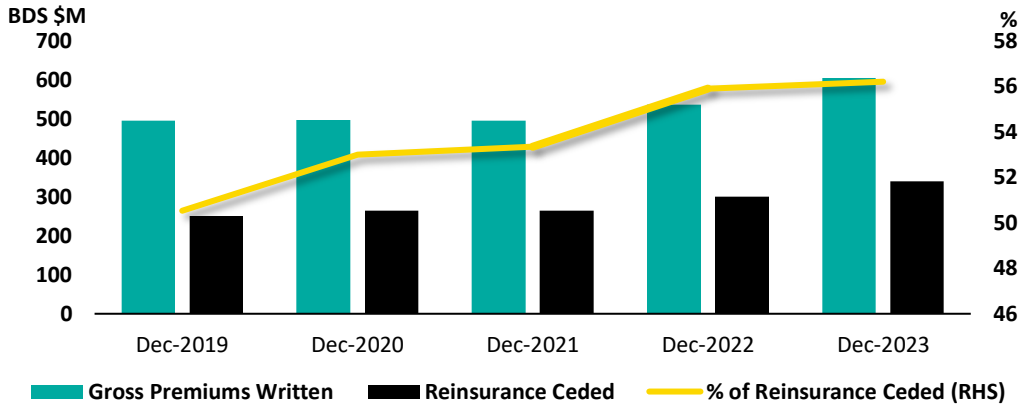
Source: Financial Services Commission

The evolution of climate risks makes it increasingly difficult to secure adequate coverage within the region. In 2023, an estimated 56.2 percent of total business was transferred to reinsurers (Figure 25), with the most ceded risks being property insurance. Though the industry utilises a combination of proportional and non-proportional treaties to limit financial losses, excess-of-loss

[28] A hard reinsurance market is a situation in which certain reinsurance coverage is limited, and the resulting costs of the available coverage are expensive. Reinsurers may tighten their standards, increase costs, and require more stringent conditions to access coverage.

treaties are generally employed to provide further protection against catastrophic events.[29] However, given the region's vulnerabilities, insurers are finding it difficult to secure adequate reinsurance coverage, thus limiting their capacity to underwrite property business. Whilst this may not be a direct financial stability concern, it presents implications for the broader economy as the country's protection gap widens, increasing strain on state resources should an event materialise.

Figure 25: General Insurance Gross Premiums Written vs. Reinsurance Ceded[1]



Source: Financial Services Commission

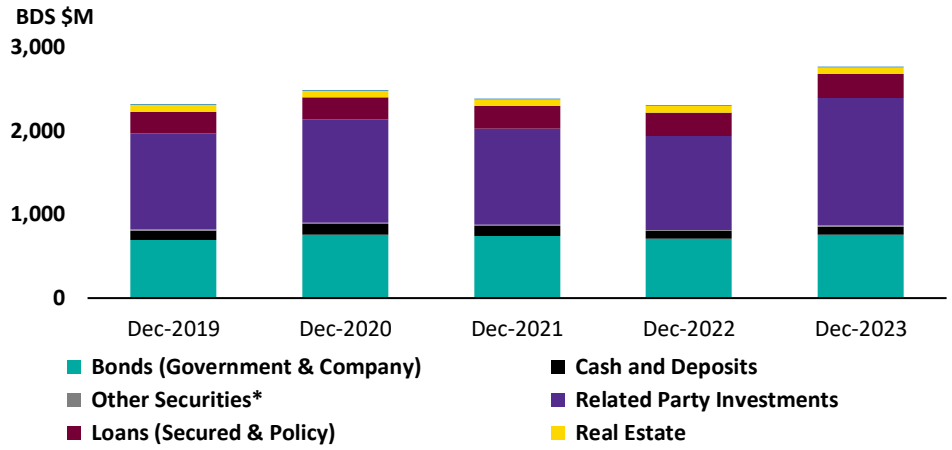
[1] Reinsurance ceded refers to the portion of risk that an insurance company (the ceding company) transfers to a reinsurance company. This process involves the ceding company purchasing reinsurance to protect itself from significant losses by spreading the risk. In return, the reinsurer receives a portion of the premiums paid by the policyholders of the ceding company.

3.3.2 Life Insurance Industry

The life insurance industry continued to experience positive growth in 2023. The size of the sector relative to economic activity for the year was 25.2 percent compared to 23.7 percent in the prior year. Industry assets grew by 16.1 percent driven primarily by related-party investments and increased holdings in Government securities (Figure 26). Similarly, gross premiums written for the industry grew by 4.3 percent over the prior year. Much of this growth stemmed from ordinary life business, accounting for almost 60 percent of total industry activity. Despite the industry's positive performance, profitability declined at year-end as the ROA fell from 4 percent to 1.1 percent in 2023 (Figure 27).

[29] Reinsurance arrangements typically have short durations, which allows the reinsurance market to quickly incorporate the latest findings from scientific research and risk assessments into pricing.

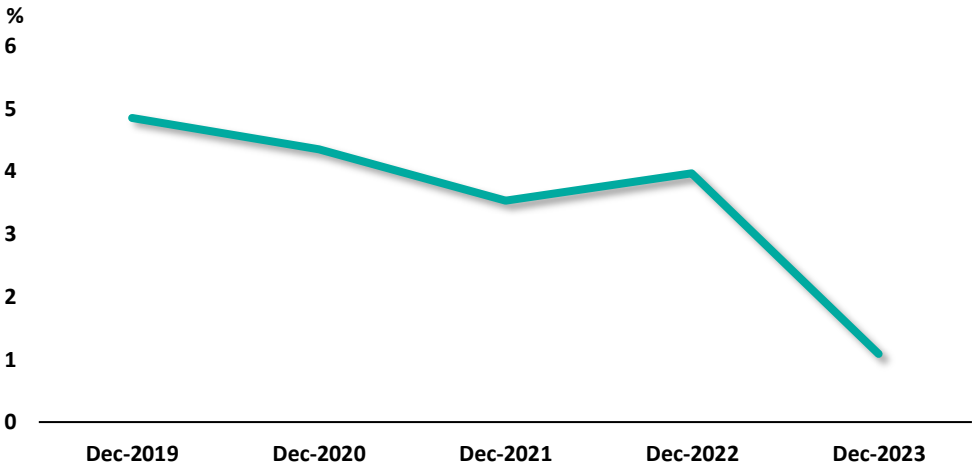
Figure 26: Life Insurance Classes of Investments



*Mutual Funds, Shares, Unit Trusts

Source: Financial Services Commission

Figure 27: Life Insurance Return on Assets (ROA)



Source: Financial Services Commission

The potential global economic slowdown may limit further growth in the life insurance industry. As the global economy slows, premium growth from new business is expected to slow due to lower consumer demand. Additionally, the industry may experience increased policy lapses and

surrenders as consumers navigate the effects of reduced global economic activity. Further, with more than half of total investments in related parties, the possible global economic slowdown could negatively impact the value of these investments in the portfolio as related-parties encounter financial strain. The industry may need to adjust its portfolios to lessen its exposure to this potential risk.

Anticipated monetary policy easing in advanced economies is expected to have a limited impact on life insurers' balance sheets.[30] Changes in interest rates generally impact investment portfolios and discount rate assumptions used in actuarial valuations.[31] Given life insurers' negative duration gap, liabilities tend to be more sensitive to interest rates through discounting. However, as most investments are held locally, global interest rate movements are expected to have little impact on insurer portfolios and, thereby, discount rate assumptions.[32] Therefore, solvency margins are expected to remain stable as life insurers continue to maintain adequate capital buffers to meet future commitments.

3.4 Securities Sector

Barbados' securities sector features a mutual funds sub-sector serving as an investment vehicle for local pension plans. The sector comprises 19 mutual funds licensed to conduct business directly with the Barbadian public.[33] The mutual funds sector acts as a prominent investment intermediary for other economic sectors, giving rise to growing levels of interconnectedness within the financial system. Specifically, three of the largest mutual funds, constituting approximately 54.9 percent of the net assets, offer direct exposure to the occupational pensions sector**.**

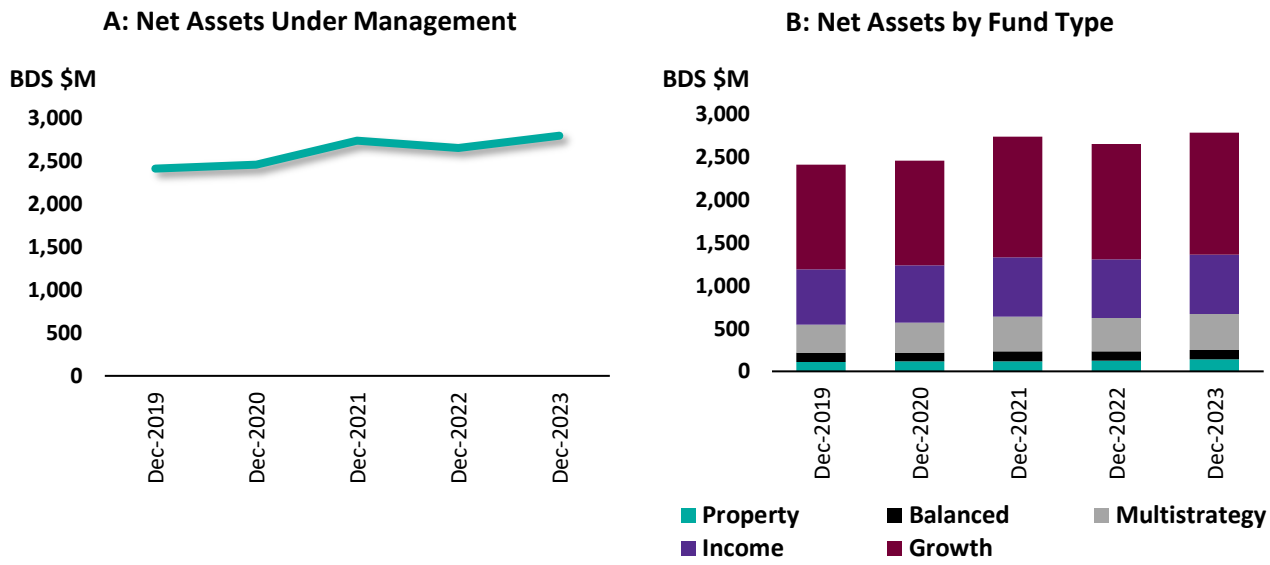
The mutual fund sector remains most significantly exposed to equity risks from international markets, with interest rate risk being less of an issue. The sector recorded a modest 5.3 percent year-on-year growth in net assets under management (NAUM), driven primarily by funds with high equity exposure (Figure 28). As most funds are exposed to international equity markets, the potential economic slowdown would negatively impact equity prices, impeding future fund growth. However, the sector's exposure to global interest rate volatility is subdued, given that much of the fixed-income securities are held in local government paper.

The mutual funds sector maintained high levels of liquidity, demonstrating its ability to meet investor demands without significant market disruptions. Most of the funds in the sector are "open funds",[34] which continuously allow shares to be issued and redeemed based on investor demand. Historically, the sector has maintained cash reserves well above redemption levels,

[30] The Financial Services Commission Guideline No. 5 stipulates that most financial assets should be valued using the fair market value approach. Insurers conduct valuations frequently (monthly or quarterly), so changes to insurer balance sheets are considered market-consistent upon reporting.
[31] Discount rates are usually reviewed quarterly and changes in the risk-free rate are considered. Actuarial valuations also consider assumptions about mortality, morbidity, and lapse rates, etc.
[32] The Insurance Act, CAP. 310 Section 34 (1) outlines "Every company shall invest in Barbados an amount equal to at least 80 percent of the value of the assets in each statutory fund."
[33] The mutual funds subsector comprised seven growth funds, six income funds, three property funds, and three balanced and multi-strategy funds as of December 31, 2023.
[34] More than 90 percent of registered mutual funds are open funds, with only two registered closed funds.

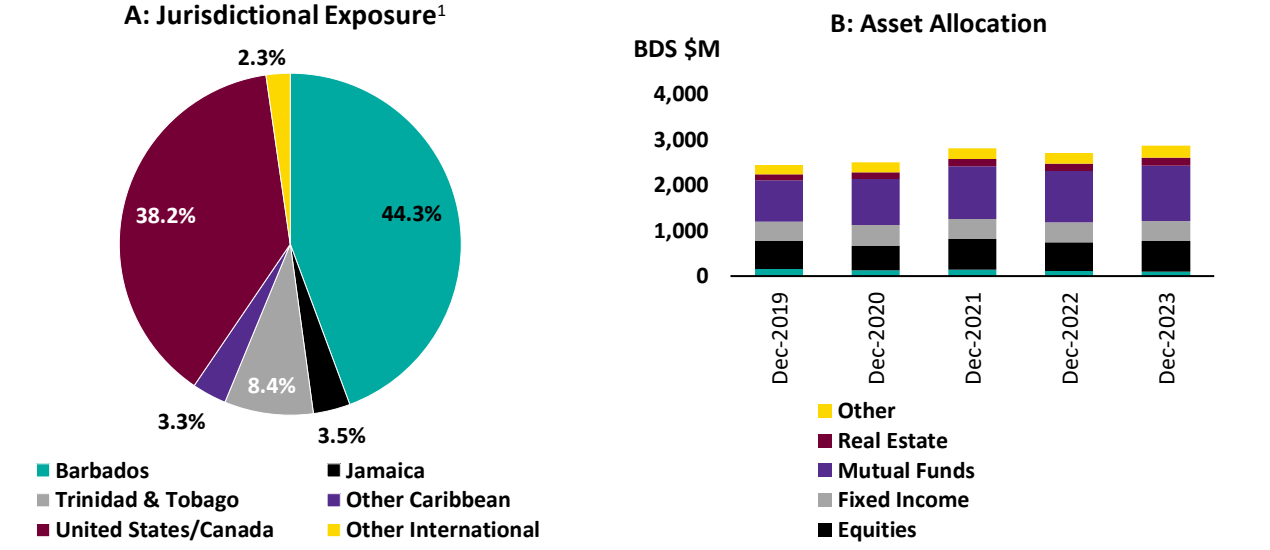
signalling its ability to meet investor obligations (Figure 30). While the gap between cash reserves and redemptions has been shrinking in recent times, the sector maintains an adequate stock of liquid investments.

Figure 28: Net Assets



Source: Financial Services Commission

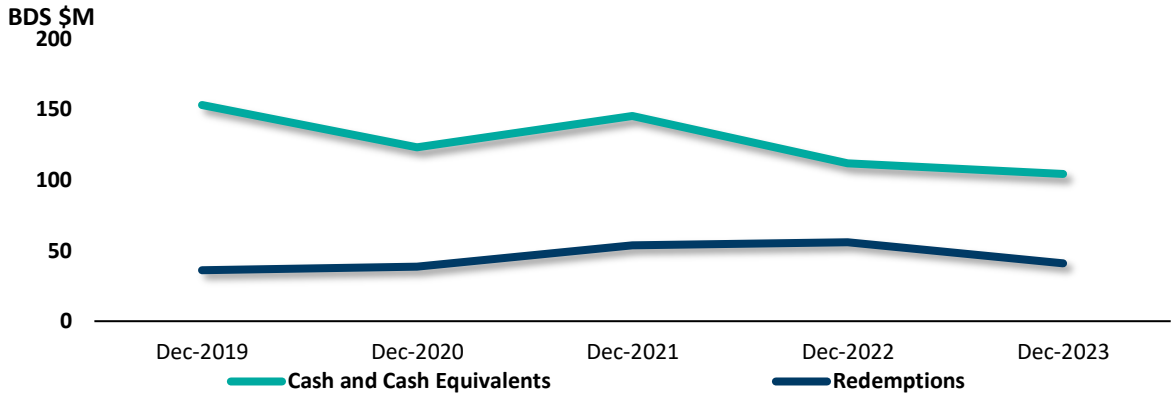
Figure 29: Mutual Funds



Source: Financial Services Commission

[1] Jurisdictional exposure is based on the statutory reports from regulated mutual funds however the location of underlying investments may differ from reported. The FSC continues to conduct research on the true location and jurisdictional exposure of investment instruments held by mutual funds.

Figure 30: Mutual Funds' Cash Reserves vs. Redemptions



Source: Financial Services Commission

3.5 Occupational Pension Sector

Pension coverage continued to decline as wind-ups outpaced new registrants over the past five years.[35] The sector is comprised 245 occupational pension plans, of which 58 percent are defined-contribution (DC), 32 percent are defined-benefit (DB), and 10 percent are hybrid (DB+DC combined) pension plans. Since 2019, 39 pension plans within the sector have wound-up, primarily originating from within the financial, services, tourism, and sales/distributions sectors. While the sector has experienced eight wind-ups over the past year, the global slowdown will likely impact these economic sectors and threaten the viability of occupational pension plans. The sector's size relative to the economy stood at 22.1 percent at year-end compared to 24.1 percent in the prior year.

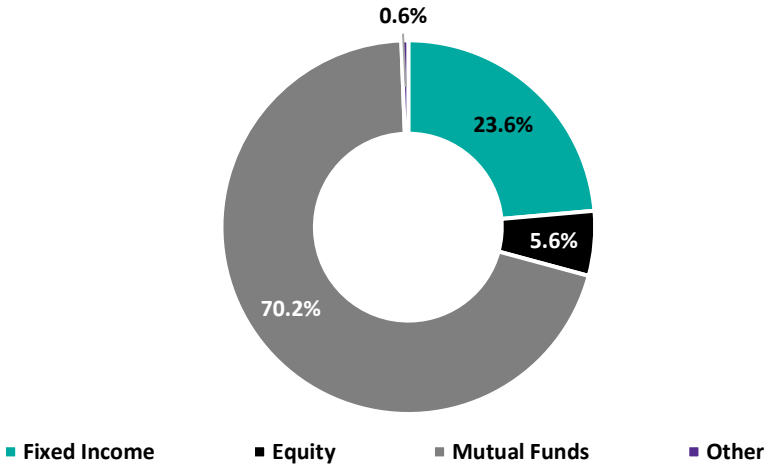
Defined-benefit pension plans have greater systemic implications for financial stability. Even though the number of DC plans is greatest, DB plans constitute a higher proportion of the sector's assets at 50.6 percent. DB plans are of greater concern for financial stability due to the inherent guaranteed element of expected benefits and promised annuity payments upon retirement. Therefore, underfunding presents significant solvency implications for these types of funds. Approximately 28.2 percent of the total DB plans were underfunded on a solvency basis,[36] with an average funding ratio of 84.1 percent. Similarly, 29.2 percent of hybrid plans were underfunded with an average funding ratio of 66.3 percent. Consequently, many employers have found themselves

[35] Density ratio which represents the ratio of total plan members to the total population.
[36] Solvency Basis: This valuation basis assumes that the pension fund will be wound up or terminated as of the valuation date. All assets and liabilities are at market value.

burdened by the challenges of administering and funding pension plans and there has been a gradual shift from DB structures towards DC pension plans.

Barbados' occupational pensions sector continues to be exposed to developments in the mutual funds sector. The industry continued to rely significantly on local mutual funds, which comprised the largest portion of the portfolio (Figure 31). The investments were mainly concentrated in three mutual funds, which together, had high exposure to international equity markets. In contrast, the exposures to fixed-income securities were relatively lower and constant across the three funds, with the majority of holdings in local government debt. As such, a slowdown in the global economy would increase volatility in equity markets, with potential negative impacts on pension investments. As a result, declining investment portfolios could further exacerbate solvency deficits.

Figure 31: Distribution of Pension Funds Investment Portfolio



Source: Financial Services Commission

4. Emerging Risks: Cyber Risk and Climate Risk

The financial system, specifically banks and finance companies, have shown awareness and, to a certain extent, have integrated climate risk into their risk management frameworks. One key finding from a survey the Bank administered to these institutions in 2024 was that institutions included climate-related risks within their assessment of financing requests from customers. Regarding borrowers' default risk, only two banks implemented climate risks factors in relation to borrowers' default. Taking into consideration that the country is faced with potential severe weather systems every year, some DTIs have built-in the impact of climate change with respect to the valuation of collateral.

Cyber-attacks have become an increasing area of concern for commercial banks and finance companies in Barbados. Analysis of the results from a financial stability survey of DTIs administered by the Bank, revealed that these institutions are treating cyber-attacks as a top

priority.[37] With the increase in cyber-attacks since the pandemic period, both domestically and globally, institutions have integrated cyber risk policies into their respective corporate strategies. In 2023, the majority of attacks which the banks and finance companies in Barbados experienced were via spam and phishing attacks.[38] Continuous training of employees, retaining and attracting cyber security experts, and improving both corporate governance and communications are seen as ways to enhance institutional resilience and preparedness against current and future cyber-attacks. Additionally, most institutions surveyed, implemented internal risk mitigation frameworks to regularly test and assess their readiness.

Generally, the survey results suggest that financial institutions in Barbados consider cyber risk a priority, including it as part of their corporate strategy. Based on the growing number of attacks that these institutions face on a day-to-day basis, it is imperative that they continue to rely on their cyber risk management frameworks, aligned with the Bank's Technology and Cyber Risk Management Guideline,[39] to promote cyber resilience and preparedness.

Box 2: Potential Impact of Climate Change on Caribbean Economies

Written by Christopher L.A Kinch, Senior Economist, Research and Economic Analysis Department of the Central Bank of Barbados. Email: christopher.kinch@centralbank.org.bb

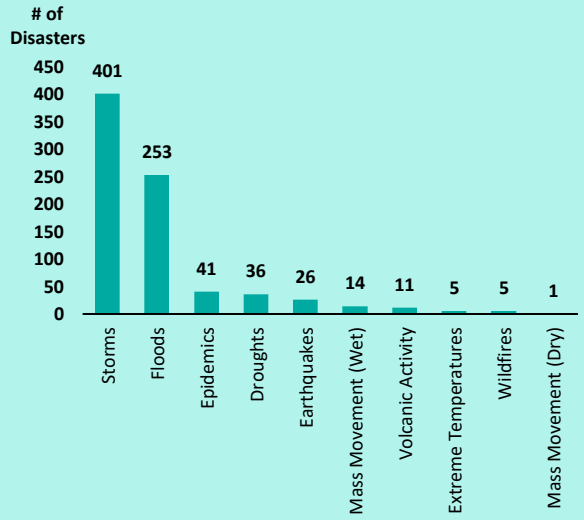
Caribbean nations are becoming increasingly concerned with the impact of climate change on their economies. According to Rudebusch (2021), climate change can be defined as the long-term shift to higher surface temperatures along with a change in environmental patterns such as rising sea levels, more severe weather systems such as storms, increased flooding, and more frequent and extreme heat waves. Economies within the Caribbean are highly vulnerable to both the direct and indirect effects of climate change, based on their location and size. Over the years, these territories have experienced the negative impacts of more severe and frequent climatic events such as hurricanes and tropical cyclones, recurring droughts, increasing floods, and declining shorelines due to increased sea levels (Fuller, Kurnoth and Mosello, 2020). Hurricane Dorian, a category 5 hurricane, was one of the strongest hurricanes to impact any Caribbean country, reaching maximum wind speeds of 185 miles per hour.

This hurricane resulted in US$3.4 billion in damages to The Bahamas in 2019, worsening the country's fiscal balance and increasing debt levels (Economic Commission for Latin America and the Caribbean 2022). In 2017, Hurricane Maria ravaged Dominica. The economic losses from this hurricane were estimated at 226 percent of GDP, compounding the US $483 million economic losses from Tropical Storm Erika in 2015 (International Monetary Fund, 2021).

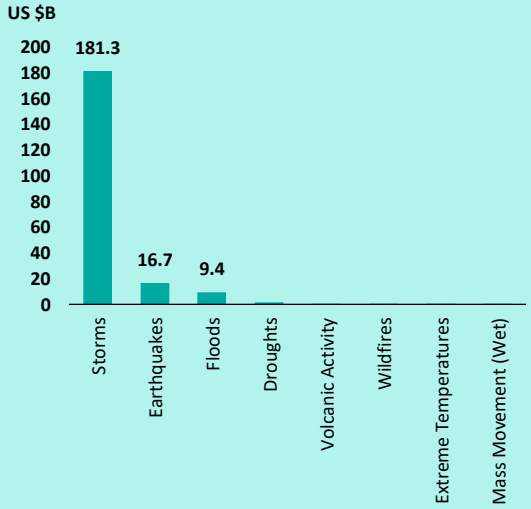
The Caribbean has experienced a significant number of natural disasters over the years. Between 2000 and 2023, there were 793 climatic events impacting the region, with tropical storms and floods accounting for 50.6 percent and 31.9 percent of the total, respectively (Figure 1A). Tropical storms accounted for US$181.3 billion of the total estimated damages, followed by earthquakes and floods, which represented the majority of the remainder (Figure 1B). For the same period, Barbados registered 14 natural disasters, where storms represented 71.4 percent of the total (Figure 1C). For Barbados, total economic losses amounted to US$ 0.3 billion (Figure 1D).

Figure 1: Types and Estimated Cost of Natural Disasters Within the Caribbean

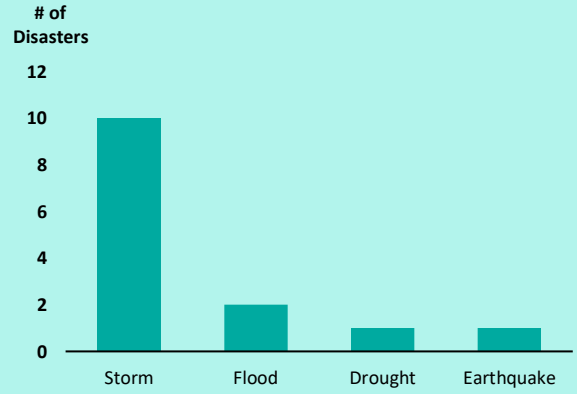
A: Types of Natural Disasters in the Caribbean (2000 to 2023)



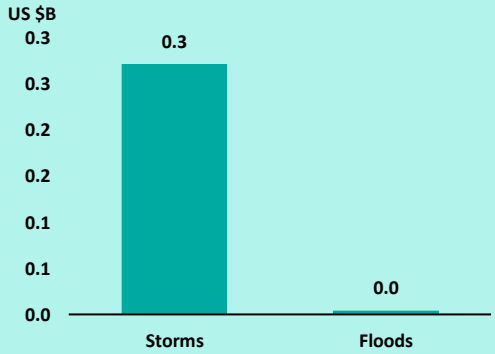
B: Estimated Damages by Type of Natural Disasters Within the Caribbean (2000 to 2023)



C: Types of Natural Disasters for Barbados (2000 to 2003)



D: Estimated Damages by Types of Natural Disasters for Barbados (2000 to 2023)



Source: Emergency Events Database (EM-Dat): The International Disaster Database

Based on their level of vulnerability, many countries within the region, including Barbados, are heavily exposed to the external risks that natural disasters pose. In 2020, the World Bank published natural disaster risk profiles for Barbados and many other countries across the Caribbean. The total projected economic losses to capital was US$1,127.4 billion if a natural disaster impacted each Caribbean economy (Figure 2A). For Barbados, the total macroeconomic loss to the capital stock from a natural disaster was an estimated US$14 billion

(Figure 2A). Due to the diverse exposure of countries in the region, natural disasters can cause highly varied levels of economic losses (Figure 2A).

Figure 2: Estimated Damage to Capital Stock for Caribbean Economies

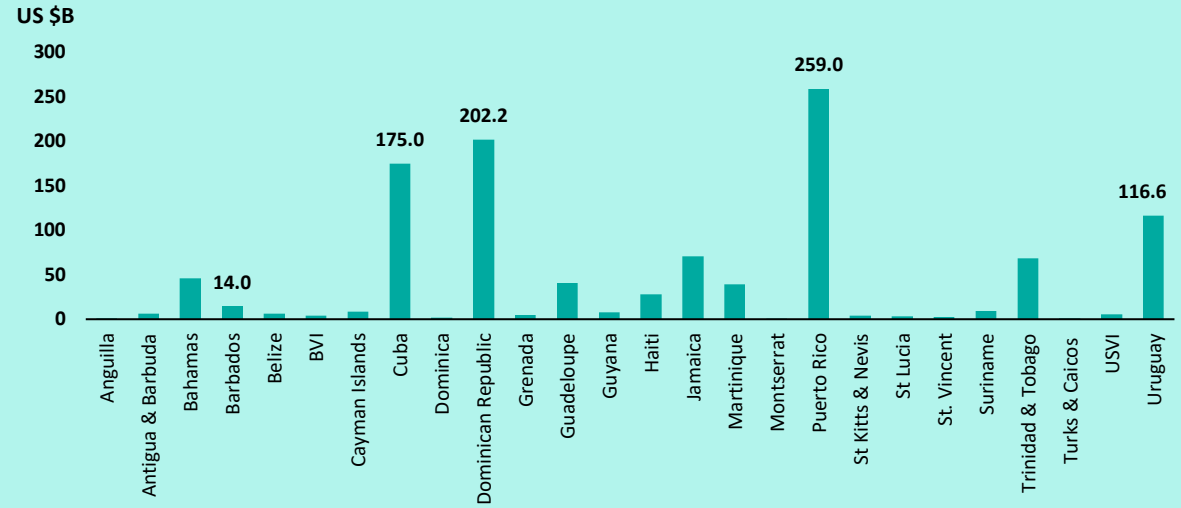
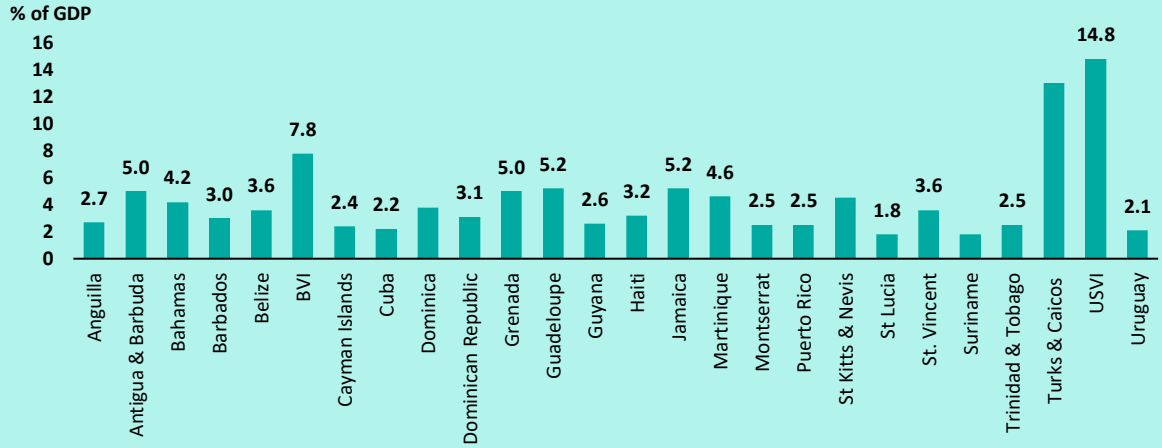


Figure 3: Estimated Damage to Capital Stock as a Percentage of GDP



Source: World Bank Risk Viewer

Although climate change can negatively impact an economy, it also has the potential to impact the stability of the financial system. According to Battiston, Dafermos and Monasterolo (2021), the ever-increasing threats posed by natural disasters and other climate-related events have pushed central banks and other financial regulators across the globe to assess climate risks to economies.

Within the Caribbean, some central banks have started to investigate the climate-related risks to financial stability within their economies. The Central Bank of Trinidad and Tobago (CBTT) has sought to address the data gaps that exists in terms of monitoring climate risks related to financial stability (Central Bank of Trinidad and Tobago, 2023). The data gap will be strengthened through the collection of climate-related data, and the CBTT will include climate-related policies in their macroeconomic framework over the medium-term.

The Bank of Jamaica (BOJ) outlined plans to integrate climate-related financial risks into their financial stability framework, which will help with the assessment of these risks among supervised institutions (Bank of Jamaica, 2023). In the future, the BOJ wants to include climate risks in its supervisory framework and macroeconomic policy decisions.

For Caribbean islands, physical risks are the main type of climate-related financial risks. Physical risks are defined as the damage to infrastructure and the associated financial losses caused by events such as tropical storms, hurricanes, floods, extreme heat, and wildfires (Kirova, 2021). This type of risk can be either acute or chronic in nature, but still has an impact on the economy in either scenario. Physical risks from climate change can translate into some of the following effects on financial markets: "decline in real estate prices, increase in risk premiums, increase in NPLs, revenue losses, reduced profits, contraction in the prices within the equity and bond markets, and carbon asset write-offs." (Rudebusch, 2021; Oesterreichische Nationalbank, 2019). Therefore, the impact on the financial sector is dependent on the severity of the damage caused, especially in terms of the capital stock.

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5. Payments Systems Developments

In 2023, Barbados' payment systems and infrastructure remained robust and resilient, while improvements to the domestic payments infrastructure led to an increase in electronic payments. Payment systems play a crucial role in ensuring financial stability and are an integral part of the overall health of the financial system. Efficient payment systems ensure smooth fund transfers, reducing the risk of transaction delays and disruptions. Payment systems also mitigate counterparty risk, particularly in large-value transactions, and facilitate effective liquidity management in financial markets, ensuring institutions can access necessary funds. Additionally, robust payment systems enhance market confidence, thereby fostering participant engagement. By reducing systemic risks through the timely settlement of transactions and risk management, payment systems prevent the spread of financial distress. Moreover, well-functioning, secure, and regulated payment systems like those operating locally significantly contribute to domestic financial stability, mitigating risks that could lead to broader systemic disruptions.

Throughout 2023, there was a notable increase in the aggregate volume and value of electronic transactions, including both large-value and retail payments, as the economy continued to recover from the COVID-19 pandemic. This was particularly evident in the higher activity witnessed within the Real-Time Gross Settlement System (RTGS),[40] the Barbados Automated Clearing House Services (BACHSI),[41] and credit card transactions. There was a marked resurgence in consumer behaviour, with people returning to dining out and higher demand for retail goods such as clothing and household furnishings. This contributed to an overall boost in the value of electronic payments. Partly responsible for this increase was the launch of real-time payment capabilities by the BACHSI system in February 2023. The introduction of instant payment alternatives for both households and businesses led to a noticeable shift from the conventional direct electronic payment method to the real-time payment option.

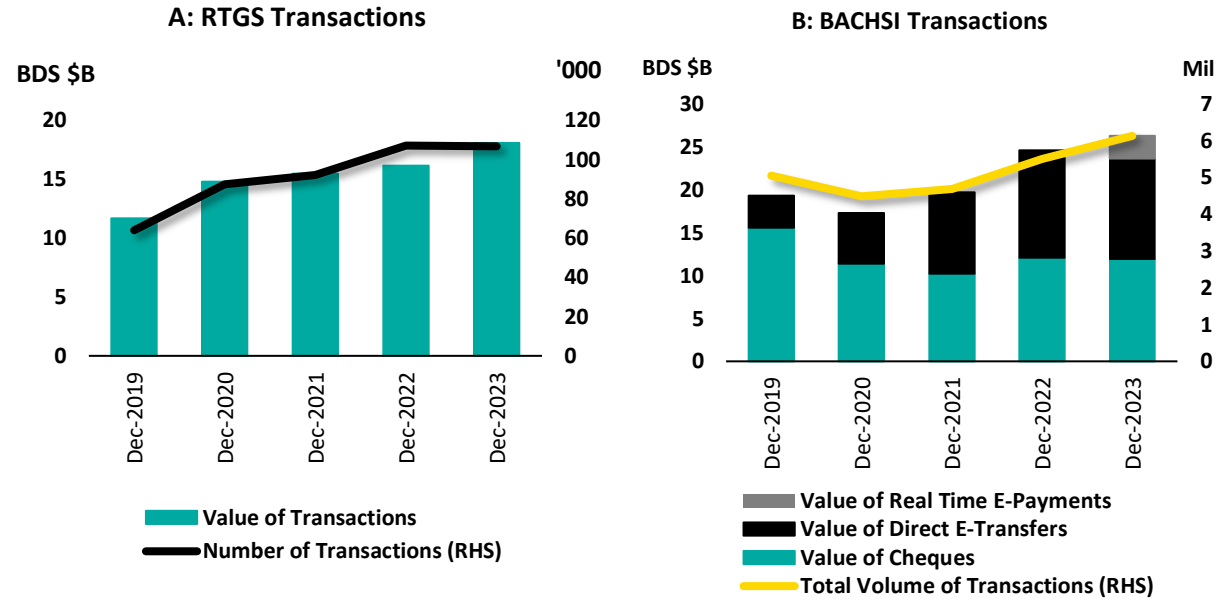
Although the volume of transactions completed through the RTGS system contracted by 0.4 percent in 2023, the value of transactions expanded by 11.9 percent (compared to an expansion of 4.4 percent in 2022) (Figure 32A). The latter contributed to the average value per transaction growing by 12.3 percent, amounting to $169,558.00. Increased domestic economic

[40] RTGS processes large value and/or time sensitive payments between the domestic banking system and the Central Bank.
[41] BACHSI facilitates the clearing of cheques, direct payments, and daily bank settlements.

activity, greater activity within the securities market, and higher settlement of payments related to goods and services propelled the growth in the value of transactions processed through the RTGS system.

In 2023, the total value of payments transferred through the BACHSI system rose by 7 percent to $26.2 billion, mainly on account of the expansion in the value of electronic transfers. For a second consecutive year (since the inception of the automated clearing house), electronic fund transfers surpassed paper-based payments (cheques) accounting for 54.7 percent of all automated clearing house transactions. The total value of electronic funds processed expanded by 15 percent (Figure 32B), which was partly due to the processing of transactions through the new instant payment method, real-time processing (RTP), which was initiated in February 2023. With the greater shift towards the use of electronic settlement of payments, the number of cheques processed decreased by 7.9 percent. Meanwhile, with the introduction of the instant payment option, there was a noticeable shift from the standard direct e-payment method to the RTP option as the number of direct payments fell by 6.3 percent. The increased activity within the BACHSI system was indicative of improved economic conditions, in conjunction with the upgrades of the system to handle instant payments.

Figure 32: RTGS and BACHSI Transactions

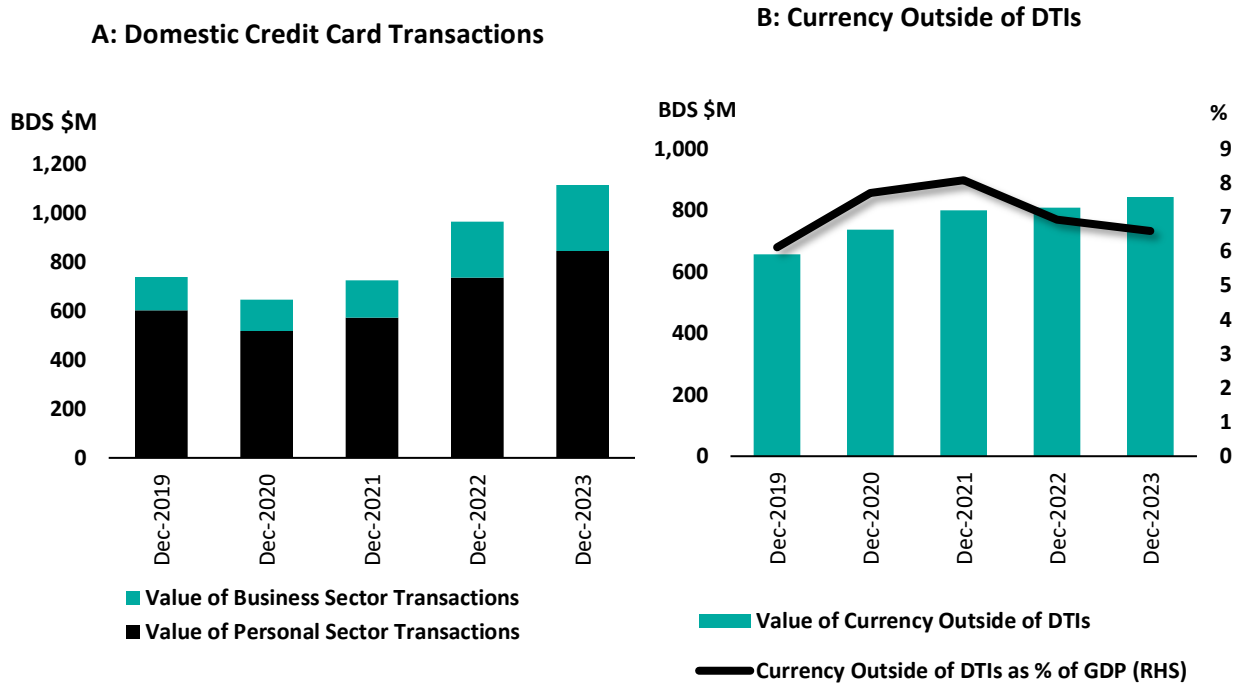


Source: Central Bank of Barbados

The value of domestic credit card payments grew by 15.5 percent in 2023. As economic activity continued to expand, domestic credit card transactions increased by $150 million (Figure 33A). The household sector accounted for about 75.8 percent of the total value of credit card transactions. Higher usage by both households and NFCs led to the increase in the value of domestic credit card transactions. The value of household credit card transactions increased by 14.8 percent, while private sector credit card transactions increased by 17.5 percent.

Unlike the previous year,[42] the reliance on cash as a payment method increased during 2023. The demand for cash (currency in circulation outside of DTIs) increased by 4.3 percent, amounting to $843 million by the end of 2023 (Figure 33B). However, in line with sustained economic growth and a shift towards electronic payments, currency holdings by the public as a percent of GDP decreased to 6.6 percent in 2023, down from 6.9 percent in the previous year.

Figure 33: Domestic Credit Card Transactions and Currency Outside of DTIs



Source: Central Bank of Barbados

[42] Growth in currency in circulation outside of DTIs slowed to 1.2 percent in 2022 after growing by 8.4 percent in 2021.

6. Thematic Articles

Navigating Credit Risk Uncertainty: A Framework for Financial Stability Stress Testing

Written by Anton D. Belgrave[43] and Saida Teleu[44]

Abstract

This paper addresses the issue of model uncertainty in stress testing frameworks used by financial institutions. We focus on the use of satellite models linking risk parameters with macroeconomic and financial factors. Our research highlights the potential for underestimating risk parameter responses, leading to an overestimation of banks' ability to absorb losses. To mitigate this, we propose the adoption of Bayesian Averaging of Classical Estimates (BACE) methodology. Our findings underscore the importance of addressing model uncertainty to enhance the reliability of stress testing frameworks and improve financial stability and resilience.

Introduction

Stress testing has become a conventional tool over the past decades for evaluating the resilience of financial institutions to hypothetical macro-financial stress scenarios.

The paper aims to address a crucial aspect present in all stress tests: the use of auxiliary equation systems to translate macro-financial shock scenarios into risk parameters at the bank level, whether conducted internally by financial institutions (in a bottom-up fashion) or overseen by central authorities (in a top-down fashion). These models, often referred to as satellite models, are employed to forecast the trajectory of the bank's balance sheet under baseline, moderate, and adverse scenarios. Extensive literature is available that presents empirical satellite models for different types of risks, notably credit and interest rate risks. However, most papers written on credit risk for the Caribbean area tend to overlook the presence of model uncertainty. Despite the apparent solidity of the bridge equations for a specific risk parameter at the bank level from economic and econometric perspectives, there exists a potential for underestimating the reaction of the risk parameter. Consequently, this could result in an overestimation of the bank's ability to absorb losses. The selection of equations, leading to excessively optimistic scenario forecasts, might be influenced by explicit incentives for banks to minimise risk costs or might occur inadvertently.

To address these concerns, we advocate for the adoption of satellite model methodologies that encompass a pool of equations rather than relying on a single equation. Specifically, we propose the utilisation of Bayesian Averaging of Classical Estimates (BACE) for stress test modelling purposes. In addition to the aforementioned reasons for the utility of model averaging, two further aspects support this approach. Firstly, there exists significant uncertainty regarding the drivers of credit risk dynamics, making an agnostic approach and model averaging beneficial. Secondly, the short time

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The views expressed in this thematic article are those of the authors and not necessarily the views of the Central Bank of Barbados.

series for credit risk measures such as default rates makes it impractical to construct a comprehensive multivariate model, rendering general-to-specific model structuring methods potentially inferior.

It's worth noting that stress tests carried out by financial institutions are not just considered helpful, but are also indeed mandated by regulatory standards, as outlined in the Basel accords. Pillar II, which holds significant relevance to our paper's focus, requires banks to utilise stress testing methodologies to evaluate their capacity to withstand hypothetical, severe macroeconomic stress scenarios. Specifically, as highlighted in the Basel Committee on Banking Supervision (BCBS) (2006), paragraph 775 emphasises the necessity for banks' management to conduct periodic stress tests on their major credit risk concentrations. These tests ensure that banks can analyse and respond to potential changes in market conditions that could negatively affect their performance. Additionally, paragraph 777 underlines the supervisory responsibility to take appropriate measures if risks stemming from a bank's credit risk concentrations are inadequately addressed by the bank.

Literature Review

The banking sector in the Caribbean region has attracted considerable attention from researchers due to its unique characteristics and vulnerabilities. The presence and impact of non-performing loans (NPLs) within these markets have been a focal point of various studies aiming to understand their determinants and implications for financial stability and growth.

A seminal IMF technical note (2009) on stress testing the banking system in Barbados provided valuable insights into the macroeconomic variables affecting NPLs. However, the focus on aggregate projections overlooked idiosyncratic effects. Furthermore, Greenidge and Grosvenor (2010) provided early insights into the dynamics of NPLs for Barbados, laying the groundwork for subsequent research in this area. Their analysis offered valuable perspectives on the drivers of NPL accumulation and resolution challenges, setting the stage for further investigation into this critical aspect of Barbadian banking sector performance.

Tracey and Leon (2011) delved into the dynamics of NPLs in the context of loan growth, focusing on Trinidad and Tobago and Jamaica. Their findings shed light on the interplay between NPL levels and the expansion of loan portfolios, highlighting the importance of asset quality in driving banking sector performance.

Similarly, Jordan and Tucker (2013) explored the relationship between NPLs and economic growth, particularly in The Bahamas. Their analysis revealed the intricate connections between NPL trends and broader macroeconomic conditions, emphasising the significance of banking sector stability for overall economic resilience.

Building upon these initial insights, Beaton et al. (2016) conducted a comprehensive study on NPL determinants in the Eastern Caribbean Currency Union (ECCU). Employing panel data analysis and dynamic regression models, they identified both macroeconomic and bank-specific factors influencing asset quality. Their findings underscored the importance of foreign ownership and profitability in mitigating NPL risks, while also highlighting the impact of regional economic trends on banking sector performance.

Beaton et al. (2017) used dynamic panel regressions to analyse the determinants of NPLs using both country data and detailed bank-level data for 16 Caribbean countries. Their results suggested that deteriorating asset quality can be attributed to both macroeconomic and bank-specific factors. These authors found that NPLs are affected by the business cycle: low economic growth weakens asset quality, particularly in tourism-dependent economies. After controlling for endogeneity between NPLs and bank fundamentals, results from similar regressions with a novel bank-level data set also suggest that banks with weaker fundamentals (lower profitability, capital adequacy, and efficiency) also tend to suffer from weaker asset quality.

Wood and Skinner (2018) extended this line of inquiry by examining the broader implications of NPLs for banking stability in the Caribbean. Their research emphasised the systemic risks associated with deteriorating asset quality, emphasising the need for proactive measures to address NPL accumulation and resolution challenges.

Noel et al. (2021) examines the relationship between sovereign credit ratings and non-performing loans (NPLs) in Central America and the Caribbean (CAC). Analysing data from 1999 to 2014 involving 177 banks across 24 countries, the study finds that sovereign rating downgrades anticipate NPL increases, emphasising the significance of understanding sovereign risk's impact on NPL trends. Nations with low foreign currency reserves, limited financial transparency, and weak central bank independence, exhibit heightened effects of sovereign risk spill-overs on NPLs.

Our paper highlights the widespread use of single-equation satellite models by financial institutions and scholars to connect risk parameters at the bank level with macroeconomic and financial variables at the national level. Termed handpicked equations, these models are chosen from a range of options that individually meet economic and econometric criteria for internal risk management or regulatory approval. Institutions can incentivise to select equations that minimise provisioning needs and capital requirements under specific scenarios, while still meeting basic standards of economic and statistical validity. According to Gross and Población (2015), the use of handpicked equations poses two main risks: firstly, the potential for underestimating risk parameter responses to adverse scenarios, leading to insufficient loss absorption capacity; and secondly, the possibility of skewed risk assessments across different portfolios and regions within an institution, affecting both adverse scenario planning and baseline outlooks for business decisions. Additionally, banks with similar risk profiles using different handpicked equations may appear to have varying sensitivities to macroeconomic conditions, contrary to their actual risk dynamics. Conversely, banks with different risk profiles might coincidentally select models suggesting similar sensitivities to macro-financial conditions. To tackle these concerns, we propose adopting satellite model methodologies, such as Bayesian Averaging of Classical Estimates (BACE), for stress test modelling.

An additional reference pertinent to our discussion is Hardy and Schmieder (2011), which advocates for stress testing to involve simple yet robust rules of thumb, particularly in the context of satellite modelling. They emphasise the importance of considering model uncertainty, a principle aligned with our aim of promoting model averaging methodologies to develop simple and robust models.

Methodology and Data

The credit risk model of the Central Bank of Barbados' macro-stress test framework has been revised on the basis of newly-developed specifications for the projections of the NPL ratio for deposit-taking institutions (DTIs). Given that domestic banks follow the Standardised Approach, the probability of default (PD) and loss given default (LGD) are not part of banks' regulatory reporting requirements. Instead, the NPL ratio is projected at bank level based on a set of macroeconomic and financial variables, under the baseline, moderate, and the adverse scenarios defined earlier. Moreover, considering that the NPL ratio at portfolio level would react to different macroeconomic and financial variables, credit risk is estimated separately for mortgages and loans to NFCs.

In both cases, the estimation is based on quarterly bank-by-bank NPL ratios computed from the CBOSS9 reporting, whilst the macroeconomic and financial variables are sourced from the Central Bank of Barbados. The sample considered in the analysis spans from 2013Q1 till 2023Q4.

The NPL ratio is transformed using a logistic transformation to ensure that the projected NPL ratios at the bank level fall in the zero-to-one range for both mortgages and NFCs. This ensures that potential non-linear relationships between the dependent variable (NPL ratio) and the independent variables (macroeconomic and financial variables) in the specifications are captured.

All equations in the model were individually estimated and aggregated in the posterior model space for each segment. Individual equations were formed based on the autoregressive distributed lag model (ARDL) structure, where the dependent variable Y_t is a dependent variable and a function of its own lags as well as contemporaneous, and possibly further lags of a set of predictor variables.

$$Y_t = \alpha + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \sum_{s=1}^{s_i} (\beta_0^k X_t^k + \ldots + \beta_q^k X_{t-q}^k) + \varepsilon_t \qquad (1)$$

A common set of macroeconomic predictor variables cited in the literature are included in the analysis including the rate of growth of GDP, tourist arrivals, the rate of inflation, and unemployment. While non-exhaustive, Bayesian Averaging of Classical Estimates (BACE) is relatively robust to model misspecification, especially in the context of prediction purposes (Hoeting, J.A. et al, 1999). The model selection for the model space follows several criteria to determine the best specification for each model: a relatively high R-square, the Durbin Watson statistics between 1.5 - 2.5, number of significant variables, and a small root-mean-square-error. Additionally, sign restrictions are imposed with respect to the long run multiplier, excluding the equations in the posterior model that do not correspond to the classical economic relations between the variables. Part of multimodal inference is to rank the fitted models based on the standard Bayesian information criterion (BIC).

Furthermore, we set the 85 percent threshold for superior model. In case none of the model is superior, we compute the posterior coefficient mean by weighting individual equations' coefficients by $P(M_i|y)$, which is the BIC. The Bayesian model averaged predictor of y follows:

$$E(\beta|y) = \sum_{i=1}^{I} P(M_i|y)\widehat{\beta}_\iota \qquad (2)$$

where $\widehat{\beta}_\iota$ being the posterior mean under model M_i.

In addition to the parameters of the posterior model, there is a key focus on the likelihood of a specific predictor being incorporated into the model space, known as the posterior inclusion probability. This probability is calculated by summing up the posterior model probabilities that include the specific predictor. It is important to highlight that a predictor variable is considered significant in the posterior model if its corresponding posterior inclusion probability exceeds the prior inclusion probability.

Results

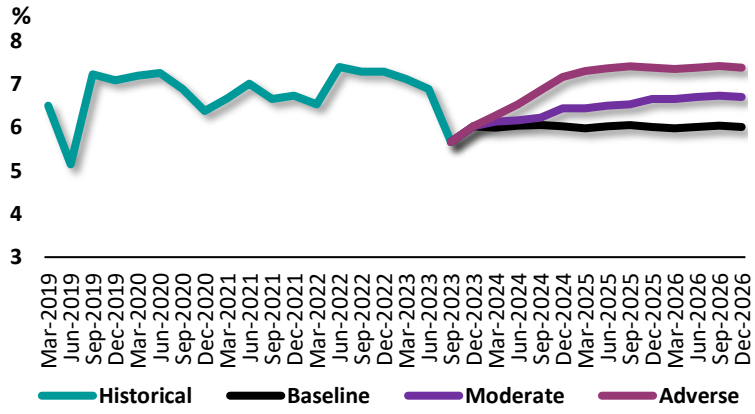
In this study, we explore the dynamics of non-performing loans (NPLs) across various sectors by incorporating lagged effects of both the dependent variables and select economic indicators. Four distinct models were evaluated for each type of NPL: Total NPLs, Mortgage NPLs, NFC (Non-Financial Corporations) NPLs, and personal NPLs. The models integrate immediate and lagged effects of Gross Domestic Product growth, inflation, unemployment, and tourist arrivals, providing an understanding of economic influences on loan performance.

All predictor variables that relate to economic activity (GDP, tourist arrivals) were assigned a negative sign constraint to reflect that an economic downturn should induce NPLs to increase. The opposite holds true for inflation and unemployment, and these variables were assigned a positive constraint.

Given the number of potential predictor variables (4) and the setting for the maximum model dimension (maximum two lags of exogenous variables beyond their contemporaneous inclusion), the number of equations in the model space for each sector equals 24.

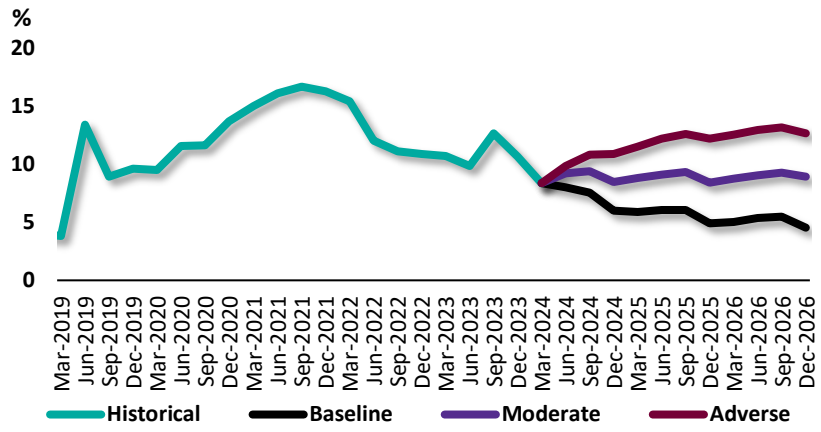
In terms of the structure of the posterior models across the sector, variables that appear more prominently as relevant predictors of NPLs are some measure of real activity, in particular GDP and employment. The model for mortgage NPLs underscores the direct effects of economic growth and tourist arrivals on mortgage NPLs. Economic performance and labour market conditions are integrally linked to the financial health of non-financial corporations (NFCs), with GDP, unemployment, and inflation playing critical roles.

Figure 1: Total Mortgage NPLs



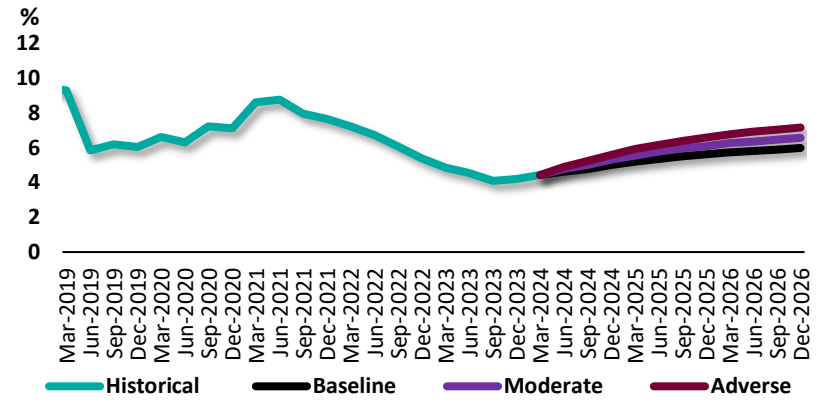
Source: Central Bank of Barbados

Figure 2: Personal NPLs



Source: Central Bank of Barbados

Figure 3: Non-Financial Corporations NPLS



Source: Central Bank of Barbados

Over the next three years, there is a prevailing expectation of a global macroeconomic slowdown, which could lead to detrimental effects on non-performing loans (NPLs) across various key sectors if realised in terms of a slowing in local tourist arrivals. This slowdown could manifest in increased difficulties for borrowers in meeting their repayment obligations, resulting in higher levels of NPLs. Sectors particularly vulnerable to this trend include personal loans (Figure 1,2,3), where borrowers may face challenges in maintaining timely payments due to economic uncertainties.

Conclusion

The study concludes by emphasising the critical role of comprehensive modelling approaches in stress testing frameworks to predict non-performing loans (NPLs) effectively. By integrating Bayesian Averaging of Classical Estimates (BACE) into the satellite models, financial institutions can address the prevalent underestimation of risk parameter responses, thereby enhancing their capacity to absorb potential losses during adverse economic conditions.

Our examination of the dynamic relationships between economic indicators – such as GDP, unemployment, inflation, and even external factors like tourist arrivals and NPLs – highlights the

nuanced ways in which economic shifts impact bank stability. The models demonstrate that while GDP consistently influences NPL outcomes across all categories, the effects of other variables like tourist arrivals and inflation are more pronounced in specific sectors such as mortgages and NFCs loans.

Ultimately, the paper advocates for a methodological refinement in stress testing practices mandated by regulatory standards under frameworks like the Basel accords. By adopting more robust and diversified modelling approaches, banks can better navigate the complexities of financial markets and enhance their resilience against macro-financial shocks. This research contributes to the ongoing dialogue on improving financial stability and offers actionable insights for both policymakers and financial institutions aiming to fortify their risk assessment.

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A Climate Risk Assessment of the Barbadian Financial System

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Abstract

We conduct the first climate risk assessment for Barbados involving the financial system (individual commercial banks, individual finance companies, and the credit union sector as a whole) by adopting a macro-approach. The assessment is completed in two stages: First, we determine the macroeconomic impacts of the climate scenarios by reducing the hotel stock under each scenario, and then, utilising a ratio of hotel capital stock to tourist arrivals, to estimate its impact on GDP growth. Secondly, we determine the impact on the financial system using a Bayesian averaging credit risk satellite model and a dynamic balance sheet stress testing tool. The results indicate that in the face of the most severe scenario (one-in-100-year storm surge), the NPL ratio peaks at 11 percent compared to 7 percent in the baseline scenario and the proxy probability of default almost doubles. Additionally, all but two institutions register losses in the initial year when the climate event occurs. The overall deposit-taking institutions sector remains resilient with a CAR above the 8 percent requirement but measuring 6.4 percentage points below the baseline scenario.

Introduction

Climate change is increasingly a major issue for the financial system. The Basel Committee on Bank Supervision (BCBS) (2020) describes climate-related financial risks as potential risks emanating from climate change that could disrupt institutional and system-wide financial soundness and stability (Basel Committee on Bank Supervision, 2020). The financial system is intricately linked to the climate change agenda through its intermediation function, channelling funds towards the transition of economies to net-zero and away from brown-industries. Bank credit and insurance compensation also play a critical role in economic recovery post-climatic events.

With the prominent threat of increased frequency and intensity of severe climatic events, physical risk is paramount. Assuming no policy action to combat rising global temperatures, it is likely that the severity and frequency of natural disasters will increase. The emanating "damages to facilities, operations, and assets" are referred to as physical risk (Belgrave 2023). With the loss of infrastructure and business operations, an economy loses a significant amount of its productive capacity, which increases counterparty risks for banks. Corporate borrowers lose their revenue generating capacity, while households find themselves with the loss of employment from the

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The views expressed in this thematic article are those of the authors and not necessarily the views of the Central Bank of Barbados.

corporate sector. Together, those impacts result in heightened credit risk manifested as higher non-performing loans, higher loan losses, and higher probabilities of defaults across sectors.

Some central banks around the world (European Central Bank, US Federal Reserve) and key financial stability-related organisations such as the Network for Greening the Financial System (NGFS) have utilised climate risk stress tests to assess the impact of plausible extreme climate events on the macroeconomy and financial sector outcomes. The results of those stress tests indicate the resilience of the respective financial sector to physical climate risk. Despite the Caribbean being one of the most vulnerable related to natural disasters, climate risk assessments from a macroprudential perspective are lacking in the region to date. To contribute to this research gap in the region, we conduct the first climate risk assessment on Barbadian deposit-taking institutions, a precursor for future stress testing work. This climate-risk assessment examines the impact of a one-in-50-year and a one-in-100-year rainfall flooding, wind, and storm surge scenarios on the macroeconomy and the banking sector.

The rest of the paper is organised as follows. In the next section, we review existing literature on the transmission of physical risk to the banking sector, drawing on the experience and guidance of international central banks that have conducted climate-related stress tests. The methodology is presented in Section 3 and the climate scenarios are described in Section 4. The results are provided and discussed in Section 5 and finally, Section 6 concludes.

Literature Review

Climate change is an urgent concern within the realm of financial stability. The physical and transition risks emanating from climate change have the potential to present themselves as traditional bank risks and amplify any existing vulnerabilities within the system (Belgrave, Climate Risk and the Financial Sector, 2023). Assessing the impact of physical risks is extremely relevant as increased intensity and frequency of natural disasters are monumental threats of climate change. Furthermore, results of the economy-wide European Central Bank stress test indicate that the damage from physical risk is much greater than the impact of transition risks, further underscoring the gravity of physical risk (European Central Bank, 2021). Transition risks resulted in a positive 2 percent impact on GDP while physical risk resulted in a 10 percent decline in GDP. The larger impact on GDP mainly stems from the loss of productive capacity across numerous sectors due to physical damage (European Central Bank, 2021). When considering physical risk, geographical location is critical in determining the vulnerability of various economic entities (such as households and corporates) to natural disasters (European Central Bank, 2021). For example, coastal properties would be more vulnerable to a sea level rise climate scenario.

How can those physical risks impact the banking sector? Schüwer, Lambert, & Noth (2019) and Brei, Mohan, Barahona, & Strobl (2023) provide insights on the effects of natural disaster shocks on the banking sector in the US and the Caribbean, respectively. Foremost, physical damage (for example, to housing, inventory, equipment or infrastructure) reduces borrowers' capacity to repay their debts which results in heightened credit risk, probability of defaults, and loan losses. Additionally, banks may also face immediate deposit withdrawals, which dampen liquidity and also choose to limit their exposure to non-financial firms through lower lending or loan sales. Moreover, physical damage is likely to have second round effects through disruptions to transportation, electricity, and supply

chains (OECD, 2018). While Schüwer, Lambert, & Noth (2019) speak to the strengthening of capital ratios post hurricane Katrina, the transmission channels described do not examine the likely increase in the provisioning levels of banks. As the environment becomes riskier after a natural disaster, banks may choose to boost their provisioning against likely loan losses and this has implications for the profitability of banks and in turn, their ability to strengthen their capital buffers. Moreover, Belgrave (2023) speaks to the fact that the occurrence of physical damage can also manifest as heightened claims on the insurance sector.

Deposit-taking institutions in less developed and small countries are more vulnerable to natural disasters since they manage portfolios with greater geographic and sectoral concentration (BCBS, 2010). Moreover, the banking sector in such countries also faces higher counterparty risks because fewer households and firms are insured against weather related damages, lower quality of infrastructure, and smaller social safety nets compared to advanced economies (Lashley, 2012, Bueno et al., 2008, Pelham et al., 2011). Despite its heightened vulnerability, there has been far too little research and action in the Caribbean related to investigating whether deposit-taking institutions can absorb possible damage from various climate scenarios. While Brei, Mohan, Barahona, & Strobl (2023) and Brei, Mohan, & Strobl (2019) were able to decipher the impacts of previous tropical storms and hurricanes in the Caribbean on the banking sector, it is forward-looking assessments such as the climate risk assessment presented in this paper that will allow regulators to identify vulnerabilities in the financial sector and implement corrective action to build resilience before a natural disaster. This stress-testing exercise is also the first of its kind in the Caribbean.

The existing methodological frameworks to assess physical risk rely on: 1. the design of relevant and plausible scenarios for the country (exogenous shocks), 2. translating the climate state in each scenario to quantified impacts on macroeconomic variables, 3. linking the macroeconomic variables to financial outcomes. Reinders, Schoenmaker, & Dijk (2023) and Acharya, et al. (2023) propose the inclusion of feedback effects so that climate stress testing results can capture second-round effects that can amplify the initial shock.

Climate change scenarios for physical risk are generally presented as what if scenarios, whose impacts are compared to a baseline. It is not only important that climate scenarios should be relevant to the country, but also the time horizon of the scenario must be adequate to capture the long-term impacts of the natural disaster shocks (European Central Bank, 2021). The impact on macroeconomic outcomes are estimated within a macroeconomic model, which is then linked to financial outcomes via satellite models as macro-financial linkages are not usually present in the macroeconomic model. Reinders, Schoenmaker and Dijk. (2023), the European Central Bank (2021) and Hallegatte, et al. (2022) completed more comprehensive and advanced climate stress tests that adopt a micro-approach and utilise damage functions to explore the impact of climate scenario at a corporate and sectoral level. In the literature, a damage function is defined as a relationship between a climate variable and an economic variable such as output or productivity (Roson, 2013). Due to data challenges in the Caribbean, this advanced approach cannot be adopted as yet and hence, a more aggregative approach was utilised in this paper. Nonetheless, the dynamic stress testing tool employed in this research allows for sectoral NPL add-ons to capture elevated credit risk in the economic sectors.

The forecasted increase in the frequency and intensity of natural disaster shocks is critical for the financial sector as physical risks have severe negative implications for the macroeconomy and financial outcomes, even more than transition risk. With greater vulnerability for small economies like ours, the Bank has taken the first step in the Caribbean to assess the resilience of deposit-taking institutions to acute climate change-induced events. Effective climate stress testing relies on appropriate scenario design and capturing the resulting macroeconomic and financial outcomes. While those core elements are present in this climate-risk assessment by the Bank, the framework can be further improved by estimating sectoral damage functions used by the European Central Bank (2021) and Hallegatte, et al. (2022), as well as accounting for feedback effects as proposed by Reinders, Schoenmaker, & Dijk (2023).

Methodology

Designing relevant and plausible climate scenarios is at the core of any climate risk assessment. The most recent climate risk profile for the Caribbean highlight increased hurricane intensity and sea level rise among other natural disasters as key realised climate threats for the region (USAID, 2021). Given this, along with greater negative effects of physical risks (European Central Bank, 2021), physical climate stress scenarios are designed for the Bank's stress testing exercise. The climate scenarios of high windfall, rainfall flooding, and storm surges are selected because those climate events are prevalent in the Caribbean and are also the triggering events for the Caribbean Catastrophe Risk Insurance Facility (CCRIF). Moreover, as explained in the stress test results of the ECB, geographical location can amplify the vulnerability to physical risks. In the scenarios designed, coastal properties face extreme vulnerability to storm surges, rainfall flooding, and even on shore winds. One known fact for Barbados is that tourism properties occupy the majority of its coast (Belgrave & Wilson, 2022). The tourism sector is also the principal economic driver of the country, accounting for approximately 12 percent of GDP directly and is estimated to account for as much as 30-40 percent of GDP when indirect and induced effects are considered. With this in mind, we find it appropriate to consider the impact of the climate scenarios on the hotel stock. The climate scenarios solely consider physical risks, implying that there is no climate change policy action by government or financial institutions

This climate risk assessment utilises both the Bank's in-house macroeconomic framework and a dynamic macroprudential stress testing tool for banks' balance sheets. As iterated in the literature review, a key element of a climate stress test is the translation of the climate state to macroeconomic impacts (Reinders, Schoenmaker, & Dijk, 2023). The varying levels of the adverse shock to the hotel stock is applied via the Bank's macro-economic model (hereinafter referred to as the Model). The Model employs a combination of econometrics and an accounting framework in Excel spreadsheets to provide estimates and forecasts of economic activity over both the medium "five-years"- and the long-term horizons (currently up to 2040). The core of the model is built upon the calculation of nominal GDP. In terms of the scenarios, the estimated damage to the hotel stock under each scenario is derived using a probabilistic hazard assessment process. The damage is placed in the Model by assuming a contraction is the supply of rooms, manifested as a commensurate reduction in bed nights and tourism value-added. Utilising a ratio of the hotel capital stock to tourist arrivals, the impact on tourist arrivals is estimated and this has a direct impact on GDP growth and in turn

credit growth within the Model. Further work by the Bank on estimating damage functions will allow us to assess the spill overs on other sectors such as agriculture.

Furthermore, a satellite credit risk model is used to estimate credit risk shocks under each scenario using Bayesian averaging of classical errors. Quarterly NPL ratios are projected based on a set of macroeconomic and financial variables. The potential non-linear relationships between the NPL ratio and the independent variables (macroeconomic and financial variables) are captured through logistic transformation of the NPL ratio. The individual equations were formed using an ARDL model, and the best model specification was selected based on a variety of criteria.

The projected NPL ratios from the satellite model are applied to the DTIs' balance sheet via the dynamic stress testing tool. Noting that there was no significant deterioration in the credit quality of the hotels and restaurant segment after Hurricane Elsa and Tropical Storm Bret (most recent adverse weather events affecting Barbados), an add-on credit shock was not applied to the segment. In addition to the NPL ratios, the scenario-specific GDP growth and credit growth paths from the Model are fed into the dynamic stress testing tool as a severe scenario. The growth of loan stocks and other assets (risk and zero risk-weighted assets) of individual institutions follow the credit growth. Higher provisioning rates and NPL write-off rates are applied under the various climate scenarios, reflecting the worsened recovery of bad loans due to the loss of productive capacity and revenues. This places downward pressure on the profitability of banks. Other profitability measures such as the net interest margin and the change in the non-interest income are also assumed to decline under the climate scenarios due to the elevated credit risk. Non-interest expenses are held constant as the literature only speaks to the operating expenses of corporates increasing due to a natural disaster (European Central Bank, 2021).

Scenarios

The climate risk assessment team at the Bank alongside the Coastal Zone Management Unit (CZMU)[49] of Barbados designed one-in-50-year and one-in-100-year rainfall flooding, windfall and storm surge scenarios. The climate scenarios estimate the impact of infrastructural damage on the demand for the country's tourism product. To simplify the analysis, the percentage loss in the country's hotel stock as a result of a weather-related shock is used to estimate the loss in tourist arrivals. In this instance, the rainfall flooding and wind speed scenarios are classified as moderate scenarios with an estimated reduction of the hotel stock ranging from 4 percent to 9 percent. On the other hand, the storm surge scenarios are classified as severe scenarios and assumes a reduction of the hotel stock between 22 percent and 53 percent. The recovery period depends on the severity of the weather shock and ranges from one year in the least severe wind speed scenario to five years in the case of the severe storm surge scenario. A unique assumption in the severe scenario is that the Government faces significant deterioration of its fiscal position and activates its natural disaster clause.[50]

[49] The Bank extends appreciation to the CZMU team for the provision of critical inputs that facilitated the implementation of this crucial climate-risk assessment.

[50] Barbados' natural disaster clause allows for a two-year deferral of debt payments in the event of a major natural disaster, which can include earthquakes, hurricanes, or heavy rainfall. The natural disaster clause is

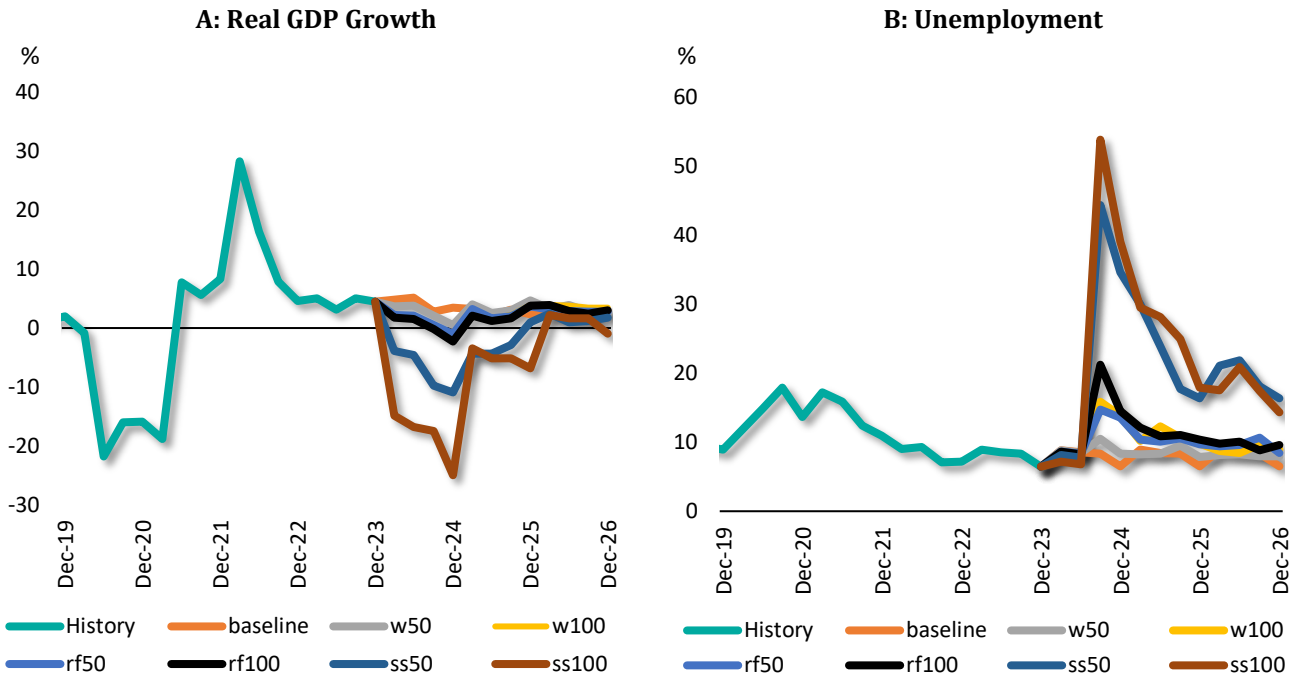
A fall in the hotel room stock resulting from a natural disaster limits the accommodation options for tourists, thereby causing a reduced appetite for the country's tourism product. The reduction in tourism activity also dampens the demand for goods and services in the non-traded sector, which will constrain growth in sectors such as wholesale & retail, transportation, and service industries dependent on tourism, including tour operator activities, motor vehicle renting and leasing, as well as entertainment services.

A fall in GDP as a result of reduced activity in the traded and non-traded sectors creates a domino effect, which will lead to higher unemployment and negatively impact a number of macroeconomic indicators. The contraction in economic activity reduces income levels for individuals and businesses, which erodes tax revenues and widens the Government's fiscal deficit. The combination of reduced growth and increased fiscal deficits results in an expansion of the country's debt-to-GDP ratio. Furthermore, the reduction in tourist arrivals triggers a drop in travel credits, thereby widening the current account deficit and constraining foreign-currency earnings. Credit growth is also likely to decrease as consumers and businesses become less inclined to borrow during crisis periods. Additionally, a decline in GDP (Figure 1A) often leads to increased defaults on loans as individuals and businesses struggle to settle outstanding debt obligations during economic downturns. Consequently, this failure results in a rise in non-performing loans (NPLs) for banks, which puts pressure on their balance sheets and potentially causes financial instability if not managed effectively. The results and macroeconomic linkages from the climate risk scenario are presented in Table 1.

Generally, in the scenarios, economic downturns are experienced in the first four quarters and then recovery ensues as a result of rebuilding efforts. GDP contractions in the wind and rainfall flooding fall slightly below the baseline, and then return to the economic growth path. As expected, the macro economic shocks are more severe in the storm surge scenarios as a substantial amount of the hotel stock is damaged. In the SS100 event, GDP is forecasted to contract by 25 percent in December 2024, a slightly larger contraction than during the pandemic.

applied when the country receives an insurance policy pay-out from the Caribbean Catastrophe Risk Insurance Facility, which is set at US$5 million for an earthquake or rainfall event and at US$7.5 million for hurricanes.

Figure 1: Real GDP Growth and Unemployment



Source: Authors' Calculations

Table 1: Summary of Scenario Design and Results

	Scenario	2019 Value of Capital Stock BDS M$	2024 Value of Capital Stock after Natural Disaster	% Change in Capital Stock & Tourist Arrivals	Recovery Period	2024 Results Post-Shock versus Baseline*
Moderate Scenarios	Wind 50 year (W50)	3,280.2	3,154.7	4%	1 year	GDP growth slows by 1.5 percentage points (pp), primary surplus (%GDP) falls by 0.1 pp, debt-to-GDP increases by 1.4 pp, external current account worsens 6.6%, credit growth slows by 0.36 pp.
	Wind 100 year (W100)	3,280.2	3,006.4	8%	2 years	GDP growth slows by 3.1 pp, primary surplus (%GDP) falls by 0.3 pp, debt-to-GDP increases by 3.0 pp, external current account worsens, credit growth slows by 0.75 pp.
	Rainfall Flooding 50 year (RF50)	3,280.2	3,020.9	8%	2 years	GDP growth slows by 3.1 pp, primary surplus (%GDP) falls by 0.3 pp, debt-to-GDP increases by 3.0 pp, external current account worsens by 13.7%, credit growth slows 0.74 pp.
	Rainfall Flooding 100 year (RF100)	3,280.2	2,989.8	9%	2 years	GDP growth slows by 3.5 pp, primary surplus (%GDP) falls by 0.4 pp, debt-to-GDP increases by 3.4 pp, external current account worsens by 14%, credit growth slows 0.85 pp.
Severe Senarios	Storm Surge 50 year (SS50)	3,280.2	2,550.9	22%	4 years	Percentage change in GDP contracts by 11.3 pp, primary surplus (%GDP) falls by 1.6 pp, debt-to-GDP increases by 13.7 pp, external current account worsens by 28%, percentage change in credt declines by 2.72 pp.
	Storm Surge 100 year (SS100)	3,280.2	1,547.4	53%	5 years	Percentage change in GDP contracts by 22.6 pp, primary surplus (%GDP) falls by 5.2 pp, debt-to-GDP increases by 27.7 pp, external current account worsens 89.8%, percentage change in credt declines by 5.48 pp.

Source: Coastal Zone Management Unit and authors' calculations

Results

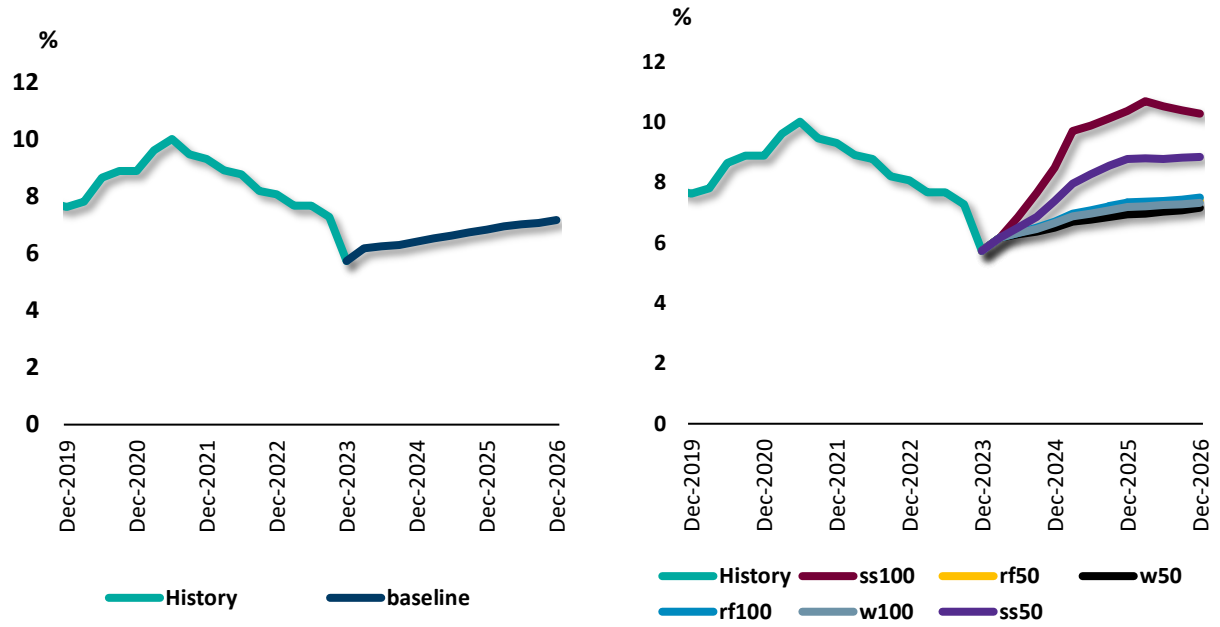
The Bank conducted its first ever climate risk assessment, assessing the potential impact of various climate change scenarios on the balance sheet of DTIs. Climate risk persists as a critical issue for financial stability. Barbados' hotel stock is positioned at the forefront of the climate crisis, as it is primarily situated along the island's coast and is poised to suffer significant damage in the event of climate change-induced events such as rising sea levels. The physical damage of the hotel stock would have negative implications for Barbados' core economic driver, tourism, which could manifest as impaired collateral value and asset quality for DTIs. In view of this, the principal aim of this exercise is to investigate DTIs'[51] resilience in the face of climate change-induced events. That is, whether DTIs are adequately capitalised to absorb losses emanating from the various climate scenarios.

Credit quality deteriorates during the climate scenarios. Damage to the hotel stock impairs borrowers' balance sheet as hotel operators lose their means of generating revenue and households lose their source of income. In the baseline scenario, the NPL ratio is expected to follow a gradual increase to 7.2 percent (Figure 2A). In the moderate scenarios, the NPL ratio is projected to increase to only slightly above the baseline while rising at a much faster pace in severe scenarios (Figure 2B). The severe scenario is characterised by an average peak unemployment rate of 49.1 percent and an NPL ratio of approximately 10.3 percent, which is on par with the peak of 10 percent recorded during the pandemic. This ratio has the potential to be lower if a forbearance policy is implemented as was the case during the pandemic.

Figure 2: NPL Ratios

A: Baseline **B: Climate Scenarios**

[51] The credit union sector was not stressed by institution but as an aggregate.



Source: Authors' Calculations

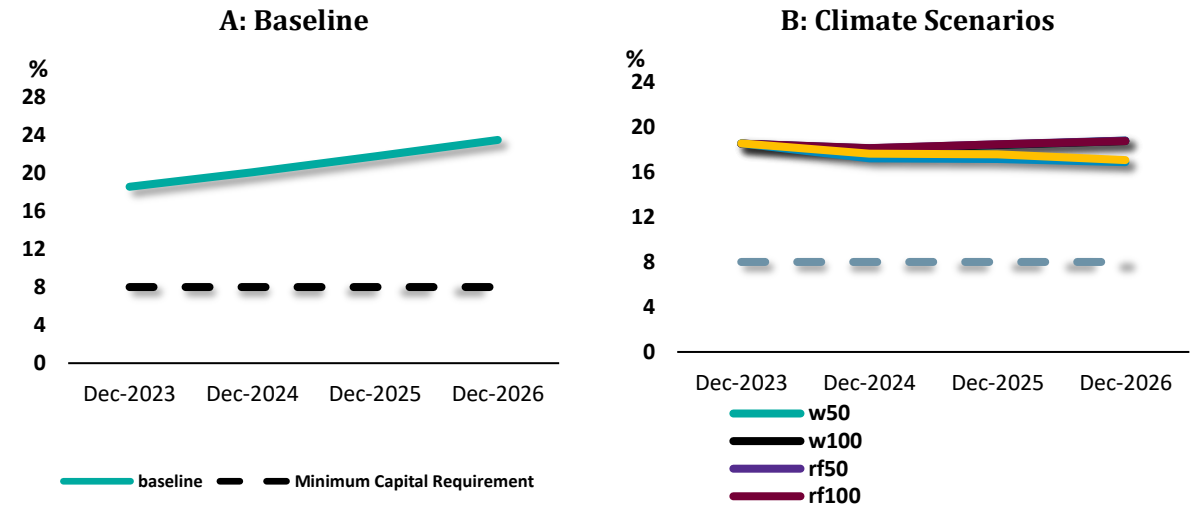
Loan loss provisions increase significantly during the severe climate scenarios. As economic conditions worsen after climate shocks, borrowers' likelihood of default increases. The proxy probability of default utilised in the climate risk assessment rose from 1.3 percent in the baseline to 1.8 percent in moderate scenarios and 2.4 percent in the severe scenarios. With the deterioration of credit quality during the climate scenarios, it is expected that more NPLs will end up in the more-provisioned (based on IFRS 9 expected credit loss provisioning) NPL categories of doubtful and loss. The results of this climate-risk assessment indicate that the stock of provisions more than doubles in the least severe scenario (w50) and more than triples in the most severe scenario (ss100). Additionally, the increase in loss loans is expected to trigger greater write-offs as the existing regulation states that loss loans need to be written-off within three months. Consequently, the write-off rate is shocked by 15 percent in the moderate climate scenarios and 20 percent in the severe scenarios.

Heightened provisions and lower credit growth during the initial economic downturn negatively impacted the profitability of the sector. Interest income accounts for the majority of the institutions' revenue and hence in periods when credit contracts, their profitability is adversely affected. In line with the initial contraction of credit during the first four quarters of all scenarios, all institutions except two face losses despite recording profits in the initial period. However, as the economy returns to recovery, and credit expands due to rebuilding efforts, profitability of the sector improves.

Ultimately, the results show that the overall DTI sector is resilient, but a combination of weak profitability and low credit quality pre-shock can reduce resilience. The overall DTI sector remained resilient across all climate scenarios with the sector's ending CAR reaching 17.6 percent in the most severe scenario of ss100 (Figure 3A and 3B). From the first year, one institution fell below the minimum capital adequacy requirement of 8 percent. This institution began the exercise with

below-average profitability and credit quality when compared to other DTIs. In the last year, an additional institution also falls below the requirement. Those two institutions would require a capital injection of 0.4 percent of GDP.

Figure 3: Capital Adequacy Ratios



Source: Authors' Calculations

Conclusion

Climate risk, especially physical risk, is expected to remain a critical financial stability issue. Physical risk has significant repercussions for the Barbadian economy, especially for the hotel stock, which is primarily positioned along the coastline. Damage estimates from the CZMU range from 4 percent to 9 percent in moderate scenarios and 22 percent to 53 percent in the severe scenarios. In line with this, GDP contracted more negatively in the severe scenarios ranging between an 11.6 percent and 22.6 percent contraction.

Results from a satellite credit risk model indicate that credit quality measures significantly worsen during and post climatic scenarios, with the NPL ratio reaching a peak of 10.3 percent and taking relatively longer to return to the baseline trajectory. Additionally, the probability of default almost doubles in the severe scenario, requiring institutions to hold more than three times the provisioning levels than in the baseline scenario.

With such implications, policymakers must consider mitigative policy actions such as the forbearance policy, which was implemented during the pandemic to ease the costs of poor credit quality. Nonetheless, the results indicate that the overall DTI sector remains resilient, maintaining a CAR above the requirement, but institutions with weak profitability and credit quality pre-shock are the most vulnerable. This also signals to policymakers the need to examine the resilience of individual institutions and not just the overall sector. The Central Bank of Barbados plans to continue improving the methodology applied in its climate risk assessments, expanding its scope to include the insurance sector, feedback effects, and other satellite models.

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Appendix A: Macroeconomic Stress Testing Methodology

Following the IMF 2023 Technical Assistance recommendations, the macroeconomic stress test framework has been implemented on the basis of newly developed specifications for the projections of the sectoral NPL ratio for deposit-taking institutions' (DTIs): commercial banks, finance companies, and credit unions.[52] The stress test tool uses existing accounting, tax, and regulatory rules for DTIs. In particular, the projected loan loss provisions were based on the IFRS 9 Expected Credit Loss concept. These provisions entail time-varying provisioning rates across various credit quality classes of loans. Such rates increase during periods of economic downturns and decrease during periods of economic prosperity. This dynamic reflects an additional channel through which adverse economic conditions impact DTIs. Furthermore, adherence to the definition of regulatory capital for banks, including the limits on the inclusion of selected Tier 2 items (such as general provisions), is ensured. This encompasses compliance with distinct minimum capital adequacy ratio levels for Tier 1 and total regulatory capital. For credit unions, capital adequacy is assessed using the minimum Tier 1 Leverage ratio (total capital as a percentage of non-risk weighted assets) of 4 percent, consistent with Basel standards. Finally, the stress test tool includes both corporate income tax and the recently introduced tax on assets.

The stress test framework is based on explicit calibrated macroeconomic scenarios – one baseline and two adverse. The baseline scenario reflects the Bank's most recent macroeconomic forecast, while two adverse scenarios (titled "moderate" and "severe") were calibrated to capture different intensities of an economic recession. The macroeconomic projection framework that was used for the baseline scenario includes various interlinkages among key macroeconomic variables and economic sectors, which ensures internal consistency and was used to project macroeconomic variables at a quarterly frequency for the next three years (2024-2026). The scenario-specific macroeconomic projections were used to predict non-performing loans (NPLs) via a sectoral credit risk satellite models for banks, finance companies, and credit unions. For each sectoral institution, the absolute change in the projected aggregate NPL ratio is applied onto the starting NPL ratio level in each of the loan segments. Using absolute rather than relative changes ensures that even institutions with a 0 percent starting level of the NPL ratio in some loan segments are hit by new NPLs in times of adverse economic developments.

In addition to the NPL ratio, the stress test tool projected the special-mention-to-performing loans ratio for each institution and each segment. Banks and finance companies use IFRS 9 to create provisions and provisioning rules are different for the three IFRS 9 credit quality "stages". As the breakdown by IFRS 9 stages is not currently collected by the Bank, the stress test tool approximates the provisioning with the credit quality classes reported to the Bank by banks (good/pass loans represent the Stage 1, special mention loans represent Stage 2, and non-performing loans represent Stage 3). In times of adverse economic conditions, the proportion of special mention (Stage 2) loans in performing loans typically increases, too, along with the NPL ratio. Instead of estimating a separate model, the projection for special-mention-to-performing loans ratio is linked to the projection of the NPL ratio, using an elasticity specified as a parameter that is set by expert judgment. The loan growth projection calibrated as part of the scenario and, for simplicity, applied

[52] The stress test was used separately for commercial banks/finance companies and credit unions.

equally across all loan segments and institutions, would then jointly with the credit risk projections (NPL ratio, special-mention-to-performing loans ratio) determine the paths of the good, special mention, and non-performing loan exposures.

Projection of loan loss provisions is based on the assumptions about the provisioning rates for the three credit risk classes, approximating the IFRS 9 Expected Credit Loss (ECL). The NPL provisioning levels are institution- and segment-specific, constructed for each year of the horizon as the starting NPL provisioning rate of the institution in that segment plus an assumed increase of around 10-20 percentage points (cumulative) in both adverse scenarios (typically no change from the starting level for the baseline scenario). This shock reflects a worsened recovery of bad loans, for example due to a decrease in the value of collateral. This change of the NPL provisioning level is then used as a proxy for a change in the Loss Given Default (LGD), which is needed to approximate the changes in provisioning for Stage 1 (one-year ECL) and Stage 2 (lifetime ECL) loans. The other key credit risk parameter needed for the ECL is the probability of default (PD), which is – as a proxy – derived from the NPL ratio projections, assuming a particular level of NPL write-offs. The changes in PD and LGD are then used jointly to project changes from the initial provisioning rates for Stage 1 and Stage 2 loans, with an additional expert adjustment using a pre-defined (and changeable) passthrough elasticity to safeguard relatively smooth changes over time. Provisions created for good loans are considered general provisions and qualify as Tier 2 regulatory capital up to 1.25 percent of credit risk-weighted assets, in line with Basel standards. Final loan loss provisions impacting the P&L are derived from the projected stocks, considering scenario- and year-specific NPL write-offs. These are calibrated by expert judgment using the information about past write-offs in the banking sector.

A shock to NPL provisioning rate (which serves as a proxy for the loss given default, LGD) of 10 percentage points in the moderate scenario and of 20 percentage points in the severe scenario was assumed and applied in the first period of the horizon (the increased NPL provisioning rate was kept for the next two years). On average, the starting NPL provisioning was 5.3 percent (end-2023). For the severe scenario, these rates increase to about 33 percent. The NPL write-off rate was set to equal 10 percent for the baseline, 15 percent for the moderate, and 20 percent for the severe. The assumed increase in the NPL write-off rate was in keeping with the severity of the economic recession and reflects the regulation that requires banks to write off loans that are in the loss category (i.e., more than 360 days past due).

No market risk impact is assumed. This reflects the common practice of banks in Barbados to not mark-to-market the securities held in their balance sheets to account for market interest rate developments. Banks hold government securities, which are an important source of interest income, but they are not revalued.[53] For the foreign exchange risk, the long-standing peg of the Barbadian dollar to the US dollar virtually removes the exchange rate risk in the institutions' balance sheets and was thus not considered an item to be stressed.

Pre-provision income is projected as a sum of net interest income and non-interest income minus non-interest expenses, serving as the first line of defence against credit losses. Net interest income is a product of the institution-specific net interest margin (defined as the initial ratio of net interest income to interest bearing assets adjusted for a possible haircut in adverse scenarios)

[53] Licensees report the book value of investments (foreign and local) to the Bank.

and scenario-specific interest-bearing assets, which typically decline in adverse scenarios amid the migration of performing loans to NPLs. Non-interest income and expenses are projected to be a product of the institution-specific starting point and a haircut set by expert judgment. The net interest margin was assumed to remain at the initial institution-specific levels, but the underlying interest-bearing assets are in general, lower in the adverse scenarios, leading to a lower net interest income. This is driven mainly by the evolution of performing loans (which decline given their move to the NPL category), as the additional asset items that might bring interest income such as debt securities, reserves at the Bank (for commercial banks), and claims on banks were assumed to remain at initial levels. The non-interest income was assumed to remain at the previous year's level in the baseline and then drop by 5 percent and 10 percent in the moderate and the severe scenarios, respectively. Non-interest expenses are assumed to remain stable in all scenarios.

Capital is projected consistently with the existing regulatory framework, changing over the horizon as a function of net income. Negative net income – accounting losses – decreases capital, while positive net income is first subject to the distribution decision so that only the retained part (after the dividend pay-outs) is topping up the capital. The assumptions about dividend pay-outs are institution-specific, reflecting their typical dividend pay-out behaviour. Banks do not *typically* pay dividends, so this parameter was set to zero.

Total assets are projected as the sum of time-varying net loans and other financial assets, while credit risk-weighted assets (RWAs) are projected as a function of net exposures and the initial average risk weight. RWAs for market and operational risk were kept constant. Total assets and also RWAs will thus be driven by credit growth, the evolution of the NPL ratio, and provisioning, and both would typically decline in adverse scenarios amid very low or negative gross credit growth, migration of a large part of loans to NPLs, and higher average NPL provisioning, bringing the net value of loans down.

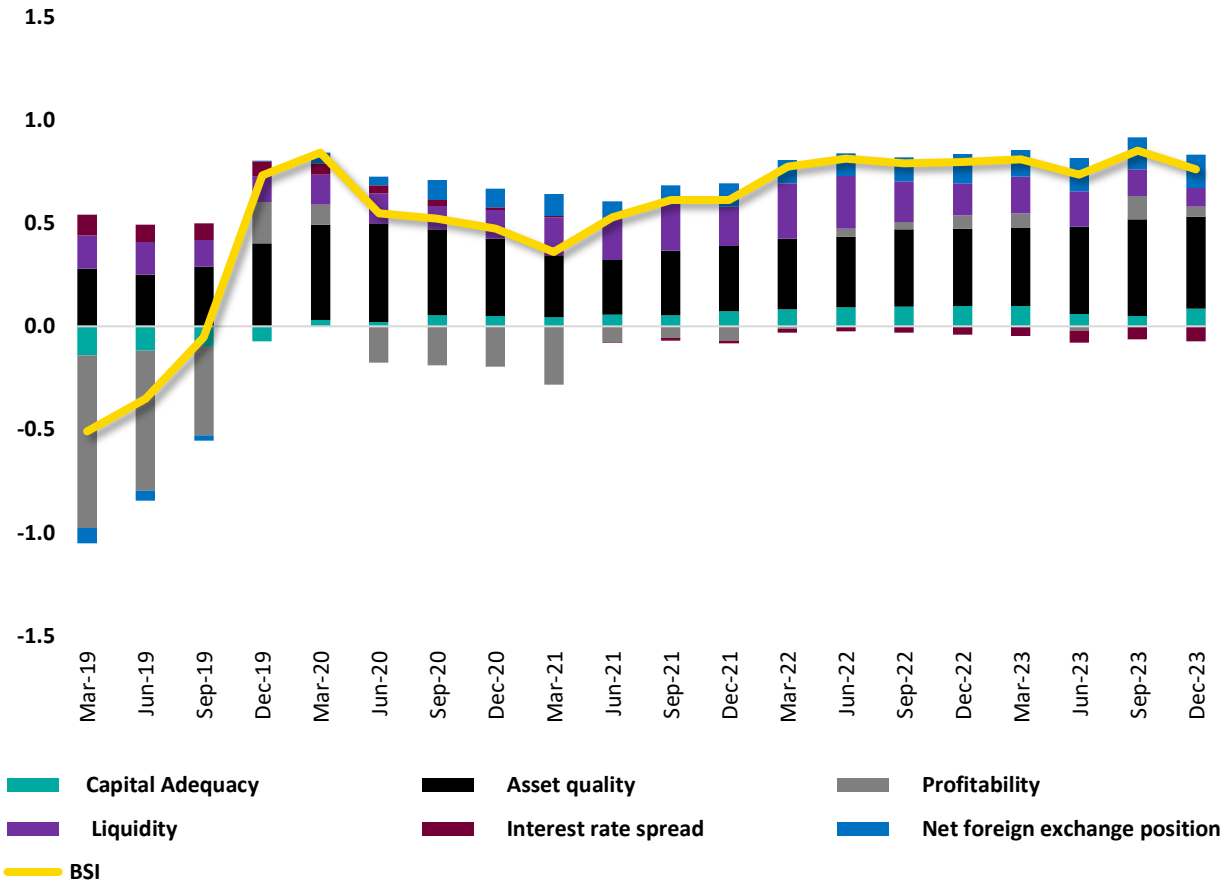
The tool reports the key results based on capital ratios. Apart from the scenario-specific evolution of the capital adequacy ratio for banks and finance companies, the tool shows the factors that contribute to the changes in the capital (adequacy) ratio such as net interest income (+), other income/expenses (+/-), credit losses (-), dividend pay-outs and taxes (-), and the change in the denominator of the ratio, that is, (risk-weighted) assets (+/-). Also, a number of institutions in each year and scenario that are below a specified hurdle rate for the total capital (adequacy) ratio (and Tier 1 ratio for banks) and their share in the sector's assets is reported, together with capital injections (expressed as a percentage of GDP) that are needed to bring all institutions to at least the minimum capital (adequacy) ratio.

Appendix B: Macroprudential Indicators

Banking Stability Index (BSI)

Despite improvements in NPLs and ROA during 2023, the Banking Stability Index (BSI) declined marginally. The BSI, a composite indicator of bank performance, reflects the stability of the financial system. With lower NPLs, the asset quality component recorded the largest improvement. In contrast, the liquidity, return on equity, and interest rate spread were all lower relative to the end of 2022 and this resulted in the BSI score declining slightly from 0.85 in 2022 to 0.76 at end 2023 (Figure B1).

Figure B1: Partial Indicators for Banking Stability Index



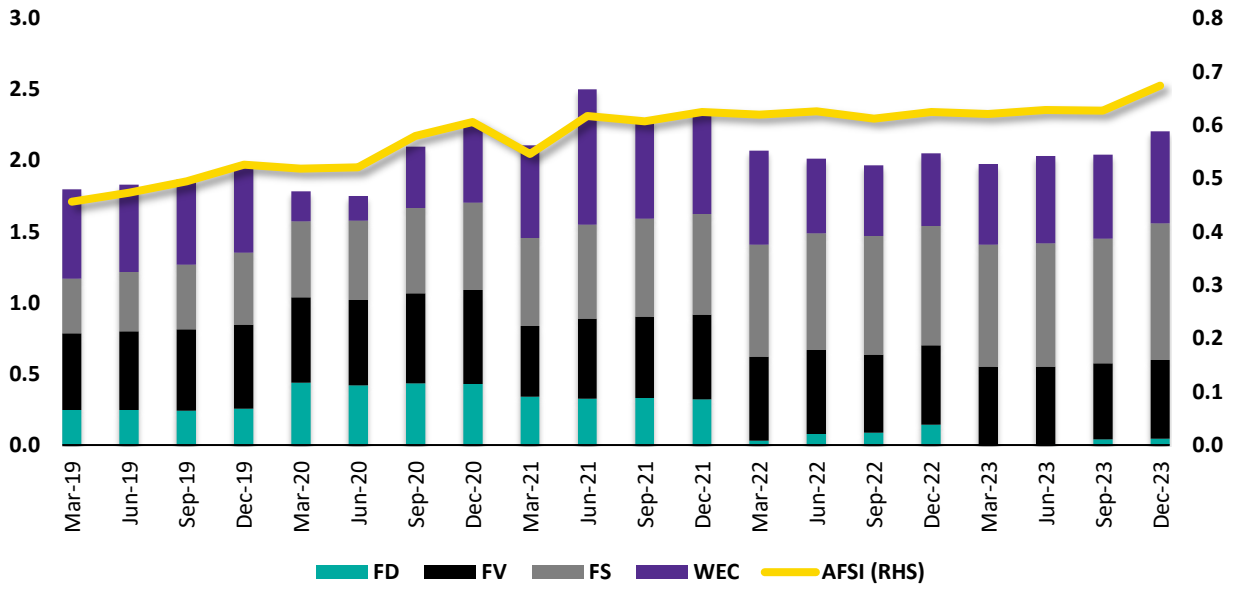
Source: Central Bank of Barbados

Aggregate Financial Stability Index (AFSI)

The Aggregated Financial Stability Index (ASFI) is a composite measure evaluating the stability of the commercial banking sector. It is derived as a weighted average of normalised macroeconomic and financial statement variables, with four key sub-indices: financial development (FD), financial vulnerability (FV), financial soundness (FS), and the world's economic climate (WEC). Each variable is normalised so that an increase denotes an improvement in financial stability. The sub-indices are equally weighted, and the ASFI is a weighted sum of these variables.

Figure B2 illustrates that the ASFI improved in 2023, particularly in the final quarter. This enhancement was driven by steady global economic growth, reduced volatility in the US stock market, better non-performing loan ratios, and stronger capital positions of local banks. Given this, movements in the WEC and FS sub-indices were the major contributors to the progress in the AFSI. The ASFI averaged 0.64 in 2023, up from an average of 0.62 in 2022, while the WEC and FS sub-indices averaged 0.55 and 0.82, respectively, in 2022 compared to 0.60 and 0.89, respectively, in 2023.

Figure B2: Aggregate Financial Stability Index



Source: Central Bank of Barbados

Appendix C: Financial Development Indicators

Table C1: Key Indicators of the Structure of the Financial System

	2017	2018	2019	2020	2021	2022	2023
Number of:							
Total DTIs	46	45	43	42	41	38	37
Commercial Banks	5	5	5	5	6	6	6
Finance Companies	8	12	9	8	7	6	4
Credit Unions	33	33	33	32	32	29	27
Insurance Companies	23	22	22	22	20	20	20
Life	7	7	7	6	6	6	6
Non-Life	16	15	15	16	14	14	14
Pension Plans	287	274	260	261	251	248	245
Mutual Funds	16	16	16	16	18	19	19
Assets to Total Financial System Assets (%)							
Total DTIs	67.9	66.6	65.4	65.5	64.7	66.7	65.2
Commercial Banks	53.0	52.4	51.2	51.0	50.2	51.8	50.7
Finance Companies	6.2	4.2	3.9	3.8	3.8	3.9	3.6
Credit Unions	8.7	10.0	10.3	10.8	10.7	11.0	10.9
Insurance Companies	14.1	14.3	14.4	14.6	13.9	13.5	14.1
Life	9.9	10.1	10.3	10.6	10.1	9.9	11.1
Non-Life	4.2	4.2	4.1	4.0	3.8	3.7	4.0
Pension Plans	9.1	10.2	10.5	10.3	11.2	10.1	9.8
Mutual Funds	8.8	8.9	9.6	9.6	10.2	9.7	9.9
Assets to GDP (%)							
Total DTIs	171.7	157.0	153.0	177.7	179.3	158.4	147.5
Commercial Banks	134.7	123.5	119.5	138.1	139.1	122.9	114.7
Finance Companies	14.9	9.9	9.3	10.4	10.4	9.3	8.1
Credit Unions	22.1	23.6	24.3	29.3	29.8	26.2	24.7
Insurance Companies	35.9	34.0	34.2	40.4	39.4	32.9	34.3[p]
Life	25.3	24.1	24.4	29.4	28.6	24.0	25.2[p]
Non-Life	10.6	9.9	9.8	11.0	10.8	8.9	9.1[p]
Pension Plans	23.3	24.2	24.9	28.8	31.8	26.5	22.1[e]
Mutual Funds	22.6	21.1	22.9	26.7	29.0	23.4	22.5
Memo:							
Credit Union Membership (000's)	195	206	216	222	228	235	240
Pension Plans Membership (000's)	28	29	26	24	28	27	27

Sources: Central Bank of Barbados and Financial Services Commission

p – Provisional

e – Estimate

Table C2: Key Indicators of the Payments System

$ Millions	2017	2018	2019	2020	2021	2022	2023
RTGS Transactions	36,781	27,001	11,668	14,771	15,488	16,163	18,092
ACH Transactions	19,584	19,559	19,293	17,268	19,710	24,566	26,274
Cheques	17,343	17,151	15,573	11,412	10,198	12,079	11,910
Direct Payments	2,241	2,408	3,719	5,855	9,512	12,487	11,715
Debit Card Transactions	1,197	1,248	1,324	1,223	658	N/A	N/A
ATM Transactions	660	675	698	611	329	N/A	N/A
Debit Card POS Transactions	537	573	626	612	328	N/A	N/A
Credit Card Transactions	725	717	739	646	726	967	1,116
Personal Sector	615	607	604	520	574	737	847
Business Sector	110	110	135	126	152	230	270
Currency in Circulation Outside of Commercial Banks and Finance Companies	599	626	656	736	799	808	843

Source: Central Bank of Barbados

N/A – Not Available

Appendix D: Financial Soundness Indicators

Table D1: Financial Soundness Indicators – Commercial Banks

	2017	2018	2019	2020	2021	2022	2023 Q1	2023 Q2	2023 Q3	2023 Q4
Solvency Indicators (%)										
Capital adequacy ratio (CAR)	17	13.8	13.5	16.0	16.8	17.6	18.4	18.6	18.7	20.9
Leverage ratio	8.6	7.5	7.0	9.5	9.9	10.5	11.0	11.0	11.1	12.6
Non-performing loans net of provisions to capital	7.4	14.8	16.3	11.6	11.4	11.1	10.8	10.6	9.1	9.2
Liquidity Indicators (%)										
Loan-to-deposit ratio	74.8	63	61.7	57.1	53.0	53.1	52.2	52.2	53.7	54.3
Transferable deposits to total deposits	90.1	92.3	94.8	95.9	96.3	97.0	97.1	97.0	97.3	97.2
Transferable deposits to total deposits (Domestic currency)	91.5	92.7	94.9	95.9	96.4	96.9	97.0	97.1	97.3	97.3
Liquid assets to total assets	29.7	25.9	26.0	27.4	31.1	32.0	32.6	32.5	31.7	30.8
Liquid assets to total assets (Domestic currency)	32.6	26.1	21.8	25.4	28.8	28.9	30.0	30.3	28.8	28.1
Liquid assets to transferable deposits	43.0	34.0	28.1	31.9	35.8	36.1	37.0	37.7	36.1	35.3
Credit Risk Indicators (%)										
Total loans	1.4	-0.7	-0.6	-2.1	-2.1	6.2	6.7	6.8	5.7	2.7
NPL ratio	7.7	7.4	6.6	7.3	7.4	5.9	5.7	5.5	4.9	5.0
Substandard loans to total loans	6.1	5.7	5.2	5.5	5.7	4.9	4.8	4.5	4.2	4.2
Doubtful loans to total Loans	0.8	0.9	0.5	1.3	1.0	0.6	0.5	0.5	0.4	0.4
Loss loans to total loans	0.8	0.8	0.9	0.5	0.6	0.4	0.4	0.5	0.3	0.3
Provisions to NPLs	80.4	67.3	59.4	62.0	60.3	50.8	51.2	49.3	50.6	50.3
Foreign Exchange Risk Indicators (%)										
Foreign-currency loans to total loans	4.4	4.0	2.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3
Foreign-currency deposits to total deposits	8.1	6.8	6.7	8.0	7.8	8.9	9.8	9.1	9.2	8.8
Liquid assets to transferable deposits (Foreign currency)	90.7	73.1	140.8	96.2	92.8	85.9	78.9	77.2	83.2	83.5
Profitability Indicators (%)										
Return on equity	11.1	-2.1	5.1	6.9	9.9	11.5	11.8	12.4	17.6	15.7
Return on average assets	1.3	-0.2	0.6	0.8	1.1	1.3	1.3	1.4	2.0	1.8
Net interest margin	5.2	5.3	5.7	4.9	4.5	4.8	4.8	4.8	4.8	4.8
Interest rate spread	5.8	6.0	6.1	5.7	5.6	5.5	5.2	5.2	5.2	5.1

Source: Central Bank of Barbados

Table D2: Financial Stability Indicators (FSIs) – Finance Companies

	2017	2018	2019	2020	2021	2022	2023 Q1	2023 Q2	2023 Q3	2023 Q4
Solvency Indicators (%)										
Capital adequacy ratio (CAR)	38.8	21.8	18.4	19.3	19.0	19.8	21.0	20.3	20.5	20.7
Leverage ratio	22.0	11.5	11.2	12.1	12.4	12.8	14.4	13.9	13.7	14.1
Non-performing loans net of provisions to capital	11.8	24.5	43.0	42.5	63.1	51.2	45.0	42.5	44.7	42.1
Liquidity Indicators (%)										
Loan-to-deposit ratio	103.2	97.3	97.2	103.0	100.6	107.8	114.0	113.1	113.5	119.8
Transferable deposits to total deposits	18.6	1.4	2.6	3.7	5.6	5.1	5.4	6.2	7.0	3.4
Transferable deposits to total deposits (Domestic currency)	18.4	1.3	1.6	2.4	2.1	2.9	2.7	2.7	2.8	2.5
Liquid assets to total assets	19.3	13.7	12.9	11.9	13.3	18.0	14.8	13.9	15.1	13.7
Liquid assets to total assets (Domestic currency)	17.7	12.2	9.7	8.8	6.9	12.7	8.9	8.6	10.6	8.8
Liquid assets to transferable deposits	170.0	1382.0	678.2	459.3	332.0	544.7	478.6	468.2	589.9	554.5
Credit Risk Indicators (%)										
Total loans	(1.7)	(25.0)	(0.0)	1.8	1.8	3.1	3.4	1.2	1.5	-0.1
Non-performing loans ratio	9.4	8.4	11.3	11.7	16.1	14.1	12.5	12.2	12.8	12.2
Substandard loans to total loans	6.4	6.8	8.9	9.3	13.3	11.8	10.7	10.3	6.8	10.3
Doubtful loans to total loans	0.8	0.6	0.6	0.9	0.7	0.3	0.3	0.6	4.4	0.6
Loss loans to total loans	2.3	1.0	1.7	1.5	2.0	2.0	1.5	1.3	1.6	1.4
Provisions to NPLs	44.9	31.0	26.0	24.1	24.0	26.1	26.1	28.1	27.1	26.5
Foreign Exchange Risk Indicators (%)										
Foreign-currency deposits to total deposits	1.4	0.2	1.3	1.7	5.1	3.0	3.1	4.0	4.6	1.4
Liquid assets to transferable deposits (Foreign currency)	2189.3	2528.1	486.7	360.0	266.1	369.2	363.9	258.0	198.0	893.0
Profitability Indicators (%)										
Return on equity	4.4	2.6	9.1	5.3	6.8	8.5	8.4	7.7	7.2	7.4
Return on average assets	1.2	0.4	1.2	0.7	1.0	1.2	1.2	1.1	1.1	1.1
Net interest margin	4.7	4.7	4.5	4.5	4.4	4.6	4.5	4.4	4.4	4.8
Interest rate spread	4.7	4.4	4.5	4.3	4.2	4.2	4.0	3.9	3.9	4.0

Source: Central Bank of Barbados

Table D3: Performance Indicators – Credit Unions

	2017	2018	2019	2020	2021	2022	2023
Solvency Indicators (%)							
Total capital to total deposits	14.3	13.7	13.0	12.6	12.8	12.9	12.9
Total capital to total assets	12.2	11.8	11.3	11.0	11.1	11.2	11.2
Total NPLs on total capital	47.0	53.3	58.1	76.7	73.0	73.6	73.7
Total NPLs net of provisions to total capital	32.7	37.7	41.2	58.7	50.1	50.3	54.5
Liquidity (%)							
Liquid assets to total assets	5.7	10.0	14.0	17.7	17.6	15.3	14.5
Liquid assets to total deposits	6.6	11.6	16.1	20.3	20.3	17.7	16.7
Total loans to total deposits	86.7	81.9	78.3	73.4	73.2	74.6	74.6
Credit Risk Indicators (%)							
Total loans to total assets	74.4	70.8	68.2	64.0	63.5	64.7	64.7
Total NPLs to total loans	7.7	8.9	9.6	13.2	12.8	12.7	12.8
Total NPLs net of provisions to total loans	5.4	6.3	6.8	10.1	8.8	8.7	9.4
Provisions to total NPLs	30.4	29.3	29.2	23.4	31.4	31.7	26.0
Provisions to total loans	2.4	2.6	2.8	3.1	4.0	4.0	3.3
Profitability Indicators (%)							
Return on average assets	1.2	0.9	0.9	0.7	0.7	0.8	0.5
Interest margin to gross income	63.9	62.0	68.4	67.4	65.2	67.5	65.6
Growth Indicators (%)							
Total assets	8.7	9.6	7.5	7.3	5.3	4.6	2.9
Total deposits	9.4	10.4	8.3	7.6	4.8	4.4	2.8
Total loans	6.3	4.2	3.5	0.8	4.4	6.0	2.8

Source: Financial Services Commission

Table D4: Performance Indicators – General Insurance

	2017	2018	2019	2020	2021	2022	2023
Capital Adequacy (%)							
Net prem. to capital	80.9	114.1	143.6	135.5	83.6	112.3	91.7
Capital-to-assets ratio	26.2	20.4	17.2	17.8	27.9	21.7	26.3
Capital-to-liabilities ratio	35.6	25.7	20.8	21.7	38.8	27.8	35.7
Asset Quality (%)							
Equities to total assets	4.4	5.0	3.9	4.8	7.9	7.9	7.3
Receivables to (GPW and Rein. Recoveries)	17.7	17.4	15.1	16.1	18.3	15.1	15.0
Reinsurance and Actuarial Issues (%)							
Rein. ceded to GPW	51.5	52.1	50.5	53	53.4	55.9	56.2
Earnings & Profitability (%)							
Loss Ratio	64.3	64.7	60.7	57.2	63.2	69.3	64.7
Return on assets	0.1	-2.4	2.1	4	5.1	-2.9	3.9
Return on equity	0.4	-11.8	12.2	22.3	18.1	-13.3	14.8
Net income to GPW	0.3	-5.2	4.4	8.2	10.7	-5.5	7.5
Liquidity (%)							
Liquid assets to total liabilities	23.5	26.2	28.6	25.2	30.5	26.5	26.0

Source: Financial Services Commission

Table D5: Performance Indicators – Life Insurance

	2017	2018	2019	2020	2021	2022	2023
Capital Adequacy (%)							
Net prem. to capital	18.6	21.2	19.9	17.7	17.6	18.1	15.3
Capital-to-technical reserves	93.6	91.8	93.7	100.6	98.8	102.1	124.2
Asset Quality (%)							
Equities to total assets	1.1	0.5	0.5	0.4	0.4	0.3	0.4
Real estate to total assets	3.5	3.5	3.3	3.0	2.9	2.8	2.3
Related-party investments to total assets	41.6	42.6	43.9	44.9	41.4	40.6	47.3
Earnings & Profitability (%)							
Investment income to invested assets	2.8	-1.8	2.8	2.3	2.4	2.6	2.6
Return on assets	5.3	6.3	4.8	4.4	3.5	4.0	1.1
Return on equity	11.6	14.0	10.4	9.0	7.3	8.1	2.0
Net income to GPW	53.9	58.5	46.3	45.5	38.3	41.6	12.7
Liquidity (%)							
Liquid assets to total liabilities	7.4	8.1	7.8	9.1	8.4	6.8	6.4

Source: Financial Services Commission

Table D6: Performance Indicators – Mutual Funds

	2017	2018	2019	2020	2021	2022	2023
Asset Concentration (%)							
Related-party investments to total assets	27.2	28.4	30.0	30.7	30.7	30.1	27.9
Liquidity (%)							
Cash & cash equivalents to total assets	7.7	6.1	6.3	4.9	5.2	4.1	3.6
Liquid investments to total assets	32.0	28.1	27.5	25.8	25.1	24.8	27.5
Asset Growth (%)							
Return on net assets (net income/net assets)	13.3	-1.8	8.6	-3.6	24.0	-1.2	15.6
Net assets under management	26.4	-3.8	13.5	1.9	11.5	-3.1	5.3

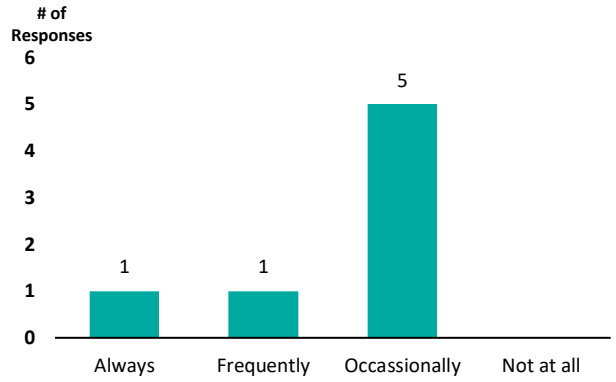
Source: Financial Services Commission

Appendix E: Climate and Environmental Risk Management Survey Report

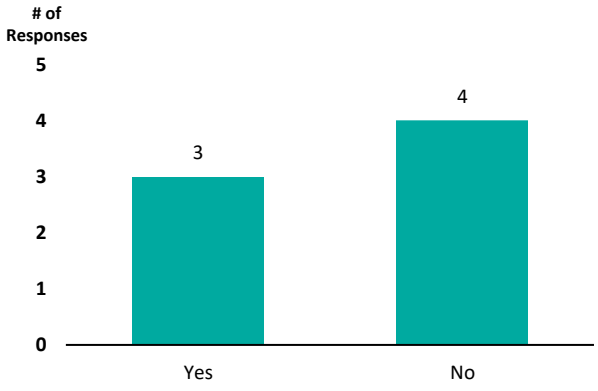
Deposit taking institutions within Barbados have started to incorporate climate-related risks into their assessments as it relates to the granting of credit. Seven respondents to the survey indicated that they incorporate climate-related and environmental risks throughout the credit granting process (Figure E1A). In assessing the effects of climate-related factors on a borrower's default risk, three institutions indicated "Yes" (Figure E1B). Regarding the valuation of assets, four institutions incorporated climate-related and environmental risks in relation to the valuation of collateral, specifically in relation to physical locations (Figure E2A). However, this was not the case pertaining to climate-related risk premiums on assets. Seven respondents indicated that they do not apply that type of premium on any of the items on the asset side of their balance sheet (Figure E2B).

Figure E1: Climate-Related Risks Assessment

A: Does your institution incorporate climate-related and environmental risks in all relevant stages of the credit-granting process?



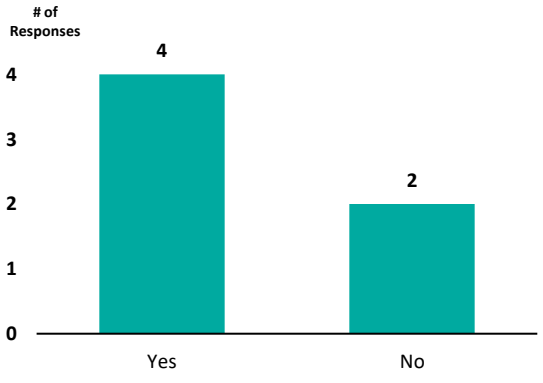
B: Does your institution assess the impact of climate-related and environmental factors on a borrower's default risk?



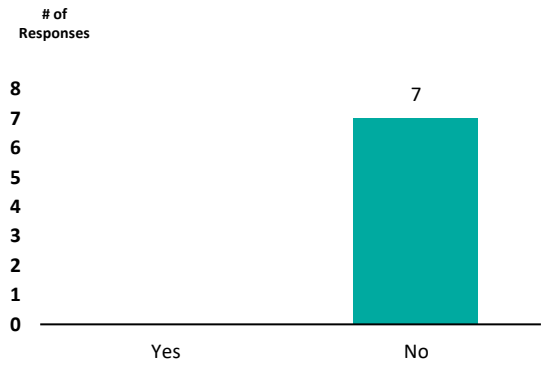
Source: Central Bank of Barbados

Figure E2: Valuation of Assets

A: Does your institution consider climate-related and environmental risks in collateral valuations, particularly in relation to the physical locations?



B: Does your institution apply a climate-related risk premium on its assets?



Source: Central Bank of Barbados

Banks and finance companies have placed an emphasis on Environmental, Social and Governance (ESG) within their corporate strategy.[54] Institutions have not only committed to going paperless or using minimal paper within their operations, but also using recyclable materials and more energy efficient equipment. In terms of supporting greening initiatives, they have provided products such as loans for commercial and household solar generation and the purchasing of hybrid and electric vehicles. Some institutions have decided to allow some employees to work remotely in order to decrease the carbon footprint.

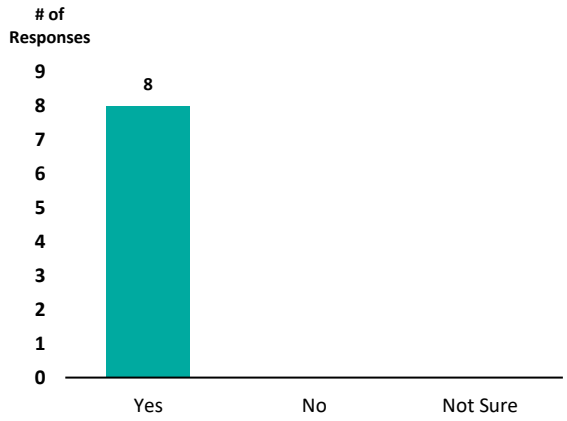
[54] Derived from a survey issued to both banks and finance companies in which part was focused on climate and risk management assessment for financial institutions.

Appendix F: Cyber Risk Survey Report

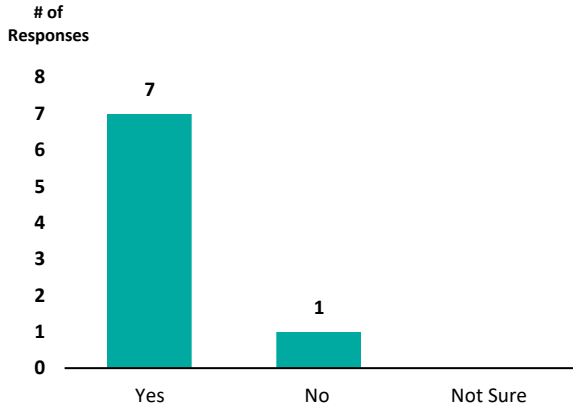
All respondents (six commercial banks and two finance companies) indicated that cyber risk is deemed as a priority (Figure F1A). Further, all institutions, save one, indicated that they have a board-approved cyber security strategy in place (Figure F1B). As a result, these DTIs have implemented cyber security policies (Figure F1C) which encompass both a documented and regularly tested cyber incident response plan internally (Figure F1D). In terms of their management framework, seven of the eight respondents incorporated recovery activities which include procedures on returning to normal business operations or to a pre-defined acceptable level of operations (Figure F1E). In order to strengthen their preparedness against attacks, all respondents have put in place internal cyber security training for their employees (Figure F1F).

Figure F1: Cyber Risks as A Priority and Company Strategy

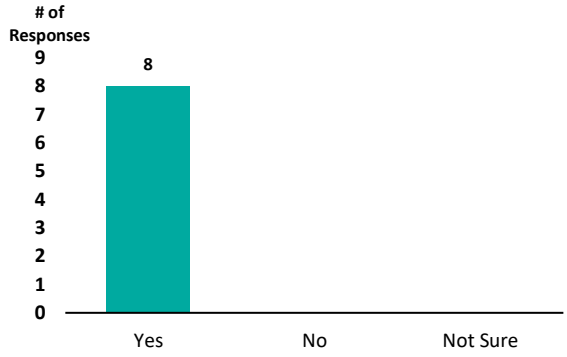
A: 1. Considering the increasing risks posed by cyber threats to the entire financial system, has your institution made cyber risk a priority?



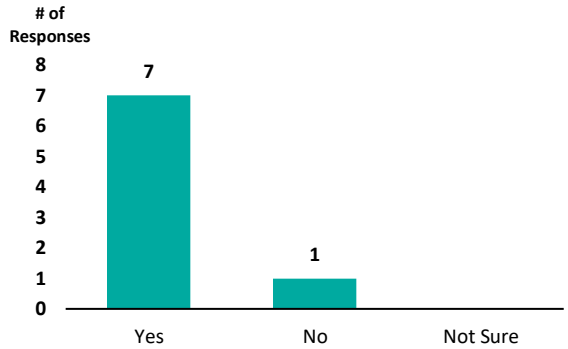
B: 2. Do you have a cyber security strategy that has been approved by the board?



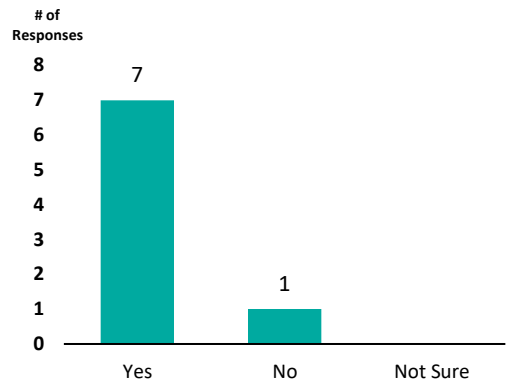
C: 3. To your knowledge, does your institution have a cyber risk policy?



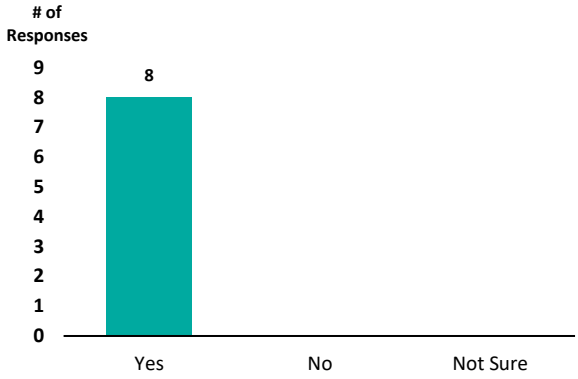
D: 4. Do you have a documented and regularly tested cyber incident response plan?



E: 5. Does your cyber incident management framework explicitly include recovery activities, covering returning to normal operations, or to a pre-defined, acceptable level?



F: 6. Considering the increasing risk related to cyber threats, has all staff been provided with cyber security training?



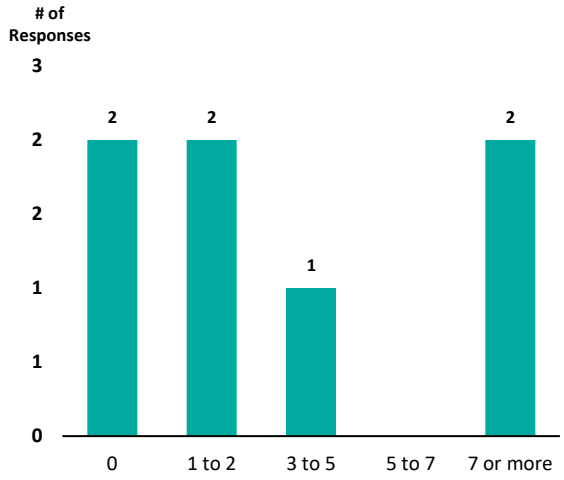
Source: Central Bank of Barbados

Five institutions reported that their banking systems were attacked during 2023 with varying frequencies (Figure F2A). Banks and finance companies experienced different types of cyber-attacks in 2023, where the majority was "Spam & Phishing" attacks.

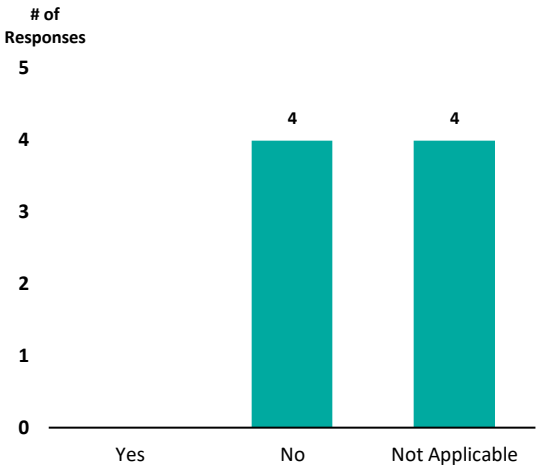
As it relates to data leaks, four instititutions responded that no information was leaked, and four others indicated "Not Applicable" (Figure F2B). In terms of financial losses or damages, three specified that there were no losses incurred, and the other five respondents answered "Not Applicable" (Figure F2C).

Figure F2: Cyber Threats

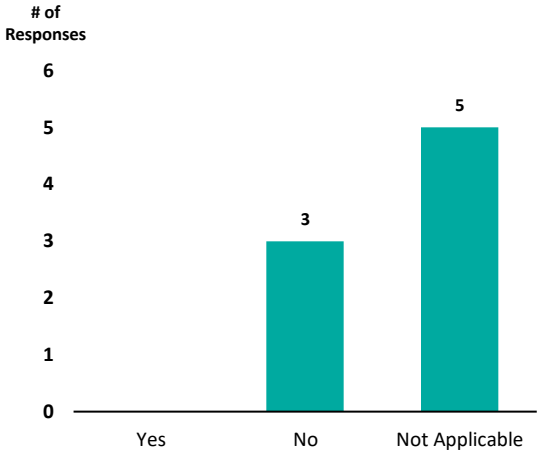
A: 7. What was the number of cyber threats encountered by your institution during 2023?



B: 8. To the best of your knowledge, was any data leaked or lost during any of the cyber-attacks?



C: 9. Kindly, can you indicate if there were any losses financially?



As it relates to each institution's preparedness (Figure E3), respondents answered a question, "Kindly, can you state where the institution can improve in terms of better preparedness as it relates to cyber security?". Based on their responses, four of them indicated that implementing great technology tools was an area where they could enhance their level of preparedness against cyber-attacks, along with training and educating employees. Three of the responding institutions specified that attracting and retaining highly skilled talent was also a priority, while to a lower extent, they indicated that improving communication was important.

Figure F3: Improving Preparedness

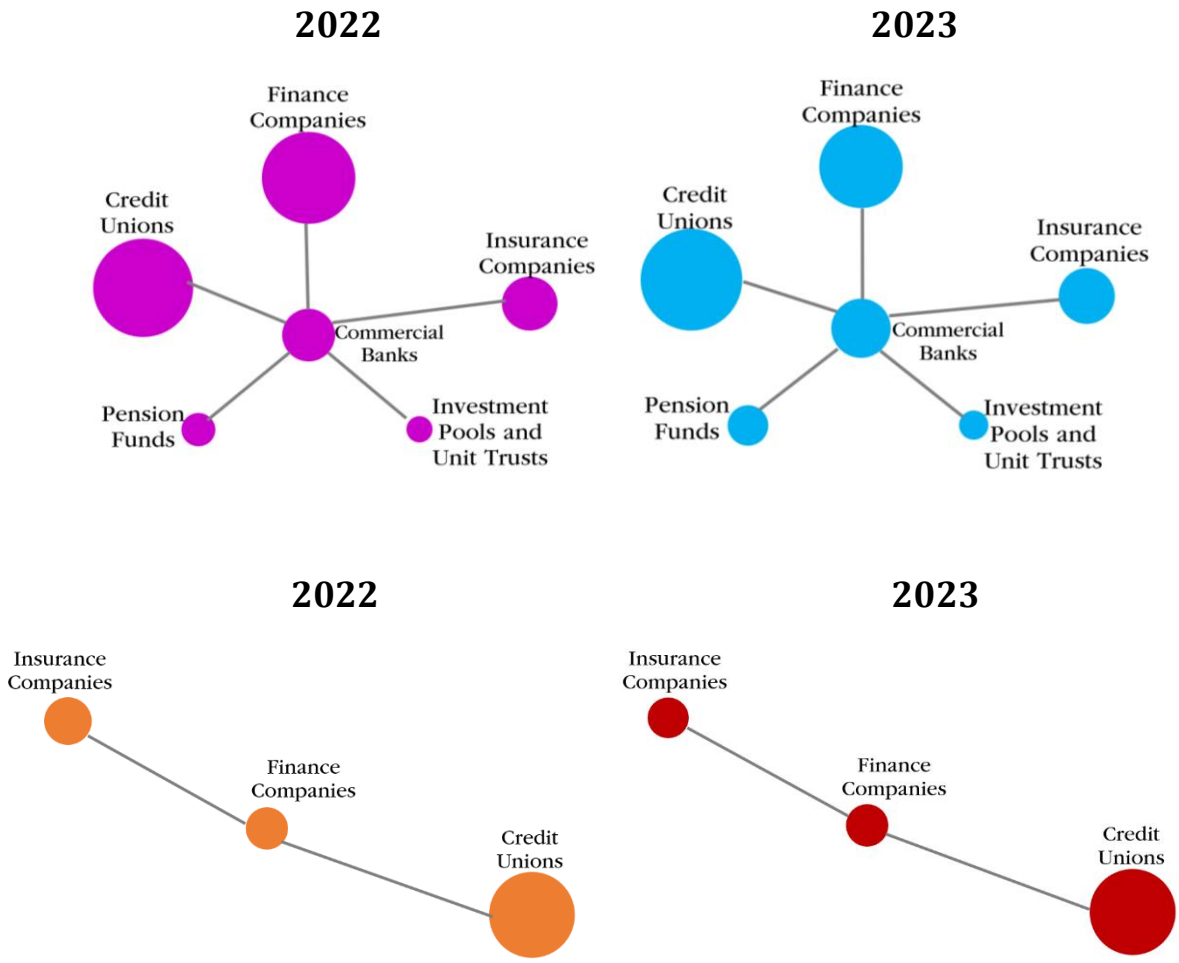
Source: Central Bank of Barbados

Appendix G: Domestic and Cross-Border Network Analysis

Cross-Sectoral Analysis

Tighter liquidity conditions in finance companies and credit unions resulted in a decline in their deposits held at commercial banks. The proportion of their deposits in commercial banks relative to their total assets reduced from 12.7 percent to 11.6 percent for finance companies and from 14.5 percent to 11.8 percent for credit unions. The ratio of all other financial subsectors remained stable.

Credit unions' deposits in finance companies increased, while those of insurance companies declined. The ratio for credit unions remained virtually the same as last year, while that of insurance companies fell from 0.7 percent to 0.5 percent.



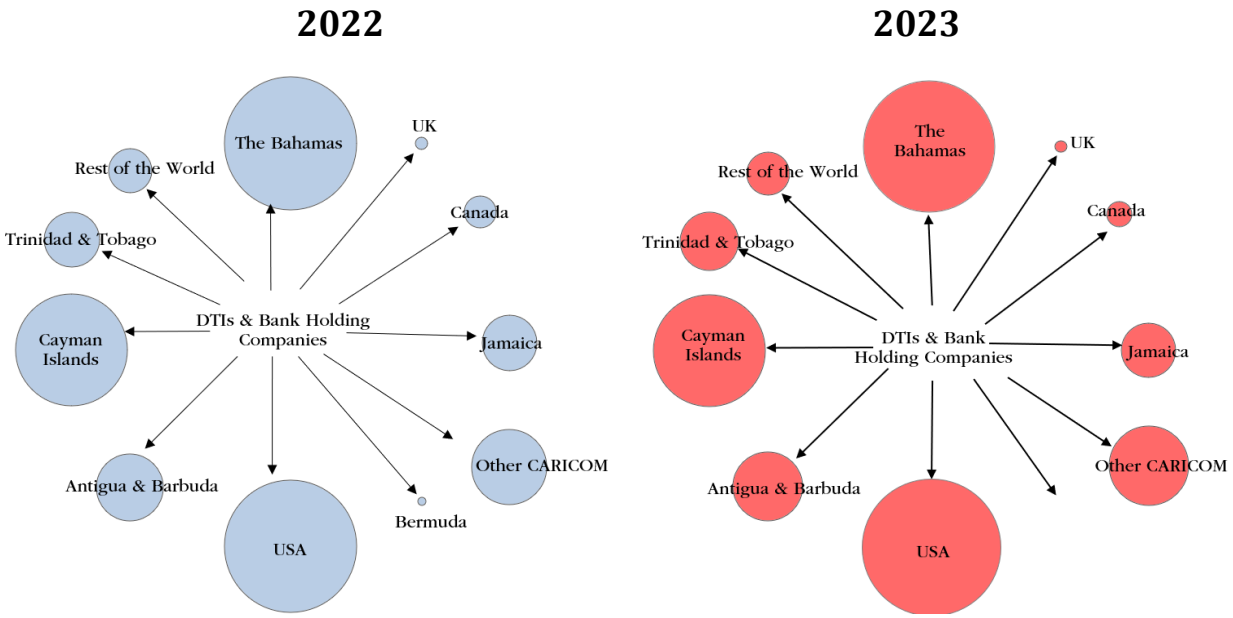
Source: Central Bank of Barbados

Note: Outer nodes represent subsectors' deposits in the centre node relative to the assets of that financial subsector.

Cross-Border Assets of DTIs and Bank Holding Companies by Geographical Location

At the end of 2023, cross-border assets of DTIs and bank holding companies were 4.5 percent lower than 2022 levels and accounted for 16.7 percent of their assets. The share of investments in equity and debt instruments remained comparable to last year, measuring 52 percent and 48 percent, respectively. A substantial reduction of debt instrument claims on the USA drove the contraction in cross-border assets and resulted in the Bahamas being the largest exposure. During the year, there were increased claims on Antigua & Barbuda, Trinidad & Tobago, and other CARICOM countries.

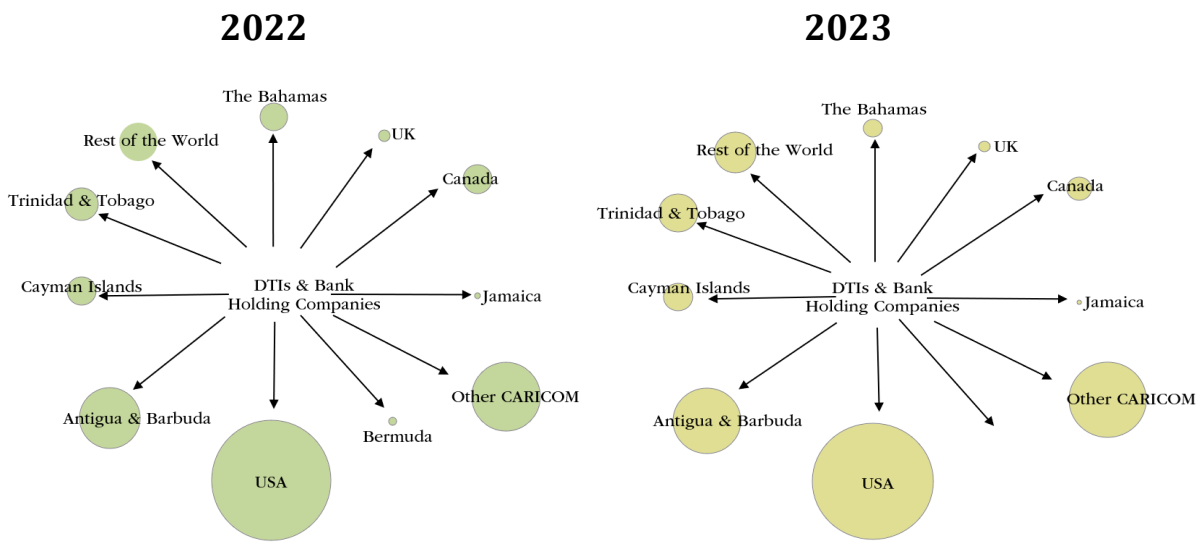
Total Claims on Non-Residents by Country and Region of Residence



Source: Central Bank of Barbados

Declines in long-term debt securities and deposits held in unaffiliated institutions in the USA reduced debt instrument claims. However, deposits held in subsidiaries in Antigua & Barbuda, Trinidad & Tobago, and other CARICOM countries registered increases. At the end of the review period, no institution held financial derivatives.

Debt Instrument Claims on Non-Residents by Country and Region of Residence

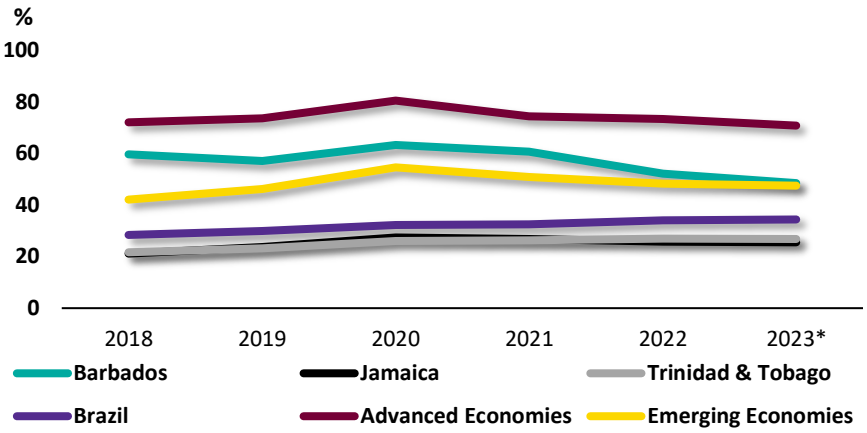


Source: Central Bank of Barbados

Note: Debt instrument claims are assets in the form of debt instruments. They comprise deposits, debt securities, loans, accounts receivable, and cash.

Chart Annex

Figure J1: Household Debt to GDP



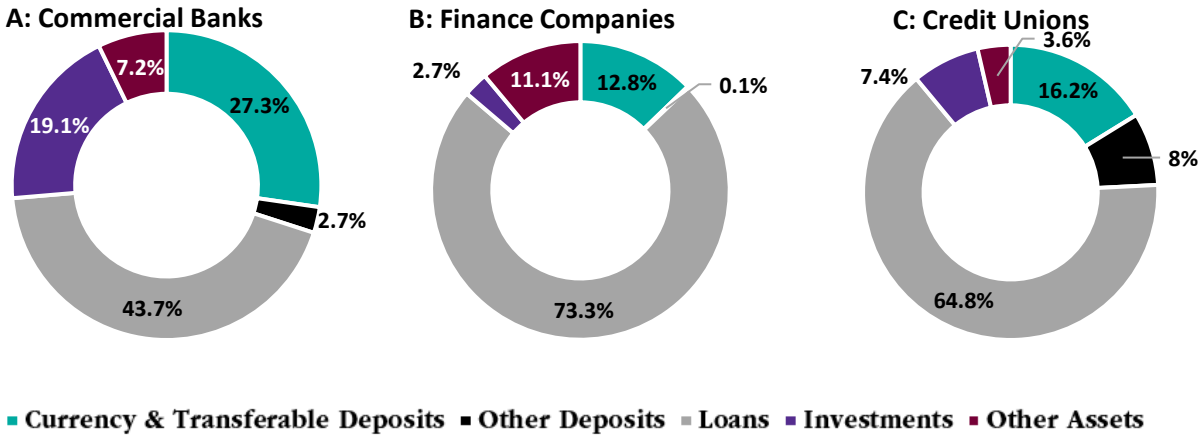
* Trinidad & Tobago is as at March 2023, Brazil, Emerging Economies and Advanced Economies are as at September 2023, and Barbados as at December 2023

Sources: Statistical Institute of Jamaica, Bank of Jamaica, Bank for International Settlements Statistics Explorer

Table J1: Total Assets of the Financial System (BDS $M)

	2019	2020	2021	2022	2023
Commercial Banks	12,825	13,202	13,760	14,357	14,655
Insurance Companies	3,647	3,780	3,817	3,795	4,379
Finance Companies	995	991	1,031	1,087	1,036
Credit Unions	2,606	2,797	2,946	3,063	3,152
Mutual Funds	2,437	2,494	2,811	2,702	2,871
Pension Funds	2,654	2,690	3,085	2,814	2,825
Total	**25,166**	**25,954**	**27,449**	**27,817**	**28,918**

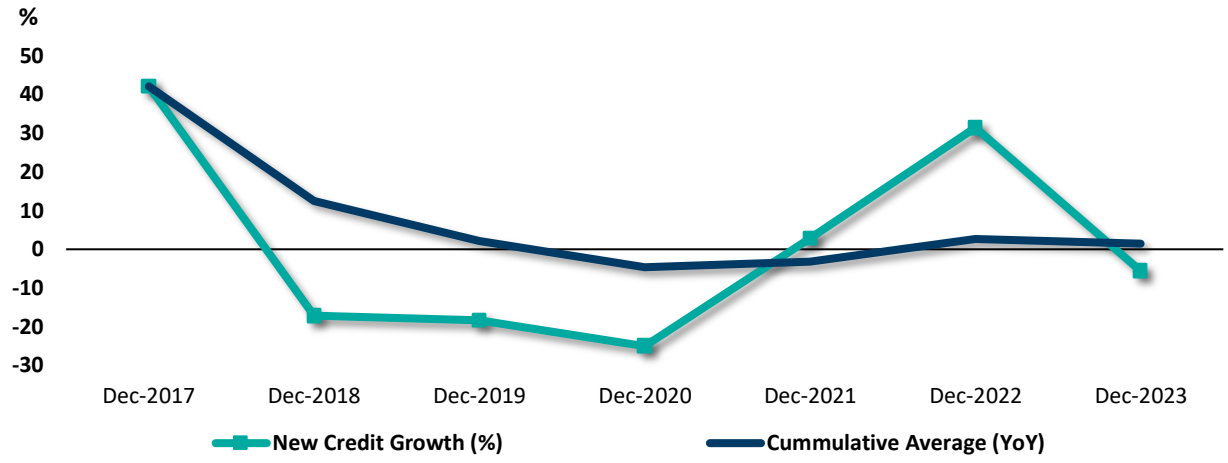
Figure J2:Asset Composition



Sources: Central Bank of Barbados and Financial Services Commission

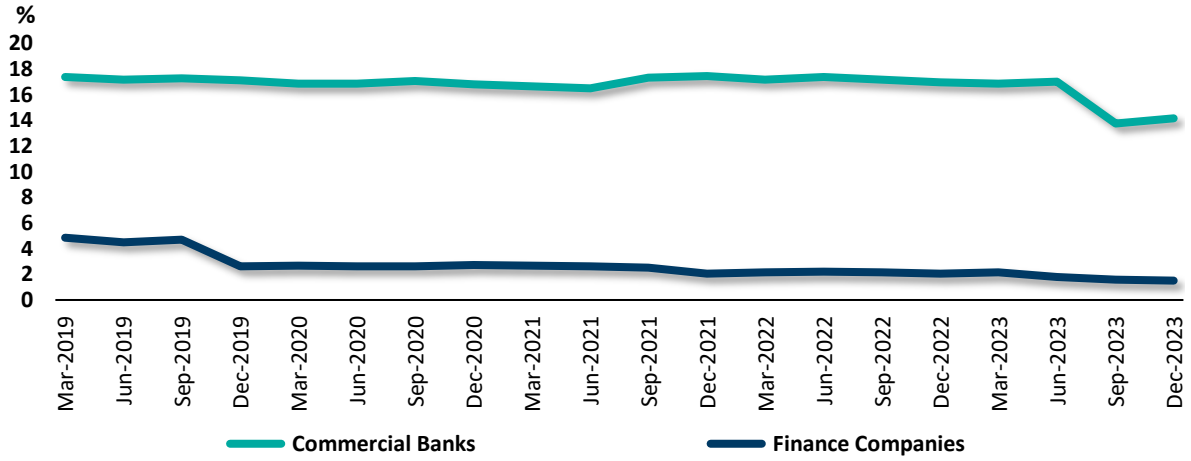
Sources: Central Bank of Barbados and Financial Services Commission

Figure J3: New Credit Growth



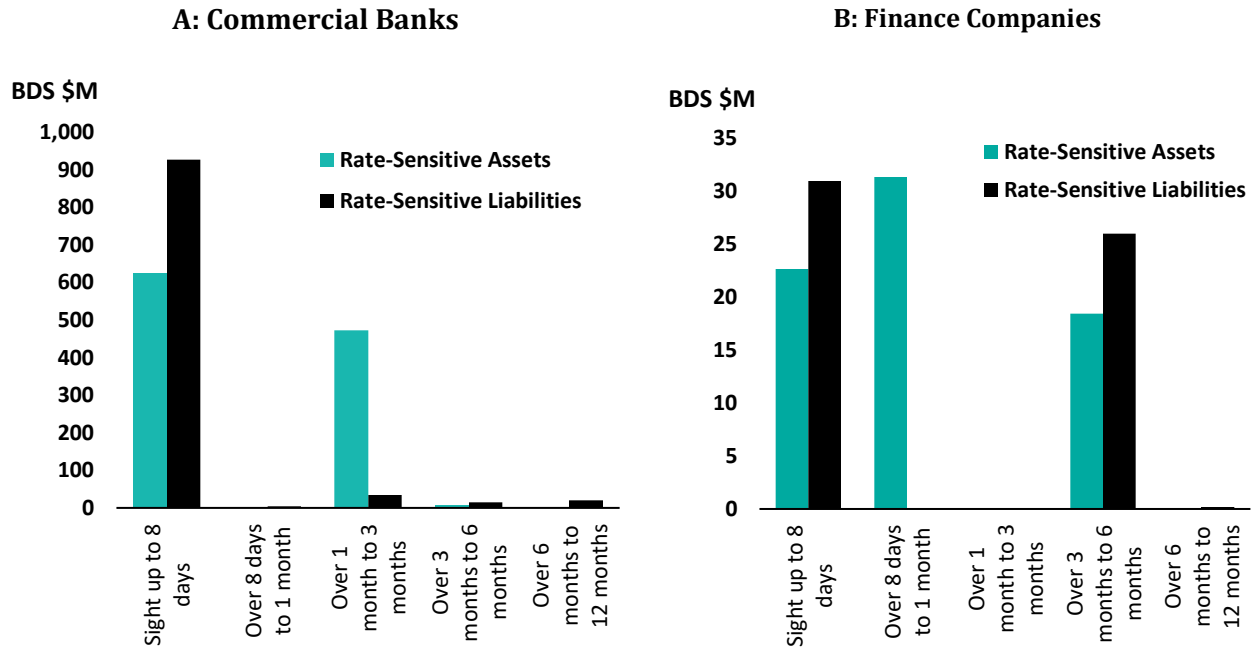
Sources: Central Bank of Barbados and Staff Calculations

Figure J4: Sovereign Exposure - Government Debt Securities to Total Assets



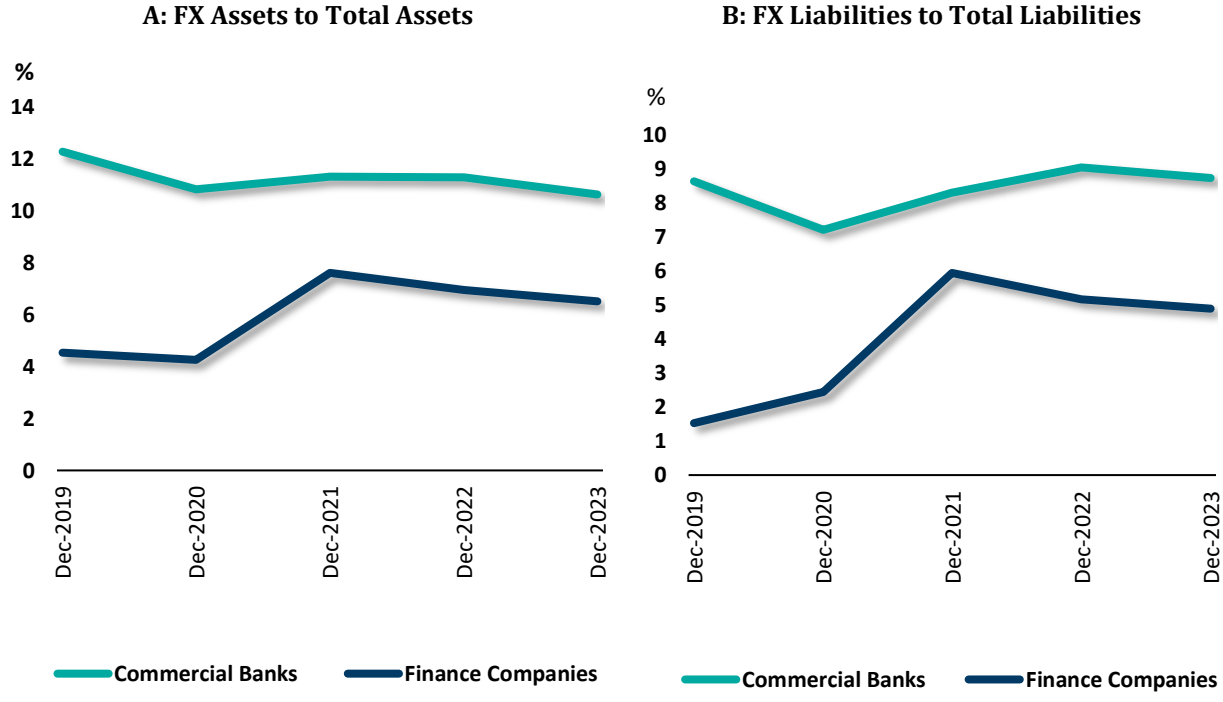
Source: Central Bank of Barbados

Figure J5: Maturity Gap Analysis (USD$)



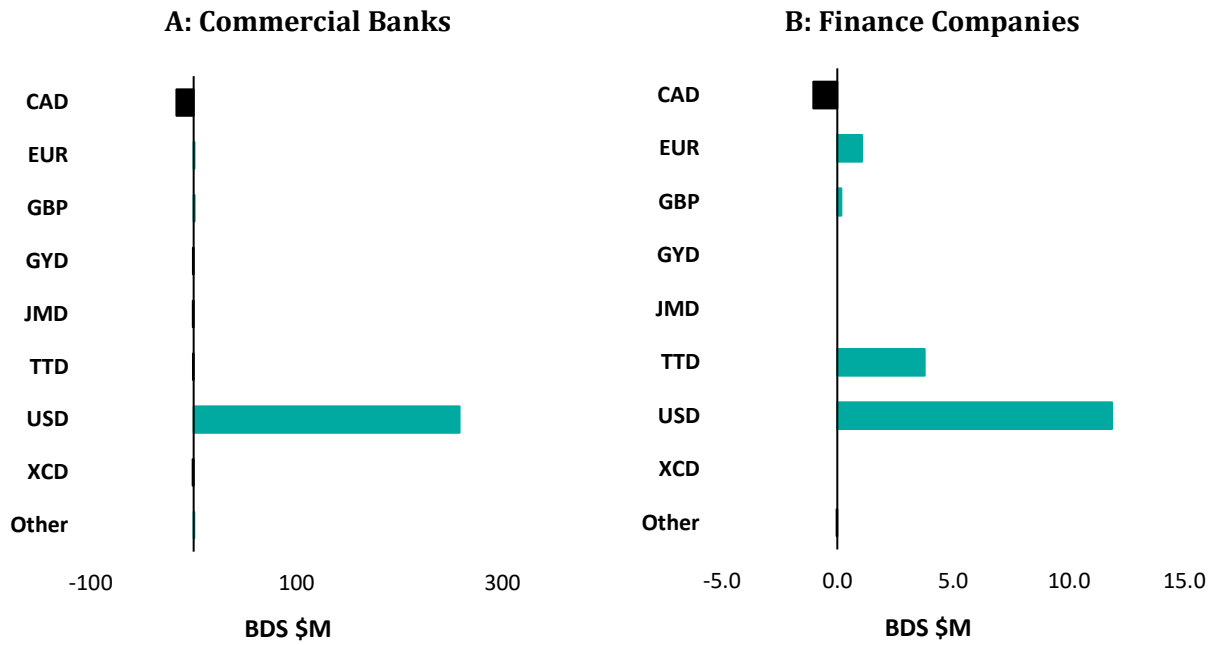
Source: Central Bank of Barbados

Figure J6: Foreign-Currency Exposure



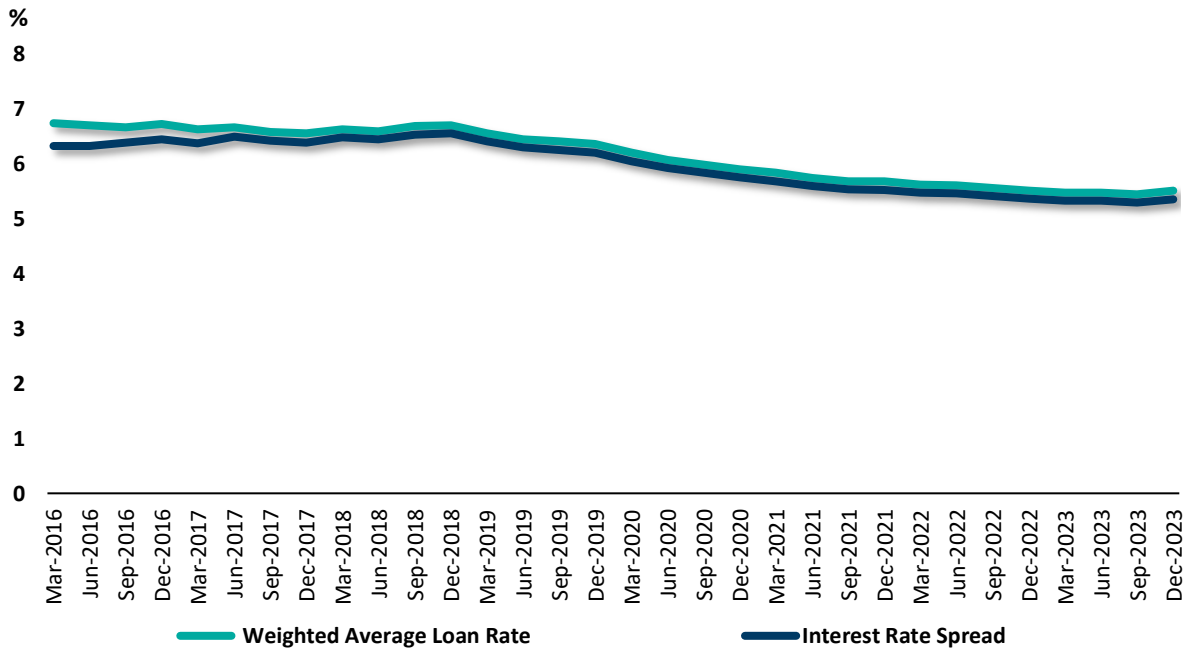
Source: Central Bank of Barbados

Figure J7: Net Open Position in Foreign Currency



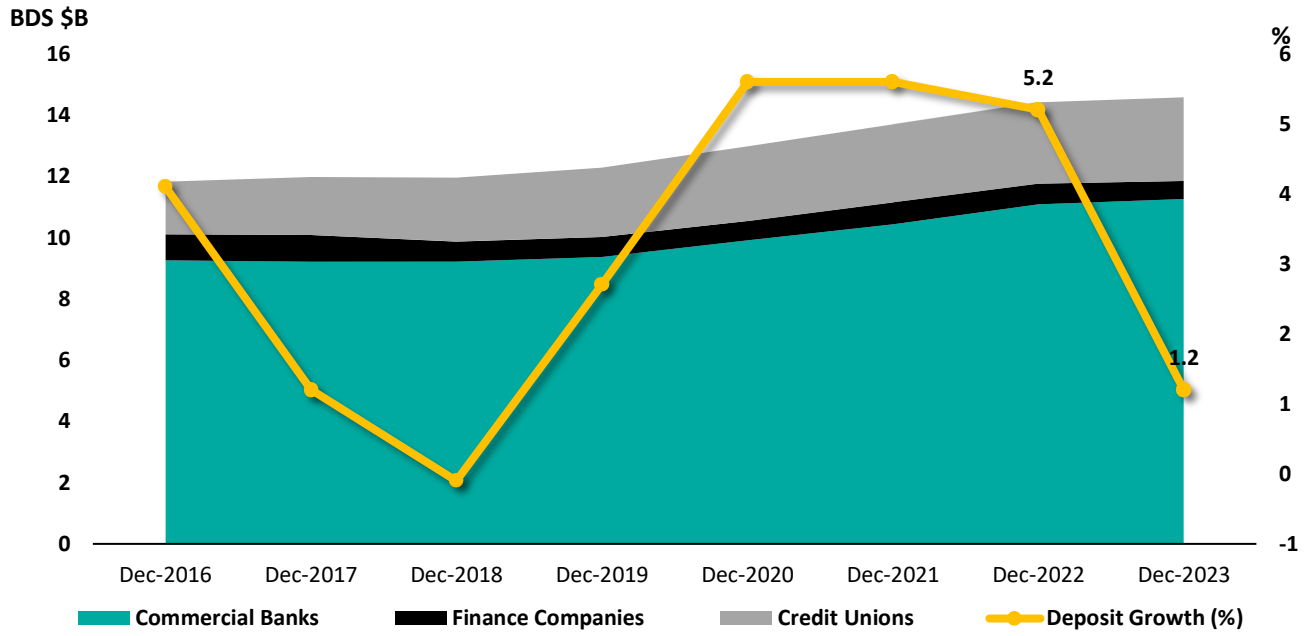
Source: Central Bank of Barbados

Figure J8: Interest Rate Spread



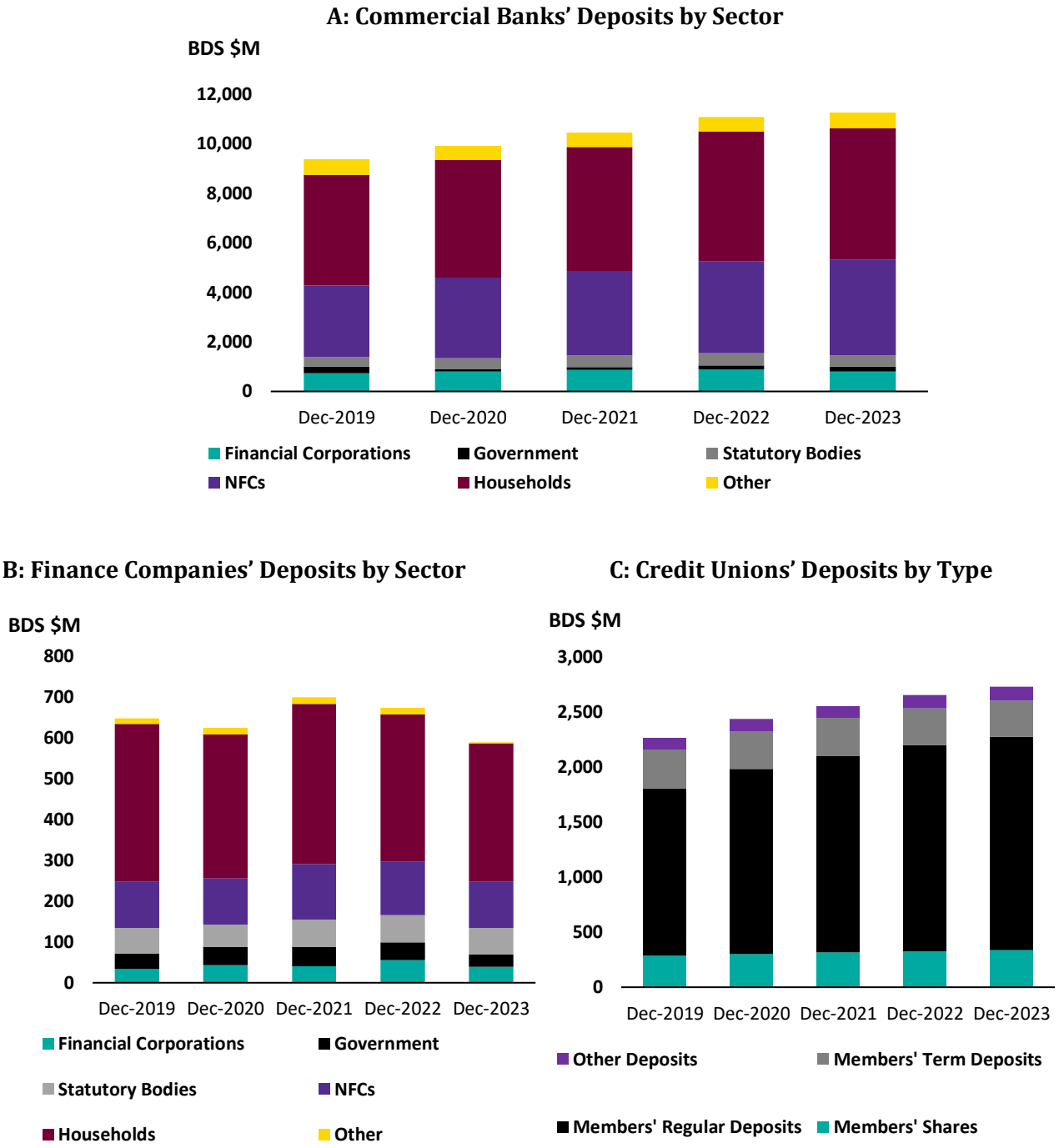
Source: Central Bank of Barbados

Figure J9: Consolidated Deposits



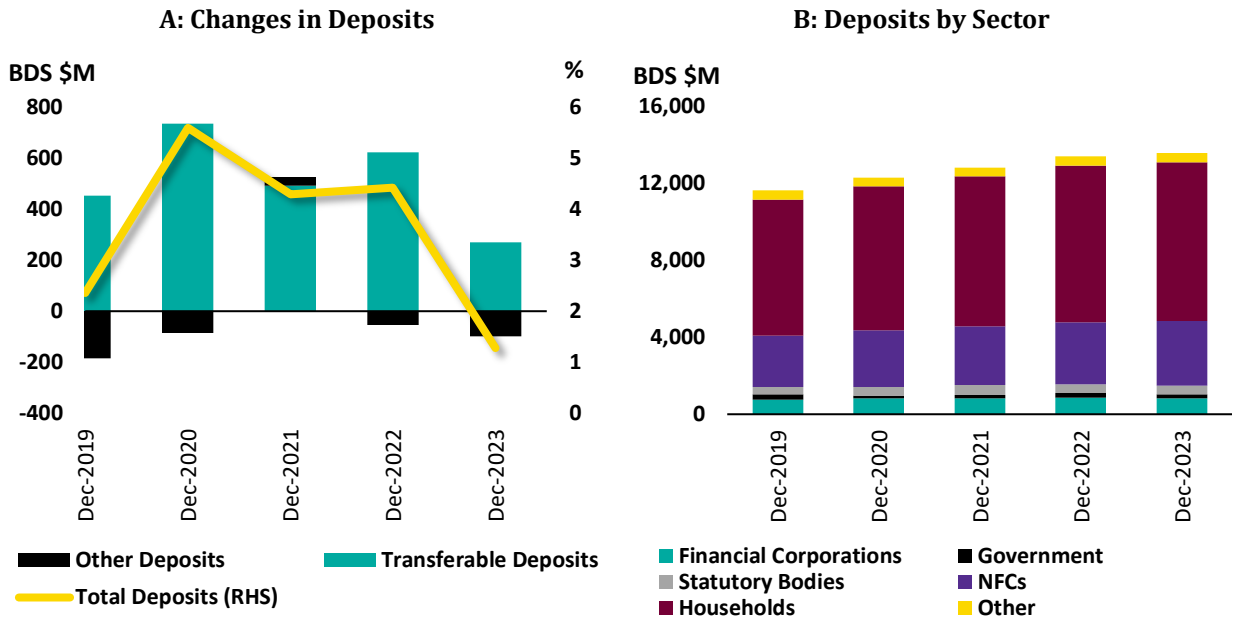
Sources: Central Bank of Barbados and Financial Services Commission

Figure J10: Total Deposits



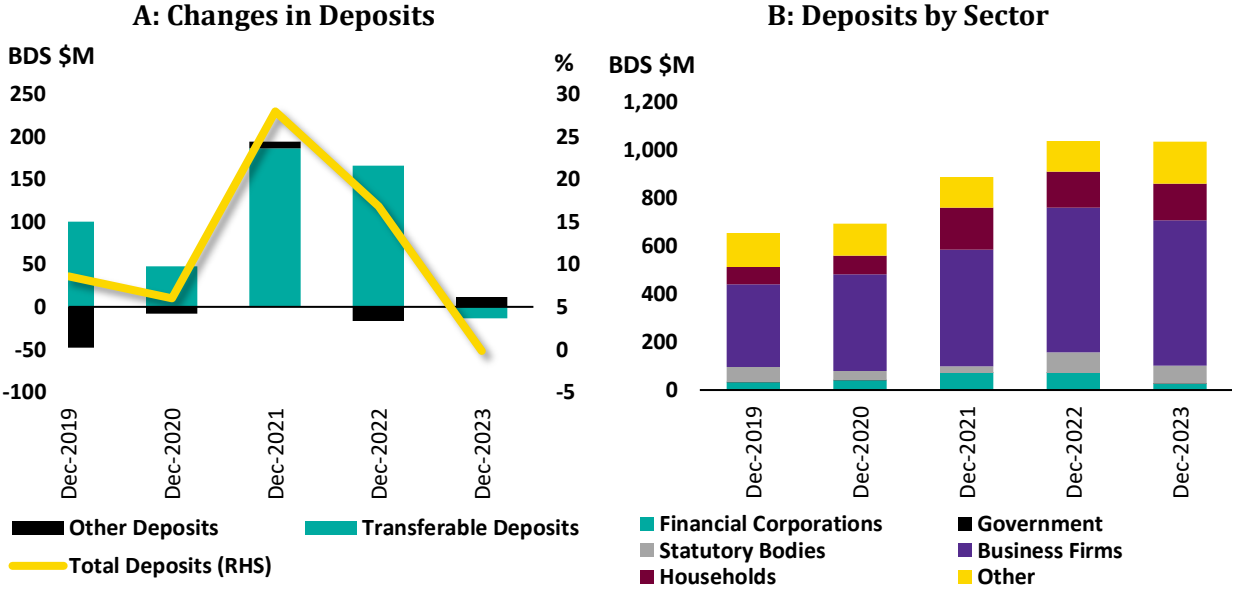
Sources: Central Bank of Barbados and Financial Services Commission

Figure J11: Domestic-Currency Deposits



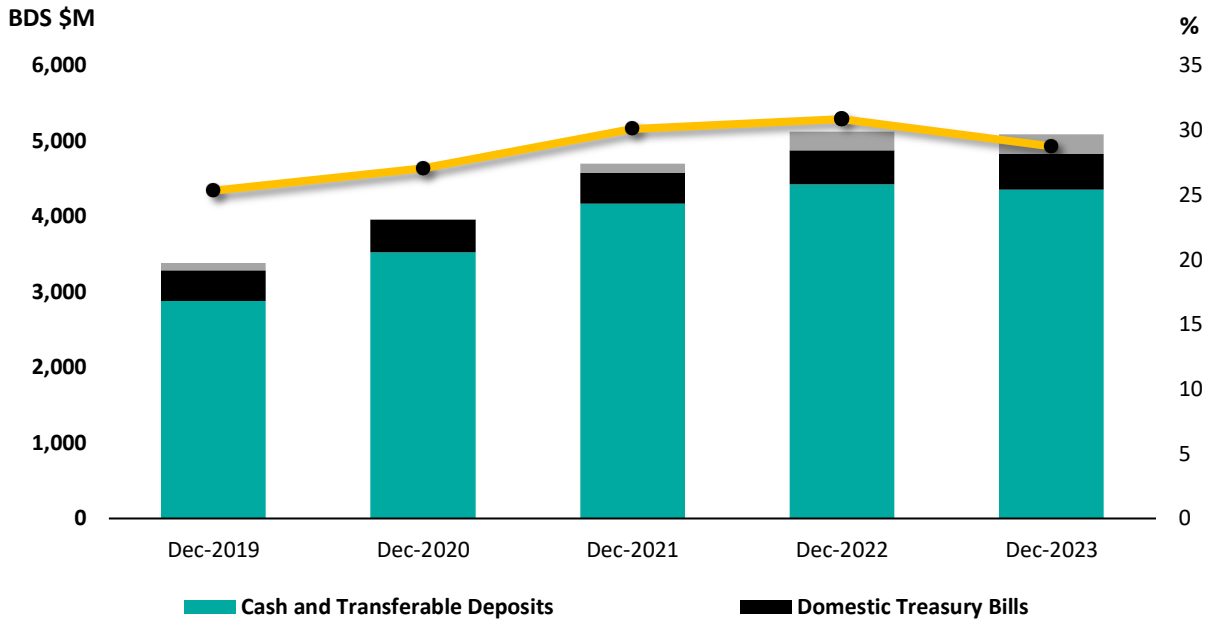
Sources: Central Bank of Barbados and Financial Services Commission

Figure J12: Foreign-Currency Deposits



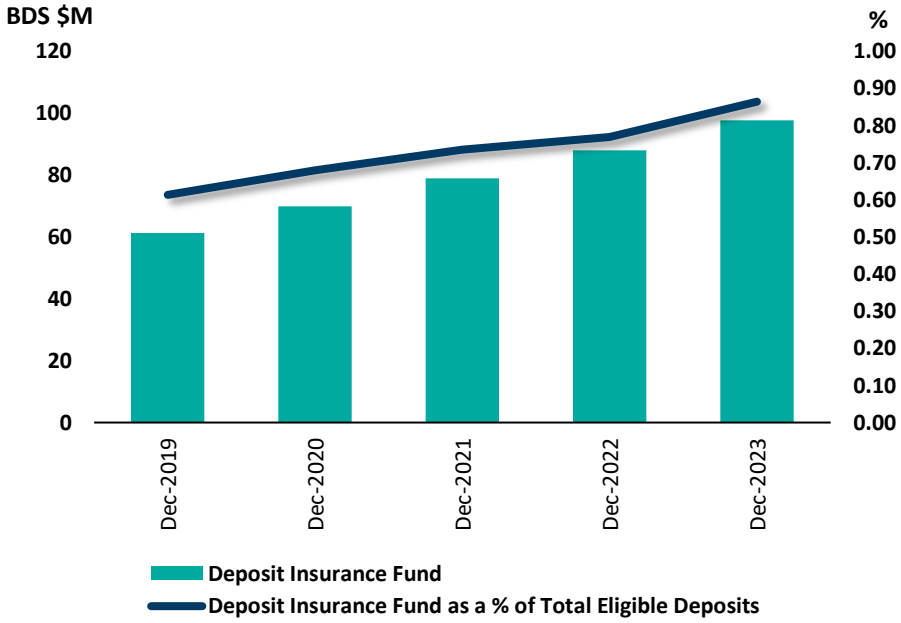
Sources: Central Bank of Barbados and Financial Services Commission

Figure J13: Liquidity Components



Sources: Central Bank of Barbados and Financial Services Commission

Figure J14: Deposit Insurance Fund



Source: Barbados Deposit Insurance Corporation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