

MEASURING SYSTEMIC RISK FOR ZAMBIA'S BANKING
INSTITUTIONS – A PROACTIVE APPROACH

BY

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A THESIS SUBMITTED TO THE UNIVERSITY OF ZAMBIA IN FULFILMENT OF
THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF PHD IN BUSINESS
AND MANAGEMENT

THE UNIVERSITY OF ZAMBIA

LUSAKA

2025

DECLARATION

I, **Chresta C. Kaluba**, do hereby declare that this work is my original work achieved through personal reading and research. This work has never been submitted to the University of Zambia or any other Universities. All sources of data used and literature on related works previously done by others, used in the production of this Thesis have been duly acknowledged. If any omission has been made, it is not by choice but by error.

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ABSTRACT

This study develops a proactive approach to measuring systemic risk in Zambia's banking institutions, addressing the inadequacies of existing methodologies that rely on stock market data and focus primarily on the industry as a whole rather than individual institutions. Using a combination of case study analysis and quantitative research, data from Zambian commercial banks between 2010 and 2022 was analysed to identify patterns of vulnerability and resilience during systemic shocks. The research proposes a novel Systemic Vulnerability Score (SVS), a forward-looking metric that quantifies a bank's susceptibility to systemic risk using publicly available data. Key findings reveal that systemic shocks, such as the 2015 copper price drop and the COVID-19 pandemic, impacted all banks but with varying intensity. Factors like liquidity management, asset growth, and equity stability were significant in determining resilience. The SVS effectively distinguished systemically vulnerable banks from resilient ones, demonstrating its utility for both strategic planning and regulatory oversight. This study's significance lies in bridging the gap between theory and practice in systemic risk management for emerging markets. By offering a robust, institution-focused model, it empowers financial institutions to identify vulnerabilities and implement strategic risk mitigation measures proactively. For policymakers and regulators, the findings provide a critical tool for fostering stability and resilience in Zambia's banking sector.

Key Words: Systemic Risk, Forward-Looking Risk Assessment, Bank Resilience, Strategic Risk Management, Liquidity Volatility, Systemic Vulnerability Score, Proactive Management

ACKNOWLEDGEMENTS

This work stands as a testament to the unwavering love and support of family, friends, and mentors—a collective strength that made this journey possible. The weight of this endeavour was immense, yet every effort was made to shield loved ones from its burden—a small offering of gratitude for their steadfast presence.

My mother's prayers, unyielding and full of faith, lit the path forward. Though my father's voice no longer fills the room, his quiet pride was ever-present, a steady force that shaped my resolve. My sisters, brilliant and steadfast, stood not just as family but as a sanctuary of wisdom and understanding—a reminder that no road is ever walked alone. My brother, unwavering in his loyalty, turned every challenge into a shared pursuit, grounding this journey with a bond that made each step lighter. This was never just my journey—it was ours, and for that, I am profoundly grateful.

To my friends, Brian and George—your presence brought more than just companionship; it was a lifeline. In moments of doubt, your laughter broke through the weight of it all, your support a quiet assurance that even the heaviest burdens are lighter when shared.

At the Graduate School of Business at the University of Zambia, I found the guidance and structure necessary to shape this research. My deepest gratitude goes to my PhD supervisor, Dr. Lubinda Haabazoka, whose mentorship, insight, and unwavering support provided both direction and confidence at every stage of this academic pursuit.

Though the work itself is mine, it was strengthened by the belief, encouragement, and quiet sacrifices of those around me. This thesis stands not just as an academic milestone, but as a reflection of the resilience, trust, and unwavering support that carried me through.

DEDICATION

To

Kalonga, Tumbiko, Bukata, Kachema, Kalenga

and

Susan

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LIST OF ABBREVIATIONS

1. BoZ - Bank of Zambia
2. CCA - Contingent Claims Analysis
3. CCAR - Comprehensive Capital Analysis and Review
4. CDOs - Collateralized Debt Obligations
5. Co-RaR - Co-Risk Assessment and Research
6. CoVaR - Conditional Value at Risk
7. COVID - Corona Virus Disease
8. DCoVaR - Delta Conditional Value at Risk
9. DFAST - Dodd-Frank Act Stress Test
10. D-SIBs - Domestic Systemically Important Banks
11. EDF - Expected Default Frequency
12. ETL - Expected Tail Loss
13. FCI - Financial Connectedness Index
14. FSSD - Financial Sector Supervision Department
15. GDP - Gross Domestic Product
16. G-SIBs - Global Systemically Important Banks
17. HQLA - High-Quality Liquid Assets
18. IFRS - International Financial Reporting Standards
19. LCR - Liquidity Coverage Ratio
20. LGD - Loss Given Default
21. LTD - Lower Tail Dependence
22. MAD - Mean Absolute Deviation

23. MDA - Model Driven Architecture
24. MES - Marginal Expected Shortfall
25. NIM - Net Interest Margin
26. NSFR - Net Stable Funding Ratio
27. PD - Probability of Default
28. ROA - Return on Assets
29. ROE - Return on Equity
30. RWA - Risk Weighted Assets
31. SRI - Systemic Risk Indicator
32. SRISK - Systemic Risk Index
33. SVaR - Systemic Value-at-Risk
34. SVS – Systemic Vulnerability Score
35. VaR - Value at Risk

CHAPTER ONE – RESEARCH BACKGROUND

1.0. Introduction

How does a crisis become global? The 2008 global financial crisis was caused by a combination of factors, ultimately highlighted by the proliferation of risky mortgage products, excessive borrowing by households and financial institutions, and lax regulations in the financial sector. Fligstein and Goldstein (2010) posit that the crisis can be traced back to 2006, when the U.S. mortgage market began to decline, and subprime mortgages started defaulting. This was eventually exacerbated by the bursting of the housing bubble, which had been fuelled by the easy availability of credit, leading to the issuance of mortgages to individuals who were ultimately unable to afford them. As housing prices started to decline, many homeowners, who had benefited from the lax lending standards, found themselves unable to make their mortgage payments, resulting in a wave of foreclosures.

The number of foreclosures exceeded banks' expectations, leading to an excess of houses in the market and a dramatic drop in housing prices. This decline in housing prices, in turn, made collateralized debt obligations (CDOs), which are investment vehicles comprised of mortgage-backed securities, lose all their value. The crisis reached its apex with the bankruptcy of Lehman Brothers on 15th September 2008, which precipitated a worldwide economic collapse. Laeven and Valencia (2010) found that by the end of 2009, as many as 23 countries had experienced a systemic bank crisis as a result of the events of the preceding year.

So how does a crisis become global? The short answer is systemic risk. The process by which a crisis escalates to become a global phenomenon is inherently tied to systemic risk. The 2008 financial crisis serves as a poignant illustration of how a shock originating in one institution can swiftly permeate an entire industry, transcending national boundaries to exert a pervasive influence on the global economy. This crisis epitomized the manifestation of systemic risk, as the collapse of the housing market in the United States reverberated across financial systems

worldwide, underscoring the interconnectedness and interdependence of modern economies on a global scale.

The far-reaching ramifications of the 2008 crisis laid bare the vulnerabilities inherent in the financial system, sparking a cascade of adverse consequences that precipitated a profound global economic downturn. Dell'Ariccia, Detragiache, and Rajan (2008) elucidate the debilitating effects of systemic banking crises on the economy, emphasising the magnitude of disruptions they inflict, thus presenting a formidable challenge for regulators and policymakers tasked with mitigating their impact.

In the aftermath of the 2008 crisis, systemic risk regulation emerged as a focal point of regulatory reform efforts, with a pivotal legislative response being the enactment of the Dodd-Frank Wall Street Reform and Consumer Protection Act in the United States in 2010. Labonte (2022) delineates the multifaceted nature of post-crisis reforms, categorising them into three distinct domains: bolstering the surveillance and assessment of systemic risk, implementing measures to curtail systemic risk, particularly targeting the root causes that precipitated the crisis, and augmenting the regulatory apparatus to furnish government agencies with enhanced intervention capabilities during financial crises.

The regulatory landscape underwent a profound transformation in the wake of the Global Financial Crisis, arming regulators with the requisite tools and authority imperative for the appraisal and management of systemic risk. These reforms signify a concerted effort to fortify the resilience of financial systems against the pernicious effects of systemic risk, underscoring the imperative of proactive regulatory oversight and robust risk-management frameworks to safeguard the stability and integrity of global financial markets. Regulators endeavour to mitigate the probability of future systemic failures through meticulous regulatory scrutiny and prudent risk-mitigation strategies, thereby fostering a more resilient financial ecosystem conducive to sustainable economic growth and stability on a global scale.

This reaction underscores the fact that measuring systemic risk has generally been the prerogative of regulators and policymakers looking at the industry as a whole, and as such, the focus has been on minimizing the impact on the industry as a whole and not on individual institutions. If attention has been given to individual institutions, it has been more about assessing the impact they have as possible sources and transmitters of systemic risk. Equipping financial institutions' management executives to protect their institutions has not received much attention. A key challenge in the management of risk faced by financial institutions is therefore predicting how systemic events will affect their institution and putting in place measures to ensure that the institution survives the systemic events.

Banks manage systemic risk through various measures and strategies aimed at identifying, monitoring, and mitigating potential risks that could have a widespread impact on the financial system. The following are some key ways in which banks manage systemic risk.

- *Risk Assessments:* Banks perform comprehensive risk assessments to identify potential sources of systemic risk that could impact the stability of the financial system. This process involves evaluating various types of risks, such as credit risk, market risk, operational risk, and liquidity risk. Edwards (2010) explains that both qualitative and quantitative risk assessments are essential for developing effective risk mitigation strategies. Qualitative assessments involve expert judgment, scenario analysis, and stress testing, and provide insights into the potential impact of different risk factors. Quantitative assessments, on the other hand, use statistical models and historical data to numerically measure the likelihood and potential impact of risks. By thoroughly understanding the various risks that they face, banks can implement appropriate measures to manage and mitigate them. These measures can include setting aside capital reserves to cover potential losses, diversifying investment portfolios, enhancing internal controls, and developing contingency plans. Effective risk management helps ensure a bank's stability and resilience, protecting both the institution and its customers. Conducting thorough risk assessments allows banks to proactively identify and address potential

vulnerabilities, thereby reducing the likelihood of unexpected losses. They also help banks comply with regulatory requirements, maintain their reputations, and build trust with stakeholders. Ultimately, effective risk management contributes to the financial system's overall health and stability.

- *Diversification:* Banks diversify their portfolios by spreading their investments across different sectors, regions, and asset classes. This strategy helps reduce the concentration of risk and it minimizes the impact of a potential failure in any particular area. By investing in a wide range of sectors, banks ensure that poor performance in one sector does not significantly affect their overall financial health. For instance, regional diversification allows banks to mitigate risks associated with specific geographic areas, such as economic downturns or political instability. Additionally, diversification across asset classes, including equities, bonds, real estate, and commodities, helps balance the risk and return profile of the portfolio. Diversification is a key component of risk management, enabling banks to achieve more stable and predictable returns, while protecting themselves from significant losses due to isolated events. This approach supports banks' long-term stability and resilience, benefiting both the institution and its stakeholders.
- *Stress Testing:* Banks perform stress tests to evaluate the resilience of their balance sheets and assess the potential impact of adverse scenarios on their overall financial health. Stress tests simulate extreme conditions to determine if the bank has sufficient capital and liquidity to withstand such events (Petrella & Resti, 2012). These tests involve modelling various hypothetical situations, such as severe economic downturns, market crashes, or sudden liquidity shortages, to see how a bank's finances would hold up. The aim is to identify potential weaknesses and ensure that banks can maintain stability, even under the most challenging circumstances. Orlov et al. (2018) confirm that optimal stress test design incorporates contingent capital requirements, creating a liquidity buffer to protect against crises, such as a fire sale. This means that banks must have plans to quickly

access additional capital if needed, ensuring that they can continue operations without significant disruption. By conducting regular stress tests, banks can proactively manage their risk exposure, maintain regulatory compliance, and enhance overall resilience. This practice is crucial for safeguarding bank financial health and maintaining confidence among customers, investors, and regulators.

- *Capital Adequacy:* Banks also use capital adequacy to manage systemic risk, which involves ensuring that banks maintain sufficient capital to function as a buffer against unexpected losses. Banks are required to adhere to regulatory capital requirements, which set a minimum level of capital they must hold to safeguard themselves against potential financial shocks. Acharya et al. (2013) highlight that reliance on regulatory risk weights in determining capital levels can sometimes lead to under-capitalization in certain scenarios. This means that the prescribed capital may not always be adequate to cover unexpected losses, particularly in times of financial stress. Maintaining adequate capital levels is crucial to enhance banks' ability to absorb losses and promote overall financial stability. Higher capital levels provide a stronger cushion, enabling banks to withstand economic downturns, market volatility, and other adverse conditions, without jeopardizing their solvency. Miani et al. (2018) emphasize that higher capital levels significantly improve banks' resilience during financial stress. By ensuring sufficient capital, banks can better manage systemic risk, protect their stakeholders, and contribute to the stability of the broader financial system. This proactive approach to capital adequacy supports a robust banking sector and helps prevent the propagation of financial crises.
- *Risk Monitoring and Reporting:* Effectively managing systemic risk also requires banks to employ sophisticated risk monitoring systems that track and analyse risk exposures in real time. These systems enable banks to promptly identify emerging risks and vulnerabilities, and this is crucial for maintaining financial stability. Real-time risk monitoring utilizes advanced models and analytics to detect potential threats as they develop. By continuously assessing various risk factors, banks can

respond quickly to changing conditions and mitigate potential impacts before they escalate. In addition, banks have robust reporting mechanisms to communicate risk information to regulators and other stakeholders. This transparency ensures that all relevant parties are informed of the bank's risk profile and any significant changes that may affect its stability. By implementing comprehensive risk monitoring and reporting systems, banks can proactively manage systemic risk, enhance their resilience, and maintain the trust of regulators, investors, and customers. This approach provides a more stable and secure financial environment, reducing the likelihood of widespread financial disruptions.

- *Collaboration and coordination:* Effective management of systemic risk requires banks to cooperate with regulatory authorities, central banks, and other financial institutions. This collaboration ensures the sharing of vital information and the coordination of efforts to address potential threats to the financial system. By working together, banks and regulatory bodies can exchange crucial information regarding emerging risks, best practices, and regulatory changes. This collective approach enhances the ability to respond swiftly and efficiently to systemic risks, thus minimizing their impact on the financial system. Wijaya et al. (2023) highlight that collaborative efforts among banks, regulatory authorities, and central banks are essential for a coordinated response to systemic risk. Through regular communication and joint initiatives, these entities can align their strategies and actions to bolster financial stability. Collaboration and coordination promote a unified approach to risk management, ensuring that all stakeholders are prepared to effectively address and mitigate systemic risks. This teamwork helps to build a more resilient financial system capable of withstanding and recovering from adverse events.
- *Regulatory Interventions:* Managing systemic risk involves strict adherence to a range of regulations designed to safeguard the stability of the financial system. Banks must comply with regulatory requirements including capital adequacy

standards, liquidity rules, stress testing, risk management guidelines, and reporting obligations. These regulations ensure that banks have robust risk management frameworks in place. Capital adequacy standards require banks to maintain sufficient capital reserves to absorb potential losses, while liquidity rules ensure that banks have sufficient liquid assets to meet short-term obligations. Stress testing evaluates the resilience of banks under extreme conditions, helping to identify vulnerabilities. Risk management guidelines provide a structured approach to identifying, assessing, and mitigating risks, while reporting obligations ensure transparency and accountability. By complying with these regulations, banks contribute to the financial system's overall stability and resilience. Dobránszky (2011) emphasized that regulatory compliance is essential for mitigating systemic risk as it ensures that banks operate within a framework that promotes sound risk management practices, enhancing their ability to withstand financial shocks and protecting the broader economy from potential disruptions.

- *Contingency Planning:* Managing systemic risk involves developing comprehensive contingency plans to address potential crises and ensuring continued operation under adverse conditions. Banks create plans to prepare for a wide range of scenarios, enabling them to respond swiftly and effectively to financial disruptions. Contingency plans include strategies for raising capital and ensuring that banks can access additional funds when needed to maintain stability. Liquidity management strategies help banks maintain sufficient liquid assets to meet their obligations even during periods of market stress. Asset sales may be part of a contingency plan, allowing banks to quickly convert assets into cash to bolster their liquidity. Additionally, cooperation with government agencies or other banks is often included to facilitate a coordinated response to systemic stress, leveraging external support to stabilize the situation. By having robust contingency plans in place, banks can enhance their resilience, minimize the impact of financial crises, and maintain confidence among stakeholders. These proactive measures are crucial for mitigating systemic risk and ensuring the stability of the broader financial system.

Despite their usefulness, these measures have certain limitations in managing systemic risk:

1. *Complexity and Interconnectedness*: The financial system is extraordinarily complex and interconnected, which makes it challenging to anticipate and manage all potential systemic risks. Interdependencies among institutions, markets, and financial products can lead to unforeseen consequences.
2. *Uncertainty and Unpredictability*: Systemic risks often emerge from unexpected events or combinations of events. Predicting and modelling such risks accurately is inherently difficult, limiting the effectiveness of risk management strategies.
3. *Behavioural Factors*: Systemic risks can be influenced by human behaviour, market sentiment, and psychological factors. These factors are challenging to model and manage effectively because they introduce elements of unpredictability.
4. *Regulatory Arbitrage*: Stringent regulations in one jurisdiction may lead to the migration of risks to less regulated areas or sectors. This regulatory arbitrage can undermine the effectiveness of risk management measures and create vulnerabilities in the system.
5. *Speed of Response*: Systemic risks can evolve rapidly, requiring swift and coordinated actions. Delays in response or insufficient coordination among stakeholders can hinder the effectiveness of risk management efforts.
6. *Data Limitations*: Systemic risk management relies on accurate and timely data. However, data gaps, data quality issues, and limitations in data collection can impede the identification and assessment of systemic risks.

7. *Regulatory Capture*: There is a risk of regulatory capture, where regulatory agencies may become overly influenced by the institutions they supervise, leading to inadequate oversight and failure to address systemic risks effectively.

Particularly because systemic risks can evolve very quickly and materialize over a very short period of time, it is imperative that systemic risk management efforts are strategic in nature and designed to make sure that by the time the shock that could result in systemic risk is occurring, the vulnerability of the institution to systemic shocks is already well quantified and strategies to ensure that the organization survives are already in place.

Quantifying a bank's systemic risk exposure is important for several reasons.

1. **Risk Management**: Quantifying systemic risk exposure allows banks to understand the potential impact of systemic events on their financial health. This helps identify and assess vulnerabilities, enabling more effective risk management strategies and mitigation measures.
2. **Capital Planning**: Quantification of systemic risk exposure aids in determining the appropriate level of capital required to withstand potential systemic shocks. Banks can assess whether they have sufficient capital buffers to absorb losses and maintain solvency during times of financial stress (Maree 2017).
3. **Stress Testing**: Systemic risk quantification is crucial to effectively conduct stress tests. Stress tests simulate extreme scenarios to evaluate the resilience of a bank. By quantifying systemic risk exposure, banks can model various stress scenarios and assess the impact on their capital, liquidity, and overall financial stability.

4. **Risk Appetite and Risk Limits:** Quantification of systemic risk exposure helps banks establish risk appetite frameworks and set risk limits. This enables them to define acceptable levels of exposure to systemic risks and establish risk thresholds that align with their overall risk management strategies.
5. **Regulatory Compliance:** Regulatory frameworks often require banks to measure and report systemic risk exposure. By quantifying systemic risk, banks can comply with regulatory requirements and provide transparent information to regulators, investors, and stakeholders.
6. **Risk Communication:** Quantifying systemic risk exposure enhances banks' ability to communicate effectively with regulators, investors, and the public. It enables clearer and more precise communication of potential risks, their potential impact on the bank, and the steps taken to manage and mitigate these risks.
7. **Business strategy and decision making:** Understanding the magnitude of systemic risk exposure informs banks' business strategies and decision-making processes. This helps them identify areas of their operations that may be more vulnerable to systemic risks, allowing for informed choices regarding risk-taking, expansion into new markets, or adjustments to their business models.
8. **Capital Allocation and Pricing:** Quantification of systemic risk exposure contributes to the allocation of capital within a bank. It helps determine the appropriate capital allocation to different business lines or activities based on their systemic risk profiles. Additionally, quantifying systemic risk exposure aids in pricing financial products and services by considering the inherent risks associated with systemic events.

If systemic risk is not properly and proactively quantified, an institution cannot take steps to proactively brace itself against future shocks. This is especially important because actions to brace an institution should be commensurate with the potential threat to the institution. If an organization is particularly vulnerable, it should do more to brace itself than an institution which is not as vulnerable to external shocks.

1.1. Background

The study of systemic risk represents a pivotal domain within the realms of economics and finance, and its origins date back to the 19th century. This era witnessed the nascent recognition of intricate interconnections that pervaded financial systems and institutions. As economies grew and global trade flourished, scholars and analysts grappled with the inherent risks posed by burgeoning interdependence within financial networks.

During the 19th century, seminal contributions laid the foundation for understanding systemic risk in response to what would eventually be the dawn of modern capitalism. One of the most notable works is that of Walter Bagehot (1873). Bagehot's seminal treatise outlines the causes and potential remedies for systemic financial risk. Central to his thesis was the assertion that the availability of liquidity during periods of financial distress was paramount in preventing systemic crises. Bagehot argued that ensuring financial institutions' access to ample liquidity bolstered their ability to meet obligations, thereby averting cascading failures that could destabilize the broader financial system.

Simultaneously, the discourse on systemic risk was enriched by the contributions of the French economist Jules Dupuit. Dupuit's insights, as expounded by Ekelund and Burton (1967), underscored the pivotal role of governmental intervention in safeguarding financial stability. He advocated for the implementation of safety nets to shield financial institutions, thereby mitigating the contagion effect and curbing systemic collapse.

Transitioning into the 20th century, the aftermath of the 1929 stock market crash and the ensuing Great Depression thrust systemic risk into the forefront of academic inquiry. This period marked a watershed moment in the conceptualization and understanding of systemic risk and its implications for financial stability. The ensuing decades have witnessed a deepening exploration of systemic risk dynamics, with scholars delving into the mechanisms that underpin financial instability.

The 1960s and 1970s heralded significant advancements in the study of systemic risk, as economists such as Myers (1977) elucidated the critical role of financial intermediaries in the economy. Myers' seminal work shed light on the vital functions performed by financial intermediaries in facilitating the flow of funds from savers to borrowers. Moreover, the era witnessed the ground-breaking contributions of Merton (1973), who pioneered a seminal theory of portfolio risk management. Merton's insights underscore the importance of asset correlations in determining overall portfolio risk, challenging the conventional notions of risk assessment.

Additionally, Eichengreen and Temin (1989) offer critical insights into the systemic ramifications of bank failures during the Great Depression. Their analysis revealed the compounding effects of widespread bank failures, precipitating a credit crunch that exacerbated the economic downturn. These seminal contributions have laid the groundwork for a deeper understanding of systemic risk dynamics, underscoring the intricate interplay between financial institutions and broader economic phenomena.

As the study of systemic risk matured, scholars embraced interdisciplinary perspectives transcending traditional finance paradigms. The 1980s and the 1990s witnessed a proliferation of research exploring systemic risks in complex systems beyond financial networks. Notably, the work of Albert-László Barabási and Réka Albert (1999) on network theory unveiled the vulnerabilities inherent in scale-free networks, elucidating how certain nodes, or "hubs," could precipitate cascading failures within the network.

Furthermore, Costanza et al. (1997) delved into the dynamics of ecological systems, illuminating how disturbances in one part of an ecosystem could propagate and impact the entire system. Their findings underscore the intricate interdependencies within ecosystems and the critical role of biodiversity in maintaining ecological resilience.

However, it was the 2008 global financial crisis that catalysed a seismic shift in the study of systemic risk. This unprecedented event laid bare the systemic vulnerabilities embedded within financial systems and prompted a re-evaluation of existing risk management frameworks. In the aftermath of the crisis, scholars intensified efforts to identify and mitigate systemic risks, drawing on insights from diverse disciplines, ranging from economics and finance to computer science and engineering.

Interdisciplinary collaboration has facilitated the development of innovative methodologies and analytical tools aimed at enhancing systemic risk assessment and management. Today, the study of systemic risk continues to evolve, driven by ongoing advancements in technology and interdisciplinary collaboration. Researchers are actively exploring novel approaches to address systemic risks across complex systems, including financial, ecological, and social networks.

The ultimate goal is to develop robust risk management frameworks capable of safeguarding against catastrophic failures and promoting resilience in the face of systemic shocks.

The Bank of Zambia (BoZ) has taken a series of proactive measures to mitigate systemic risks within the country's financial sector. One key initiative includes conducting stress tests to evaluate the resilience of banks against environmental and economic challenges. For instance, in 2024, BoZ collaborated with the African Natural Capital Alliance (ANCA) in a stress test examining the potential effects of nature loss on Zambia's banking sector. This analysis revealed that sectors such as agriculture and mining face significant profit reductions due to environmental degradation, which could adversely impact financial stability. Consequently,

BoZ has advocated for a transition in lending practices towards sustainable, nature-friendly activities to mitigate these risks (Reuters, 2024). Additionally, BoZ has recognised the growing complexities associated with financial innovation. Kasonde (2014) underscores the importance of modern risk management frameworks to address the challenges posed by emerging financial products and services. This emphasis on robust risk management reflects BoZ's commitment to ensuring sectoral resilience amidst evolving financial landscapes. Moreover, Musumali (2021) highlights the systemic risks associated with fragmented supervisory regimes. This further demonstrates the Bank's recognition of the need for enhanced supervisory structures to safeguard the broader financial system. These initiatives collectively underline BoZ's dedication to maintaining the stability of Zambia's financial sector through comprehensive risk management strategies.

1.2. Statement of the problem

Gerlach (2009), commenting on the Global Financial Crash of 2008, observed that on the causes of the crisis, it is difficult to deny that the management of financial firms, who must ensure the viability of their institutions, and policy makers responsible for financial stability underestimated the potential for (what admittedly initially appeared to be) isolated tension in a small part of the financial system to lead to a systemic crisis. As a response to this, policymakers (and regulators) have received much attention, but not enough attention has been paid to address the needs of financial institutions in managing systemic risk.

The different ways of measuring systemic risk currently in use have the following limitations.

1. Dependence on stock/equity market data. This limits their usefulness in markets where the equity markets are less developed.
2. Focus on the industry as a whole and, therefore, is more useful to regulators than individual financial institutions.

The absence of a method to quantify systemic risk without relying on stock market data limits individual institutions' ability to proactively assess their vulnerability to market shocks and

develop forward-looking strategies to enhance resilience, undermining effective risk management across the industry.

A systemic shock is unlikely to result in the failure of all the banks in the industry. Which banks will fail? Which Banks will be only moderately affected? Which Banks will not be affected at all? Being able to ascertain this in advance can help Banks with their strategic planning. The extent to which an industry participant is going to be affected in the event of a shock depends on several factors such as capitalization, financial performance, reserves, and balance sheet size. If an industry participant were able to calculate with reasonable accuracy how their institution would be affected in the event of a systemic risk shock, they would be able to take steps to protect themselves. This is confirmed by Oordt and Zhou (2016), who observe that a bank's systemic risk can be measured by evaluating its sensitivity to shocks in the financial system.

1.3. Purpose of the study

When a shock to the banking industry is expected, most existing measures of systemic risk can assist regulators, such as the central bank, in determining the vulnerability of the industry as a whole to this shock and which industry participants may fail as a result. Unfortunately, most available measures are not particularly useful for the management of any particular institution within that industry, as they are not designed to provide information regarding an institution's vulnerability to industry-wide shocks. This is especially the case for markets that do not have a well-developed equity market, as the few measures that could potentially serve this purpose rely heavily on market information.

This study introduces a novel measure of systemic risk aimed at providing banks with an accurate assessment of their susceptibility to industry-wide shocks at any given time. With this measure, institutions can quantify their vulnerability to external shocks and formulate tailored strategies to ensure long-term sustainability. Notably, this measure focuses on quantifying the

vulnerability of individual institutions to systemic risk without relying on stock market data, instead utilizing publicly available financial information.

1.4. Research Objectives

1.4.1. General objective:

To develop a method for quantifying the vulnerability of a banking financial institution to systemic risk that will allow the management of that institution to use it proactively and thereby position itself to develop strategies that ensure the sustainability of the institution.

1.4.2. Specific objectives:

1. Critically evaluate existing methodologies for measuring systemic risk, identifying their theoretical underpinnings, limitations, and applicability across varying banking environments.
2. Conduct a comprehensive assessment of systemic risk prevalence in the Zambian banking sector, integrating advanced quantitative techniques and qualitative insights to contextualize systemic risk within the unique dynamics of the local financial system.
3. Develop a multidimensional framework to systematically identify and prioritise the factors contributing to institutional vulnerability to systemic risk, ensuring the framework is both adaptable and empirically validated.
4. Design and validate an innovative, forward-looking method for quantifying systemic risk, capable of assessing the susceptibility of individual institutions and providing actionable insights for strategic planning, leveraging publicly available data and advanced predictive modelling.

1.5. Research questions

1. How do the conceptual underpinnings and methodological frameworks of systemic risk measurement vary, and what are their implications for diverse financial systems, particularly in emerging markets?
2. To what extent does systemic risk permeate Zambia's banking sector, and how do its unique economic and institutional characteristics influence the propagation of financial shocks?
3. Why do certain financial institutions exhibit greater vulnerability to systemic risk, and how do internal governance, operational strategies, and external market dynamics interact to shape their resilience?
4. How can a context-specific systemic risk measurement model be designed, validated, and applied to accurately assess the vulnerability of financial institutions in emerging markets?

1.6. Significance of the study

The findings of this study carry profound implications for financial institutions, regulatory bodies, and the broader financial ecosystem, with far-reaching benefits for financial stability and the protection of depositors. The primary beneficiaries of this research are financial institutions, particularly banks, which now have access to a rigorous and standardised measure of systemic vulnerability. By quantifying their susceptibility to systemic shocks, banks are empowered to proactively identify potential weaknesses and develop robust strategies to enhance resilience. This enables them to safeguard their operations, protect depositor funds, and ensure their long-term sustainability, even in the face of severe economic disruptions.

For regulators and policymakers, this study offers a pivotal tool for strengthening oversight and regulatory frameworks. The systemic vulnerability score provides regulators with an objective and standardised metric to assess the systemic risk exposure of individual institutions and the banking sector as a whole. Equipped with these insights, regulators can implement targeted measures to address vulnerabilities and fortify the sector against systemic risks.

Policymakers, on the other hand, can leverage this measure to design and implement macroprudential policies aimed at mitigating the impact of systemic crises, ensuring the financial system remains resilient under stress.

The broader implications of this study extend to the financial industry at large, contributing to the resilience and stability of the entire system. By introducing a robust and replicable methodology for assessing systemic risk, the study enhances transparency, accountability, and trust within the financial ecosystem. The adoption of such a measure fosters market confidence, reinforcing depositor and investor trust in the stability of financial institutions. Furthermore, the ability to identify and address systemic risks proactively reduces the likelihood of widespread crises, protecting depositors from potential losses and ensuring the integrity of the financial system.

Ultimately, this study makes a meaningful contribution to the global effort to enhance financial stability. By equipping financial institutions and regulators with a practical and standardised tool for managing systemic risk, it addresses one of the most critical challenges facing modern banking: the prevention of systemic crises that threaten the stability of entire economies. This proactive approach not only safeguards individual banks but also strengthens the entire financial sector, ensuring its ability to withstand external shocks and continue serving as a cornerstone of economic stability and growth.

1.7. Scope of the study

This study is restricted to the Zambian commercial banking industry. The study sample included all commercial banks in operation in Zambia over the period January 2010 to December 2022. January 2010 was chosen because a number of banks started their operations in 2009; in 2006, there were 13 commercial banks in Zambia, and since 2008, six more foreign bank subsidiaries were registered, bringing the total number to 19 commercial banks for the whole sector at the end of 2012. (Zambia Invest 2022)

1.8. Ethical considerations

Given the nature of the study, particularly the use of published information, no potential ethical challenges were envisioned or encountered in this study. Even with the publicly available information, care was taken to mask the names of individual Banks in the study so that none of them could potentially be affected by reputational issues.

1.9. Thesis Outline

1.9.1. Chapter One – Research Background

This chapter outlines the background of systemic risk management, highlighting the shift from traditional methods to a proactive approach. It discusses how systemic risk involves events or shocks within a financial system that can propagate and negatively impact interconnected institutions, leading to a domino effect of failures. The chapter emphasises the importance of proactive, long-term measures to manage this risk and ensure organisational resilience. It also outlines the need for identifying banks' vulnerability in advance to aid strategic planning and mitigate the rapid evolution of systemic shocks.

1.9.2. Chapter Two - Literature Review

In this chapter, the existing research on systemic risk and its measurement is reviewed, underscoring its complexity and multifaceted nature. The chapter highlights the importance of proactive systemic risk management for ensuring long-term viability and success. It critiques current measures, noting their limitations in informing individual institutions, especially in markets without well-developed equity markets. The need for proactive measures to prevent and mitigate the impact of systemic risk on operations is emphasised.

1.9.3. Chapter Three - Theoretical Framework

This chapter provides the theoretical framework for the study, guiding hypothesis development and data analysis. Adopting a positivist paradigm, the study embraces the assumption that knowledge is objective and can be quantitatively investigated. The focus

is on measuring systemic risk without relying on stock market data, which is particularly relevant for emerging markets. The chapter aims to develop a model for measuring systemic risk for individual financial institutions by analysing the relationship between market shocks and systemic risk.

1.9.4. Chapter Four - Conceptual Framework

The conceptual framework of the study is presented, defining key concepts and theories to ensure focused and coherent research. The chapter discusses the importance of accurately predicting a shock's impact on financial institutions for protective measures. It explores how major shocks manifest in various parameters such as performance, growth rates, and capitalisation, and how the impact on individual firms depends on factors like size and management. By analysing past responses to shocks, the study aims to predict future vulnerabilities and develop sustainability strategies.

1.9.5. Chapter Five – Research Methodology

This chapter outlines the research methodology, aiming to develop a model for measuring a bank's vulnerability to systemic risk. The study investigates measurement methods, the prevalence of systemic risk in Zambia's banking industry, and factors affecting institutional vulnerability. It combines case study and quantitative approaches, focusing on Zambia's banking sector from January 2010 to December 2022. The sample includes all commercial banks operating during this period, reflecting the sector's growth.

1.9.6. Chapter Six – Data Presentation and Analysis

In this chapter, the collected data are analysed, starting with general market movements to identify systemic risk periods in Zambia. Specific stress periods are identified, and two banks (one vulnerable and one resilient) are analysed in detail using correlation, covariance, financial ratio, and volatility analyses. The analysis reveals diverse sensitivity levels to market movements, with banks showing varying correlations and performance trends during stressed periods. Volatility in key ratios provides further insights into risk

profiles, indicating resilience or vulnerability. This chapter also derives the Systemic Vulnerability Score (SVS) to calculate bank vulnerability, demonstrating its effectiveness in predicting vulnerability using the COVID-19 pandemic as a reference.

1.9.7. Chapter Seven - Discussion of Results

This chapter builds on the analysis from Chapter Six, discussing the key findings and the practical implications of the Systemic Vulnerability Score (SVS). It explores how the SVS can aid in developing strategies to mitigate systemic risk before shocks occur, enhancing the resilience of financial institutions. The chapter also validates the SVS and discusses its reliability and usefulness in real-world applications.

1.9.8. Chapter Eight - Conclusions and Recommendations

The final chapter concludes the study, highlighting the successful creation of a systemic vulnerability measure valuable for banks and regulators. For banks, this measure offers insights into potential weaknesses, aiding strategic decision-making, capital allocation, and risk mitigation. Regulators benefit from a standardised metric for assessing individual and overall banking system resilience, informing interventions and stress testing scenarios. The systemic risk vulnerability score enhances proactive risk management and contributes to the stability and resilience of the financial system.

CHAPTER TWO - LITERATURE REVIEW

2.0. Introduction

This chapter provides a review of the existing research on systemic risk and its measurement. The measurement of systemic risk is a crucial aspect of managing and mitigating this risk, and it involves the use of complex mathematical and statistical tools.

The chapter first explores the complex nature of systemic risk and the lack of consensus in defining it. Various definitions of systemic risk are presented, focusing on distinct aspects such as imbalances, correlated exposures, contagion, and negative externalities. The chapter highlights that systemic risk is a multifaceted issue that requires comprehensive measures and principles for accurate measurement. Contagion, the spread of financial distress among interconnected institutions, is identified as a crucial element of systemic risk. The section also examines factors that cause or affect systemic risk, such as bank size, interconnection, leverage, liquidity, and regulation. Understanding these factors is vital for mitigating systemic risks and promoting the stability of the banking sector and the broader economy.

The chapter then discusses various measures used to assess systemic risk in financial institutions. It highlights measures such as the Systemic Risk Index, CoVaR, Systemic Value-at-Risk, Systemic Risk Index (based on bank failure impact), Financial Connectedness Index, Marginal Expected Shortfall (MES), SRISK, Lower Tail Dependence (LTD), and Contingent Claims Analysis (CCA). These measures aim to capture distinct aspects of systemic risk, including contagion effects, interconnectedness, potential losses, and joint default risk. Each measure has its strengths and weaknesses, such as reliance on market data or limited applicability in under-developed stock markets. The use of stock market data is discussed in more detail and the chapter explores different approaches to using stock market data, including analysing market volatility, correlation between stocks, and overall leverage levels. These approaches help identify potential areas of systemic risk and inform risk mitigation efforts. This section concludes by discussing the limitations of using stock market data, such as

providing a partial view of the financial system and being influenced by a range of factors, biases, and heuristics.

Due to the fact that the study is focused on the Zambian Banking sector, the next section gives an overview of the sector, its history and how systemic risk has been manifesting in the sector in the past. From this discussion, an overview of the causes of systemic bank failures in Zambia is presented.

The chapter then discusses the limitations of the existing literature on systemic risk and the gaps in knowledge identified by the researcher, and how this study is meant to contribute to the knowledge base of the area of study.

2.1. Overview of Systemic Risk

2.1.1. Definition of Systemic Risk

A systemic risk literature review by Galati and Moessner (2010) concludes that despite the wealth of research on the subject, there is still no consensus on the definition of systemic risk. They observe that in the case of financial stability, there are many systemic risk definitions, but it remains difficult to operationalize them.

For instance, in their reviews, Bisias et al. (2012) and Oosterloo and de Haan (2003) both identified a range of definitions for systemic risk, which focus on different aspects of the phenomenon. These definitions include imbalances, correlated exposures of financial institutions, negative impacts on the real economy, information asymmetry, feedback effects, asset bubbles, contagion, and negative externalities.

Despite the lack of consensus in the literature, it is clear that systemic risk is a complex and multifaceted issue that requires various measures and principles to accurately measure it. Eijffinger (2012) provides a selection of definitions for systemic risk and notes that,

regardless of its form, it ultimately leads to a loss of confidence and increased uncertainty in the financial system and its individual components.

According to Smaga (2013), central banks generally do not offer definitions of systemic risk. Instead, as noted in Oosterloo and de Haan's (2003) survey, central banks tend to focus on defining financial stability rather than financial crisis or systemic risk. However, Ostalecka (2012) emphasizes that despite differences in definitions, there is no doubt that systemic risk in the financial system poses significant risks to financial stability.

According to Kaufman and Scott (2002), systemic risk refers to an event having effects on the entire banking, financial, or economic system, rather than just one or a few institutions. On the other hand, Mishkin (1995) defines systemic risk as the likelihood of a sudden, usually unexpected, event that disrupts information in financial markets, making them unable to effectively channel funds to those parties with the most productive investment opportunities.

In 2009, the IMF, the FSB and the BIS proposed defining a “systemic event” as “a risk of disruption to financial services that (i) is caused by an impairment of all or parts of the financial system and (ii) has the potential to have serious negative consequences for the real economy.”

According to Szpunar (2012), systemic risk can be defined as the potential for a risk source within or outside of the financial system, or the interconnectedness of specific financial institutions and financial markets and their impact on the real economy. Zigrand (2014) takes a slightly different approach, defining systemic risk as comprising both the risk to the proper functioning of the system and the risk created by the system. Allen and Carletti (2011) identify six types of systemic risk, including common exposure to asset price bubbles (especially real estate bubbles), liquidity provision and mispricing of assets,

multiple equilibria and panics, contagion, sovereign default, and currency mismatches in the banking system.

As can be seen above, there are many different definitions of systemic risk because the concept of systemic risk is complex and multifaceted. Systemic risk encompasses a wide range of potential risks that can affect financial systems, including financial contagion, macroeconomic shocks, and the failure of individual institutions. Because of this complexity, different definitions of systemic risk tend to focus on different aspects of the concept. For example, some definitions focus on the potential for financial contagion, while others focus on the impact of systemic risks on the broader economy.

The proliferation of different definitions of systemic risk has several implications. One is that it can make it difficult to compare and contrast different approaches to measuring and managing systemic risk. Different definitions may use different criteria and focus on distinct aspects of systemic risk, making it difficult to compare the results of different studies or proposals.

Another implication is that it can make it difficult to develop a consistent approach to measuring and managing systemic risk. Different definitions may lead to different approaches to assessing and addressing systemic risks, which can make it challenging to coordinate efforts across different institutions or countries.

For purposes of this study, systemic risk will be defined as the risk that an institution will be negatively affected by an industry event that occurs outside its sphere of control and affects the industry as a whole.

2.1.2. Contagion and Systemic Risk

One of the definitions offered for systemic risk in the financial system is that it is the risk that the failure of an institution to meet its contractual obligations may in turn cause other institutions to default, with the chain reaction leading to broader financial difficulties (Bank for International Settlements 1994). From this definition, it is clear that an important concept in the discussion of the definition of systemic risk is Contagion.

Contagion in the banking industry refers to the spread of financial distress from one institution to others. This can occur when banks are interconnected through various channels, such as through interbank lending or common exposures to certain assets or liabilities. When one bank experiences financial difficulties, this can have negative impacts on the other banks that are connected to it, potentially triggering a cascade of failures and putting the stability of the entire banking system at risk. (Daly et al, 2019)

Contagion in the banking industry can be caused by a wide range of factors. For example, it can be triggered by a sudden drop in asset values, such as the bursting of a housing bubble or the collapse of a major stock market index. It can also be caused by a sudden increase in borrowing costs, such as when the central bank raises interest rates or when credit markets seize up. In both cases, the impact of the negative shock can be amplified by the interconnectedness of the banks, leading to a cascading effect.

According to Smaga (2014), contagion effect can be defined as the probability that the instability of a given institution (instrument, market, infrastructure, financial system sector) will spread to other parts of the financial system with negative effects, leading to a system-wide crisis. Smaga explains that this definition is based on the assumptions that contagion cannot occur without an initial shock, and that the scale and pace of transmission between institutions (markets) exceeds what one would expect under "normal" market conditions.

Smaga also notes that systemic risk varies substantially and encompasses a broad range of features. This means that a financial instrument, institution, market, market infrastructure, or segment of the financial system may be the source of systemic risk, the transmitter of it, as well as be affected by it. It can be difficult to determine whether the scale of an event is (or will become) systemic, as the extent to which it affects other parts of the system may be subject to dynamic changes and assessment may be prone to underestimation bias during turbulent periods. Systemic risk can have its source within or outside of the financial system, or it can result from the interconnectedness of particular financial institutions and financial markets and their exposure to the real economy.

According to Constâncio (2012), contagion occurs when financial institutions are interlinked like in interbank markets. This interconnection can result in an increased liquidity in the system and better risk sharing among the banks. Contagion is inherent to the systemic risk and occurs when systemic risk materializes. Contagion is the main mechanism through which financial instability becomes so widespread that a crisis reaches systemic dimensions.

The banking system is inherently more vulnerable to contagion. According to Kaufmann (1992), bank failure contagion occurs faster, spreads more broadly within the industry, results in a larger number of failures, results in larger losses to creditors (depositors) at failed banks and spreads further beyond the banking industry, causing substantial damage to the financial system as a whole and the macroeconomy. Contagion effect is often due to market participants insufficiently taking into account negative externalities (increase systemic risk) caused by their activities and interconnectedness. Contagion effect can therefore affect all institutions, not just those with weaker financial conditions, but also those in sound condition that are affected by second-round effects of domino effect and changing financial market conditions.

One way to measure the potential for contagion in the banking industry is to analyse the level of interbank lending and other forms of interconnectedness. By examining the extent to which banks are exposed to each other through these channels, analysts can identify potential sources of contagion and assess the likelihood of its occurrence.

Additionally, regulators and policymakers can also take steps to mitigate the risks of contagion in the banking industry. For example, they can implement measures to increase the resilience of individual banks, such as by requiring them to hold higher levels of capital or liquidity. They can also put in place measures to enhance the stability of the broader financial system, such as by establishing mechanisms for resolving failing banks or providing emergency liquidity support to institutions in need.

2.1.3. Main factors that cause or affect systemic risk

Various studies have identified different factors that cause or affect systemic risk. Krause et al. (2015) found that a bank's contribution to systemic risk increases with its size, profitability, and the share of nonperforming loans. Ahrend and Goujard (2012) also observed that a gravitation towards external liabilities, particularly debt, significantly raises the risk of a systemic banking crisis.

Further, Kearns (2021) identified several factors that increase the likelihood of bank risk becoming systemic risk. These factors include:

- If the affected bank is large, its failure could have substantial repercussions throughout the financial system.
- If the nature of the risk is correlated across banks, causing simultaneous realizations in multiple banks. For example, a deposit run on one bank might precipitate runs on others perceived as similar.
- If there is a high degree of interconnection or the risk affects a critical node of the financial system, it can lead to widespread instability.

- If the realization of that risk is likely to be persistent, causing long-lasting effects on the financial system.
- If it occurs during periods of high uncertainty or risk aversion, such as during a global pandemic, the impact can be more severe due to heightened sensitivity and reduced confidence in the financial markets.

In 2009, the International Monetary Fund (IMF), the Financial Stability Board (FSB), and the Bank for International Settlements (BIS) set out an approach to assessing systemic importance. They outlined three main criteria to assess the “systemic importance” of firms, markets, or instruments: size, substitutability, and interconnectedness. Size refers to the volume of financial services provided by a component of the financial system. Substitutability is the extent to which other components can provide the same services in the event of a failure. Interconnectedness denotes the linkages with other components of the system. These criteria should be complemented by considering financial vulnerabilities such as leverage, liquidity risk, maturity mismatches, and complexity, as well as the capacity of the institutional framework to deal with financial failures. These guidelines offered an early conceptual framework, serving as a useful reference point for supervisors and industry participants.

Kleinow and Nell (2015) contribute to this body of research by identifying key determinants of systemic risk in the European banking sector. They found that systemic risk is influenced by several factors, including bank size, loan ratio, non-interest income, leverage, and liquidity. Their findings support the notion that larger banks pose higher systemic risks due to their significant market presence and interconnectedness. High loan ratios indicate lower risk diversification, and higher non-interest income from activities like investment banking correlates with increased systemic risk. While leverage did not show a significant impact in their study, higher liquidity ratios unexpectedly increased systemic risk, possibly due to inefficient capital allocation.

Moreover, Kleinow and Nell highlighted that political stability, regulatory quality, bank concentration, government debt ratios, and bank claims on government also affect systemic risk. Political stability and high government debt ratios, surprisingly, were associated with higher systemic risk, suggesting that stable environments might lead to complacency and higher interconnectedness. Higher regulatory quality generally reduced systemic risk, while higher bank concentration and claims on government increased it.

Building on these insights, the factors influencing systemic risk can be consolidated into the following categories:

2.1.3.1. Interconnectedness of Financial Institutions

Systemic risk increases when financial institutions are highly interconnected because this heightens the potential for financial contagion to spread from one institution to another. Interconnectedness means that the failure or distress of one bank can quickly impact others due to their financial linkages. Jackson and Pernoud (2020) found that limited connectedness can function as an insulator against systemic shocks. This interconnectedness can be exacerbated by complex financial products and interbank lending, where institutions are heavily reliant on each other.

2.1.3.2. Level of Leverage in the Financial System

Elevated levels of leverage across the financial system increase systemic risk by making institutions more vulnerable to shocks and raising the potential for cascading failures. Leverage amplifies the financial activities of institutions by allowing them to borrow extensively to increase their asset base. While this can enhance profitability in stable times, it significantly heightens the risk during downturns. This is corroborated by Meuleman and Vander Venet (2019), who found that excessive leverage can lead to rapid declines in asset values, causing a chain reaction of failures.

2.1.3.3. Size of an Institution

The size of an institution affects both the amount of systemic risk it contributes to the industry and its vulnerability to systemic shocks. Larger institutions, due to their substantial market presence and extensive connections within the financial system, pose greater risks. Their failure can lead to significant disruptions in the financial markets, as noted by Acemoglu et al. (2013). The concept of "too big to fail" underscores the idea that the collapse of a large bank could necessitate government intervention to prevent widespread economic fallout.

2.1.3.4. Level of Liquidity in the Financial System

Low liquidity levels increase systemic risk because institutions may struggle to meet their obligations, raising the likelihood of failures. Liquidity refers to the ability of an institution to quickly convert assets into cash without significant loss of value. Davydov et al. (2020) highlighted the critical role of liquidity in maintaining financial stability, noting that liquidity shortages can trigger panic and rapid asset sell-offs, further destabilizing the system.

2.1.3.5. Level of Regulation and Supervision

Poor regulation and supervision increase systemic risk by allowing risky behaviour and potential failures. Effective oversight is essential to mitigate these risks, as noted by Meuleman and Vander Venet (2019). Regulatory frameworks that enforce prudent risk management practices and monitor financial institutions' activities can help prevent excessive risk-taking and ensure stability. Additionally, regulations need to adapt to the evolving financial landscape, addressing new risks as they emerge.

2.1.3.6. Profitability and Risk-Taking Behaviour

High profitability can indicate either stability due to successful operations or higher risk due to potentially risky activities driving profitability. Kleinow and Nell (2015)

found that profitability metrics have both risk-enhancing and risk-reducing effects on systemic risk. Institutions engaging in high-risk, high-reward activities might show strong profitability, but these activities can also make them more susceptible to systemic shocks.

2.1.3.7. Macroeconomic Conditions and Policy Environment

Political stability and regulatory quality significantly impact systemic risk. While political stability was found to increase systemic risk, likely due to increased interconnectedness and complacency, high regulatory quality generally mitigates systemic risk. The policy environment, including the extent of government involvement in the financial sector and the robustness of regulatory frameworks, plays a crucial role in shaping systemic risk. Effective policies that promote financial stability and prevent excessive risk-taking are essential for maintaining a resilient financial system.

2.2. Systemic Risk and Proactive Management Practices

2.2.1. Strategic Vision and Organisational Alignment

Proactive management is a critical component for organisations seeking to navigate the complexities of their operating environments. It involves deliberate decision-making and the execution of strategies that shape the organisation's future trajectory (Babafemi, 2015). This approach centres on defining clear strategic visions and priorities, ensuring all actions are aligned with overarching goals. By involving all tiers of management, proactive strategies ensure alignment, coherence, and efficacy across organisational levels. This alignment not only streamlines decision-making but also fosters internal collaboration, improving efficiency and effectiveness in achieving long-term objectives.

2.2.2. Anticipation of Environmental Changes

The core of proactive management lies in its capacity to foresee and respond to changes within the external environment. Through rigorous analysis of market and industry dynamics, organisations can identify potential disruptions and adapt their strategies accordingly (Adeleke et al., 2008). By anticipating external shocks, proactive management empowers organisations to mitigate risks before they materialise, ensuring operational continuity and preserving competitive positioning. This forward-looking approach is particularly critical in industries such as banking, where systemic risks can have far-reaching implications for financial stability (Sezer & Kurt, 2020; Prymostka & Prymostka, 2019).

2.2.3. Organisational Competitiveness and Strategic Adaptability

Proactive management is indispensable for sustaining long-term competitiveness. Regular reviews and revisions of strategic plans enable organisations to remain adaptive in evolving environments, ensuring their strategies stay relevant and effective. This adaptability strengthens competitive advantage, supports growth, and maintains operational continuity over time. Research underscores the link between proactive planning and superior organisational performance. Studies by Sihab et al. (2012), Lorange (1977), and Steiner (1979) have demonstrated correlations between proactive strategies and improved sales, earnings, and debt-equity ratios (Ramanujam et al., 1986). Further evidence from Ansoff et al. (1970) highlights that firms engaging in proactive planning often achieve superior outcomes in mergers and acquisitions compared to reactive approaches.

2.2.4. Proactive Risk Management in Banking

In the banking sector, proactive risk management plays a pivotal role in safeguarding stability, security, and profitability. The ability to anticipate risks and implement pre-

emptive measures is essential, as banking institutions face unique challenges that affect not only their operations but also the broader financial system. Prymostka and Prymostka (2019) highlight that proactive management is essential for identifying and addressing risks, creating conditions for reliable functioning, and preserving capital. This comprehensive approach involves continuous monitoring, assessment, and strategic adjustment to mitigate potential disruptions before they escalate.

Modern risk management approaches, including advanced risk assessment tools, allow banks to respond swiftly to external shocks, reducing the impact of adverse events on liquidity and profitability (Kazbekova et al., 2020). Proactive management further supports regulatory compliance, enhances capital reserves, and protects depositor funds—key pillars of stability in the banking industry.

2.2.5. Proactive Management as a Driver of Resilience

Ajugwe (2016) emphasises that a proactive risk management framework is critical for banks to operate profitably and mitigate risks effectively. This involves integrating risk management into the organisational culture, ensuring that all operational and strategic decisions consider risk implications. Sabirova et al. (2020) add that proactive strategies enable banks to neutralise the effects of risk events while minimising losses, ultimately strengthening their operational framework and enhancing the quality of their products and services.

Effective risk management is not a static process; it requires continuous assessment and recalibration to address emerging threats. Yoseph (2018) argues for integrated risk management systems that minimise losses and ensure survival, while Kerimov (2017)

highlights the role of proactive management in sustaining commercial banks during periods of financial instability.

2.2.6. Core Competencies and Growth Opportunities

Proactive management also involves identifying and leveraging core competencies—unique capabilities that differentiate a bank from its competitors and deliver maximum value to its clients. By focusing on these strengths, banks can allocate resources efficiently and solidify their competitive advantage. Additionally, proactive management supports growth by identifying and capitalising on new opportunities, such as entering untapped markets, launching innovative products, or pursuing strategic acquisitions. These initiatives position banks for sustained success and increased market share.

2.2.7. Managing Systemic Risks and Ensuring Stability

Understanding and managing systemic risks is central to proactive management in banking. This entails anticipating potential crises and preparing strategies to mitigate their impact, rather than reacting to events after they occur. Proactive risk management fosters stability and security amidst volatile internal and external conditions, ensuring the bank's sustained viability and operational success (Kazbekova et al., 2020; Stulz, 2014; Prymostka & Prymostka, 2019).

Proactive management serves as a cornerstone for organisational resilience and long-term success. In the banking sector, it ensures stability, protects depositor funds, and sustains profitability by addressing risks before they escalate. By adopting proactive strategies, banks not only safeguard their own operations but also contribute to the broader stability of the financial system. This approach, grounded in foresight and adaptability, enables financial institutions to remain competitive and secure in a rapidly changing environment.

2.3. Review of Similar Studies

Understanding systemic risk is paramount in safeguarding financial stability, especially in the wake of global financial crises. A plethora of studies have endeavoured to develop measures capable of comprehensively capturing the intricacies of systemic risk within financial systems. These measures vary in conceptual frameworks, computational methodologies, and intended applications, reflecting the diverse dimensions of systemic risk.

According to Acharya and Steffen (2012), papers that proposed measures of systemic risk include Acharya et al. (2010), Brunnermeier and Adrian (2010), Allen, Bali, and Tang (2010), Billio et al. (2010), Brownlees and Engle (2010), Chan-Lau (2010), Huang, Zhou, and Zhu (2010), and Tarashev, Borio, and Tsatsaronis (2010). The measures proposed by these papers and others related to them are analysed in a comprehensive overview provided by Kleinow and Nell (2015), who note that the literature can be divided into two streams: systemic risk contribution and systemic risk sensitivity, as shown in

Table 2-1.

Table 2-1 Systemic risk Sensitivity and systemic risk contribution: Measures of Systemic risk

<i>Systemic risk contribution</i> How does a single institution contribute to systemic risk?		<i>Systemic risk sensitivity</i> To what extent is a single institution affected by systemic risk?	
<i>ACoVar</i>	captures the marginal contribution of a particular institution (in a non-causal sense) to the overall systemic risk by applying quantile regressions (Adrian and Brunnermeier, 2011)	<i>Marginal Expected Shortfall (MES)</i>	determines the level of systemic risk by measuring an institution's losses (in terms of negative index returns) when the (financial) system as a whole is doing poorly (Acharya et al., 2011)
<i>Co-Risk</i>	analyses the tails of the default distributions for pairs of institutions, or – to put it simply – it analyses how the default risk of an institution affects the default risk of another institution (Chan-Lau, 2010)	<i>SRISK</i>	is an index formed by the leverage, size and the MES of a firm (Brownlees and Engle, 2012)
<i>Granger Causality</i>	measures the directionality of relationships or causality of price movements of securities issued by financial institutions (Billio et al., 2012)	<i>Lower Tail Dependence (LTD)</i>	is a measure of the propensity of a single financial institution to experience joint extreme adverse effects (measured in price returns) with the market (Weiß et al., 2014)
<i>Principal Component Analysis (PCA)</i>	is a technique to decompose asset returns of a sample of financial institutions into linkages between those institutions (León and Murcia, 2013)	<i>Contingent Claims Analysis (CCA)</i>	measures systemic solvency risk based on market-implied expected losses of financial institutions by generating aggregate estimates of the joint default risk of multiple institutions as a conditional tail expectation (Jobst and Gray, 2013)

This table summarises a selection of common systemic risk measures for financial institutions from the *systemic risk sensitivity* and *systemic risk contribution* streams.

Source Kleinow and Nell (2015)

The work done by Kleinow and Nell (2015) highlights significant gaps in the field of systemic risk, particularly for risk practitioners within the industry as opposed to regulators or policymakers. They demonstrated that a considerable proportion of the available methods for measuring systemic risk focus on the systemic risk contribution of institutions, addressing the question, “How does a single institution contribute to systemic risk?” However, these measures are not particularly useful to practitioners because the extent to which an institution contributes to systemic risk does not indicate how vulnerable that institution is to systemic risk. Their distinction between systemic risk contribution and systemic risk sensitivity underscores this point. This distinction is also made by Zheng et al. (2019), who found that there was no significant correlation between the systemic importance and vulnerability of financial institutions in the cross-sectional dimension. Their study also distinguished between two key aspects of systemic risk: risk contribution,

which reflects systemic importance, and risk exposure, which reflects systemic vulnerability.

Kleinow and Nell (2015) do however discuss methods that can be used to measure the systemic risk sensitivity of financial institutions, measures that seek to answer the question “To what extent is a single institution affected by systemic risk?”. These methods are relevant to this study and ideally, should address the problem identified in section 1.3.

2.3.1. Systemic Risk Contribution Measures

Systemic risk contribution measures assess how individual institutions contribute to the overall risk of the financial system. These measures are crucial for identifying institutions whose distress could precipitate systemic crises. The concept of systemic risk contribution revolves around understanding the extent to which the failure or distress of a single financial institution can impact the broader financial ecosystem. By identifying and quantifying this contribution, policymakers, regulators, and financial institutions themselves can better grasp the potential threats to financial stability and take appropriate actions to mitigate these risks.

Systemic risk contribution measures aim to quantify the extent to which an individual financial institution adds to the overall risk within the financial system. This is based on the premise that the failure or significant distress of one institution can trigger a chain reaction, leading to widespread financial instability or even a systemic crisis.

2.3.1.1. CoVaR: Conditional Value at Risk

Acharya et al. (2010) introduced the concept of "CoVaR" (Conditional Value at Risk) as a measure to assess systemic risk within financial systems, with a particular emphasis on capturing the interconnectedness among financial institutions and the spillover effects of individual failures. CoVaR operates by quantifying the potential

increase in Value at Risk (VaR) for the entire financial system when a specific institution experiences distress. This measure aims to provide insights into how the failure of one institution can transmit risks to the broader financial landscape, thereby highlighting systemic vulnerabilities.

One of CoVaR's notable strengths lies in its interpretability and computational simplicity, making it accessible for both academics and practitioners. By directly quantifying the potential spillover effects of individual failures, CoVaR offers a clear and intuitive metric for assessing systemic risk dynamics. Additionally, its emphasis on interconnectedness aligns well with contemporary understandings of systemic risk, acknowledging the importance of network effects within financial systems.

However, despite its merits, CoVaR exhibits several limitations that warrant consideration. Foremost among these limitations is its neglect of the contagion effect, whereby distress in one institution triggers adverse outcomes in others through various channels of transmission. By focusing solely on the spillover effects of individual failures, CoVaR may present an incomplete view of systemic risk dynamics, potentially underestimating the true extent of interconnected vulnerabilities.

Moreover, CoVaR's reliance on stock market data for its calculation may restrict its applicability in less-developed financial markets. In contexts where comprehensive market data is scarce or unreliable, CoVaR's effectiveness as a risk assessment tool may be compromised, limiting its utility for comprehensive risk management strategies.

In summary therefore, while CoVaR offers valuable insights into the interconnectedness of financial institutions and the spillover effects of individual failures, its neglect of the contagion effect and reliance on stock market data pose significant limitations to its applicability and effectiveness. Future research endeavours

should focus on enhancing CoVaR's methodology to address these limitations, thereby strengthening its utility as a robust measure of systemic risk within financial systems.

2.3.1.2. Δ CoVaR (Delta Conditional Value at Risk)

Δ CoVaR (Delta Conditional Value at Risk), developed by Adrian and Brunnermeier (2011), quantifies the additional risk a financial institution imposes on the system when it is in distress. This measure is derived using quantile regressions to capture the tail co-movements between the institution and the financial system. Δ CoVaR is defined as the difference between the Value at Risk (VaR) of the financial system conditional on the institution being in distress and the VaR of the financial system in the median state. Δ CoVaR requires data on the institution's and the system's returns, particularly focusing on extreme negative returns. This measure captures tail dependencies and is particularly useful for identifying institutions that are systemically important under stress conditions. However, the method relies heavily on the correct specification of the quantile regression model and assumes that the relationships between variables are stable over time. Δ CoVaR might not effectively capture dynamic changes in risk interdependencies, and its accuracy can be influenced by the choice of quantiles and the period of data used. Despite these limitations, Δ CoVaR can help financial institutions understand their potential impact on the financial system under distress, guiding them in implementing risk management strategies to mitigate their systemic importance.

2.3.1.3. Co-Risk

Co-Risk, introduced by Chan-Lau (2010), evaluates the default dependencies between financial institutions. By analysing the joint distribution of defaults, Co-Risk measures how the default risk of one institution influences another. This measure requires data on the default probabilities and correlations between institutions. Co-Risk helps identify the network of interdependencies among financial institutions, which is crucial for understanding contagion risks. However, estimating joint default probabilities can

be complex and data-intensive, requiring sophisticated statistical techniques. Co-Risk might not capture nonlinear dependencies effectively, and its accuracy can be influenced by the choice of the default threshold. Despite these challenges, Co-Risk can inform institutions about their exposure to counterparty risk, enabling them to manage their interbank lending and borrowing relationships more prudently.

2.3.1.4. Granger causality tests,

Granger causality tests, as used by Billio et al. (2012), determine the directionality of risk transmission between financial institutions. This method identifies causal relationships in price movements, providing insights into how shocks propagate through the financial system. Granger causality requires time series data on the price movements or returns of financial institutions. This measure helps in identifying the lead-lag relationships between institutions, which is crucial for understanding the pathways of risk transmission. However, Granger causality tests assume linear relationships, which might not capture the complexities of financial markets. The method's reliance on historical data limits its predictive power, and it might not account for structural changes in the market. Despite these limitations, Granger causality can help institutions identify their systemic interconnectedness, allowing them to manage their risk exposures and network dependencies more effectively.

2.3.1.5. Principal Component Analysis (PCA),

Principal Component Analysis (PCA), as employed by León and Murcia (2013), decomposes the returns of a sample of financial institutions into principal components to identify linkages. This technique reduces the dimensionality of the data, highlighting the most significant sources of co-movement. PCA requires return data for a sample of financial institutions. PCA effectively identifies common factors driving the co-movement of asset returns, making it useful for detecting latent systemic risks. However, the results of PCA can be challenging to interpret, and the method assumes that the principal components are linear combinations of the original variables. PCA

might not capture nonlinear relationships effectively, and its reliance on historical data limits its predictive power. Despite these challenges, PCA provides insights into the underlying risk factors affecting multiple institutions, aiding in portfolio diversification and risk management.

2.3.2. Systemic Risk Sensitivity Measures

Systemic risk sensitivity measures evaluate the extent to which individual institutions are affected by systemic risk. These measures are essential for assessing the vulnerability of institutions to systemic events. By focusing on the susceptibility of financial institutions to external shocks and systemic disruptions, these measures provide valuable insights into which entities are most at risk during periods of financial instability. This understanding is crucial for developing strategies to enhance the resilience of financial institutions and the broader financial system.

Systemic risk sensitivity measures aim to quantify how vulnerable individual financial institutions are to systemic shocks. Unlike systemic risk contribution measures, which focus on the impact an institution has on the financial system, sensitivity measures concentrate on the reverse: how the financial system impacts the institution. These measures are critical for identifying institutions that are particularly susceptible to systemic crises, thereby allowing for proactive risk management and mitigation strategies.

Systemic risk sensitivity measures are crucial for several reasons:

1. **Identifying Vulnerable Institutions:** By quantifying the susceptibility of individual institutions to systemic shocks, these measures help identify which entities are most at risk during financial crises. This knowledge allows for targeted risk management strategies to strengthen the resilience of these vulnerable institutions.
2. **Enhancing Risk Management Practices:** Systemic risk sensitivity measures provide valuable insights into the specific risk factors that make institutions susceptible to systemic

events. This information is critical for developing and implementing effective risk management practices, such as stress testing, scenario analysis, and capital planning.

3. **Informing Regulatory Policies:** Regulators can use systemic risk sensitivity measures to monitor the health of financial institutions and the broader financial system. By understanding which institutions are most vulnerable to systemic shocks, regulators can implement policies and regulations to mitigate these risks and enhance financial stability.
4. **Facilitating Preventive Measures:** Early identification of vulnerable institutions allows for the implementation of preventive measures, such as increasing capital buffers, improving liquidity management, and reducing interconnectedness. These measures help mitigate the impact of systemic events and prevent the spread of financial contagion.

The following are the systemic risk measures specifically designed to focus on systemic risk sensitivity:

2.3.2.1. Marginal Expected Shortfall (MES),

Marginal Expected Shortfall (MES), proposed by Acharya et al. (2011), measures the expected loss of a financial institution when the overall market is performing poorly. It is calculated as the average return of the institution during the worst-performing days of the market. This measure requires return data for both the institution and the market, specifically focusing on extreme negative market returns. MES directly links the institution's risk to market downturns, making it highly relevant for stress testing and scenario analysis. The measure assumes that past market behaviour is indicative of future risk, which might not always hold true. MES does not account for the feedback effects between institutions and the market, and its reliance on historical data can limit its predictive power. Nonetheless, MES provides valuable insights into an institution's vulnerability during market downturns, aiding in the development of capital adequacy and liquidity management plans to withstand systemic shocks.

2.3.2.2. SRISK,

SRISK, developed by Brownlees and Engle (2017), evaluates institutions' potential losses during severe market declines, providing a comprehensive assessment of systemic risk dynamics. SRISK generates rankings of systemically risky institutions, facilitating targeted interventions and regulatory oversight. This ranking system enhances transparency in systemic risk assessment and supports proactive measures to mitigate potential threats to financial stability. However, SRISK's reliance on market data and sensitivity to model assumptions introduce potential biases. The accuracy of SRISK estimates relies heavily on underlying assumptions and methodologies, necessitating robust validation procedures and careful consideration of model inputs.

2.3.2.3. Lower Tail Dependence (LTD),

Lower Tail Dependence (LTD), explored by Weiß et al. (2014), assesses the likelihood of joint extreme adverse effects between a financial institution and the market. It measures the propensity for simultaneous extreme losses. LTD requires data on the extreme negative returns of the institution and the market. This measure captures the joint tail risk, providing a clear picture of how an institution might fare during market-wide stress events. LTD can be sensitive to the choice of thresholds for defining extreme events, which can impact its robustness. LTD's reliance on historical data might not fully capture future risk dynamics, and it might not account for structural changes in the market. Nevertheless, LTD helps institutions understand their exposure to systemic tail risks, informing their stress testing and capital planning processes.

2.3.2.4. Contingent Claims Analysis (CCA),

Contingent Claims Analysis (CCA), applied by Gray et al. (2013), measures systemic solvency risk based on market-implied expected losses. This approach uses option pricing theory to estimate the risk of default and the potential losses in a systemic event. CCA requires market data on asset values, liabilities, and volatility for financial institutions. CCA provides a forward-looking measure of solvency risk, incorporating

market expectations and volatilities. However, the method requires detailed market data and can be sensitive to the assumptions underlying the option pricing model. CCA's effectiveness depends on the accuracy of market inputs, and it might not fully capture off-balance-sheet risks. Nonetheless, CCA helps institutions assess their solvency under different market conditions, guiding their capital adequacy and risk management strategies.

2.3.3. Additional Measures and Their Limitations

2.3.3.1. Systemic Risk Index (SRI),

Systemic Risk Index (SRI), developed by Brownlees and Engle (2012), combines leverage, size, and MES to create a comprehensive index of systemic risk. This measure encapsulates both the firm's risk exposure and its contribution to systemic risk. SRI requires data on the institution's leverage, size, and MES. The SRI provides a single metric that captures multiple dimensions of systemic risk, facilitating more effective monitoring and regulation. However, the composite nature of SRI might obscure the individual contributions of its components, making it challenging to disentangle the specific sources of risk. SRI's effectiveness depends on the accuracy and timeliness of its input data, and it might not fully capture dynamic risk interdependencies. Nonetheless, SRI offers a holistic view of an institution's systemic risk profile, assisting in comprehensive risk management and regulatory compliance efforts.

2.3.3.2. Systemic Value-at-Risk (SVaR),

Systemic Value-at-Risk (SVaR), proposed by Dowd and Dowd (2010), applies the value-at-risk (VaR) metric to the entirety of the financial system. SVaR aims to provide a comprehensive assessment of potential losses across the financial landscape, offering insights into the collective risk exposure of multiple institutions. SVaR captures the collective risk profile, enabling stakeholders to gauge the magnitude of potential losses under adverse conditions. However, SVaR's disregard for interconnectedness among financial institutions may underestimate systemic vulnerabilities. Its reliance on market

data for its calculation introduces uncertainties, particularly during periods of market stress, potentially leading to inaccurate assessments of systemic risk.

2.3.3.3. Bank Failure Impact Measure,

Bank Failure Impact Measure, introduced by Valkanov (2011), quantifies the repercussions of individual bank failures on the broader banking industry. This measure focuses on capturing the contagion effect, providing insights into the potential spillover effects of isolated incidents within the financial system. By highlighting the interconnectedness among banks, this measure offers valuable insights into the dynamics of financial contagion. However, its oversight of broader interconnectedness among financial institutions may lead to an incomplete assessment of systemic risk. Its applicability may be limited in complex financial systems characterized by intricate interdependencies, potentially overlooking indirect transmission channels of systemic risks.

2.3.3.4. Financial Connectedness Index (FCI)

Financial Connectedness Index (FCI), proposed by Guembel, Rocholl, and Steffen (2013), quantifies the direction and strength of linkages between financial institutions. The FCI provides a comprehensive assessment of interconnectedness within the financial system, offering insights into the degree of interdependence among institutions and potential transmission channels for systemic risk. The FCI captures the structure of financial networks and the extent of linkages among institutions. However, its failure to account for the contagion effect may overlook potential amplification of systemic risks. The reliance on market data may pose challenges in less-developed financial markets, affecting the accuracy and reliability of the index.

2.4. Application of Systemic Risk Measures

The quantification of systemic risk has become a focal point of financial research, especially in the wake of the 2007-2009 financial crisis. This has led to the development and application

of a variety of measurement methods, each aiming to capture different aspects of systemic risk within the financial system. These methods have been scrutinized and applied in diverse contexts, yielding valuable insights as well as highlighting certain limitations.

In their innovative study, Feinstein et al. (2015) introduce an approach for measuring systemic risk based on the capital endowments of financial firms. This method uses a cash flow or value model in conjunction with an acceptability criterion established by regulatory authorities. The application of this method demonstrates its effectiveness in providing a structured assessment of firm capital benefactions. However, one potential drawback is its dependence on regulatory standards, which may limit its adaptability across different financial environments.

In a comprehensive review conducted by Kukreja and Karmarkar (2018), various systemic risk measures such as SRISK, MES, and CCA are critically evaluated against CoVaR and Granger Causality. Their research highlights that SRISK, MES, and CCA are more accurate in identifying systemically important financial institutions when analysed through market data. The research found that despite their precision in this regard, these sophisticated measures tend to require complex data inputs, which can pose accessibility challenges for a broader range of financial entities.

Grundke and Tuchscherer (2018) also focused on measures such as MES, SRISK, and Δ CoVaR, which were developed in response to the financial crisis. Their findings indicate that these measures are statistically significant in predicting systemic events. However, the economic significance of these measures was found to be relatively low, implying that while they are useful in signalling potential crises, their practical implications for economic decision-making are somewhat limited.

Pankoke (2014) provides a comparative analysis of simple systemic risk measures, such as total debt, against more sophisticated measures like SRISK. His study concludes that simpler measures might be more effective in identifying institutions contributing to systemic risk. Total debt, in particular, is found to be a highly suitable indicator. Conversely, sophisticated

measures like SRISK, though detailed and comprehensive, can be more cumbersome and less intuitive for straightforward application.

De Bandt et al. (n.d.) offer a broad discussion on various systemic risk indicators, including those related to financial markets and interconnections. Their comprehensive approach reveals that a diverse array of indicators can provide a multifaceted view of systemic risk. Nonetheless, the complexity involved in integrating multiple measures can pose significant challenges.

Gan (2014) explores the historical context of systemic risk measures and suggests future research directions, emphasizing the critical role of balance sheet choices between debt and equity in systemic risk measurement. This historical perspective underscores the evolving nature of risk measurement and the need for adaptable models that can address emerging financial dynamics.

Kovacevic and Pflug (2015) apply structural credit modelling to quantify systemic risk. This method utilizes joint probability distributions and copula functions to capture the interrelations among financial institutions effectively. Although this method is highly detailed and precise, its complexity can limit its practical application outside of highly technical and specialized settings.

Brunnermeier and Cheridito (2019) introduce the SystRisk framework, which captures the cost of providing tail-risk insurance to the financial system and allocates systemic risk based on the size-shifted marginal contributions of institutions. Their application of this framework demonstrates its effectiveness in distributing systemic risk appropriately. However, the framework's dependence on accurate tail-risk estimation presents a potential limitation.

Suh et al. (2013) propose using credit default swap (CDS) data to measure systemic risk. This method provides various consistent risk indicators and has been praised for its practicality in reflecting real-time market data. Nevertheless, the approach may be limited by the availability and quality of CDS data, which can vary significantly across different markets.

Cadenas-Santiago et al. (2010) advocate for a continuous approach to systemic risk assessment. They argue that all institutions should be considered systemic, but to varying degrees. This approach aims to reduce measurement errors and offers a more nuanced understanding of systemic risk. However, it can complicate the process of pinpointing specific high-risk institutions.

Sun (2020) introduces total systemic risk statistics as a novel approach to addressing systemic risk. This methodology allows for a dual representation of systemic risk, offering a fresh perspective on risk assessment. While innovative, the application of this method is still in its nascent stages, and its long-term efficacy has yet to be fully validated.

Chen et al. (2013) discuss an axiomatic framework for systemic risk measurement, which analyses outcomes across agents and scenarios. This decentralized approach allows for the association of shadow prices to individual agents, providing a detailed systemic risk assessment. Despite its thoroughness, the complexity of this method can be a barrier to widespread adoption.

El Amraoui (2018) explores various systemic risk measures, including the introduction of "Asset Commonality" and examines the relationship between systemic risk and corporate social responsibility. These applications highlight the interconnected nature of systemic risk but also reveal the difficulty in isolating specific risk factors due to the complexity of interrelations within financial systems.

Sun and Dong (2020) further discuss systemic risk statistics with scenario analysis, providing a new methodology for measuring systemic risk in large-scale financial systems. This approach's robustness across diverse scenarios makes it promising, although its comprehensive data requirements may limit its practical application.

Lastly, Schneider (1990) examines methods for measuring systemic risk through systematic studies in populations and the comparison of rates in different conditions. His findings underscore the importance of comparative analyses in various scenarios, though the extent to

which such methods can be generalised is limited by the specific characteristics of the populations studied.

Overall, the literature indicates that while various systemic risk measures have proven effective in different contexts, their application is often constrained by factors such as complexity, data requirements, and practical considerations. Future research should focus on developing more accessible and integrative approaches that balance precision with practicality.

2.5. Systemic Risk Events

2.5.1. Definition of Systemic Shocks

A systemic shock, often termed a systemic risk event, refers to a sudden and unexpected disruption that compromises the stability or functionality of an entire system. These shocks are defined by their cascading effects across interconnected components within the system, resulting in widespread instability or potential failure. Systemic shocks are significant because they often overwhelm a system's inherent ability to absorb stress or adapt to new conditions. Unlike isolated disruptions, their impact is pervasive and long-lasting, making them a key focus in risk management and resilience studies (World Bank Group, 2021).

2.5.2. Key Characteristics of Systemic Shocks

Systemic shocks are defined by several unique characteristics that distinguish them from other forms of risk:

1. Interconnectedness

Systemic shocks are amplified by the interconnections and interdependencies within a system. Modern systems, such as financial markets, healthcare networks, or global supply chains, are characterised by their complex interlinkages. A disturbance in one component can propagate through these connections, causing a

ripple effect. For example, during the 2008 financial crisis, the interconnected nature of financial institutions enabled the collapse of Lehman Brothers to destabilise credit markets globally (Brunnermeier et al., 2009).

2. Nonlinear Amplification

Unlike risks with proportional effects, systemic shocks often display nonlinear behaviour, where small initial disruptions grow exponentially as they propagate. This amplification arises from feedback loops within systems. For instance, in financial systems, a decrease in asset prices can trigger forced liquidations, further depressing prices and creating a downward spiral (Adrian & Shin, 2010).

3. Cross-Sector and Cross-Border Impact

Systemic shocks rarely remain confined to a single sector or region. Instead, they disrupt multiple sectors and often transcend national boundaries. The COVID-19 pandemic is a prime example, where a health crisis quickly became an economic, social, and political issue of global scale (Esade, 2020).

4. Threshold Effects

Systemic shocks typically occur when a critical threshold is surpassed. These thresholds can be financial (e.g., excessive leverage), ecological (e.g., biodiversity loss), or operational (e.g., infrastructure capacity limits). Once crossed, the system's ability to maintain equilibrium collapses, leading to cascading failures (Haldane & May, 2011).

5. Long-Term Consequences

Systemic shocks are often followed by persistent consequences that reshape systems for years or decades. These include structural changes to economies, societal shifts, or lasting damage to ecosystems. For instance, the Great Depression of the 1930s led to sweeping regulatory reforms and long-term economic transformations (Eichengreen, 1995).

2.5.3. Examples of Systemic Shocks

1. 2008 Global Financial Crisis

The collapse of Lehman Brothers in 2008 triggered a global financial crisis, illustrating how the failure of a single institution can lead to a systemic shock. The crisis exposed vulnerabilities in the financial system, including excessive leverage and opaque derivatives trading, resulting in severe economic consequences worldwide (Brunnermeier, 2009).

2. COVID-19 Pandemic

The COVID-19 pandemic represents a multifaceted systemic shock. Beyond the immediate health impacts, it disrupted global supply chains, strained healthcare systems, and triggered simultaneous demand and supply shocks. Its effects highlighted the vulnerability of interconnected systems and the need for cross-sectoral resilience (Esade, 2020).

3. **Climate-Induced Natural Disasters**

Events such as hurricanes, floods, and wildfires, intensified by climate change, exemplify environmental systemic shocks. For instance, Hurricane Katrina in 2005 caused extensive damage to infrastructure, displaced millions, and had long-term economic impacts, revealing the interdependence between environmental and economic systems (World Bank Group, 2021).

2.5.4. **Types of Systemic Shocks**

Systemic shocks are broadly categorised based on their origin and pathways of disruption:

1. **Economic Shocks**

Economic systemic shocks include sudden financial disruptions such as market crashes, currency devaluations, or sharp changes in trade policies. The 1997 Asian Financial Crisis demonstrated how rapid capital flight could destabilise multiple economies across a region, leading to social and political unrest (Corsetti et al., 1998).

2. **Environmental Shocks**

Environmental shocks are caused by natural or anthropogenic events, such as earthquakes, hurricanes, or industrial accidents. For instance, the 2011 Fukushima nuclear disaster highlighted how such shocks could affect energy policy, public trust, and environmental safety (World Bank Group, 2021).

3. Technological Shocks

These shocks result from rapid advancements or failures in technology, such as the introduction of disruptive innovations or large-scale cybersecurity breaches. For example, the global ransomware attack “WannaCry” in 2017 disrupted healthcare services and highlighted vulnerabilities in digital infrastructure (Adrian & Shin, 2010).

4. Health Shocks

Health-related systemic shocks, such as pandemics, strain healthcare systems and have widespread economic and societal effects. The COVID-19 pandemic demonstrated how global health crises can destabilise interconnected systems (Esade, 2020).

2.6. Use of stock Market Data

Biase and Apolito (2012) conducted a study that highlighted the importance of using stock market data to evaluate risk in the banking sector. Their research showed connections between bank equity beta and various banking indicators like bank size (book value of total assets) loan to asset ratio and intangibles to asset ratio. This indicates that equity beta can provide insights into the risk profiles of individual banks.

Stock market data offers ways to assess risk. One method involves analysing market volatility levels as volatility can indicate increased risk with price fluctuations suggesting instability in the financial system. According to Acharya et al. (2017) tracking volatility trends over time helps analysts determine whether the market is getting riskier or safer guiding risk management strategies. This is crucial because rising volatility often reflects underlying pressures that could spread throughout the system.

Another approach involves examining correlations among stocks. Strong correlations between stock movements may point to factors influencing their performance raising the potential, for market disruptions. Engle et al (2012) pointed out that examining stock correlations helps identify areas of risk allowing stakeholders to take targeted actions to lessen impacts. For example, when the market is under pressure, stocks tend to move together indicating broader shocks rather than individual ones.

Moreover, using stock market information enables analysts to evaluate the level of borrowing in the market. High leverage, which involves dependence on borrowed money can increase the likelihood of crises if market conditions worsen. According to Allen and Gale (2000) monitoring leverage levels assists analysts in identifying sources of risk and implementing preventive measures to strengthen financial resilience. By assessing leverage levels analysts can anticipate chain reactions of defaults that may disrupt the system.

The utilization of stock market data is significant for this study due to its benefits highlighted by Lahmann and Kaserer (2011). Firstly, these methods allow for updates often on a daily basis enabling timely assessment and management of risks. Secondly metrics based on stock market data provide insights into trends helping in forecasting systemic risks. Lastly the accessibility and availability of stock market data empower stakeholders to implement approaches, for measuring systemic risk. These measures could be incorporated into real time monitoring systems to offer insights, into the changing risk environment.

However, there are limitations to using stock market data for assessing risk. One key drawback is that it only provides a view of the system. The stock market represents a portion of the financial landscape potentially overlooking systemic risks in other sectors like banking or non-stock market financial entities. Adrian and Brunnermeier (2016) highlight that this restricted perspective may result in an evaluation of risk. For example, risks in the shadow banking system, which stock market data may not capture could be significant.

Furthermore, stock market data can be influenced by factors—both financial and non-financial—which can complicate accurate interpretation and risk evaluation. For instance, sudden fluctuations in stock prices may be driven by factors to risk, such as natural disasters or political events leading to potentially misleading assessments of systemic risk levels (Baker & Wurgler 2007). Political instability or geopolitical tensions might trigger market disruptions that do not necessarily reflect underlying instability but external shocks.

In addition, investor behaviour introduces biases and heuristics into stock market data. Biases held by individuals, such, as being overly confident or following the crowd can skew market data and affect the accuracy of assessing risks. According to Shiller (2003) the inherent noise and fluctuations in stock market data make it challenging to gauge risk levels accurately. Sudden price changes may mask trends or patterns making risk analysis more complex. Behavioural biases can result in market movements that do not align with realities making risk assessments more puzzling.

Stock markets in developing nations often encounter obstacles that influence the use of stock market data for evaluating risks. These markets are typically less developed have liquidity levels and experience volatility than established markets. Moreover, their regulatory frameworks may be less sturdy. Their market infrastructure less advanced, which can impede risk monitoring and management. For example, Zambia’s stock market shares similarities with developing nations—it lacks depth and variety. The Lusaka Securities Exchange (LuSE) has a few listed companies reducing investment choices. Additionally, low trading volumes and sporadic trading activity contribute to increased price volatility and susceptibility, to manipulation (Mwanza, 2016).

The characteristics mentioned here create challenges when using stock market data in risk models. Firstly, the low liquidity can cause prices to be influenced by trades rather than reflecting true market conditions leading to potentially misleading risk signals. Secondly the high volatility and sporadic trading patterns make it difficult to obtain risk metrics, like equity

beta or volatility indices. Furthermore, the limited number of listed companies hinders the ability to perform diversification analyses and correlation studies. With fewer stocks available for analysis identifying patterns or drawing conclusions about financial stability becomes quite challenging. Additionally, when market capital is concentrated in a few firms it tends to skew systemic risk assessments as their performance disproportionately impacts market indices and other aggregated measures (LuSE, 2017).

The fledgling state of frameworks and market infrastructure, in Zambia and similar developing markets also poses obstacles to risk monitoring. Inadequate regulatory oversight may fail to enforce disclosure requirements resulting in data gaps. Additionally, the absence of trading systems and analytical tools can hinder the accurate evaluation of market risks. Despite these challenges efforts are underway to strengthen the resilience of stock markets in developing nations. Efforts to enhance frameworks improve market infrastructure. Increase transparency and disclosure play a crucial role, in building more dependable and resilient markets. It is important to strengthen bodies and promote collaboration with financial institutions to tackle these challenges effectively (ZICA, 2018).

Similarly, many other developing nations encounter obstacles. For instance, Nigeria's stock market grapples with issues like liquidity and high volatility hindering the use of stock market data for assessing systemic risks (Osamwonyi & Kasimu 2013). In Kenya, the Nairobi Securities Exchange faces challenges such as trading volumes and a limited number of listed companies limiting the depth of analysis with stock market information (Wachira et al., 2018). In Ghana, the Ghana Stock Exchange encounters problems including market activity and a narrow market base that impede thorough risk analysis (Afawubo et al., 2019). Pakistan's Karachi Stock Exchange deals with issues like market manipulation and a restricted investor base making it harder to utilize stock market data for measuring risks (Khan et al., 2017).

2.7. Zambian Banking Sector

2.7.1. Overview and Background of the Sector

Since gaining independence, Zambia has undergone significant transformations in its banking sector, reflecting a dynamic interplay of historical, regulatory, and economic factors. Initially, the banking landscape was dominated by foreign commercial banks, which played a crucial role in providing financial services to both domestic and international clients (Brownbridge, 1996). However, in the pursuit of financial sovereignty and inclusive development, the government embarked on a policy of nationalization, leading to the establishment of state-owned banks aimed at expanding access to financial services for the local population.

Brownbridge (1996) noted that the Zambian private sector made its foray into the banking industry in 1984 with the founding of Meridien Bank, marking a pivotal moment in the sector's evolution. By the mid-1990s, the emergence of local private sector investors led to the establishment of approximately 13 banks, heralding a new era of indigenous participation in Zambia's banking sector. These developments coincided with the government's liberalization of the banking industry, allowing for increased competition and the diversification of financial services (Simwanza & Awolusi, 2020).

The liberalization of the Zambian economy in the early 1990s ushered in a period of significant growth and transformation, with notable expansions observed across various sectors, including banking and finance (Simwanza & Awolusi, 2020). The proliferation of banks and non-bank financial institutions underscored the dynamism and resilience of Zambia's financial sector amidst evolving economic conditions and regulatory frameworks.

Haabazoka (2012) highlighted the robust growth trajectory of Zambia's banking sector, particularly from the early 2000s onwards. The sector's expansion was characterized by steady increases in total assets relative to GDP, reflecting growing market penetration and financial intermediation. Despite temporary setbacks such as the global financial crisis of

2008, which led to a slight reduction in total assets, Zambia's banking sector demonstrated resilience and continued to exhibit positive growth trends.

The period between 2015 and 2020 witnessed remarkable growth in Zambia's banking sector, with total assets surging by over 50%, signalling buoyant market conditions and sustained investor confidence (Haabazoka, 2012). As of 2020, the banking landscape boasted a diverse array of institutions, comprising 19 commercial banks, including both domestic players and foreign-owned entities.

Despite the strong growth, the performance of the sector has been mixed in recent years. While some banks have demonstrated improved performance, the sector has also faced challenges such as high levels of non-performing loans, declining profitability, and liquidity issues. These challenges have been attributed to a number of factors, including a challenging macroeconomic environment and increased competition.

Most bank failures in Zambia were observed during the turbulent period of the 1990s, marking a significant episode in the country's financial history. Maimbo (2001) extensively documented the sequence of events, highlighting the systemic vulnerabilities and structural deficiencies that precipitated the crisis. In the third quarter of 1993, and persisting throughout 1994, adverse developments began to manifest, setting the stage for the ensuing financial turmoil. Banks, driven by fierce competition to attract and retain customers, deviated from prudent lending practices, overlooking critical factors such as loan application procedures and collateral arrangements. This recklessness in lending practices resulted in a proliferation of unrecoverable loans, significantly undermining the stability of the banking sector.

Concurrently, a confluence of macroeconomic challenges exacerbated the situation, exacerbating the financial distress of banks. Factors such as a surge in the cost of funds, liquidity shortages, diminished earnings from treasury bills and foreign exchange

operations, and capital inadequacies further compounded the industry's woes (Muke, 1996). Against this backdrop of mounting pressures, the financial deterioration of banks accelerated, culminating in a series of bank closures that sent shockwaves through the Zambian financial landscape.

The year 1995 witnessed the collapse of three prominent banks, sending ripples of uncertainty across the sector. Meridien BIAO Bank, then ranked as the fourth-largest bank in Zambia, succumbed to financial insolvency on 19 May 1995, marking a significant milestone in the country's banking history. Shortly thereafter, African Commercial Bank followed suit, succumbing to the pressures of the crisis on 17 November 1995, followed by the demise of Commerce Bank on 29 November 1995. These closures, occurring in rapid succession, underscored the severity of the systemic vulnerabilities afflicting the Zambian banking sector.

However, the crisis was far from over, as subsequent years bore witness to a continuation of the banking sector's downward spiral. Despite efforts by the Bank of Zambia (BoZ) to stem the tide of financial distress, the last quarter of 1997 ushered in a fresh wave of bank failures, further exacerbating the systemic fragility. Prudence Bank collapsed on 17 October 1997, signalling yet another blow to the stability of the banking sector. This was followed by the demise of Credit Africa Bank on 2 December 1997, Manifold Investment Bank on 5 December 1997, and Firstly Merchant Bank on 2 February 1998. The frequency and magnitude of these failures underscored the depth of the crisis, as the Zambian banking sector grappled with unprecedented levels of instability and uncertainty.

Over the span of just three years, from 1995 to 1998, a total of nine commercial banks succumbed to financial insolvency, leaving a trail of economic disruption and social upheaval in their wake. This period marked a watershed moment in Zambia's financial history, prompting a re-evaluation of regulatory frameworks, risk management practices,

and institutional safeguards aimed at fortifying the resilience of the banking sector against future crises.

During the early 2000s, Zambia's banking sector faced a series of challenges stemming from its exposure to the government's debt, which had undergone restructuring in the aftermath of a financial crisis. The repercussions of these events reverberated throughout the financial landscape, ultimately leading to the closure of several banks. Hinfelaar (2020) provided insights into the unfolding of these events, highlighting the significant strain placed on Zambia's financial system and the erosion of confidence in the Bank of Zambia's supervisory capabilities (McPherson, 2004b; Mwape, 2014).

The closure of Meridien Bank, in particular, marked a pivotal moment in Zambia's banking history, with far-reaching implications for the sector as a whole. McPherson (2004b: 205) attributed the subsequent failure of five smaller local banks, at least in part, to the knock-on effects of Meridien Bank's difficulties. This interconnectedness within the banking system underscores the systemic risks inherent in financial networks, where the distress of one institution can precipitate cascading failures across the sector.

The aftermath of these closures cast a shadow of uncertainty over Zambia's banking sector, exacerbating existing challenges and raising concerns about the resilience of financial institutions in the face of economic downturns. The economic landscape in Zambia, characterized by fluctuating growth rates, currency depreciation, and fiscal imbalances, posed additional challenges for banks already grappling with the aftermath of the financial crisis (Zambia National Commercial Bank, 2020).

In recent years, the banking sector has confronted a myriad of challenges amidst the economic downturn, as evidenced by the struggles faced by several banks in navigating the turbulent economic environment. The erosion of asset quality, liquidity constraints, and heightened credit risks have tested the resilience of financial institutions, underscoring the

importance of robust risk management practices and regulatory oversight (Mwaba et al., 2019).

The challenges facing Zambia's banking sector underscore the imperative of proactive measures to strengthen financial stability and mitigate systemic risks. Efforts to enhance regulatory frameworks, improve risk management practices, and promote transparency and accountability within the banking sector are crucial for safeguarding against future crises (Bank of Zambia, 2020). Furthermore, fostering a culture of prudence, resilience, and innovation can bolster the sector's capacity to weather economic shocks and contribute to sustainable economic growth and development.

2.7.2. Drivers of Systemic Risk in Zambia

Some of the key failures of Zambian Banks are as follows:

2.7.2.1. Meridian BIAO

The failure of Meridian BIAO Bank (MBBZ) in 1995 stands as a stark reminder of the intricate web of factors that can precipitate the downfall of a financial institution. Maimbo (2001) delves into the multifaceted nature of MBBZ's collapse, attributing it to a combination of internal mismanagement and external vulnerabilities, particularly in the realm of foreign exchange exposure.

Internally, MBBZ was plagued by a host of issues that undermined its operational resilience and financial stability. Maimbo (2001) points to instances of internal abuse and mismanagement, where the bank's resources were misappropriated or utilized inefficiently, eroding its capital base and diminishing its ability to weather external shocks. Moreover, incompetent management practices further exacerbated the situation, as inadequate strategic direction and decision-making processes failed to steer the bank away from impending risks. The Board of Directors, entrusted with oversight and governance responsibilities, proved ineffective in their roles, failing to

provide the necessary checks and balances to safeguard the bank's interests and uphold regulatory compliance standards.

Externally, MBBZ grappled with the challenges posed by foreign exchange exposure, exposing it to volatility and currency fluctuations in global markets. As noted by Maimbo (2001), the bank's inadequate risk management frameworks and strategies left it vulnerable to adverse movements in exchange rates, amplifying the impact of external economic shocks on its financial health. This underscores the importance of robust risk mitigation measures and prudent hedging strategies to shield financial institutions from external currency risks and macroeconomic uncertainties.

The failure of MBBZ serves as a cautionary tale for the banking industry, highlighting the imperative of sound corporate governance practices, effective risk management frameworks, and prudent business strategies. In hindsight, the collapse of MBBZ underscores the critical role of regulatory oversight and supervisory mechanisms in ensuring the stability and resilience of financial institutions. Regulatory authorities must remain vigilant in monitoring and enforcing compliance with prudential regulations, addressing lapses in governance and risk management practices, and fostering a culture of accountability and transparency within the banking sector.

Furthermore, the lessons gleaned from MBBZ's demise underscore the need for continuous learning and adaptation within the banking industry. Financial institutions must remain agile and responsive to evolving market dynamics and regulatory requirements, proactively identifying and mitigating emerging risks to safeguard their long-term viability and sustainability.

In essence, the failure of Meridian BIAO Bank serves as a poignant reminder of the intricate interplay between internal dynamics and external factors in shaping the fate of financial institutions. By addressing governance deficiencies, enhancing risk

management capabilities, and fortifying regulatory oversight, the banking sector can strive towards greater resilience and stability in the face of an increasingly complex and dynamic operating environment.

2.7.2.2. African Commercial Bank

The closure of African Commercial Bank by the Bank of Zambia (BoZ) in November 1995 underscores the challenges and complexities inherent in the banking sector, particularly in the realm of financial stability and regulatory oversight. According to the Financial Sector Supervision Department (FSSD) annual report, the demise of African Commercial Bank can be attributed to a confluence of factors, chief among them being the lack of commitment from stakeholders and interested parties to salvage the institution from impending insolvency.

The FSSD's assessment highlights the crucial role of stakeholder engagement and collaboration in mitigating systemic risks and preserving the stability of financial institutions. Despite concerted efforts to devise remedial measures, including capital injections from institutional investors and the orchestrated takeover of select assets and liabilities by New Capital Bank, the absence of unwavering commitment and support from key stakeholders thwarted the implementation of these initiatives. This underscores the importance of fostering a collaborative and coordinated approach among regulatory authorities, industry players, and other stakeholders in addressing systemic vulnerabilities and safeguarding the integrity of the banking sector.

Furthermore, the case of African Commercial Bank underscores the imperative of proactive and pre-emptive regulatory intervention in identifying and addressing early warning signs of financial distress. The BoZ's decision to close the bank serves as a testament to the regulator's mandate to uphold prudential standards and protect depositor interests, even in the face of formidable challenges. By exercising regulatory

vigilance and deploying timely interventions, regulators can mitigate the adverse consequences of bank failures and preserve overall financial stability.

Moreover, the failure of African Commercial Bank underscores the importance of robust risk management practices and corporate governance frameworks within financial institutions. Weaknesses in risk identification, assessment, and mitigation mechanisms, coupled with governance lapses, can exacerbate vulnerabilities and undermine the resilience of banks to external shocks. Thus, financial institutions must prioritize the implementation of sound risk management policies, effective internal controls, and robust governance structures to fortify their resilience and enhance their capacity to navigate turbulent market conditions.

2.7.2.3. Commerce Bank Zambia

The collapse of Commerce Bank Zambia Limited in 1995 epitomizes the intricate web of challenges and systemic vulnerabilities that can precipitate the downfall of financial institutions. The Governor, in his testimony before a Parliamentary Committee, attributed the bank's demise to a confluence of interrelated factors, underscoring the multifaceted nature of the underlying issues.

A critical factor contributing to Commerce Bank's failure was its precarious financial position, characterized by chronic under-capitalization and an over-reliance on high-cost funding sources. These financial deficiencies not only undermined the bank's solvency but also constrained its ability to withstand external shocks and market fluctuations. Moreover, poor lending practices, characterized by lax credit standards and the proliferation of low-quality assets, further exacerbated the bank's financial woes and eroded its asset quality.

The prevalence of excessive connected lending and insider borrowing within Commerce Bank further compounded its operational challenges and heightened

systemic risks. These practices not only engendered conflicts of interest but also undermined the integrity of the bank's lending activities, exacerbating credit risk and eroding depositor confidence. Additionally, the negative repercussions stemming from the bank's common shareholding with Bank 18 tarnished its reputation and exacerbated depositor apprehensions, further exacerbating its liquidity pressures and precipitating its downfall.

Furthermore, the ineffectiveness of the bank's management and Board of Directors in addressing operational inefficiencies and formulating viable strategic solutions exacerbated its vulnerability to external shocks and systemic pressures. The failure of the bank's leadership to enact proactive measures to mitigate risks, enhance operational efficiency, and chart a sustainable growth trajectory underscored governance lapses and managerial shortcomings, further eroding investor confidence and exacerbating depositor flight.

The findings of the Financial Sector Supervision Department (FSSD) corroborate the multifaceted nature of Commerce Bank's failure, attributing its demise to a combination of structural deficiencies, governance lapses, and managerial ineffectiveness. The FSSD's assessment underscores the imperative of robust regulatory oversight, effective risk management, and prudent governance practices in safeguarding the stability and integrity of the banking sector.

2.7.2.4. Credit Africa Bank

The collapse of Credit Africa Bank on 28 November 1997 marked a significant episode in Zambia's financial history, underscoring the perils of regulatory lapses, governance deficiencies, and systemic vulnerabilities within the banking sector. The decision by the Bank of Zambia (BoZ) to place Credit Africa Bank in receivership followed the discovery of fraudulent transactions during a routine bank inspection, laying bare a litany of underlying issues that precipitated its downfall.

A primary contributing factor to Credit Africa Bank's demise was its precarious capital position, characterized by chronic under-capitalization that undermined its solvency and financial resilience. This structural weakness not only constrained the bank's ability to absorb losses but also exacerbated liquidity pressures and heightened systemic risks within the financial system.

Moreover, Credit Africa Bank grappled with soaring levels of non-performing loans, reflecting lax credit standards, and imprudent lending practices that compromised asset quality and impaired earnings generation. The proliferation of non-performing assets not only eroded the bank's profitability but also undermined investor confidence and exacerbated liquidity strains, hastening its downward spiral.

The bank's over-reliance on expensive funding sources further exacerbated its financial challenges, exposing it to heightened interest rate risk and constraining its ability to competitively price its products and services. This dependence on costly funds compounded the bank's profitability woes and eroded its margin resilience, exacerbating its vulnerability to external shocks and market fluctuations.

Furthermore, Credit Africa Bank's engagement in excessive connected lending and insider borrowing underscored governance lapses and ethical breaches that compromised the integrity of its operations. These practices not only engendered conflicts of interest but also undermined the transparency and fairness of the bank's lending activities, eroding depositor trust and exacerbating systemic risks.

The malpractice by directors and the absence of robust risk management practices further compounded Credit Africa Bank's woes, exposing it to operational inefficiencies and strategic missteps that undermined its long-term viability. The failure to implement effective controls and oversight mechanisms allowed

malfeasance to proliferate unchecked, hastening the bank's demise and exacerbating its impact on the broader financial system.

Moreover, Credit Africa Bank's excessive lending without sufficient collateral underscored a lax risk culture and a disregard for prudent lending principles, exposing the bank to heightened credit risk and increasing the likelihood of loan defaults. This imprudent lending behaviour not only compromised the bank's asset quality but also amplified its vulnerability to adverse economic shocks and downturns.

2.7.2.5. Prudence Bank Zambia Limited

The collapse of Prudence Bank Zambia Limited in October 1997 epitomized a confluence of systemic vulnerabilities, governance deficiencies, and operational shortcomings that precipitated its demise, underscoring the imperative of prudent management and robust regulatory oversight in safeguarding the stability of the banking sector. The decision by the Bank of Zambia (BoZ) to place Prudence Bank in receivership was emblematic of the profound challenges confronting the institution, which stemmed from a myriad of internal and external factors.

A pivotal factor contributing to Prudence Bank's downfall was its precarious funding structure, characterized by high interest rates on foreign deposits that rendered its funding base costly and unsustainable. The reliance on expensive foreign funding sources not only strained the bank's liquidity position but also undermined its profitability and financial resilience, exacerbating its vulnerability to external shocks and market fluctuations.

Moreover, Prudence Bank grappled with escalating advertising costs and overhead expenses, reflecting a profligate spending culture and operational inefficiencies that eroded its margin resilience and impaired its earnings generation capacity. The failure

to rationalize expenses and streamline operations exacerbated the bank's financial woes, exacerbating its liquidity pressures and hastening its downward spiral.

The bank's management deficiencies, typified by inexperienced leadership and a lack of strategic foresight, further compounded its challenges and undermined its ability to navigate a rapidly evolving operating environment. The absence of seasoned executives and competent leadership exacerbated decision-making bottlenecks and strategic missteps, eroding investor confidence and exacerbating the bank's vulnerability to adverse market conditions.

Additionally, Prudence Bank's governance structure, characterized by an ineffective board dominated by a single family, underscored governance lapses and conflicts of interest that compromised the integrity and independence of its oversight mechanisms. The concentration of power within a select group not only engendered governance deficiencies but also fostered a culture of complacency and impunity that undermined accountability and transparency, exacerbating the bank's operational risks and governance shortcomings.

2.7.2.6. Merchant Bank

The demise of Merchant Bank in February 1998 marked a watershed moment in Zambia's banking sector, epitomizing a catastrophic confluence of operational mismanagement, external shocks, and reputational crises that precipitated its collapse. The bank's demise can be attributed to a multifaceted array of factors, ranging from governance deficiencies to liquidity strains, underscoring the fragility of financial institutions in the face of systemic vulnerabilities and market turbulence.

Foremost among the catalysts of Merchant Bank's collapse were negative press reports surrounding the seizure of certain accounts by the Drug Enforcement Commission, which ignited a firestorm of depositor panic and triggered a precipitous bank run. The

adverse publicity not only eroded depositor confidence but also precipitated a liquidity crunch, exacerbating the bank's funding pressures and precipitating its downward spiral into insolvency.

The liquidity strains precipitated by the bank run culminated in Merchant Bank's suspension from the clearinghouse, further exacerbating its financial woes and precipitating its rapid unravelling. With depositor withdrawals intensifying and liquidity dwindling, the bank found itself ensnared in a vicious cycle of deteriorating solvency and diminishing investor trust, hastening its inexorable demise.

Moreover, Merchant Bank's collapse was exacerbated by chronic under-capitalization, which rendered the institution vulnerable to external shocks and impaired its ability to withstand liquidity pressures. The dearth of sufficient capital buffers constrained the bank's capacity to absorb losses and mitigate risks, exacerbating its fragility and amplifying the severity of its financial distress.

Additionally, malpractice by the bank's directors further undermined its stability and integrity, engendering governance deficiencies and eroding investor confidence. The governance lapses and ethical breaches perpetrated by the bank's leadership not only compromised its risk management framework but also eroded stakeholder trust, exacerbating its vulnerability to reputational damage and regulatory scrutiny.

The failures of banks in Zambia during the 1990s and early 2000s were multifaceted, stemming from a combination of internal mismanagement, external pressures, and systemic vulnerabilities. Brownbridge (1998) identifies poor loan quality as a significant internal factor, driven by moral hazard among bank owners and adverse selection of borrowers. Imprudent lending strategies, including insider lending, exacerbated this issue, while insufficient capitalization and political connections of bank owners further fuelled moral hazard.

Internally, these failures were compounded by insider abuse, fraudulent activities, and managerial incompetence within the banks. The ineffective governance structures, typified by an inadequate Board of Directors, facilitated mismanagement and compromised risk management practices. Poor lending standards and high-risk loan portfolios eroded asset quality, contributing to a surge in non-performing loans and financial deterioration.

Externally, the lack of commitment from stakeholders hindered efforts to salvage troubled banks, despite proposals for capital injection and takeovers. Negative publicity and affiliations with troubled entities tarnished the reputation of certain banks, triggering depositor panic and exacerbating financial strain. Foreign exchange exposure risks added to the challenges, exposing banks to currency fluctuations and uncertainties.

Financial factors also played a pivotal role, with under-capitalization emerging as a critical issue undermining regulatory compliance and financial stability. Reliance on expensive funding sources compounded financial strain, with high interest rates on foreign deposits escalating funding costs. Regulatory lapses, fraudulent transactions, and malpractice further compromised the integrity of banks and impeded their financial health.

Addressing these challenges requires a multifaceted approach, focusing on strengthening prudential supervision, enhancing regulatory enforcement, and fostering prudent management practices. Regulatory policies should prioritize credit risk management, enforce banking regulations rigorously, and incentivize prudent behaviour among bank owners. By fostering a culture of transparency, accountability, and sound risk management, authorities can mitigate systemic risks and bolster the resilience of the banking sector, ensuring its ability to withstand future shocks and safeguard depositor interests.

Brownbridge's insights underscore the critical role of regulatory policies in mitigating bank failures. He advocates for rigorous prudential supervision, particularly in credit policies, and enforcing banking regulations to curb moral hazard and promote financial stability.

Additionally, Brownbridge highlights the importance of improving incentives for bank owners to adopt prudent management practices, addressing systemic vulnerabilities and fostering a sound banking system. These recommendations align with broader efforts to strengthen financial oversight and governance, ensuring the long-term viability of the banking sector and safeguarding depositor interests (Brownbridge, 1998).

2.8. Critique of existing literature

The available literature provides a comprehensive overview of the measures for systemic risk, especially since the global financial crises highlighted its importance. This body of work is detailed, offering various perspectives on the validity and functioning of different measures and classifying these measures to draw out different aspects of their workings.

Despite the wealth of information and insights provided by the existing literature on systemic risk measurement, there are significant limitations and drawbacks. One primary issue is the lack of consensus on the best approach to measuring systemic risk. Different authors and studies have proposed a wide range of methods and measures, making it challenging to compare and contrast the results of different studies. This divergence in methodologies creates difficulties in achieving a standardized approach to systemic risk assessment, complicating regulatory efforts and the development of universally accepted frameworks.

The literature often focuses on specific aspects of systemic risk, such as the interconnectedness of financial institutions or the potential impact of an institution's failure. This narrow focus can hinder the ability to obtain a comprehensive view of systemic risk and assess the potential risks associated with the financial system as a whole. The fragmented nature of these studies means that each may provide valuable insights into particular dimensions of systemic risk, yet they fall short in offering a holistic understanding necessary for effective systemic risk management.

Additionally, the technical and complex nature of many systemic risk measures requires specialized knowledge and expertise to understand and apply. This complexity can be a significant barrier for policymakers and other stakeholders who must utilize these insights in their decision-making processes. The technical jargon and advanced statistical methods involved can make these studies less accessible, reducing their practical applicability and impact.

The methods discussed for measuring systemic risk are valuable tools for assessing the potential risks associated with financial systems. However, they also have inherent limitations. Many of these methods rely on models of the financial system, which are based on assumptions and estimates. The accuracy of these measures depends on the validity of the assumptions and estimates used in the models, which can be difficult to assess and validate. This reliance on assumptions introduces a layer of uncertainty that can undermine the reliability of the results.

Furthermore, these methods typically concentrate on specific aspects of systemic risk, such as the interconnectedness of financial institutions or the potential impact of an institution's failure. This focus can make it challenging to compare and contrast different measures, as they may each emphasize different dimensions of systemic risk. For instance, measures like CoVaR (Conditional Value at Risk) and MES (Marginal Expected Shortfall) are designed to capture tail risks and extreme events but may not adequately reflect more routine, interconnected financial exposures that also contribute to systemic risk.

Understanding and quantifying systemic risk is paramount for safeguarding financial stability, especially in the wake of global financial crises. Numerous studies have developed measures to capture the complexities of systemic risk within financial systems. These measures vary in conceptual frameworks, computational methodologies, and intended applications, reflecting the diverse dimensions of systemic risk.

2.8.1. Gaps in Equipping Financial Institutions

One of the main gaps in knowledge on the measurement of systemic risk is the lack of consensus on how to define systemic risk. Various definitions focus on different aspects of the phenomenon, such as financial imbalances, collapses of confidence, correlated exposures of financial institutions, and negative impacts on the real economy. This lack of consensus complicates the development of a standard set of measures that can consistently assess systemic risk across different contexts. Without a unified definition, the field lacks coherence, making collaborative efforts and cross-comparison of studies more challenging.

Another significant gap is the development of measures that can proactively assess systemic risk from an institution's perspective. Current measures are primarily designed to inform regulators about industry-wide vulnerabilities but are not particularly useful for the management of individual institutions. This is a significant issue, as proactive measures can help institutions prevent, minimize, or mitigate the impact of systemic risk on their operations. This challenge is especially pronounced in markets that lack well-developed equity markets, as many potential measures rely heavily on market information, which is often unavailable.

2.8.2. Practical Applicability of Existing Measures

One of the primary gaps in the current literature is the practical applicability of systemic risk measures for financial institutions. Many of the developed measures, such as ΔCoVaR and MES, while robust in theoretical frameworks, are complex and require sophisticated statistical techniques and extensive data. These complexities can pose significant challenges for financial institutions, particularly smaller banks or those in less-developed markets, where access to advanced computational resources and comprehensive data might be limited. As a result, the direct implementation of these measures by financial institutions can be cumbersome, limiting their practical utility in day-to-day risk management.

Moreover, measures such as ΔCoVaR and MES focus heavily on capturing the contribution of individual institutions to systemic risk, which is critical for regulatory oversight but may

not provide actionable insights for institutions seeking to understand their own vulnerabilities. Financial institutions need measures that not only identify their contribution to systemic risk but also elucidate the specific pathways and mechanisms through which systemic shocks could affect them directly. This requires a shift from a macroprudential perspective to a more institution-centric approach in the development and application of systemic risk measures.

2.8.3. Integration of Interconnectedness and Contagion Effects

Another significant gap in the literature is the insufficient integration of interconnectedness and contagion effects in systemic risk measures. While some measures, such as the Financial Connectedness Index (FCI) and Co-Risk, attempt to capture the linkages between financial institutions, they often fall short in comprehensively accounting for the complex, multi-layered networks of dependencies that characterize modern financial systems. The interconnectedness among financial institutions means that systemic risk is not just a function of individual institutions' vulnerabilities but also of the intricate web of relationships and exposures they share.

For instance, the SRI captures the contagion effect by examining the correlation of losses across institutions, but it may overlook the nuanced interdependencies such as funding relationships, asset interlinkages, and counterparty exposures. This limitation can lead to an underestimation of the systemic vulnerabilities that arise from these interconnected networks. Financial institutions need tools that provide a granular understanding of their interconnectedness and the potential contagion channels that could amplify systemic shocks.

2.8.4. Limitations of Data Reliance

The reliance on market data for many systemic risk measures presents another critical gap in the literature. Measures such as CoVaR, MES, and SRISK depend heavily on historical market data, which may not always be available or reliable, particularly in less-developed

financial markets. This reliance on market data can introduce significant uncertainties and biases, especially during periods of market stress when data might be less accurate or reflective of true risk conditions.

Additionally, the use of historical data assumes that past market behaviour is indicative of future risks, an assumption that may not hold true in rapidly changing financial environments. Financial institutions require measures that are less reliant on historical market data and more adaptable to real-time data inputs and changing market conditions. This would enhance the accuracy and relevance of systemic risk assessments, allowing institutions to respond more effectively to emerging risks.

2.8.5. Proactive Capabilities for Risk Mitigation

Another notable gap in the literature is the lack of focus on equipping financial institutions with proactive capabilities for risk mitigation. While existing measures provide valuable insights into systemic risk, they often fall short in offering actionable guidance for institutions to take pre-emptive steps to protect themselves from systemic shocks. Financial institutions need more than just diagnostic tools; they require prescriptive analytics that can inform strategic decisions and risk management practices.

2.8.6. Zambia Specific Study

Finally, no study has been conducted that has looked specifically at Zambia and quantified the systemic risk in Zambian banking institutions. Furthermore, no study has specifically developed a framework that can be used for this purpose.

2.9. Contribution to the knowledge base of the area of study

Systemic risk poses a significant threat to financial stability, encompassing events or shocks within a financial system that can propagate and negatively impact interconnected institutions, markets, and sectors. For risk practitioners, systemic risk signifies the danger that an external

shock within the industry could lead to the failure of their financial institution. This study addresses this concern by offering banks a proactive tool to manage their exposure to systemic risk and ensure long-term sustainability.

The study represents a significant advancement in the field of financial stability by introducing a new measure of systemic risk. It aims to provide banks with an accurate assessment of their susceptibility to industry-wide shocks at any given time. Unlike traditional measures that heavily rely on stock market data, this study leverages internal historical information relative to the industry, offering a novel approach to quantifying individual banks' vulnerability to systemic risk.

Traditionally, managing systemic risk has involved monitoring the external environment for potential shocks and conducting scenario stress tests to assess an institution's resilience. However, the rapid evolution of systemic shocks often hinders effective mitigation measures. This study addresses this challenge by providing banks with a proactive tool that can be used to manage systemic risk well before a shock materializes. By equipping banks to identify whether and how they are likely to be affected, whether it will be severe, moderate, or even completely unaffected by systemic shocks in advance, the study facilitates strategic planning and enables banks to implement pre-emptive measures to enhance their resilience.

The study significantly enhances the practical applicability of systemic risk management tools for financial institutions. Existing measures, such as ΔCoVaR and MES, are robust in theoretical frameworks but complex, requiring sophisticated data inputs and computational resources. This complexity is usually a barrier for many institutions, particularly in less-developed markets. In contrast, the study's reliance on internal historical data ensures that even smaller banks or those in emerging markets can utilize its findings to gain valuable insights into their systemic risk profile without needing extensive external data sources.

Another critical advantage highlighted by the study is the reduced reliance on market data, which is often a limitation for many existing systemic risk measures. Measures such as CoVaR and SRISK depend heavily on historical market data, which may not always be available or reliable, particularly in less-developed financial markets. By utilizing internal historical data from the banks themselves, the study reduces dependency on potentially unreliable external market data, enhancing its accuracy and relevance and making its findings applicable in a wider range of financial environments.

The study also provides financial institutions with proactive capabilities for risk mitigation, addressing a notable gap in the current literature. While existing measures often diagnose systemic risk, they fall short in offering actionable guidance for pre-emptive risk management. By identifying banks' susceptibility to systemic shocks in advance, the study enables institutions to take strategic actions to bolster their resilience. This proactive approach allows banks to develop and implement contingency plans, stress tests, and other risk management strategies tailored to their specific vulnerabilities, ultimately enhancing their ability to withstand systemic shocks.

In conclusion, this study represents a significant advancement in the measurement and management of systemic risk. By addressing key gaps in the existing literature—including the need for practical applicability, integration of interconnectedness, reduction in data reliance, and provision of proactive risk mitigation tools—the study enhances the ability of financial institutions to understand, assess, and manage their exposure to systemic risk. This contributes to the development of more resilient and stable financial systems, ultimately safeguarding financial stability in the face of potential systemic shocks.

2.10. Chapter Summary

This chapter provides a review of the existing research and scholarship on systemic risk and its measurement. It is noted that the measurement of systemic risk is a crucial aspect of managing and mitigating this risk, and that it involves the use of complex mathematical and

statistical tools. The chapter also notes that there are many different definitions of systemic risk because the concept of systemic risk is complex and multifaceted. Systemic risk encompasses a wide range of potential risks that can affect financial systems, including financial contagion, macroeconomic shocks, and the failure of individual banks.

The chapter demonstrates that understanding a bank's vulnerability to systemic shocks is an important part of strategic planning. By taking a proactive approach to managing systemic risks, a bank can ensure its continued viability and success in the long term. It is noted that current measures of systemic risk are designed to provide information to regulators about the vulnerability of the industry as a whole to shocks, but they are not particularly useful to the management of individual institutions, especially the case in markets that do not have well-developed equity markets, given that the few measures that could potentially serve this purpose are very heavily reliant on market information. This is a significant issue, as proactive measures can help institutions to prevent, minimize, or mitigate the impact of systemic risk on their operations.

CHAPTER THREE - THEORETICAL FRAMEWORK

3.0. Introduction

The theoretical framework is a vital component of a research study, as it provides a theoretical foundation for the research being conducted. This framework helps to structure the research, guiding the development of hypotheses and research questions, and providing a basis for the analysis and interpretation of the data.

The first section discusses the philosophical underpinnings of the study, specifically identifying the positivist paradigm as the philosophical approach for this study because of its emphasis on empirical data, objectivity, and the scientific method. Within this paradigm, quantitative research methods are commonly used to collect and analyse data systematically. The positivist paradigm aligns with an epistemological assumption that knowledge is objective and discoverable through scientific inquiry.

The next section highlights the use of mathematical concepts in the measurement of systemic risk, specifically identifying probability theory as crucial in quantifying the likelihood of different financial events occurring, while statistical inference allows researchers to draw conclusions about a population based on a sample of data. It also discusses correlation analysis which is employed to assess the relationship between variables and identify potential risks, and network theory helps model the interconnections between financial institutions and assess associated risks. These mathematical models form the basis of the analysis and derivation of the measure discussed on chapter 7.

The next section discusses the use of historical data in risk management for predicting the future and making informed decisions. It discusses the rationale for doing this and the key considerations that must be considered.

The chapter concludes by discussing the viability of a measure such as that proposed by the study. This is done by looking at different theories for the measurement of systemic risk and the factors that have been identified as being determinants of systemic risk. The main conclusion of the chapter is that given the known relationships between various factors such size, capitalization, performance and so on, and given that the existence of the relations between shocks in the market and systemic risk has been established, it is possible to combine these elements in such a way that a measure for systemic risk for a particular institution is derived.

3.1. Philosophical Underpinnings of the Study

Philosophical underpinnings refer to the underlying principles and assumptions that guide a particular study or line of research. These principles and assumptions can come from a variety of philosophical traditions and schools of thought, such as realism, positivism, and constructivism, to name a few. The philosophical underpinnings of a study are important because they provide a framework for understanding the nature of the phenomenon being studied, as well as the methods and techniques used to study it. They also help to ensure that the study is conducted in a rigorous and objective manner, and that the results are interpreted in a way that is consistent with the underlying philosophical assumptions. In short, the philosophical underpinnings of a study provide a critical foundation for the research and play a key role in determining its overall value and significance.

Creswell and Poth (2018) posit that researchers invariably carry specific beliefs and philosophical presuppositions into their research, and the beliefs that they have play a pivotal role in guiding their approach to gathering information; to addressing research inquiries and are instrumental in forming the bedrock for assessing a study. This highlights the significance of acknowledging these assumptions, as they wield considerable influence over the trajectory of the research. Researchers formulate research questions, plan how to investigate an issue, design research, and identify data collection and analysis methods. This is confirmed by Jackson (2013) who observed that a crucial aspect of choosing a methodology is ‘researcher positionality’ and the philosophical assumptions concerning beliefs, values, ontology,

epistemology and relationality since research is subjective – even the most scientific, positivist, objective, quantitative researcher will make a subjective choice, for example, of which statistical measure to apply – and interpretative as the researcher’s perceptions are utilized in all stages of decision-making throughout a research project.

Business Bliss Consultants (2018), quoting Burns & Grove, (2006) and Brink & Wood (2001), propose that Quantitative approach to research emerged from the positivist paradigm. The positivist paradigm is a philosophical approach to understanding the world that is based on the belief that natural phenomena can be studied using scientific methods. This approach emphasizes the importance of empirical data and objective observation in the study of social and natural phenomena, and it is commonly associated with the natural sciences. It assumes that there is an objective reality that exists independently of our perceptions, and that knowledge about this reality can be obtained through sensory experience and the scientific method.

This means that researchers should strive to be objective and unbiased in their observations and analyses and should use rigorous and systematic methods to collect and analyse data. These philosophical assumptions form a strong foundation for the use of quantitative research methods, which are designed to collect and analyse data in a systematic and objective manner. Quantitative research is typically associated with the positivist paradigm, as it relies on the use of statistical techniques and mathematical models to study natural and social phenomena. By using quantitative research methods, researchers can test hypotheses, make predictions, and generalize findings to larger populations, providing valuable insights into the phenomena they study.

This focus on objectivity that the positivist paradigm emphasizes ties in with epistemology which is concerned with the nature and scope of knowledge (Creswell and Poth, 2018; Slevitch, 2011). Epistemological assumptions are beliefs about the nature of knowledge and how it is acquired. These assumptions are an important aspect of any research study, as they

inform the methods and techniques used to collect and analyse data. Different philosophical traditions and research paradigms have different epistemological assumptions, which can lead to different approaches to research and different conclusions. One common epistemological assumption is that knowledge is objective and can be discovered through the scientific method. This assumption is central to the positivist paradigm, which emphasizes the importance of empirical data and objective observation in the study of natural and social phenomena. Another epistemological assumption is that knowledge is subjective and constructed through individual experiences and social interactions. This assumption is often associated with interpretive and critical theories, which focus on the role of culture, power, and social context in shaping our understanding of the world.

The philosophical underpinnings of this study are therefore a positivist paradigm with the epistemological assumption that knowledge is objective and therefore can be investigated and determined quantitatively using the scientific method. The positivist paradigm is grounded in the belief that reality is objective and can be observed and described from an external standpoint, independent of the researcher's biases or interpretations. This approach is particularly well-suited for studies that aim to develop models or frameworks based on empirical data, as it allows for the systematic collection, analysis, and interpretation of quantitative information.

In the context of this study, the aim is to develop a model for measuring the vulnerability of banking financial institutions to systemic risk. The objective nature of systemic risk, which can be quantified through various financial metrics and statistical methods, aligns with the positivist philosophy. By adopting a positivist paradigm, the researcher can ensure that the findings are based on observable, measurable phenomena, thereby enhancing the reliability and validity of the results.

This study reflects this positivist stance through several key elements:

Table 3-1: Study Elements of Positivist Approach

<p>Research Philosophy:</p>	<p>The adoption of positivism as the research philosophy underscores the commitment to objectivity and the use of scientific methods. Positivism asserts that reality exists independently of human perceptions and can be understood through empirical observation and logical analysis. This is crucial for a study that seeks to develop a predictive model, as it relies on objective data and statistical techniques to derive meaningful insights.</p>
<p>Research Type:</p>	<p>The use of a top-down approach, starting with a theory or hypothesis and then testing it through specific observations or data, is a hallmark of positivist research. This confirmatory approach is ideal for quantitative studies, where the goal is to validate or refute hypotheses based on empirical evidence. By focusing on observable data and statistical validation, the study aligns with the positivist emphasis on objectivity and replicability.</p>
<p>Research Design:</p>	<p>The combination of case study and quantitative research methods further reinforces the positivist framework. While the case study approach provides contextual insights into the Zambian banking sector, the quantitative research component ensures that these insights are grounded in empirical data. Quantitative research, characterized by numerical data collection and statistical analysis, is a core aspect of positivism, as it seeks to uncover causal relationships and test hypotheses using objective measurements.</p>

<p>Study Population and Sample:</p>	<p>The decision to include all commercial banks in Zambia that have existed since 2010 ensures a comprehensive and representative dataset, which is essential for the validity of the study’s findings. By analysing the entire population of banks, the study minimizes selection bias and enhances the generalizability of the results, which is a key objective in positivist research.</p>
<p>Data Collection Instruments and Procedure:</p>	<p>The use of financial statements, such as balance sheets and income statements, as primary data sources align with the positivist emphasis on empirical, quantifiable data. These financial documents provide objective measures of a bank’s performance and risk exposure, allowing for rigorous statistical analysis. The collaboration with the Bank of Zambia to obtain these documents ensures that the data is accurate, reliable, and consistent with regulatory standards, further supporting the positivist approach.</p>
<p>Epistemological Assumption:</p>	<p>The epistemological assumption underlying this study is that knowledge about systemic risk and bank vulnerability can be derived from objective data. This assumption is central to the positivist paradigm, which holds that knowledge is discovered through the application of the scientific method. By employing statistical techniques to analyse financial data, the study aims to uncover patterns and relationships that are not influenced by subjective interpretation, thereby producing objective and replicable results.</p>

In summary, the positivist paradigm is well-suited for this study as it provides a rigorous framework for investigating the objective reality of systemic risk in the Zambian banking sector. By emphasizing empirical observation, statistical analysis, and hypothesis testing, the

study ensures that its findings are grounded in observable phenomena and can be reliably used to inform strategic decision-making. The methodological choices made in the study, from the research design to data collection and analysis, are all aligned with the principles of positivism, thereby enhancing the credibility and utility of the developed model for measuring systemic risk.

3.2. Key Mathematical Concepts in the Measurement of Systemic Risk

This study, rooted in its philosophical underpinnings, takes a quantitative approach that leverages mathematical concepts to measure systemic risk. These methods involve the application of advanced mathematical tools and models to understand and quantify the complexities of financial systems.

3.2.1. Probability Theory

Probability theory forms a foundational framework for systemic risk measurement, offering tools to model and quantify the likelihood of financial events. Taroni (2023) describes it as a system for coherently modifying probability assignments in light of observed events or new information. In essence, probability theory allows analysts to assess the likelihood of occurrences such as the failure of financial institutions or the spread of financial contagion, essential components of systemic risk analysis.

Through techniques such as probability distributions and statistical models, probability theory facilitates the modelling of event likelihoods. For instance, it enables the evaluation of the probability of a financial institution's collapse or the spread of systemic shocks within interconnected financial networks. These methods ensure that analysts can account for diverse factors influencing financial systems' stability.

3.2.2. Statistical Inference

Statistical inference complements probability theory by enabling analysts to draw conclusions about entire populations based on sample data. Defined by John et al. (2012) as the process of making inferences about a population from sample statistics, it provides tools for estimating probabilities and identifying systemic vulnerabilities.

In systemic risk measurement, statistical inference is used to analyse financial data and infer the likelihood of critical events, such as institutional failure or financial contagion. For instance, an analyst may examine a sample of financial ratios—such as capital adequacy or leverage ratios—to estimate the probability of a financial institution failing. By utilizing statistical methods, inferences are made about the broader financial ecosystem.

3.2.3. Correlation Analysis

Correlation analysis is a statistical technique used to identify relationships between financial variables, offering insights into systemic interdependencies. Mukaka (2012) defines correlation as a method to assess linear associations between two continuous variables. In the context of systemic risk, correlation analysis helps uncover relationships between financial performance metrics of different institutions.

The correlation coefficient, a key measure in this analysis, quantifies the strength and direction of relationships. Positive correlations suggest that institutions may share vulnerabilities, while negative correlations may indicate risk diversification. By analysing these relationships, analysts can identify potential systemic risks tied to institutional interdependencies.

3.2.4. Network Theory

Network theory provides another critical framework for measuring systemic risk. As a mathematical discipline focused on the study of complex systems, network theory is

instrumental in modelling the interconnections within financial systems. It uses concepts like graph theory to represent financial institutions as nodes and their relationships as edges.

By analysing these networks, analysts can assess interconnectedness, identify vulnerabilities, and estimate the likelihood of contagion spreading through the system. This approach provides a holistic view of systemic risk, enabling policymakers and institutions to address risks arising from financial interdependencies.

3.2.5. Volatility Analysis

Volatility analysis plays a crucial role in understanding the fluctuations and unpredictability of financial data, helping analysts gauge the stability or risk inherent in asset prices, income streams, or other key financial metrics. Two widely used measures of volatility are the Mean Absolute Deviation (MAD) and the Standard Deviation (SD), both of which quantify the dispersion of data points from their central tendency (typically the mean).

Mean Absolute Deviation (MAD) calculates the average absolute difference between each data point and the mean of the data set. It is valued for its simplicity and directness, as it provides a clear measure of the magnitude of deviations without considering the direction (i.e., it disregards whether values are above or below the mean). This characteristic makes MAD particularly useful when the focus is on understanding the extent of variation in a dataset, regardless of whether it is positive or negative. In financial analysis, MAD is often employed to assess fluctuations in asset prices, revenue, or market conditions, offering insights into the level of volatility over a given period. Its ability to provide a straightforward measure of volatility is helpful in identifying periods of heightened uncertainty or stress, which may indicate increased susceptibility to systemic risks.

On the other hand, Standard Deviation (SD) also quantifies the dispersion of data points around the mean but places more emphasis on larger deviations due to its squaring of differences. This results in SD being more sensitive to extreme values or outliers. SD is widely used in finance to assess risk and volatility, particularly in models such as value-at-risk (VaR), where extreme market movements can significantly impact potential losses or gains.

Both MAD and SD serve valuable roles in financial volatility analysis. While MAD offers a more intuitive, robust measure that is less influenced by outliers, SD provides a deeper understanding of risk by considering the intensity of deviations, making it more sensitive to large fluctuations. Together, these tools help analysts evaluate the overall stability of financial markets or institutions, assess their exposure to systemic risks, and identify potential vulnerabilities that could lead to financial instability.

These mathematical concepts—probability theory, statistical inference, correlation analysis, network theory, and volatility analysis form the backbone of systemic risk measurement. Together, they provide a comprehensive toolkit for modelling, analysing, and mitigating systemic vulnerabilities in financial systems.

3.3. Theoretical Frameworks for Systemic Risk measurement

Montanga et al. (2021) provide a comprehensive overview of the theoretical frameworks employed in the measurement of systemic risk, offering valuable insights into the diverse approaches adopted in academic literature. They discern several distinct categories of theoretical frameworks, each offering unique perspectives on the assessment of systemic risk.

Firstly, there are frameworks that concentrate on capturing tail interdependence among asset market indices. Esteemed researchers such as Acharya et al. (2017) and Adrian and Brunnermeier (2016) have contributed significantly to this line of inquiry, which seeks to uncover the intricate linkages between extreme events in various market segments.

Secondly, other frameworks place emphasis on evaluating the risk emanating from interconnectedness within the financial system. Pioneering studies by Billio et al. (2012) and Diebold and Yilmaz (2008) delve into the dynamics of interconnectedness, shedding light on its implications for systemic stability and resilience.

Furthermore, there exist frameworks that adopt a comprehensive approach, encompassing the multidimensionality of systemic risk by aggregating diverse market indicators. Scholars such as Hollo et al. (2012) advocate for a comprehensive assessment that considers a spectrum of factors contributing to systemic stress.

Moreover, certain models adopt microstructural approaches, wherein interactions among individual agents are meticulously modelled to elucidate the evolution of complex systems and the propagation of financial contagion. Pioneering works by Allen and Gale (2000), Gai and Kapadia (2010), Acemoglu et al. (2012), and Montagna and Kok (2016) delve into the intricacies of agent-based modelling, offering valuable insights into the pathways through which financial shocks propagate and amplify across interconnected networks.

In synthesizing these diverse theoretical perspectives, Montanga et al. (2021) underscore the importance of a multifaceted approach to systemic risk measurement, recognizing the nuanced interplay of factors that underpin the resilience and stability of the financial system. By embracing a comprehensive array of analytical tools and methodologies, researchers and policymakers can gain deeper insights into the complex dynamics of systemic risk, thereby facilitating more informed decision-making and proactive risk management strategies.

These are discussed in greater detail below.

3.3.1. Tail Dependency

The tail dependency framework measures the likelihood that extreme events will occur simultaneously in multiple parts of the financial system. These events are often referred to as "tail events" because they lie in the tail of the probability distribution of possible outcomes. By understanding the tail dependency of different financial institutions or markets, regulators and policy makers can identify areas of the financial system that are most vulnerable to systemic risk.

One way to measure tail dependency is through the use of copulas, which are mathematical tools that describe the dependence between different random variables. Copulas allow researchers to model the tail behaviour of multiple random variables, and to identify the degree of dependence between them. By analysing the tail dependency of different financial institutions or markets, regulators and policy makers can develop strategies to mitigate systemic risk and protect the overall stability of the financial system.

3.3.2. Interconnectedness

One way to measure interconnectedness is through network analysis, which involves mapping out the connections and relationships between different entities in a system. This can help identify potential weak points or vulnerabilities in the system, as well as areas where a failure in one part of the system is likely to have the most significant impact on the rest of the system. By understanding the interconnectedness of a system, policymakers and other stakeholders can take steps to mitigate systemic risk and reduce the likelihood of a catastrophic failure.

Another way to measure interconnectedness is through stress testing, which involves simulating various scenarios and assessing the potential impact on the system. This can help identify potential vulnerabilities and provide a more comprehensive understanding of the system's overall resilience. By conducting regular stress tests and regularly monitoring interconnectedness, policymakers can better understand the potential risks and take steps

to address them before they become significant issues. Overall, the interconnectedness framework is a useful tool for assessing and managing systemic risk in complex systems.

3.3.3. Aggregate multiple market indicators

Measuring systemic risk is an important task for economists, regulators, and policymakers. One way to approach this task is to aggregate multiple market indicators into a framework. This can provide a more comprehensive view of the financial system and help identify potential sources of risk.

There are many different indicators that can be used in such a framework, including measures of market volatility, credit risk, liquidity, and leverage. By combining these indicators, analysts can get a better sense of how the different parts of the financial system are interacting and whether there are potential vulnerabilities that need to be addressed.

One approach to aggregating these indicators is to use a weighted average, where each indicator is assigned a weight based on its importance. This can help to account for the fact that some indicators may be more relevant than others in a given situation. It is also important to regularly review and update the weights to ensure that the framework remains relevant and effective over time.

3.3.4. Microstructural Approaches

Microstructural approaches are a framework for measuring systemic risk that focus on the interactions and behaviour of individual agents within a financial system. This approach emphasizes the importance of understanding the underlying microstructure of the financial system, rather than just looking at macroeconomic indicators such as GDP or the stock market.

One of the key advantages of using microstructural approaches is that they allow for a more granular analysis of the risks inherent in the financial system. By studying the behaviour of individual agents and their interactions, it is possible to identify potential sources of systemic risk that may not be apparent from macroeconomic indicators alone.

One example of a microstructural approach is network analysis, which examines the connections between different agents in the financial system. This allows for the identification of key nodes in the network that are critical for the stability of the system, and the potential impact of their failure on the overall system. By understanding the underlying microstructure of the financial system, policymakers and regulators can take targeted measures to mitigate systemic risk and prevent financial instability.

From a financial institutions point of view, if the possibility of a shock that might wipe out the institution is a risk that must be managed proactively. Knowing that systemic risk exists and has potential to have long lasting impacts on your organization is not enough if there is nothing that can be done about it.

3.4. Model for measuring systemic risk

Given the study's objective to create a model for measuring systemic risk, it is necessary to explore the theoretical framework that such a model would be based on.

A model for measuring systemic risk is a tool used to assess the likelihood and potential impact of a catastrophic event within the broader financial system. There are several key features that are typically included in such a model. First, it should be able to identify and track the various interconnections and dependencies within the financial system, such as the links between different financial institutions and markets. This is important because systemic risk can arise from the failure of one institution or market to affect others within the system. Second, the model should be able to incorporate a variety of factors that can affect systemic risk, including macroeconomic conditions, market volatility, and changes in regulation. Third, the model

should be able to provide quantifiable measures of systemic risk, such as probability estimates and potential loss scenarios. Finally, the model should be flexible and adaptable, so that it can be updated and refined as new information becomes available. Overall, a well-designed model for measuring systemic risk can provide valuable insights and help to inform decision-making within the financial system.

Smaga (2014) proposed a model for systemic risk. The model consists of the following elements:

- Shock (type, source, duration, scope)
- channels of contagion,
- institutions (affected by systemic risk) and
- structural vulnerabilities (increasing exposure to systemic risk).

The entire process starts with a shock. A shock is a sudden and unexpected event that can have significant impacts on the broader financial system. There are several types of shocks that can be a trigger for systemic risk, including economic shocks, such as recessions or changes in interest rates, and financial shocks, such as the failure of a major financial institution or a sharp decline in asset prices. These shocks can affect the stability and resilience of the financial system and may lead to a cascade of events that can have far-reaching consequences. For example, a shock to the housing market could lead to a wave of defaults and foreclosures, which in turn could affect the solvency of banks and other financial institutions. This could then lead to a credit crunch and a tightening of lending standards, which could have negative impacts on economic growth and stability.

The more systemically significant institutions it initially affects are, the stronger its influence on the financial system. Shocks can be classified as:

- endogenous or exogenous,

- resulting from the materialization of micro (understood as credit risk, liquidity risk, etc.) or macro risk,
- due to instability (default) of a single institution or problems of multiple institutions.

The shock is then transferred through interrelated contagion channels, Shocks are transmitted through contagion channels when the initial impact of the shock spreads from one part of the financial system to others. This can happen in a number of different ways. For example, a shock to the housing market can lead to a decline in the value of mortgage-backed securities, which in turn can affect the solvency of banks and other financial institutions that hold these securities. This can then lead to a reduction in lending, which can have negative impacts on the broader economy. Similarly, a shock to the stock market can affect the value of equity-based assets, which can then affect the solvency of pension funds and other investors, leading to a reduction in demand for goods and services.

Contagion channels are the mechanisms through which shocks or disturbances can spread from one part of the financial system to others. These channels can take various forms, such as direct linkages between financial institutions or markets, or indirect linkages through common exposures to certain types of assets or risks. For example, a shock to the housing market can lead to a decline in the value of mortgage-backed securities, which in turn can affect the solvency of banks and other financial institutions that hold these securities. This can then lead to a reduction in lending, which can have negative impacts on the broader economy. Similarly, a shock to the stock market can affect the value of equity-based assets, which can then affect the solvency of pension funds and other investors, leading to a reduction in demand for goods and services. Contagion channels are an important consideration in the analysis of systemic risk, as they can help to identify the potential pathways through which shocks can spread and amplify within the financial system.

The following are some of the contagion channels through which shocks are transmitted:

- bilateral: balance sheet exposures (e.g., on the interbank market) and off-balance sheet exposures (e.g., derivatives), trade channel (export/import);
- market (informative): confidence/behavioural factors (e.g. irrational behaviour, herding, moral hazard, asymmetric information), fire sale, collapse of the whole market as a result of negative external shock,
- structural: similarity in the structure of assets/liabilities (exposure to symmetric shocks) and risk management techniques or diversification methods,
- international: foreign banks (withdrawal of funding/lending during the crisis, exposure of the domestic financial system to external shocks), financing from global financial markets, capital flows,
- product: use of derivatives and securitization (results in opaque interconnectedness in the financial system and excessive leverage),
- payment system: links between (direct and indirect) participants in the payments and settlement systems, type of system.

3.5. Use of historical data to predict the future

The use of historical data to predict the future in risk management is a common practice that can help organizations make informed decisions and avoid potential risks. By studying past events and trends, organizations can gain insight into potential future risks and take steps to mitigate them.

Past trends can be used to make future predictions of events and pricing. According to a recent study by Brown et al (2020), historical data can be used to effectively predict future trends, allowing decision-makers to utilize this information strategically. By monitoring past trends and drawing parallels to current trends, it is possible to detect shifts in economic and market prices and make reasonable predictions of what will happen in the future. Such data can also help in predicting weather and other events that may affect market prices. By utilizing

historical data and market trends, decision makers are better able to make educated, informed decisions that will positively impact their organization's future.

One way that historical data is used in risk management is through statistical modelling. By analysing large amounts of data, organizations can identify patterns and trends that may indicate potential risks in the future. For example, if a company has a history of product recalls, a statistical model can help predict the likelihood of future recalls and the potential impact on the organization.

Another way that historical data is used in risk management is through scenario planning. This involves creating hypothetical future scenarios based on past events and trends. By considering a range of potential future risks, organizations can develop contingency plans and take steps to mitigate them.

In addition to identifying potential risks, historical data can also be used to assess the effectiveness of risk management strategies. By comparing the outcomes of past events to the measures taken to mitigate them, organizations can determine the effectiveness of their risk management techniques and make improvements as needed.

Overall, the use of historical data to predict the future in risk management is an important tool for organizations to manage potential risks and make informed decisions. By analysing past events and trends, organizations can gain insight into potential future risks and take steps to mitigate them. This can help organizations operate more efficiently and effectively and reduce the potential impact of unforeseen risks.

When using historical data to predict the future, there are several key considerations to keep in mind. First, it is important to recognize that past performance is not necessarily indicative of

future results. Just because a particular event or trend occurred in the past does not mean it will necessarily happen again in the future.

Second, it is important to carefully consider the timeframe of the historical data being used. Data from the past may not be relevant or applicable to the time period being predicted. For example, economic data from 20 years ago may not accurately reflect current market conditions.

Third, it is crucial to consider the potential for changes or shifts in the underlying factors that drive the events or trends being predicted. For example, changes in technology, consumer behaviour, or economic conditions can all impact the accuracy of predictions based on historical data.

Fourth, it is important to use a diverse and robust set of data when making predictions. Relying on a narrow or incomplete set of data can lead to biased or inaccurate predictions.

Finally, it is important to regularly review and update predictions based on new data and developments. As new information becomes available, it is important to incorporate it into the prediction model to improve its accuracy. Regularly re-evaluating and refining predictions can help ensure they remain relevant and useful.

Using historical data to predict the future can be problematic for several reasons. First, historical data may not accurately reflect current or future conditions. For example, economic conditions, market trends, and consumer behaviour can change rapidly, making it difficult to rely on data from the past to make accurate predictions about the future. Additionally, historical data may not include all of the variables that are relevant to predicting the future. For example, if an innovative technology or product is introduced that disrupts a market, historical data may

not provide adequate information to make accurate predictions about how this will affect the future.

One way to avoid these pitfalls is to use a variety of data sources and to consider a wide range of potential factors when making predictions. This can help to account for changes in conditions and to ensure that all relevant information is considered. Additionally, it can be helpful to use more sophisticated predictive models that are better able to incorporate a wider range of data and to account for changing conditions.

Another important consideration is the timeframe over which predictions are made. Historical data may be more reliable for making predictions over the short term, as it is less likely to be affected by changes in conditions. However, for longer-term predictions, it may be necessary to incorporate a wider range of data and to use more sophisticated predictive models in order to make accurate forecasts. Overall, the key to using historical data to predict the future is to be aware of its limitations and to take steps to overcome them in order to make the most accurate predictions possible.

3.6. Theoretical Underpinning of the Study

The present study integrates insights from the comprehensive assessment approach into the calculation of the Systemic Vulnerability Score (SVS) for individual banks within the Zambian banking sector. By quantifying various internal risk factors and dependencies, the SVS provides a holistic measure of systemic vulnerability at the bank level, enabling institutions to identify and address internal weaknesses. Through the incorporation of comprehensive assessment frameworks, the SVS offers a nuanced understanding of systemic risk dynamics within individual banks, facilitating targeted risk management strategies tailored to internal vulnerabilities.

3.7. Viability of proposed model

Oordt and Zhou (2018) noted and spoke of the relationship between financial institutions and the financial system. They went on to measure systemic risk by considering the relationship between the equity returns of a financial institution and the financial system conditional upon extremely adverse shocks in the financial system. Their work shows that there is a relationship between financial institutions and the financial market. The restriction of their work is as noted above, the dependence on market data. They observed that banks' systemic risk can be measured by evaluating their sensitivity to shocks in the financial system. One way to quantify this is by calculating the coefficient derived from a linear connection between indicators reflecting the condition of an individual bank and the overall system, as demonstrated in previous studies such as Nijskens and Wagner (2011). Nevertheless, it is essential to recognize that the association between financial institutions and the broader financial system can show significant variations when examining minor disturbances versus significant shocks, as shown in studies like those by Bartram et al. (2007), Knaup and Wagner (2012), and Fahlenbrach et al. (2012).

Yang et al (2020) found that bank systematic risk is significantly and negatively correlated with (1) a bank's profitability, as measured by earnings per share, (2) liquidity levels, i.e., the cash to assets ratio, and (3) loan loss ratio, that is the ratio of provision for loan losses to gross loans. This already demonstrates a relationship that can be built on between systemic risk some Bank parameters, this can be investigated and used.

Chan Lau (2013) observed that Correlation measures are usually employed to capture contagion and systemic risk. He further explained that work by Billio, Getmanski, Lo and Pellizon (2012) and Patro, Qi and Sun (2010) suggest that correlation analysis applied to equity returns or other risk measures could be useful for monitoring systemic risk. Usually though, this correlation analysis is applied to stock market data and the measures that depend on such correlation analysis therefore have this weakness and limitation in applicability.

The existence of the relations between shocks in the market and systemic risk is therefore established. This study will analyse this relation and use it to derive a model for measuring systemic risk for individual financial institutions with a particular focus on avoiding the use of stock market data as this is not always readily available, particularly in emerging countries.

3.8. Chapter Summary

The theoretical framework of this study helps to structure the research, guiding the development of hypotheses and research questions, and providing a basis for the analysis and interpretation of the data. The philosophical underpinnings of this study are a positivist paradigm with the epistemological assumption that knowledge is objective and it can be investigated and determined quantitatively using the scientific method. As a result, this study will have a quantitative focus, involving the use of mathematical concepts in the measurement of systemic risk. The measurement of systemic risk typically involves the use of complex mathematical concepts and models. The existence of the relations between shocks in the market and systemic risk is well-established, and this study will analyse this relationship to derive a model for measuring systemic risk for individual financial institutions. The focus of this study will be on avoiding the use of stock market data, as this data is not always readily available, particularly in emerging countries.

CHAPTER FOUR - CONCEPTUAL FRAMEWORK

4.0. Introduction

The conceptual framework is important because it provides a clear and concise structure for the research. This was helpful in organizing and ensuring that the research was focused and coherent. It also helped to guide the research process, providing a clear set of objectives and a theoretical foundation for the analysis and interpretation of the data and to identify any gaps in the existing literature and to suggest directions for future research.

4.1. Conceptual framework

The ability of financial institutions to anticipate and mitigate the impact of shocks is paramount to safeguarding their stability and resilience. Effective risk management practices necessitate the accurate prediction of how potential shocks might reverberate across the organization, prompting proactive measures to fortify institutional defences and protect against adverse outcomes. Given the systemic nature of risk within the financial industry, a major shock can manifest in various parameters that serve as barometers of industry-wide performance and resilience.

4.1.1. Performance of Each Participant:

The performance of individual institutions within the industry undergoes scrutiny in the wake of a systemic shock, with stakeholders assessing factors such as profitability, asset quality, and operational efficiency. Variances in performance metrics across participants may signal differential vulnerabilities and resilience levels, prompting market reactions and regulatory responses aimed at addressing underlying weaknesses and preserving market stability.

4.1.2. Growth Rate for Participants:

The growth trajectory of financial institutions serves as a vital indicator of their ability to navigate turbulent environments and capitalize on emerging opportunities. Following a systemic shock, growth rates may exhibit fluctuations, reflecting shifts in market dynamics, consumer behaviour, and regulatory constraints. Institutions with robust growth prospects may leverage their agility and innovation capabilities to navigate uncertainties and capitalize on emerging market trends, while others may face challenges in sustaining growth momentum amidst heightened risk aversion and economic uncertainties.

4.1.3. Capitalization of Firms in the Industry:

The capitalization levels of firms within the financial industry assume heightened significance during periods of systemic stress, serving as a buffer against potential losses and solvency risks. Well-capitalized institutions are better positioned to absorb shocks, maintain confidence among depositors and investors, and fulfil regulatory capital requirements without resorting to distress measures such as asset liquidation or capital injections. Conversely, undercapitalized firms may face heightened vulnerabilities, amplifying systemic risk and necessitating regulatory intervention to restore market confidence and stability.

4.1.4. Other Financial Performance Parameters:

A comprehensive assessment of financial performance parameters, including liquidity ratios, leverage ratios, and asset quality indicators, offers insights into the resilience and vulnerability of institutions to systemic shocks. Institutions with robust liquidity buffers, prudent risk management frameworks, and diversified revenue streams are better equipped to withstand adverse shocks and preserve financial stability. Conversely, weaknesses in these parameters may exacerbate the impact of shocks, amplifying contagion effects and systemic spill overs across the financial ecosystem.

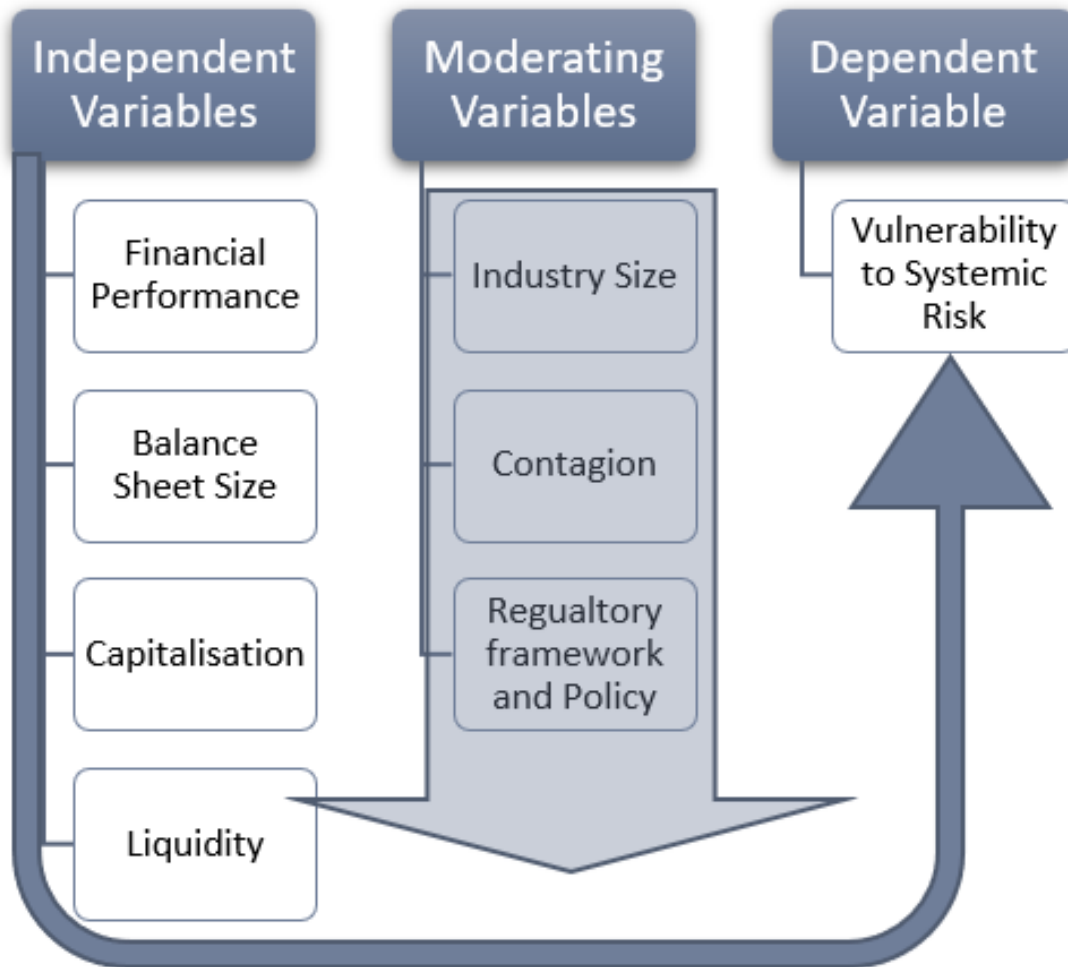
The extent of impact of a shock on individual firms hinges upon several factors, including their size, financial performance, capitalization, liquidity, and idiosyncratic risk exposures. Large institutions with extensive market presence and diversified revenue streams may exhibit greater resilience to shocks, leveraging economies of scale and risk diversification benefits to mitigate adverse outcomes. Conversely, smaller or niche players may face heightened vulnerabilities, lacking the resources and diversification benefits to weather systemic disruptions effectively.

By analysing how these parameters have responded to past shocks and identifying correlations with internal risk factors, financial institutions can enhance their predictive capabilities and develop robust frameworks for assessing vulnerability to future shocks. These risk models enable institutions to proactively identify vulnerabilities, tailor risk management strategies, and allocate resources effectively to mitigate potential threats and ensure long-term sustainability and resilience.

Predefined action plans, contingent on the assessed vulnerability levels, empower firms to respond swiftly and decisively to emerging risks, minimizing potential losses and preserving stakeholder confidence. These proactive measures encompass a range of strategies, including capital conservation measures, liquidity contingency plans, stress testing frameworks, and scenario analysis exercises aimed at enhancing preparedness and resilience in the face of systemic uncertainties.

In conclusion, effective risk management practices necessitate a comprehensive understanding of the multifaceted impacts of systemic shocks on financial institutions and the proactive adoption of measures to enhance resilience, protect against adverse outcomes, and preserve long-term sustainability. By integrating historical data, internal risk assessments, and predefined action plans, institutions can navigate uncertain environments with confidence and agility, safeguarding their stability and contributing to overall market resilience and stability.

Figure 4-1: Conceptual Framework



4.2. Explanation of Conceptual Framework Variables

4.2.1. Independent Variables:

4.2.1.1. Financial Performance:

Financial performance encompasses a range of metrics that reflect a bank's profitability, efficiency, and overall operational effectiveness. Key indicators include return on assets (ROA), which measures the bank's ability to generate profits from its asset base; return on equity (ROE), which indicates the return earned on shareholders' equity investment; net interest margin (NIM), which assesses the profitability of the bank's

core lending and investment activities; and operating efficiency ratios, such as the efficiency ratio or cost-to-income ratio, which gauge the bank's cost management and operational efficiency (Bhattacharya & Thakor, 1993; Molyneux et al., 2004). These metrics provide insights into the bank's ability to generate sustainable earnings, manage risks, and create value for shareholders.

4.2.1.2. Balance Sheet Size:

Balance sheet size refers to the total assets held by a bank, reflecting the scale of its operations, market presence, and interconnectedness within the financial system. It encompasses a diverse range of assets, including cash, loans, securities, and other investments, as well as liabilities such as deposits, borrowings, and equity capital (Kashyap et al., 2002). The size of the balance sheet influences a bank's systemic importance and its potential impact on financial stability. Larger banks may benefit from economies of scale, diversification, and access to capital markets, but they also pose greater systemic risks due to their size, complexity, and interconnected relationships with other financial institutions (Flannery & Rangan, 2006).

4.2.1.3. Capitalisation:

Capitalisation refers to the adequacy of a bank's capital reserves to absorb losses and maintain solvency in adverse scenarios. It is typically measured by capital adequacy ratios, such as the Basel III regulatory framework's common equity Tier 1 capital ratio, which compares a bank's core equity capital to its risk-weighted assets (BCBS, 2010). Capital serves as a buffer against unexpected losses, providing a cushion to absorb credit, market, and operational risks without jeopardising depositor confidence or triggering insolvency (Keeley, 1990). Well-capitalised banks are better positioned to withstand financial shocks, maintain lending activity, and support economic recovery during downturns (Berger et al., 1995).

4.2.1.4. Liquidity:

Liquidity represents a bank's ability to meet its short-term funding obligations and manage cash flow mismatches effectively. It encompasses the availability of liquid assets, such as cash reserves, central bank reserves, and marketable securities, relative to short-term liabilities, including customer deposits, interbank borrowings, and maturing debt obligations (Acharya et al., 2011). Key liquidity metrics include the liquidity coverage ratio (LCR) and net stable funding ratio (NSFR), which assess the adequacy of liquid assets relative to funding requirements under stress conditions (BCBS, 2013). Liquidity risk arises from mismatches between asset liquidity and liability maturity profiles, potentially leading to funding squeezes, fire sales of assets, and systemic disruptions (Allen & Gale, 2000). Adequate liquidity management is essential for maintaining financial stability, market confidence, and systemic resilience (Acharya et al., 2010).

4.2.2. Moderating Variables:

4.2.2.1. 1. Industry Size:

Industry size refers to the overall scale and composition of the banking sector within a specific market or jurisdiction. It encompasses factors such as the number of banks, market concentration, and the distribution of market shares among key players (Demirgüç-Kunt & Huizinga, 2001). The size and structure of the banking industry influence competition, market dynamics, and systemic risk. Highly concentrated industries dominated by a few large banks may be more susceptible to systemic risk due to interconnectedness, too-big-to-fail concerns, and the potential for contagion effects (Rochet & Tirole, 1996). In contrast, more diversified and competitive markets with a mix of large and small banks may exhibit greater resilience and stability (Boyd & De Nicolo, 2005).

4.2.2.2. 2. Contagion:

Contagion refers to the spread of financial distress or instability from one institution to another, either through direct exposures or interconnected linkages within the financial system (Allen & Gale, 2000). It can manifest as a rapid and widespread loss of confidence, leading to liquidity shortages, solvency concerns, and systemic disruptions (Freixas et al., 2000). Contagion dynamics arise from interconnected balance sheets, common exposures, counterparty relationships, and investor perceptions of interconnectedness and systemic importance (Dungey et al., 2005). Contagion dynamics play a critical role in amplifying systemic risk and propagating shocks across interconnected banks and markets. The spread of distress or instability from one institution to another can undermine market confidence, trigger panic-driven withdrawals, and exacerbate financial instability. Direct exposures, such as interbank lending and counterparty relationships, serve as channels for contagion transmission, while indirect mechanisms, including information spill overs and herding behaviour, further amplify systemic disruptions. Understanding the mechanisms and drivers of contagion is essential for assessing the interconnectedness of financial institutions and designing effective risk mitigation strategies to contain systemic risk contagion (Upper & Worms, 2004).

4.2.2.3. 3. Regulatory Framework and Policy:

The regulatory framework and policy environment encompass the rules, guidelines, and interventions implemented by regulatory authorities to promote financial stability, protect consumers, and mitigate systemic risk (Cihak & Nier, 2009). It includes prudential regulations, capital requirements, liquidity standards, risk management guidelines, and resolution frameworks designed to enhance the safety and soundness of the banking system (Allen & Gale, 2004). Regulatory policies shape the risk-taking. The regulatory framework and policy environment play a pivotal role in shaping banks' risk-taking behaviour, market conduct, and resilience to systemic risks. Prudential regulations and capital adequacy requirements set minimum standards for risk management practices and capital buffers, enhancing the safety and soundness of

financial institutions. Supervisory oversight and regulatory stress testing help identify and address emerging risks, ensuring the stability and resilience of the banking system. Effective crisis management frameworks and resolution mechanisms provide mechanisms for managing systemic crises, minimizing the spill over effects of bank failures, and maintaining market confidence (Demirgüç-Kunt & Huizinga, 2010).

4.3. Research Hypotheses

This research is underpinned by the following hypotheses.

- 1. Performance parameters of a bank will respond to shocks in the banking industry and the extent of this response will reflect the vulnerability of the bank to systemic shocks.*
- 2. Past data on the performance of the banking industry can be used to derive a relationship between the performance of a specific bank and the rest of the industry.*

4.4. Operationalisation of the Hypotheses

4.4.1. Operationalisation of the first hypothesis

To operationalize this hypothesis, it was necessary to first define the performance parameters that would be examined in relation to shocks in the banking industry. These included measures such as profitability, return on assets, and asset quality. The specific shocks in the banking industry that were studied were then identified, such as changes in interest rates or regulatory changes.

Data on the performance parameters of the banks in the industry in question over a period of time was collected, both before and after the identified shocks in the banking industry.

This data was obtained from the banks financial statements published quarterly in accordance with regulatory requirements.

When the required information had been gathered, it was analysed to ascertain how well the banks performance metrics responded to the shocks to the banking sector in order to ascertain the statistical significance of any observed changes in the performance characteristics, this included running statistical tests. In order to do this, the data was analysed in order to ascertain if there is a correlation between the performance parameters and the industry shocks as well as the degree to which the performance metrics' reaction represents the susceptibility of the banks to systemic shocks.

This was done using statistical analysis techniques, such as regression analysis, to examine the relationship between the performance parameters and the shocks in the industry. Graphical techniques, particularly line graphs, were then be used to visualize the relationship between the variables and identify any patterns or trends in the data.

Finally, the results of the analysis are used to evaluate the vulnerability of the banks to systemic shocks. Where a particular bank's performance parameters are found to be highly responsive to shocks in the banking industry, this is taken as being an indicator that that bank is vulnerable to systemic shocks and may be at risk of financial instability. On the other hand, if the bank's performance parameters are found to be relatively stable in the face of industry shocks, this suggests that the bank is less vulnerable to systemic shocks and is better able to withstand financial disruptions.

4.4.1. Operationalisation of the Second hypothesis

Identifying the pertinent banks within the industry is the first stage in operationalizing the premise that historical data on the performance of the banking industry may be utilized to infer a link between the performance of a particular bank and the rest of the industry. Then information on the operations and performance of these institutions must be gathered. In

addition to financial information, such as profit and loss accounts, balance sheets, and credit ratings information about banks activities, such as lending and investing strategies, as well as the kinds of products and services provided, may also be gathered and used.

After data collection, the next step was to clean and process the data to ensure its accuracy and readiness for analysis. This involved removing any outliers or incorrect data points and standardizing the format of the data. Once the data is prepared for analysis, statistical and analytical techniques are employed to identify patterns and trends in the data. This involved the use of regression analysis, time series analysis, or machine learning algorithms.

Once patterns and trends had been identified, they were then used to create a model that can be used to predict the relationship between the performance of the target bank and the rest of the industry. This model consists of equations or algorithms that take the current state of the other banks in the industry as input and output a prediction of the target bank's performance.

To validate the model, it was necessary to subject it to testing using a similar dataset. This made it possible to determine if the predictions made by the model using these data are consistent with the actual observations made during the relevant time period.

4.5. Chapter Summary

A conceptual framework is important because it provides a clear and concise structure for the research. It helps to define the key concepts and theories that will be discussed in the paper, and it shows how these concepts and theories are related to one another. This helps to organize and ensure that the research is focused and coherent. The basis of this study is that the management of a financial institution must be able to accurately predict how a shock might affect their organizations take steps to make sure the protect their institution. It is expected that a major shock to the industry will be visible in various parameters, such as the performance of each participant, the growth rate for participants, and the capitalization of firms in the industry.

The extent of the impact of the shock on an individual firm will depend on factors such as the size of the firm, its financial performance, its civilization, and the management of the firm, as well as other parameters specific to the firm. Based on how these parameters have responded to shocks in the past, a relationship can be derived and enhanced with internal parameters to serve as an indicator of how vulnerable the firm will be to future shocks and strategies to ensure sustainability can be developed.

CHAPTER FIVE – RESEARCH METHODOLOGY

5.1. Introduction

The aim of this study is to develop a model for the measurement of the vulnerability of a banking financial institution to systemic risk that will allow the management of that institution to use it proactively and thereby, position themselves to develop strategies that ensure the sustainability of the institution. This was done by investigating the methods of measuring systemic risk and their ideal applications; determining the extent to which systemic risk is prevalent in the Zambian Banking industry; determining the factors that affect an institutions vulnerability to systemic risk; and designing a model for measurement of systemic risk that will measure the susceptibility to systemic risk of individual units in the industry using publicly available information and be useful for strategic planning as it will be forward looking.

5.2. Research Philosophy

This research was premised on the philosophy of positivism; Positivism states that the researcher can observe reality objectively and that there is only one reality, which exists independently of the observer. As a consequence, it is quite commonly the underlying research philosophy in quantitative studies and is oftentimes the assumed philosophy in the physical sciences.

5.3. Research Type

The research type used was a top-down approach. It started with a theory or hypothesis and then tested it using specific observations or data. Therefore, the study was confirmatory in approach. This is ideal because the study is quantitative in nature.

5.4. Research Design

The study employed a combined case study and quantitative research approach. Case study analysis focused on Zambia's banking sector as an illustrative example, while quantitative

research quantified systemic risk intricacies and allowed for statistical inferences to be drawn from how the Banks had performed in the past and how this performance had responded to events that have occurred in the industry.

Quantitative research, according to Aliaga and Gunderson (2002), clarifies issues through numerical data collection and statistical analysis. Further, according to Fraser Health Authority (2011), quantitative research seeks to establish causal relationships (or association) between two or more variables, using statistical methods to test the strength and significance of the relationships.

The case study approach, focusing on the Zambian banking industry as the context for developing the systemic vulnerability score, offers several advantages in comprehensively understanding and addressing systemic risk within a specific financial ecosystem. Case studies allow for an in-depth exploration of real-world phenomena within their natural context, providing rich insights into complex interactions and dynamics that may not be captured through quantitative analysis alone. In contrast, case study research delves into specific, real-life phenomena in their context, ideal for comprehensively examining the Zambian financial sector. According to Phelan (2011), it allows for an in-depth review of new or unclear phenomena whilst retaining the holistic and meaningful characteristics of real-life events. It is therefore ideal for this study as the Zambian financial sector will be looked at holistically and interactions between the different parameters of the constituents investigated in detail. This qualitative exploration complements quantitative analyses by uncovering underlying mechanisms, causal relationships, and contextual factors that influence systemic vulnerability. By examining the entire spectrum of banks within Zambia, the study can capture the heterogeneity of risk exposures, business models, and regulatory environments present in the banking sector.

By combining quantitative and case study methods, the study leveraged precise quantitative analysis and rich case-specific insights to comprehensively address the research question. A

combination of case study approach and quantitative research was used. The case study approach was used in the sense that the Zambia banking sector was used as a use case. The intricacies of systemic risk within the sector were then be explored quantitatively and a measure for systemic risk developed.

5.5. Study area or Site

The study focus was the banking industry in Zambia which plays a significant role in the country's economy by providing financial services that support economic progress and growth. The study encompassed all banks operating in Zambia under the regulation of the Bank of Zambia. The regulatory framework ensures that these banks comply with standards related to stability, transparency, and prudent management practices, creating a dynamic environment for investigation.

5.6. Study population

The study population consisted of all banking institutions within Zambia's banking industry that have been active since 2010. This approach was adopted to capture the full spectrum of the industry's development, taking into account regulatory modifications, economic fluctuations, and market dynamics over a period spanning more than a decade.

5.7. Study sample

The study sample comprised all banks operating in Zambia from January 2010 to December 2022. Including every bank was crucial for gaining a comprehensive understanding of the industry as a whole. By examining data from all banks, the research aimed to avoid any biases that could result from sampling only a subset of institutions, thus ensuring that the conclusions accurately reflect the entire industry.

5.8. Sampling techniques

The study sample included all commercial banks in operation in Zambia over the period January 2010 to December 2022. January 2010 was chosen because a number of Banks started their operations in 2009; In 2006 there were 13 commercial banks in Zambia, since 2008, 6 more subsidiaries of foreign banks were registered, bringing the total number to 19 commercial banks for the whole sector at the end of 2012. (Zambia Invest 2022)

5.9. Data collection instruments

Financial Statements, particularly Balance Sheets and Income Statements from the commercial banks were obtained and used in the study.

5.10. Data collection procedure and timeline

The study encompassed financial data from all banks, as published. The dataset covered banks that have been active in Zambia since the year 2010. To streamline data collection, the researcher collaborated with the Bank of Zambia, which provided access to this information. Since the publicly disclosed information, as per regulatory standards, aligns with the data submitted to the regulatory body, it fulfilled the criteria outlined in objective number 4 of the study.

5.11. Reliability of Data Collected

The reliability of the data used in the study, drawn directly from the Bank of Zambia, underscores a robust foundation for conducting rigorous financial analysis. The regulatory oversight exercised by the Bank of Zambia, coupled with its adherence to internationally recognized accounting standards, such as the International Financial Reporting Standards (IFRS), enhances the credibility and integrity of the financial data. Moreover, the regulatory framework and processes implemented by the Bank of Zambia for data collection, verification, and reporting demonstrate a commitment to transparency and accuracy in financial reporting within the banking sector.

The availability of comprehensive documentation and metadata accompanying the financial data further facilitates its interpretation and ensures transparency. Stakeholder feedback, including input from banks, industry experts, and academic researchers, corroborates the reliability and usefulness of the data provided by the Bank of Zambia for scholarly inquiry and decision-making purposes. Through systematic validation procedures and adherence to regulatory standards, the data sourced from the Bank of Zambia exhibits a high degree of reliability, affirming its suitability for robust financial analysis and research endeavours.

5.12. Inclusion and Exclusion Criteria

5.12.1. Inclusion Criteria:

1. Commercial Banks in Zambia: The study sample comprised all commercial banks operating within the geographical boundaries of Zambia during the period spanning from January 2010 to December 2022.
2. Operational Period: The inclusion of data from January 2010 was based on the consideration that several banks commenced operations in 2009, ensuring the incorporation of a comprehensive dataset that reflects the banking landscape in Zambia.
3. Total Number of Banks: Given the dynamic nature of the banking sector in Zambia, encompassing 13 commercial banks in 2006 and expanding to 19 commercial banks by the end of 2012 with the registration of six additional subsidiaries of foreign banks, the study included data from all banks operating within this evolving landscape.

5.12.2. Exclusion Criteria:

1. Non-Commercial Institutions: Non-commercial financial institutions, such as credit unions, microfinance institutions, or non-banking financial entities, were excluded from

the study sample to maintain focus on the specific characteristics and dynamics of commercial banking operations.

2. **Data Quality Assurance:** Banks with incomplete, inaccurate, or unreliable financial data were excluded to ensure the integrity and reliability of the analysis.
3. **Regulatory Compliance:** Banks that did not comply with regulatory reporting requirements or standards mandated by the Bank of Zambia were excluded to uphold data consistency and regulatory compliance standards.
4. **Geographic Scope:** The study did not extend to banks operating outside the geographical boundaries of Zambia, focusing exclusively on commercial banks within the country.

5.12.3. Rationale for Criteria Selection:

The selection of inclusion and exclusion criteria was guided by the objective of capturing a comprehensive representation of the commercial banking sector in Zambia over the specified period. By including all commercial banks operating within Zambia from January 2010 onwards, the study aimed to provide a holistic analysis of the sector's performance and resilience. Exclusion criteria were established to ensure data quality, regulatory compliance, and geographic relevance, thereby enhancing the validity and reliability of the study outcomes.

5.12.4. Transparency and Reproducibility:

The application of inclusion and exclusion criteria was transparent and consistent throughout the study. All decisions regarding sample selection were documented to facilitate replication and ensure the reproducibility of the research findings. Additionally, the rationale behind each criterion was clearly articulated to provide insight into the methodological approach and enhance the transparency of the study methodology.

5.13. Data analysis instruments and procedures

Statistical analysis was the primary method used to interpret and analyse the data, employing statistical methods and techniques to comprehend patterns and relationships within the dataset. It enabled researchers to make inferences about a population based on a sample and draw conclusions about the data.

The first step involved organizing and cleaning the data, which included checking for errors, missing values, and outliers. The subsequent step entailed exploring the data, encompassing the generation of descriptive statistics like mean, median, mode, standard deviation, and range, as well as creating visualizations like histograms, scatterplots, and boxplots to gain insights into the data's distribution and patterns.

The third step entailed hypothesis testing, utilizing statistical tests such as correlation and covariance analysis and time series analysis. The fourth step involved interpreting the results and drawing conclusions based on the statistical analysis. This encompassed discussing the implications of the findings, outlining the study's limitations, and considering implications for future research.

5.14. Type of Data Analysis used in the Study

In the context of panel data analysis, the data utilized for deriving the vulnerability score for banks encompasses a longitudinal dataset consisting of multiple banks observed over a fixed period. This dataset captures variations in key financial parameters such as equity, total assets, liquidity, and earnings performance across different banks and over time. Panel data analysis offers several advantages for this type of investigation. Firstly, it allows for the examination of both cross-sectional and time-series variations, providing a comprehensive understanding of how banks' vulnerabilities evolve over time and differ across institutions. Additionally, panel data analysis enables the exploration of individual bank characteristics and their impact

on systemic risk vulnerability, facilitating the identification of key determinants and risk factors.

By leveraging panel data techniques, such as fixed-effects or random-effects models, researchers can control for unobserved heterogeneity and time-invariant factors, enhancing the robustness and reliability of the analysis. Moreover, panel data analysis facilitates the assessment of dynamic relationships and causal effects between financial parameters and systemic risk vulnerability, offering valuable insights for policy formulation and risk management strategies. Overall, the utilization of panel data in this analysis provides a rigorous framework for evaluating banks' vulnerability to systemic risks and contributes to the advancement of empirical research in financial stability and regulatory policy.

Table 5-1: Analytical Techniques used in the Study

Analysis	Description
Correlation and Covariance Analysis	Was conducted to examine the relationships between different financial parameters, such as equity, total assets, liquidity, and earnings performance. This analysis helped identify any significant correlations that may have existed among these variables, providing insights into potential interdependencies and their impact on systemic risk.
Financial Analysis	Was utilized to assess the financial health and performance of banks by analysing key financial ratios and metrics. This analysis involved examining parameters such as equity-to-assets ratio, loans-to-deposits ratio, and growth in total income to evaluate the stability, profitability, and risk exposure of banks over time.
Volatility Analysis	Mean Absolute Deviation (MAD) is a statistical measure used to quantify the dispersion or variability of a dataset around its mean. In the context of systemic vulnerability analysis, MAD offers a straightforward approach to capturing the volatility of financial parameters, reflecting the consistency or variability in key metrics

	<p>over time. MAD measures the average absolute deviation of each data point from the mean, making it an effective tool for understanding the regularity or fluctuations in financial variables such as deposits, liquidity, and equity. Its application provides insights into the stability of these parameters, with higher MAD values indicating greater variability. In the derivation of the systemic vulnerability score, MAD was used to assess the volatility of financial metrics, ensuring that the model reflects both the magnitude and stability of bank performance indicators over time.</p>
Temporal Analysis	<p>Was conducted by reviewing line graphs and charts to determine trends and patterns in the data. This analysis helped identify long-term movements and directional changes in financial parameters, contributing to a comprehensive assessment of a bank's performance and vulnerability to systemic risks.</p>

5.15. Variables and Sub-Variables in the Model Derivation

The derivation of the systemic vulnerability score (SVS) model required the identification of variables and sub-variables critical to assessing systemic risk. These variables were selected based on their theoretical relevance to bank resilience and vulnerability, as well as empirical evidence from historical performance during periods of financial stress. This section outlines the variables, their sub-variables, and the methodologies employed in the derivation of the model.

The SVS model integrates five primary variables, each encompassing sub-variables that capture distinct dimensions of systemic risk:

1. Deposits Growth Stability:

- **Variable Description:** Reflects the stability of deposit inflows, a key indicator of depositor confidence and the ability to sustain funding under stress.
- **Sub-Variable:** Deposits.

- **Metric:** Volatility-to-mean ratio of total deposits over the observation period.
- **Relevance:** Higher volatility indicates depositor uncertainty and potential vulnerability during periods of systemic stress.

2. Loan-to-Deposit Ratio (LTD):

- **Variable Description:** Measures the prudence of a bank's lending practices relative to its deposit base.
- **Sub-Variables:** Gross Loans and Advances, Deposits.
 - **Metric:** Volatility-to-mean ratio of the ratio of gross loans to deposits.
 - **Relevance:** Higher volatility suggests inconsistent lending practices, exposing the bank to liquidity mismatches.

3. Equity-to-Assets Ratio (ETA):

- **Variable Description:** Captures the bank's capital adequacy and capacity to absorb losses.
- **Sub-Variables:** Shareholders' Equity, Total Assets.
 - **Metric:** Volatility-to-mean ratio of the ratio of shareholders' equity to total assets.
 - **Relevance:** Stable and higher equity-to-assets ratios signify better capital buffers and resilience to shocks.

4. Liquid Assets to Total Assets (LAT):

- **Variable Description:** Assesses the robustness of liquidity management practices.
- **Sub-Variables:** Liquid Assets, Total Assets.
 - **Metric:** Volatility-to-mean ratio of the ratio of liquid assets to total assets.

- **Relevance:** Lower volatility and consistent liquidity levels indicate effective management of short-term obligations.

5. Profit Margin:

- **Variable Description:** Evaluates the bank's efficiency in generating income relative to its revenue.
- **Sub-Variables:** Net Interest and Other Income, Total Revenue.
 - **Metric:** Volatility-to-mean ratio of the ratio of net interest and other income to total revenue.
 - **Relevance:** Stable profit margins reflect operational efficiency and the ability to sustain income during economic downturns.

5.16. Limitations of the Study

Assumption of Linearity: The methodology may have assumed linear relationships between financial indicators and systemic vulnerability, which may not fully capture the complex and nonlinear nature of systemic risk dynamics.

Homogeneity of Data: The methodology may not have adequately accounted for heterogeneity among banks in terms of business models, risk profiles, and market exposures. This could potentially bias the results and limit the applicability of the vulnerability score model across diverse banking institutions.

Model Complexity: While the vulnerability score model offers a comprehensive assessment of systemic risk, its complexity may pose challenges in interpretation, implementation, and validation. Simplifying the model without compromising its predictive accuracy could be a methodological challenge.

Data Pre-processing Techniques: The methodology's effectiveness may be influenced by the choice of data pre-processing techniques, such as outlier detection, imputation of missing values, and normalization procedures. Inaccurate or inappropriate pre-processing techniques could introduce bias or distort the results.

CHAPTER SIX – DATA PRESENTATION AND ANALYSIS

6.0. Introduction

This chapter delves into a review of the data gathered and studied to explain how market shifts affect the banking industry, in Zambia. The main goal is to pinpoint periods of strain and scrutinize their impact on banks thereby evaluating the prevalence and consequences of systemic risk within the industry. Through this examination the section seeks to shed light on both the strength and vulnerabilities in banks.

Initially the analysis centres on market patterns to identify periods characterized by downward trends. Recognizing these periods is essential as it allows for a focus on times when systemic risk was most apparent. Subsequently two sets of banks are chosen for evaluation; one that seems susceptible to these market disturbances and another that exhibits remarkable resilience. These institutions undergo an assessment using correlation and covariance analyses, financial ratio assessments and volatility evaluations.

The correlation and covariance analyses offer insights into the performance of these banks by examining their connections with overall market movements. This examination reveals differing levels of sensitivity among banks towards market dynamics. It is noted that some banks show correlations with market shifts while others demonstrate correlations indicating distinct reactions, to economic fluctuations.

Additionally, there are varying degrees of strength, in these connections among banks with some showing correlations than others. This highlights the levels of reliance they have on market conditions.

Examining ratios during times of stress provides an insight into how resilient banks are. By monitoring changes in assets, equity and deposits this analysis helps determine which banks are better prepared to withstand economic hardships. Banks that demonstrate growth in these areas during stressful periods are seen as more resilient while those with fluctuating or negative

trends are viewed as less stable. This aspect of the analysis emphasizes the importance of tracking these factors over time to evaluate a bank’s ability to withstand situations.

Furthermore, conducting volatility analysis enhances the understanding of the risk profiles of banks. By assessing the stability of ratios like liquidity and revenue generation capacity we can identify banks that maintain stability during times compared to those more vulnerable to market fluctuations. Banks with predictable ratios are considered resilient while those with high volatility are seen as at higher risk from market changes. This analysis underscores the need to include measures of volatility, in risk assessments to capture the changing nature of markets.

The chapter concludes with the derivation of the Systemic Vulnerability Score following the identification of the parameters that signal differences between vulnerable and resilient banks. The SVS is then tested and validated to confirm its usefulness and suitability for predicting systemically vulnerable banks.

6.1. Description of Data Collected

Data was collected for twenty banks that have operated in Zambia from April 2004 to December 2022. The banks were labelled bank 1 through to 20. Table 6-1 shows the time periods for which the data was available for each Bank.

Table 6-1: Bank Data Collected

BANK	DATA AVAILABLE FROM:	DATA AVAILABLE TO:
1	November 2011	December 2022
2	January 2008	December 2022
3	September 2008	December 2022
4	January 2008	December 2022
5	January 2008	December 2022
6	No data Available	No data Available
7	January 2008	December 2022
8	September 2009	December 2022
9	January 2008	December 2022
10	No data Available	No data Available
11	June 2010	December 2022

12	April 2009	December 2022
13	No data Available	No data Available
14	January 2008	December 2022
15	January 2008	December 2022
16	January 2008	December 2022
17	April 2004	December 2022
18	January 2010	December 2022
19	January 2008	December 2022
20	April 2019	December 2022

Data for Banks 6, 10 and 13 was not available.

Altogether therefore, a total of 2,811 sets of financials were collected and used in the analysis.

6.2. Bank Performance Analysis Criteria

To facilitate the analysis of the data collected and to make it comparable among the different banks, key financial ratios were calculated. These are illustrated in Table 6-2 and Table 6-3 below:

Table 6-2: Balance Sheet Ratios

Growth in Deposits
Growth in Loans and Advances
Change in Shareholder Equity
Liquid Assets/Total Assets
Borrowed Funds/Total Assets
Loans/Deposits
Change in total Assets
Change in risk-weighted assets
Equity/Assets

Table 6-3: Income Statement Ratios

Growth in interest Income
Growth in interest Expense
Growth in Other Income
Growth in Total Income
Growth in Impairments
Growth in Operating Expenses
Growth in Salaries Expense
Cost to Income Ratio

6.2.1. Growth in Deposits:

This metric, spanning across temporal intervals, elucidates the percentage alteration in a financial institution's aggregated deposit base. It serves as a pivotal gauge for assessing the entity's capacity to amass and sustain customer deposits, a fundamental source of liquidity essential for lending and investment activities. Noteworthy elevation in growth rates may signify robust customer trust, reflective of efficient deposit mobilization strategies and superior service delivery. Conversely, a contraction in this ratio may signal challenges in deposit acquisition, potentially stemming from intensified competition or shifts in consumer preferences towards alternative investment avenues. The oscillations in deposit growth rates bear profound implications for the liquidity profile and operational resilience of financial institutions, influencing their lending capacity and overall financial health.

6.2.2. Growth in Loans and Advances:

This fundamental metric encapsulates the percentage change in a financial entity's loan portfolio over specified timeframes, offering critical insights into its lending activities and risk exposure. Heightened growth rates in this parameter may denote an assertive lending stance aimed at capitalizing on lucrative opportunities or catering to burgeoning credit demand. However, such aggressive expansion may also herald increased credit risk, necessitating stringent risk assessment frameworks to mitigate potential loan defaults and asset quality deterioration. Conversely, diminishing growth trends in loans and advances may reflect prudent risk management practices or subdued demand within key lending segments, thereby underscoring the intricate balance between growth aspirations and risk mitigation imperatives in the lending landscape.

6.2.3. Change in Shareholder Equity:

This ratio, delineating variations in an organisation's shareholder equity over time, serves as a barometer of its financial resilience and wealth generation capacity. It reflects the net impact of profits, losses, capital injections, and dividend distributions on shareholder equity, encapsulating the firm's overall financial performance and capital structure

dynamics. Positive deviations in this metric signify wealth accretion for shareholders, indicative of profitable operations and efficient capital allocation strategies. Conversely, negative fluctuations may raise concerns regarding profitability, capital erosion, or excessive dividend pay-outs, necessitating corrective measures to safeguard shareholder interests and enhance long-term sustainability.

6.2.4. Liquid Assets/Total Assets:

This crucial ratio gauges the proportion of a corporation's readily convertible or liquid assets relative to its total asset base, offering pivotal insights into its liquidity position and financial robustness. A higher ratio signifies a superior liquidity cushion, enabling the firm to meet short-term financial obligations and navigate unforeseen cash flow disruptions with resilience. Such liquidity buffers are instrumental in mitigating liquidity risks associated with sudden deposit withdrawals, market volatilities, or adverse economic shocks, thereby underpinning the firm's solvency and operational continuity. Conversely, a lower ratio may indicate liquidity constraints, impairing the firm's ability to honour financial commitments promptly and potentially exposing it to liquidity crises or distress scenarios.

6.2.5. Borrowed Funds/Total Assets:

This ratio shows how much of an entity's assets are funded by borrowing, giving essential information about its leverage and risk. A heightened ratio indicates a substantial reliance on debt financing for capitalization purposes, potentially amplifying financial risks associated with debt servicing obligations, interest rate fluctuations, or refinancing challenges. Such elevated leverage may exacerbate vulnerabilities during periods of economic downturns or market turbulence, constraining the firm's financial flexibility and jeopardizing its long-term sustainability. Conversely, a lower ratio reflects a more conservative capital structure, characterized by a prudent balance between debt and equity financing, thereby mitigating financial risks and bolstering the firm's resilience to external shocks or adverse market conditions.

6.2.6. Loans/Deposits:

This ratio quantifies the proportion of a bank's deposit base allocated towards lending activities, serving as a key indicator of liquidity risk and prudential management practices. A lower ratio suggests a more conservative approach to lending, with banks maintaining higher liquidity reserves to meet depositor withdrawal demands and regulatory requirements. Conversely, higher ratios may signal an aggressive lending stance aimed at maximizing interest income or market share, potentially exposing the bank to liquidity strains during periods of depositor runs or funding disruptions. The interplay between loans and deposits underscores the delicate balance between profitability objectives, liquidity management imperatives, and risk mitigation strategies within the banking sector.

6.2.7. Change in Total Assets:

This ratio computes the percentage variation in a firm's total asset pool over designated timeframes, serving as a barometer of its growth trajectory and business expansion dynamics. Positive deviations in this metric denote asset accumulation or business expansion initiatives, reflective of strategic investments, acquisitions, or organic growth strategies. Conversely, negative deviations may signify asset divestitures, portfolio rationalization, or contractionary measures aimed at optimizing resource allocation or addressing underperforming business segments. The analysis of total asset changes provides critical insights into a firm's strategic direction, operational efficiency, and capital allocation priorities, guiding stakeholders in assessing its long-term growth prospects and value creation potential.

These financial ratios serve as indispensable tools for investors, financial analysts, and management in assessing a company's financial performance, risk profile, and overall financial soundness. They furnish valuable insights into various facets of an entity's operations and financial management. Importantly for the purposes of this research, they allow for comparisons to be made between organisations that are vastly different in their size or operation.

The choice of ratios included in the study was driven by the factors identified in section 2.1.3 as being the factors that impact on a Banks systemic risk. These have been identified as:

1. *Size*

Ratios 1, 2 and 7

2. *Capital*

Ratios 3, 8 and 9

3. *Leverage*

Ratio 5

4. *Liquidity*

Ratios 4 and 6

5. *Performance*

Ratios 10, 11, 12 and 13

6.3. Establishing the Existence of Systemic Risk in Zambia

6.3.1. Overall Market Performance

The following insights were derived by looking at the total movements across all Banks in the review period. They generally show that the market as a whole has been on an upward trajectory during the period.

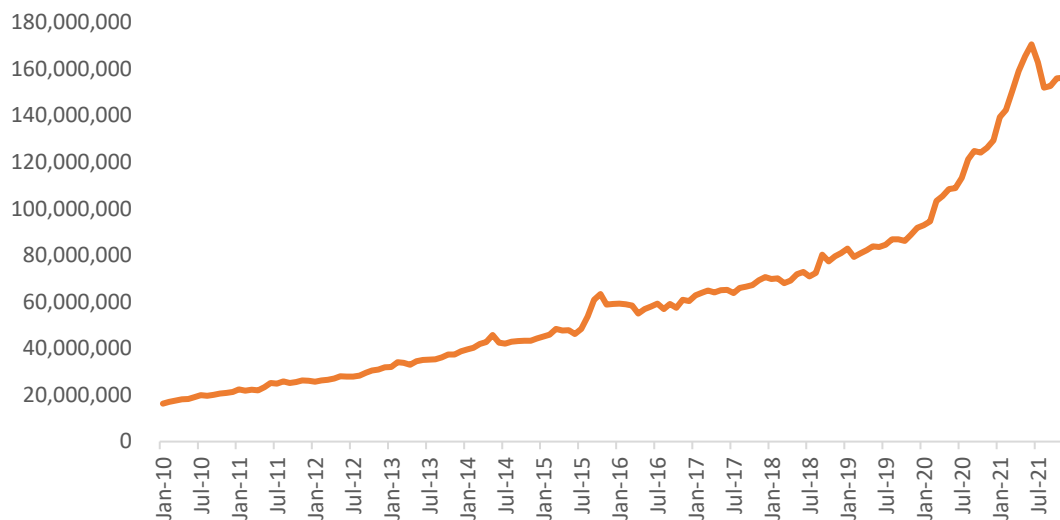


Figure 6-1: Total Assets in Banking Sector over Review Period

Source: Author Calculations

The Figure 6-1 on **Total Assets** reflects the overall performance of the Zambian banking sector from January 2010 to July 2021. The data demonstrates a consistent upward trajectory in total assets over most of the period, indicating robust growth in the sector. This upward trend suggests that the industry has experienced expansion in terms of deposit mobilization, lending, and asset acquisition, driven by increased economic activity, financial inclusion, and market confidence over the years.

Total Assets have generally been on the increase across the Banking sector, rising from K20 billion in 2010 to almost K180 billion in 2022.

Key Observations:

1. **Steady Growth (2010–2019):**

Between 2010 and 2019, total assets show a gradual and consistent rise. This steady growth likely reflects stable macroeconomic conditions and strong performance within the sector. Banks appear to have successfully managed their portfolios, growing both deposits and loans while maintaining a healthy expansion of their asset base.

2. Acceleration of Growth (2019–2020):

From mid-2019 to early 2020, the pace of growth in total assets accelerates significantly. This period coincides with the global COVID-19 pandemic, during which central banks worldwide implemented stimulus measures and liquidity injections. It is possible that Zambian banks saw increased deposit inflows, reflecting precautionary savings by individuals and businesses, as well as government or institutional financial interventions.

3. Sharp Peak (2020–2021):

Total assets reach a peak in early 2021. This surge may be attributed to heightened banking activity or asset revaluation as banks adjusted to post-pandemic conditions. However, it could also reflect increased lending in response to economic recovery or rising inflationary trends leading to asset growth in nominal terms.

4. Decline After Peak (2021):

Following the peak in early 2021, total assets show a slight decline. This drop might signal a slowdown in economic activity or a contraction in the banking sector's growth. Potential contributing factors include tightening monetary policy, reduced lending activity, or asset depreciation resulting from external economic pressures.

The chart suggests a positive long-term trend in the Zambian banking sector, with total assets growing significantly over the decade. The sector demonstrates resilience in the face of economic disruptions, particularly during the COVID-19 pandemic. However, the slight

decline after 2021 signals a need for caution, as it could indicate emerging challenges such as reduced liquidity, lower asset quality, or broader macroeconomic issues.

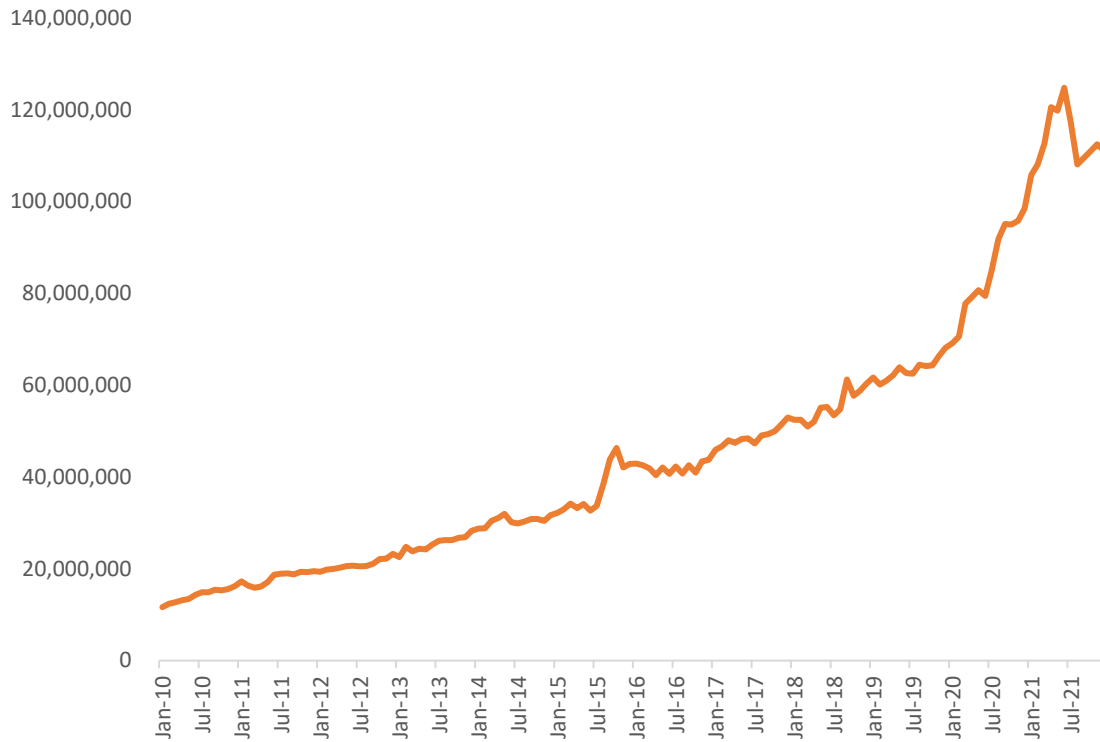


Figure 6-2: Total Deposits in Banking Sector over Review Period

Source: Author Calculations

Figure 6-2 on **Deposits** illustrates a similar growth pattern to the total assets chart, reflecting the evolution of deposit levels in the Zambian banking sector from January 2010 to July 2021. Deposits are a critical component of bank funding, and the trends observed in the chart offer valuable insights into customer confidence, liquidity conditions, and overall economic performance.

Total deposits have generally been on the increase across the Banking sector, rising from K18 billion in 2010 to almost K125 billion in 2022.

Key Observations:

1. Consistent Growth (2010–2019)

Over the decade, deposits exhibit steady and sustained growth, indicating increasing trust in the banking sector and a growing client base. This trend suggests that the sector successfully attracted deposits through financial inclusion initiatives, competitive offerings, and improved banking infrastructure.

2. Accelerated Growth (2019–2020):

Deposit levels rise more sharply starting in late 2019 and throughout 2020, reflecting a significant increase in savings during this period. This accelerated growth could be linked to precautionary savings by individuals and businesses in response to the uncertainty caused by the COVID-19 pandemic. It may also indicate an influx of government funds or institutional deposits, as central banks globally implemented stimulus measures to support economic activity.

3. Sharp Peak (2021):

Deposits reach a high point in early 2021, coinciding with the peak observed in total assets. This peak suggests a period of heightened deposit mobilization, possibly driven by short-term factors such as economic recovery, increased financial inflows, or higher nominal values due to inflationary trends.

4. Decline Post-Peak (2021):

Following the peak, there is a noticeable decline in deposit levels by mid-2021. This decrease could be attributed to factors such as reduced liquidity, withdrawals for post-pandemic consumption or investment, or economic slowdown. It may also reflect a normalization of deposit levels after the extraordinary growth observed during the COVID-19 period.

The chart highlights the overall growth of deposits in the Zambian banking sector over the decade, showcasing increasing financial sector participation and depositor confidence. The sharp acceleration in deposits during the pandemic demonstrates the sector's resilience and ability to adapt to external shocks. However, the decline following the 2021 peak signals potential challenges, such as reduced depositor confidence, economic pressures, or changes in liquidity preferences.

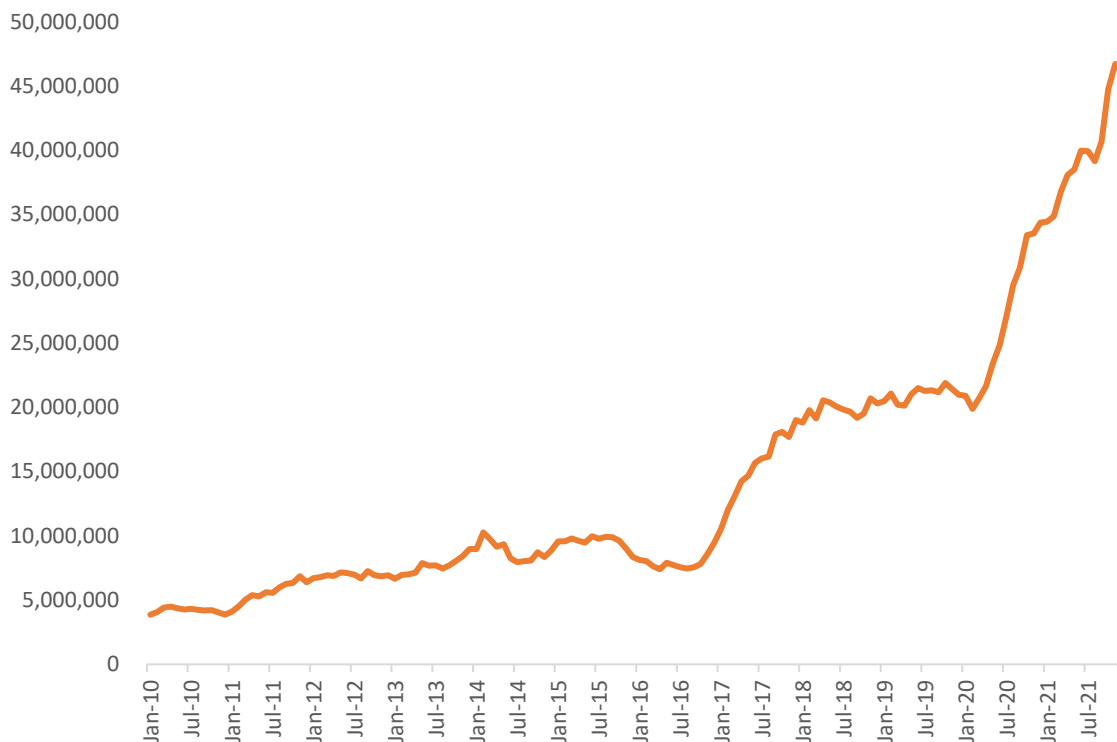


Figure 6-3: Total Investments in Securities in Banking Sector over Review Period

Source: Author Calculations

Figure 6-3 on **Investments in Securities** shows the growth of Zambian banks' investments in securities from January 2010 to July 2021. Investments in securities typically represent a safe and liquid allocation of bank assets, often comprising government bonds, treasury bills, and other financial instruments. The trends in this chart highlight how banks have

adjusted their investment strategies over time in response to market and economic conditions.

Key Observations:

1. Gradual Growth (2010–2016):

From 2010 to 2016, investments in securities exhibit slow but steady growth. This reflects a conservative and stable approach to securities investment, likely driven by macroeconomic stability and predictable market conditions during this period. Banks appear to have used securities primarily as a means of maintaining liquidity and generating modest returns.

2. Plateau Phase (2016–2018):

Between 2016 and 2018, the growth in investments in securities slows and remains relatively flat. This plateau may reflect a shift in banks' strategies, such as allocating more resources to loans or other asset classes, or it could indicate less attractive yields on securities during this period.

3. Accelerated Growth (2018–2021):

A significant uptick in investments begins in 2018 and continues through 2021, with the most dramatic rise occurring from late 2019 onwards. This surge coincides with global and local economic uncertainties, particularly the COVID-19 pandemic, when banks likely increased their holdings of securities as a risk-averse strategy. Government securities may have offered a safe haven during heightened volatility in other asset classes. Additionally, central banks' monetary policy interventions may have encouraged increased investment in securities through higher issuance or favorable interest rates.

4. Sharp Peak (2021):

By mid-2021, investments in securities reach their highest point on record. This reflects banks' continued focus on secure and liquid investments amid uncertain economic conditions. It may also indicate banks' strategic preference for safer, interest-earning assets over riskier options such as lending in a volatile market environment.

The chart demonstrates a long-term upward trend in investments in securities, particularly accelerated during times of economic stress. This indicates that Zambian banks have increasingly relied on securities as a key component of their asset portfolio, especially during periods of heightened uncertainty. The sharp rise in 2020 and 2021 suggests a defensive strategy to manage risks and maintain liquidity, while also capitalizing on opportunities for stable returns.

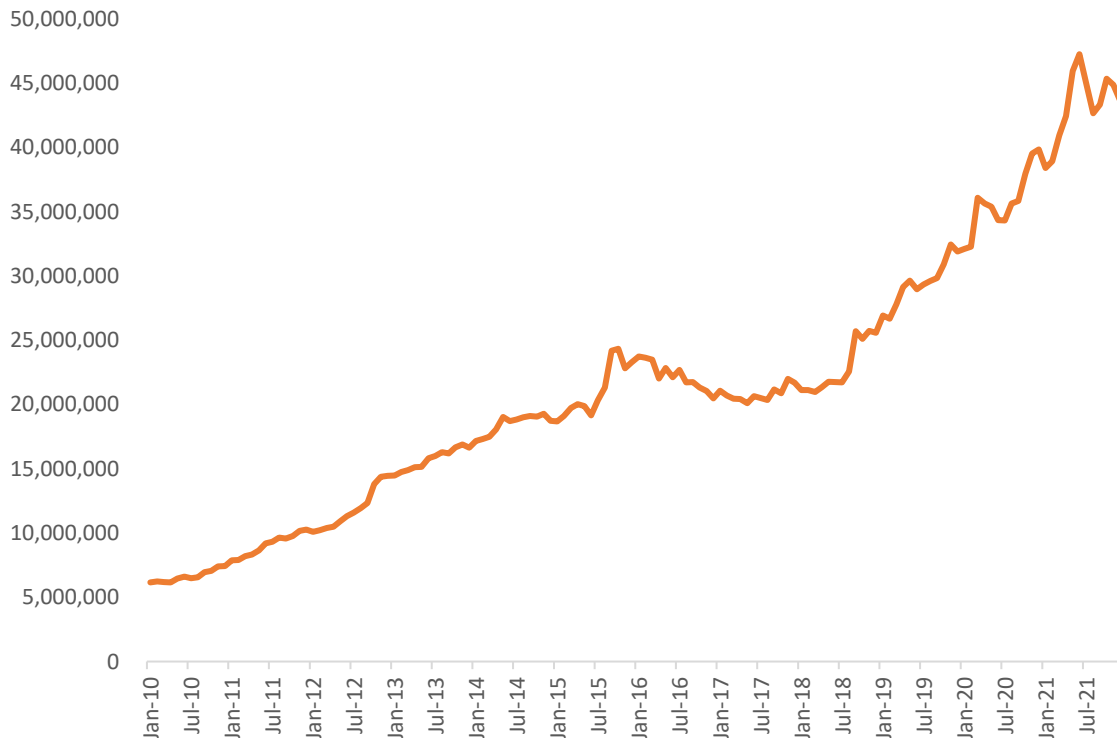


Figure 6-4: Total Net Loans and Advances in Banking Sector over Review Period

Source: Author Calculations

Figure 6-4 on **Net Loans and Advances** reflects the evolution of lending activities by Zambian banks from January 2010 to July 2021. Net loans and advances are a critical component of a bank's asset portfolio, directly linked to its role in providing credit to businesses and individuals. The trends in this chart reveal the sector's approach to credit extension, its responsiveness to market conditions, and the broader economic environment's influence on lending behaviour.

Net loans and advances have generally been on the increase across the Banking sector, rising from K10 billion in 2010 to almost K45 billion in 2022. There was a period of slight decline between 2016 and 2018 driven mostly by a shift in preference for government securities across the sector.

Key Observations:

1. Steady Growth (2010–2015):

From 2010 to 2015, net loans and advances exhibit a gradual upward trend, indicating a consistent increase in lending activity. This suggests that the sector was actively supporting economic growth during this period, as banks extended credit to businesses and individuals, likely driven by stable economic conditions and rising demand for credit.

2. Slowdown and Plateau (2015–2017):

Between 2015 and 2017, the growth in net loans and advances slows significantly, with periods of stagnation. This plateau may be attributed to macroeconomic challenges such as tightening monetary policy, increased credit risk, or reduced demand for loans during a period of economic uncertainty or downturn. Banks may have adopted more conservative lending practices to mitigate potential defaults during this time.

3. **Resumption of Growth (2018–2020):**

Lending activity picks up again starting in 2018, with a sharp increase in net loans and advances observed through 2020. This resurgence reflects renewed confidence in lending, possibly driven by improved economic conditions or targeted policy interventions to stimulate credit growth. The steady rise during this period suggests banks were actively engaging in credit extension to support business expansion and consumer spending.

4. **Peak and Decline (2020–2021):**

Lending reaches its peak in early 2021, coinciding with the post-pandemic recovery period, where demand for credit may have been exceptionally high as businesses and individuals sought to rebuild. However, by mid-2021, a slight decline is evident, indicating potential factors such as tightening credit conditions, repayment challenges, or a shift in focus away from aggressive lending. This decline might also reflect growing caution among banks in response to emerging economic uncertainties.

The chart highlights a long-term upward trend in net loans and advances, with periodic slowdowns and recoveries corresponding to changes in economic and financial conditions. The steady growth through most of the period underscores the Zambian banking sector's significant role in financing economic activity. However, the observed plateau and later decline suggest that lending activity is sensitive to external factors such as credit risk, monetary policy, and macroeconomic stability.

While the rebound in lending from 2018 to 2020 indicates resilience and adaptation, the decline after 2021 warrants attention. It may point to the need for enhanced credit risk assessment, improved borrower support mechanisms, or strategies to sustain lending in challenging environments. Balancing lending growth with prudential risk management will be key to fostering long-term financial and economic stability.

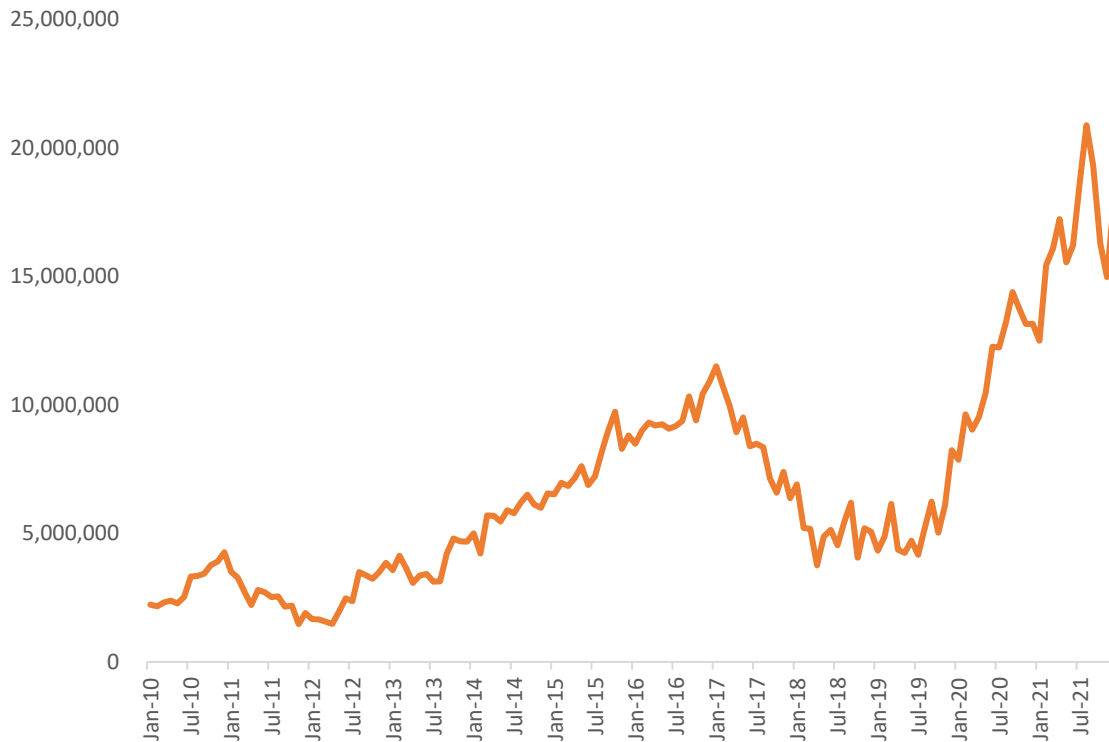


Figure 6-5: Total Balances with BOZ in Banking Sector over Review Period

Source: Author Calculations

Figure 6-5 on **Balances with the Bank of Zambia** depicts the reserves held by commercial banks with the central bank from January 2010 to July 2021. These balances are crucial for liquidity management, meeting statutory reserve requirements, and facilitating interbank and settlement transactions. The trends in this chart reflect the interplay between monetary policy, liquidity conditions, and banking sector operations during the period.

Total Balances with Bank of Zambia have generally been on the increase across the Banking sector, rising from K2 billion in 2010 to about K20 billion in 2022. There was a period of decline between 2016 and 2018, also driven by increased appetite for government securities across the sector.

Key Observations:

1. Modest Growth (2010–2014):

From 2010 to 2014, balances with the Bank of Zambia show gradual growth, reflecting stable liquidity management by commercial banks. This period likely corresponds to steady economic conditions and moderate reserve requirements set by the central bank.

2. Fluctuations (2015–2017):

Between 2015 and 2017, the chart reveals increased volatility, with notable rises and falls in balances. These fluctuations may reflect tighter monetary policy or adjustments to reserve requirements by the central bank in response to macroeconomic pressures, such as inflationary trends or currency volatility. Banks may have also faced challenges in maintaining stable liquidity during this period.

3. Significant Growth (2018–2020):

Starting in 2018, balances with the Bank of Zambia increase significantly, with a sharp rise observed from late 2019 into 2020. This growth may be attributed to the COVID-19 pandemic, during which central banks globally injected liquidity into financial systems to stabilize markets. Commercial banks may have increased their reserves to ensure compliance with statutory requirements, safeguard liquidity, or respond to heightened uncertainties.

4. Peak and Decline (2021):

Balances reach a peak in early 2021, reflecting heightened reserve accumulation, possibly driven by post-pandemic liquidity management or continued cautious strategies amid economic recovery. However, the subsequent decline by mid-2021 indicates normalization as banks adjusted their reserves in response to improving conditions or easing monetary policies.

The chart reflects a long-term upward trend in balances with the Bank of Zambia, punctuated by periods of fluctuation. This suggests a dynamic interplay between central bank policies, liquidity conditions, and commercial banks' operational needs. The sharp rise during 2020 highlights the sector's proactive approach to liquidity preservation in response to external shocks like the COVID-19 pandemic.

The decline after the early 2021 peak indicates a return to more stable reserve levels, signalling improving economic conditions or reduced liquidity pressures. However, the volatility observed in earlier periods underscores the need for robust liquidity management strategies by banks to navigate shifts in central bank policies or market conditions effectively. Ensuring a balance between maintaining sufficient reserves and optimizing capital for productive uses will remain crucial for the sector's stability and growth.

6.3.2. Key Ratio Analysis of Market Average Data

The market averages for the ratios discussed above were analysed to identify movements that demonstrated the existence of a shock to the market; this is especially so given the general smooth increase that is observed across key parameters in the analysis shown in section 6.3.1.

The results of this analysis are shown below:

6.3.2.1. Growth in Deposits

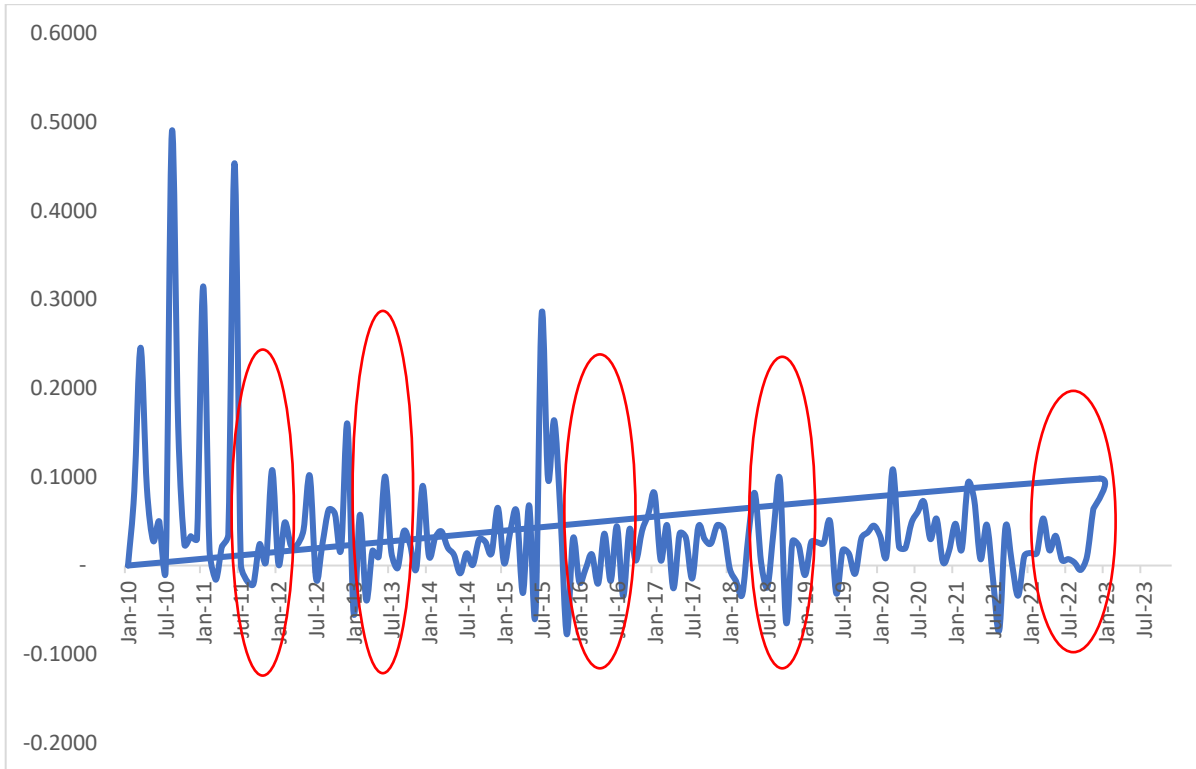


Figure 6-6: Market Average Growth in Deposits During Review Period

Source: Author Calculations

Figure 6-6 shows fluctuations in deposit growth rates for Zambian banks from 2010 to 2022, with specific periods of significant negative movements circled in red. Between 2010 and 2015, the data reveals heightened volatility, characterized by pronounced spikes and steep declines, reflecting an unstable growth trajectory during this period. Following 2015, the fluctuations appear more moderated, indicating a potential stabilization in the market. However, even during this later period, there are distinct downturns in deposit growth, with notable circled periods in 2011–2012, 2015–2016, 2018–2019, 2020–2021, and early 2022. Each of these downturns marks a contraction or a sharp decline in deposit growth, suggesting episodic stress events impacting the banking sector.

6.3.2.2. Growth in Loans and Advances

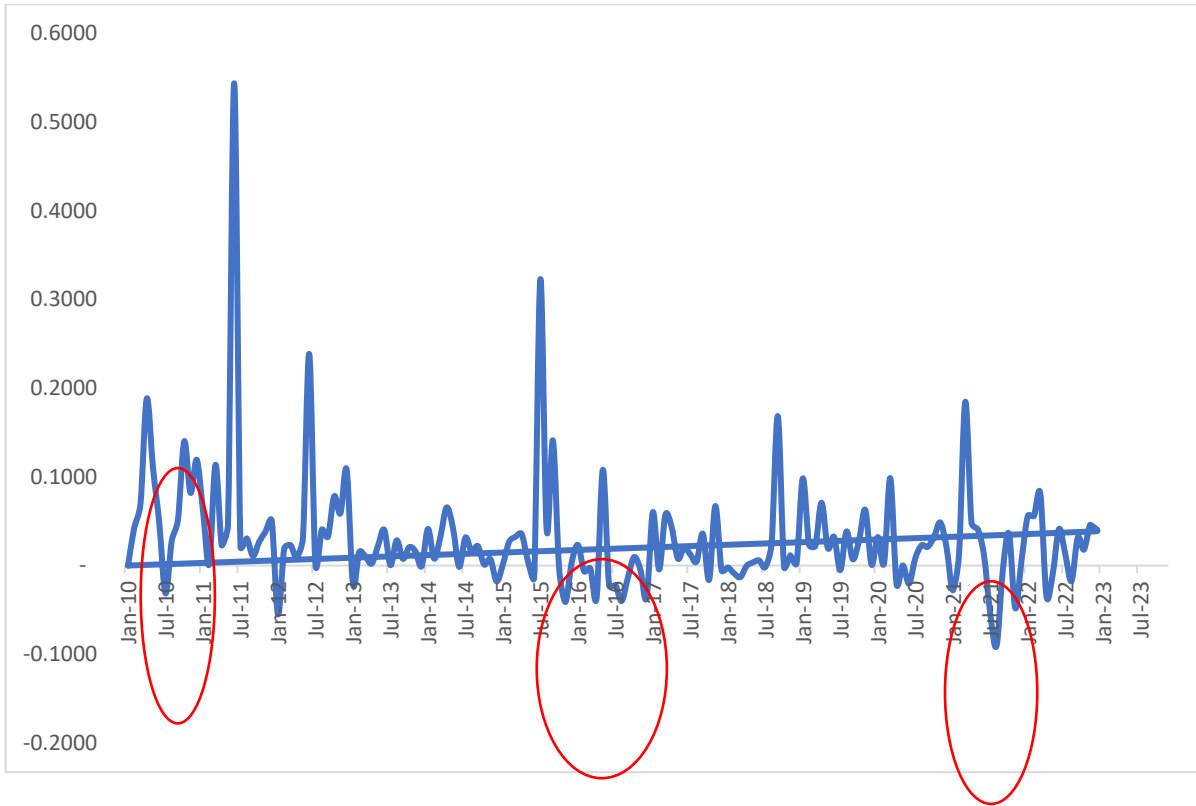


Figure 6-7: Market Average Growth in Loans and Advances During Review Period

Source: Author Calculations

Figure 6-7 shows fluctuations in loan growth rates for Zambian banks from 2010 to 2022. The data reflects a pattern of significant volatility in the earlier years, with large spikes and declines observed between 2010 and 2015, indicating a period of pronounced instability. A particularly sharp peak occurs in 2011, followed by noticeable dips in subsequent years. After 2015, the volatility appears to moderate slightly, with growth rates showing a more contained pattern, though sharp movements are still present. Notable declines in growth can be observed in 2015–2016, 2018, and 2020–2021, suggesting episodic stress within the banking sector during these periods.

6.3.2.3. Change in Shareholder Equity

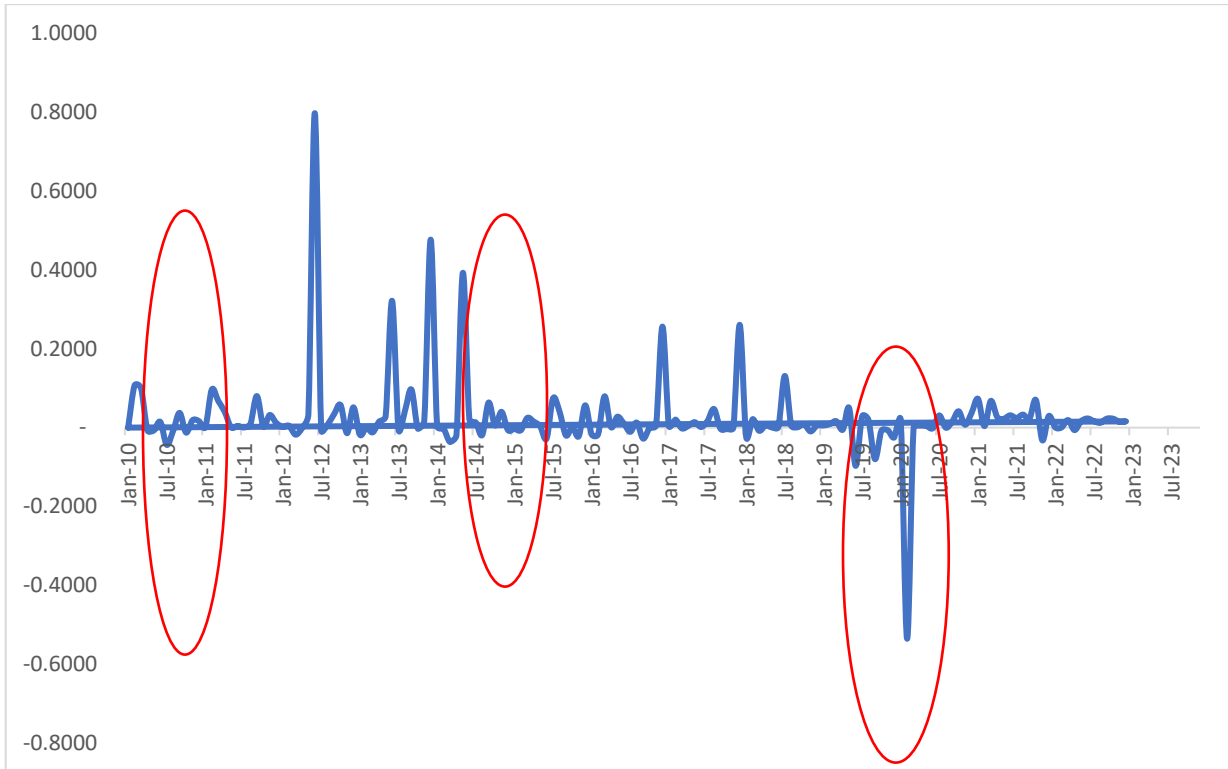


Figure 6-8: Market Average Change in Equity During Review Period

Source: Author Calculations

Figure 6-8 shows fluctuations in equity levels for Zambian banks from 2010 to 2022. The data reflects significant volatility in the earlier years, with pronounced spikes and occasional steep declines between 2010 and 2014, indicating instability in equity changes during this period. A particularly notable spike occurs in 2012, representing a sharp increase in equity, followed by fluctuations that gradually moderate over time.

After 2015, the changes in equity appear more stable, with smaller fluctuations compared to the earlier years. However, notable negative movements are observed around 2019 and 2020, with a sharp and distinct decline in early 2020. This suggests a period of significant stress affecting the equity levels of banks during that time. By 2021 and 2022, the data suggests a trend toward stabilization, with minimal fluctuations and relatively consistent equity changes.

6.3.2.4. Liquid Assets/Total Assets

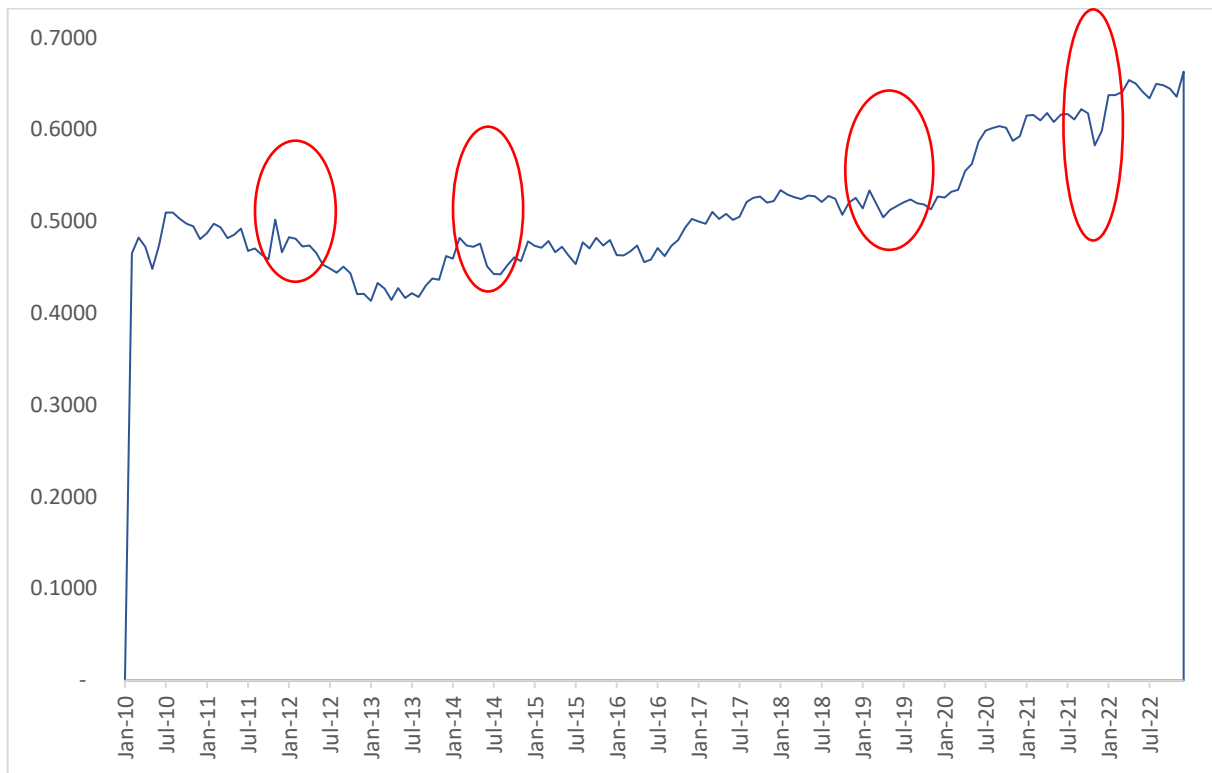


Figure 6-9: Market Average Liquid Assets to Total Assets During Review Period

Source: Author Calculations

Figure 6-9 shows the proportion of liquid assets held by Zambian banks relative to their total assets from 2010 to 2022. The data reveals a significant upward trend in liquidity levels over the years, particularly after 2015. In the earlier years, from 2010 to around 2014, the ratio shows a modest decline, suggesting a gradual reduction in liquidity relative to total assets during that period.

From 2015 onwards, the ratio stabilizes and begins to increase steadily, reflecting a shift toward maintaining higher liquidity levels. The circled period around 2020–2021 shows a marked jump in the liquid assets ratio, signalling a significant shift in banks' asset structures during

that time. This increase likely reflects a response to heightened risk perceptions, with banks prioritizing liquidity to mitigate potential shocks or uncertainties.

6.3.2.5. Borrowed Funds/Total Assets

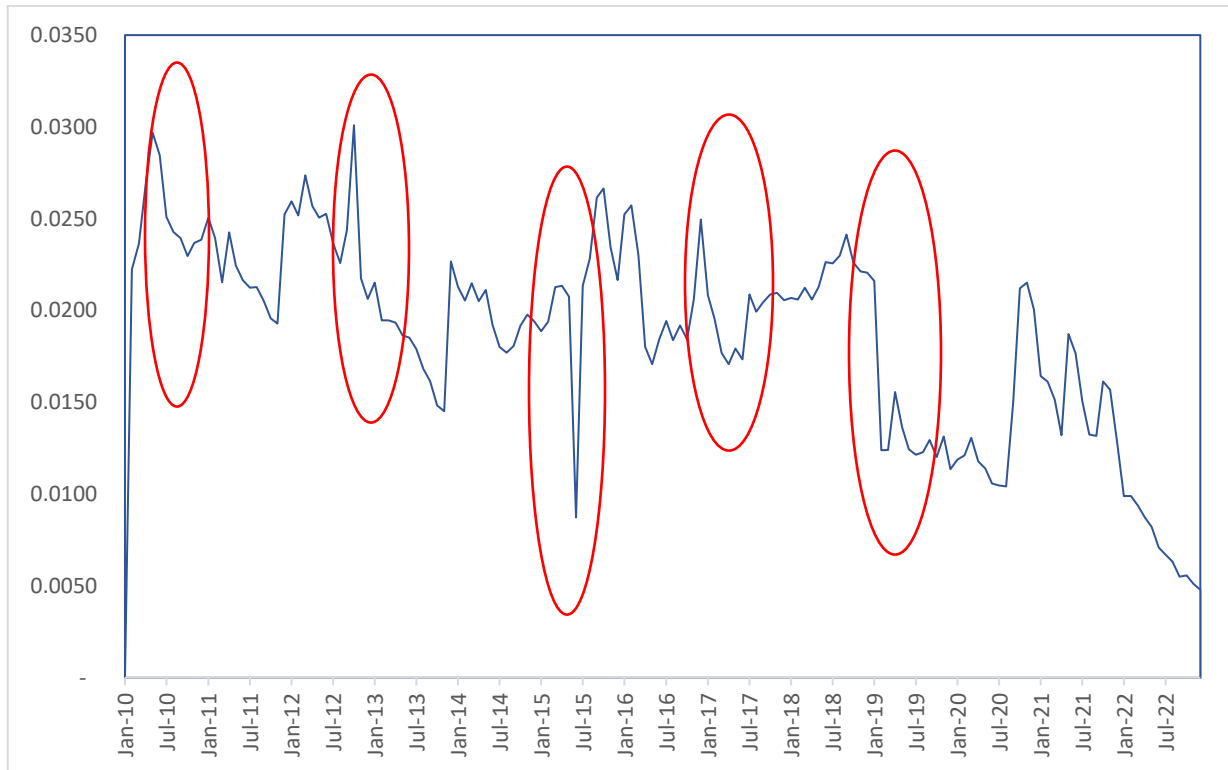


Figure 6-10: Market Average Borrowed Funds to Total Assets During Review Period

Source: Author Calculations

Figure 6-10 illustrates the proportion of borrowed funds as a share of total assets for Zambian banks from 2010 to 2022. The data reflects a clear downward trend over the period, indicating a gradual reduction in the reliance on borrowed funds relative to total assets.

In the early years (2010–2013), the ratio remains relatively higher, with noticeable fluctuations. The peaks suggest periods where banks increased their borrowing activity, possibly to fund asset growth or manage liquidity needs. Between 2013 and 2015, the ratio declines steadily,

with a pronounced dip around 2015, suggesting a sharp reduction in borrowed funds during this period.

From 2016 onward, the ratio stabilizes at a lower level but continues to show occasional fluctuations, particularly in 2020 and 2021, when small temporary increases are observed. However, by 2022, the ratio reaches its lowest point across the entire timeline, reflecting a significant shift away from borrowed funds as a financing source.

6.3.2.6. Loans/Deposits

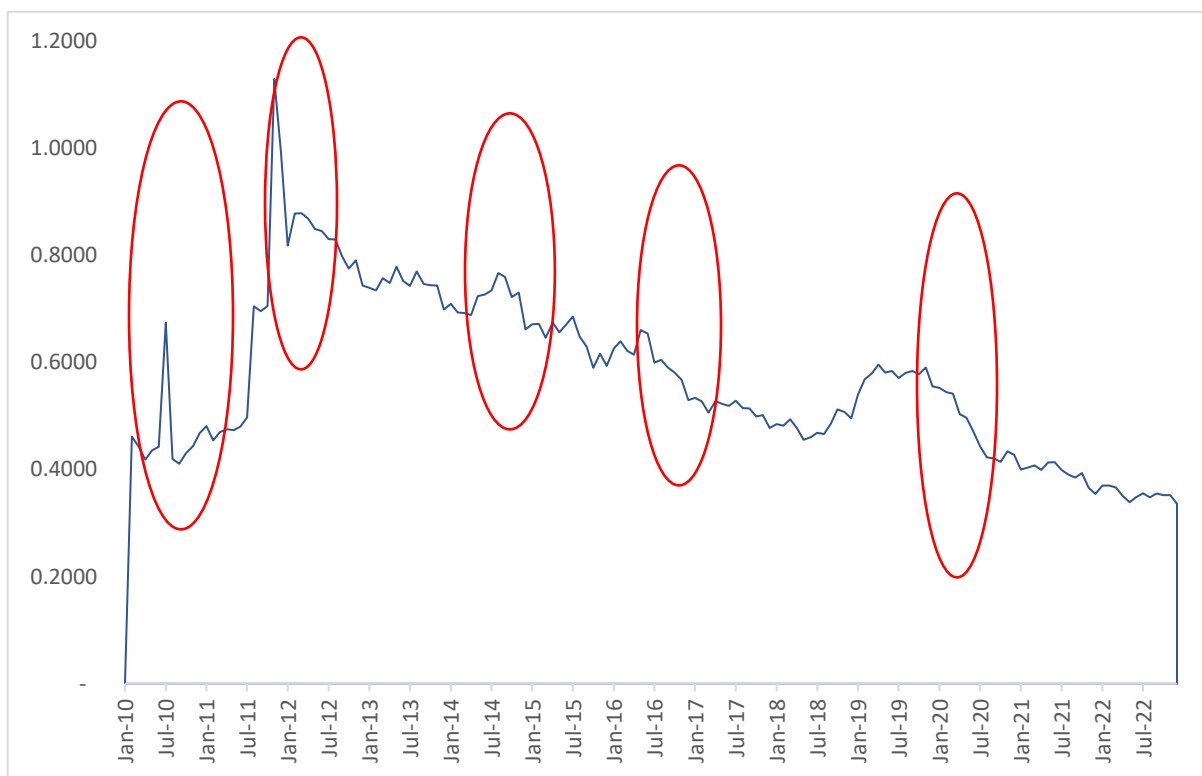


Figure 6-11: Market Average Loans to Deposits During Review Period

Source: Author Calculations

Figure 6-11 illustrates the ratio of loans to deposits for Zambian banks from 2010 to 2022, providing insight into how deposit funding has been used to support lending activities over the

years. The data shows a marked decline in this ratio over the period, reflecting a gradual reduction in the extent to which deposits are being converted into loans.

In the earlier years (2010–2012), the ratio is relatively high, with notable peaks, particularly in 2012, when it exceeds 1.0, indicating that banks were lending more than they were holding in deposits, potentially through additional borrowing or other funding mechanisms. However, from 2013 onwards, the ratio begins a steady downward trend, suggesting a shift toward more conservative lending practices or reduced loan demand relative to deposit growth.

By 2015, the ratio stabilizes somewhat but continues its downward trajectory, dropping below 0.6. Between 2017 and 2020, the decline slows but remains consistent, with brief plateaus indicating moments of relative balance. However, the ratio experiences a sharper decline from 2020 to 2022, eventually falling below 0.3, a historically low level.

6.3.2.7. Change in total Assets

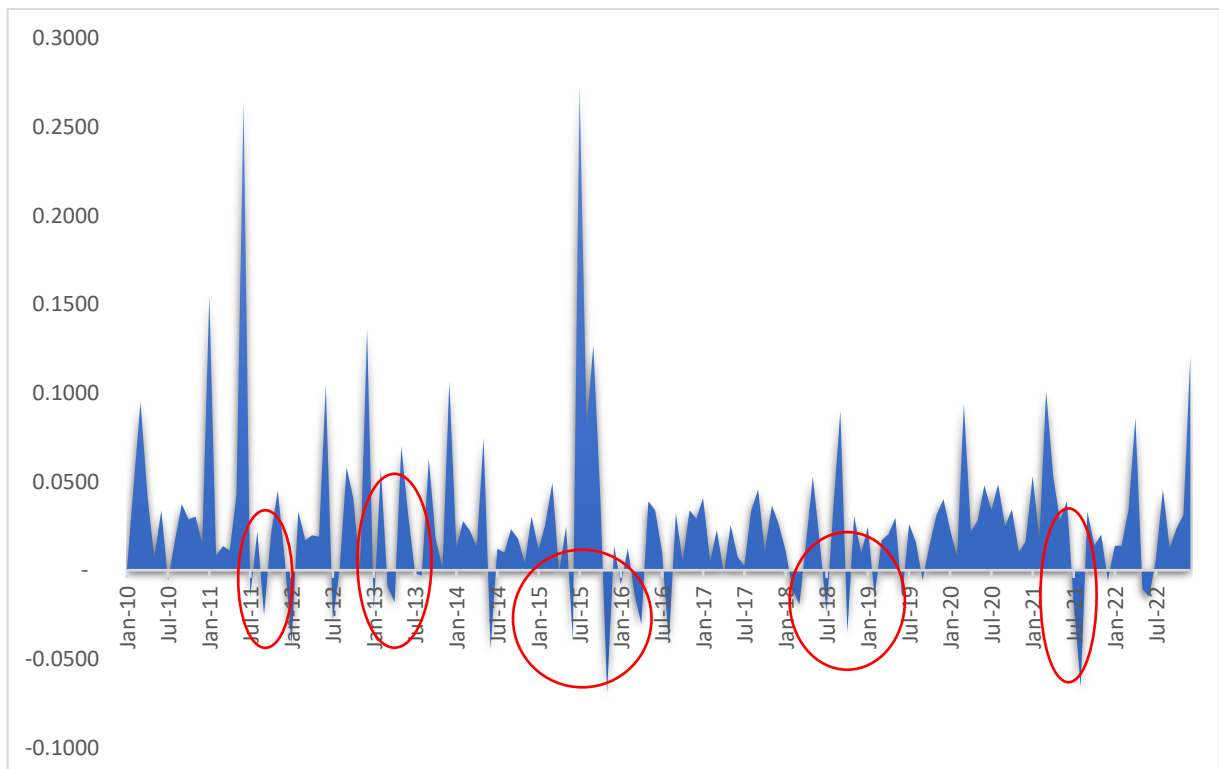


Figure 6-12: Market Average Change in Total Assets During Review Period

Source: Author Calculations

Figure 6-12 illustrates the fluctuations in total asset growth for Zambian banks from 2010 to 2022. The data exhibits significant volatility, particularly in the earlier years, with large spikes and sharp declines indicating periods of rapid expansion followed by contraction. Peaks in growth are especially pronounced in 2011, 2012, and 2015, where total asset growth surged before subsequently stabilizing or declining.

From 2016 onwards, the fluctuations become more subdued, suggesting a possible stabilization of asset growth rates. However, notable periodic spikes and dips remain, particularly in 2018, 2020, and 2022, where changes in total assets again show marked variations. The latter part of the chart suggests a more controlled pattern of asset growth, though it is still punctuated by sharp movements at specific intervals.

6.3.2.8. Chage in risk-weighted assets

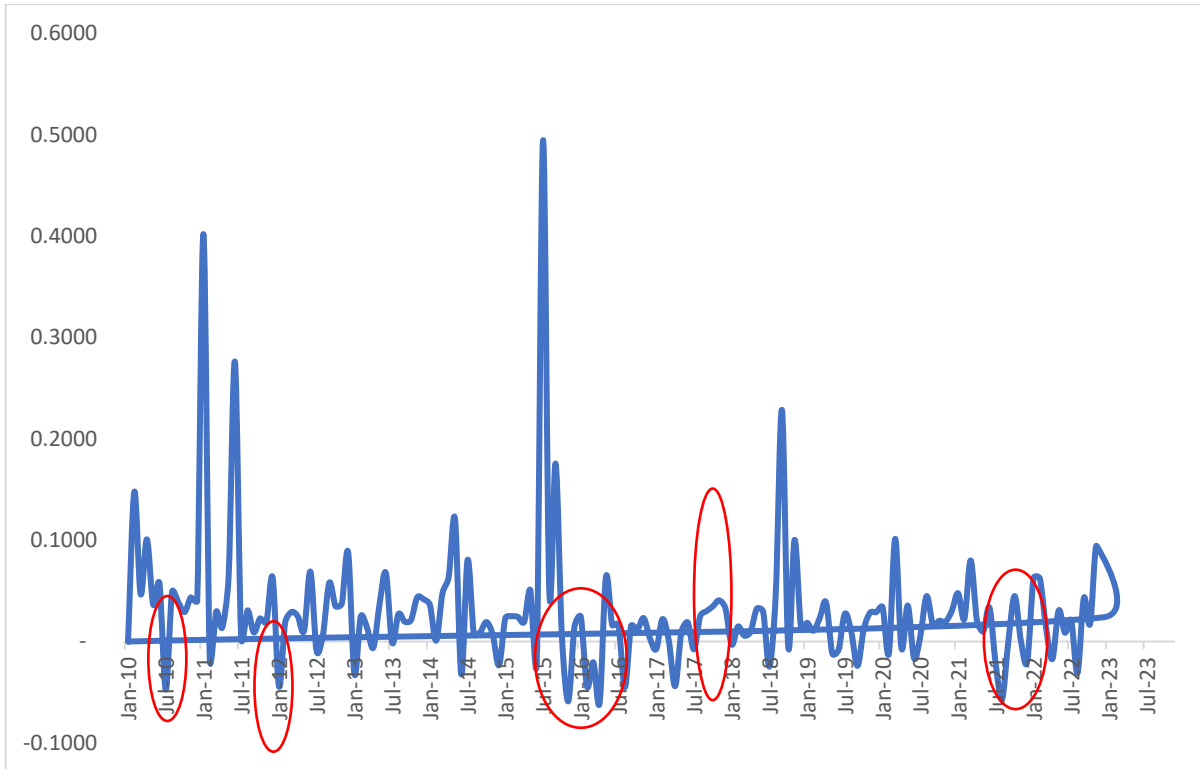


Figure 6-13: Market Average Change in Risk Weighted Assets During Review Period

Source: Author Calculations

Figure 6-13 shows the fluctuations in risk-weighted asset growth for Zambian banks from 2010 to 2022. The data highlights significant volatility in the earlier years, with sharp spikes and declines in growth. Prominent peaks occur in 2011, 2012, and 2015, indicating periods of substantial growth in RWAs, likely associated with increased lending or riskier asset portfolios during these times.

After 2015, the fluctuations appear to moderate somewhat, though notable spikes and dips persist. A particularly sharp decline is circled in 2017, marking a period of contraction in RWAs. This suggests a significant reduction in risk-weighted assets during that time, potentially reflecting tightened credit policies, deleveraging, or a shift toward less risky assets.

From 2018 onward, the volatility remains lower compared to earlier years, but distinct movements continue to indicate periodic changes in banks' asset risk profiles.

Significant negative movements are observed in 2012 Q1, 2016 Q1 and 2021 Q1.

6.3.2.9. Equity/Assets

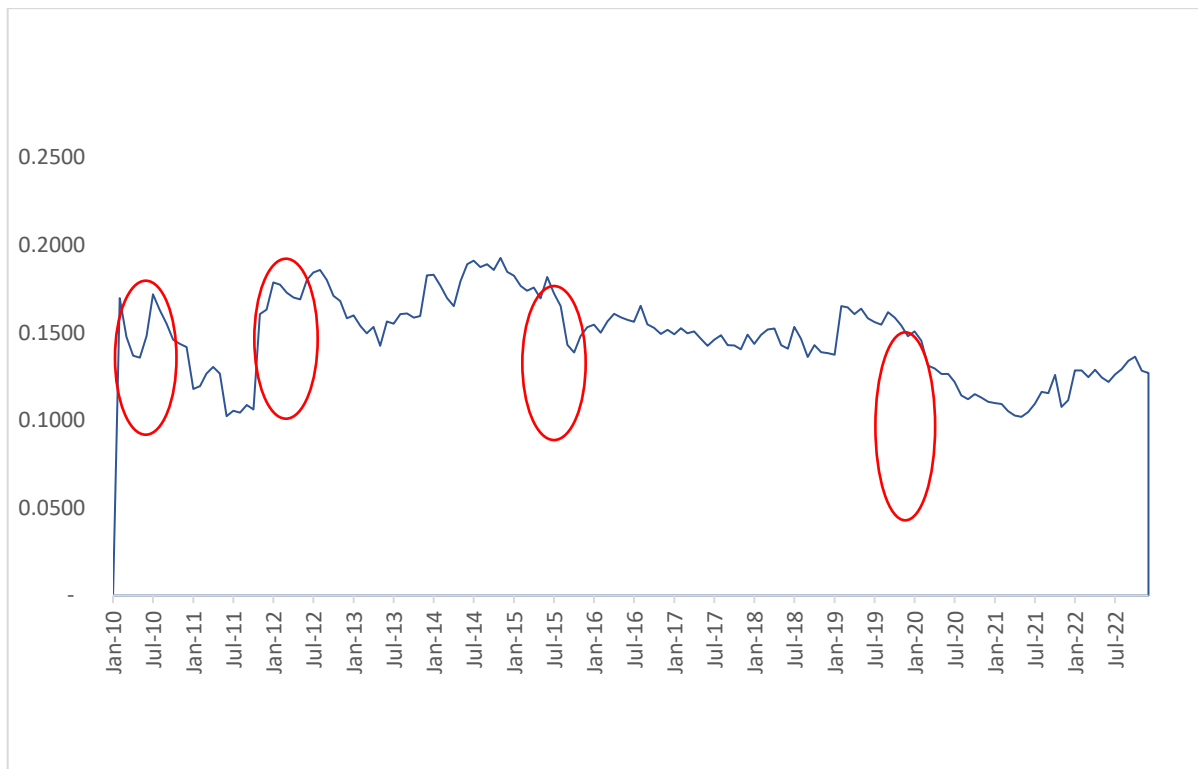


Figure 6-14: Market Average Equity to Assets During Review Period

Source: Author Calculations

Figure 6-14 illustrates the ratio of equity to total assets for Zambian banks from 2010 to 2022, providing insight into the leverage and capital structure of the banking sector over time. The data reveals a gradual downward trend, indicating a steady reduction in the proportion of equity relative to total assets.

In the earlier years, from 2010 to around 2012, the ratio experiences some fluctuations, but it remains relatively higher. Between 2012 and 2016, the ratio stabilizes at a slightly lower level, suggesting a period of consistency in the equity-to-assets structure. However, from 2016 onward, the ratio begins a noticeable decline, reflecting increasing leverage or a reduction in equity relative to asset growth. By 2020, the ratio reaches its lowest levels across the timeline, with minimal recovery observed in the years following.

Significant negative movements can be observed in 2011 Q1, in 2013 Q1, in 2015 Q3 and 2020 Q1. These negative movements are indicative of systemic shock being present in the market and affected the sector.

6.3.2.10. Growth in interest Income

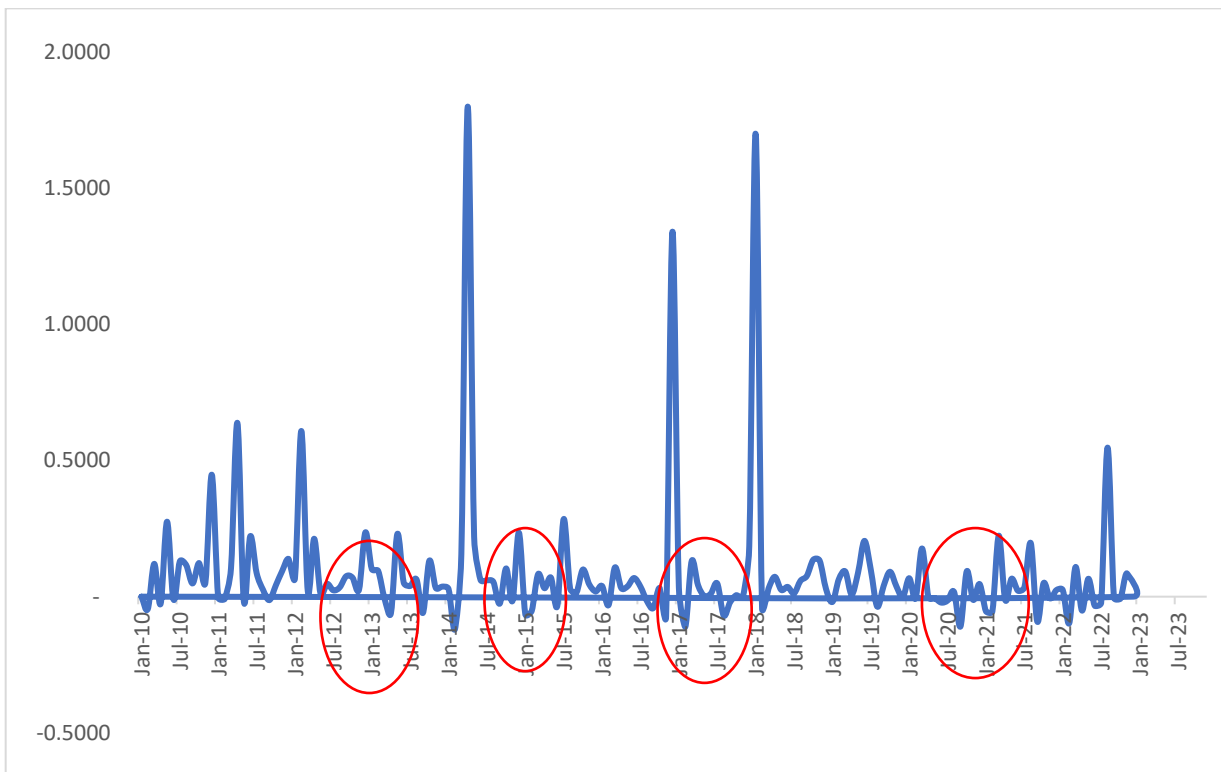


Figure 6-15: Market Average Growth in Interest Income During Review Period

Source: Author Calculations

Figure 6-15 displays the fluctuations in the growth rate of interest income for Zambian banks from 2010 to 2022. The data shows significant volatility, particularly in the earlier years, with sharp spikes and steep declines dominating the pattern. Peaks in growth are especially pronounced in 2014, 2016, and 2017, indicating moments of rapid expansion in interest income during these periods.

In contrast, the chart also highlights several periods of contraction, with growth dipping into negative territory, particularly between 2010 and 2013, as well as more subdued negative movements after 2017. The fluctuations appear to moderate slightly post-2017, though there are still visible spikes and dips, suggesting that while the volatility lessened somewhat, the trend remained unstable.

6.3.2.11. Growth in interest Expense

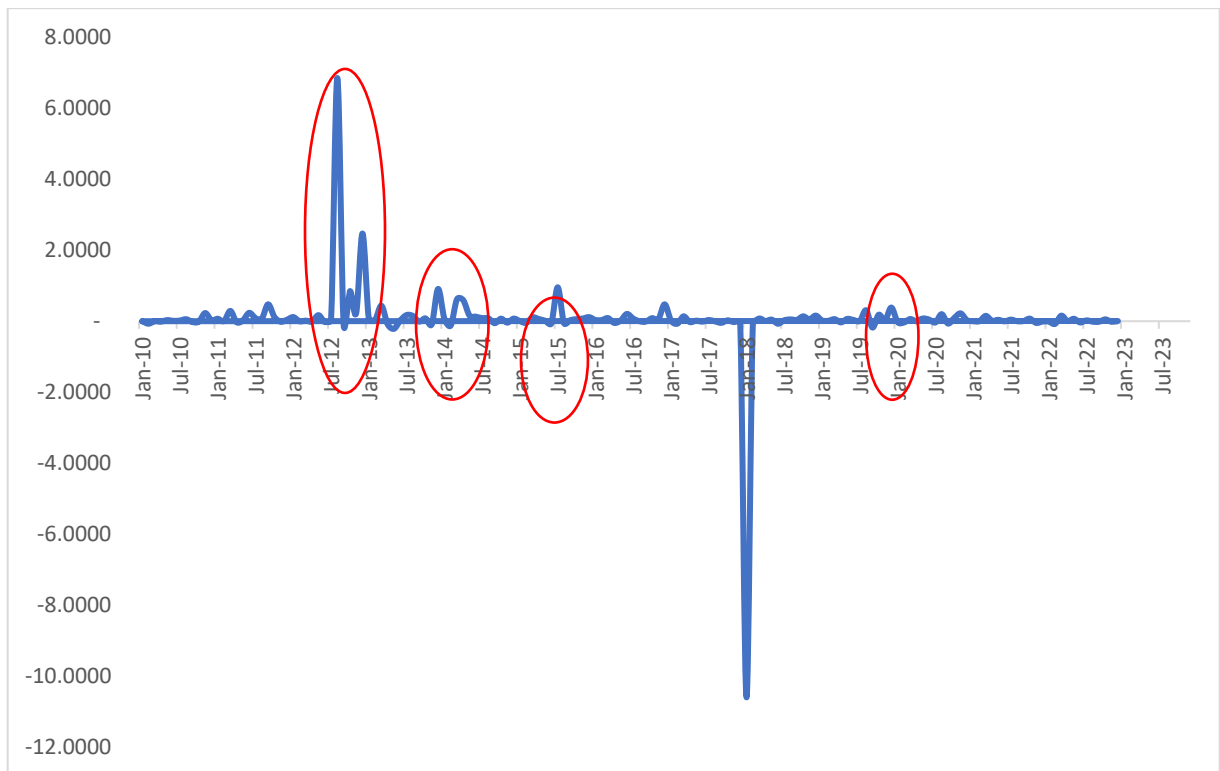


Figure 6-16: Market Average Growth in Interest Expense During Review Period

Source: Author Calculations

Figure 6-16 shows that Growth in Interest expense has generally been flat in the Zambian market as a whole with significant decrease witnessed once in early 2018. There however have been a few times when the growth has been positive as highlighted above.

6.3.2.12. Growth in Other Income

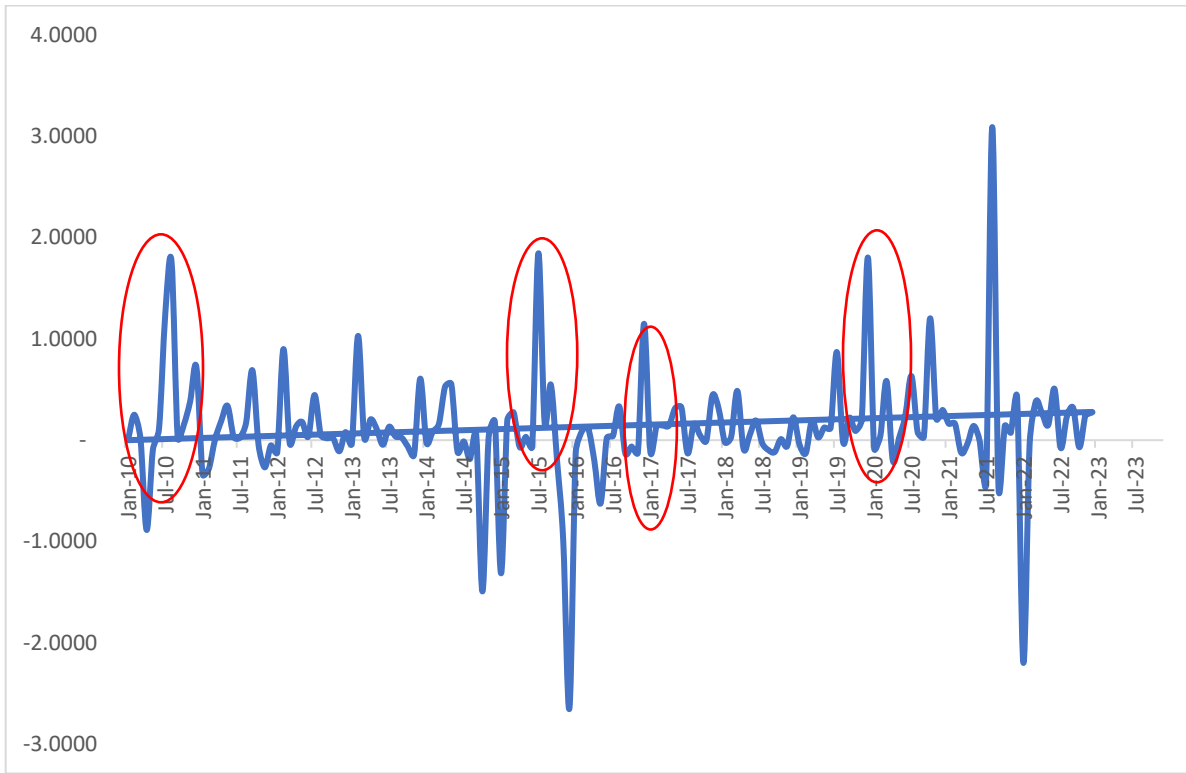


Figure 6-17: Market Average Growth in Other Income During Review Period

Source: Author Calculations

Figure 6-17 captures the fluctuations in the growth rate of interest expenses for Zambian banks from 2010 to 2022. The data exhibits significant volatility, with sharp spikes and deep troughs indicating periods of dramatic change in the cost of interest-bearing liabilities.

A particularly prominent spike is observed in 2012, suggesting a rapid increase in interest expenses during that period. Conversely, a significant and isolated decline is visible in 2017, where growth in interest expense turns sharply negative, marking a dramatic reduction in the cost of liabilities. Post-2017, the chart shows more subdued movements, with relatively smaller

spikes and dips, reflecting a possible stabilization of interest expense growth in the banking sector.

Significant negative movements can be observed in 2014 Q3 to 2015 Q2, and 2021 Q3. These negative movements are indicative of systemic shock being present in the market and affected the sector.

6.3.2.13. Growth in Total Income

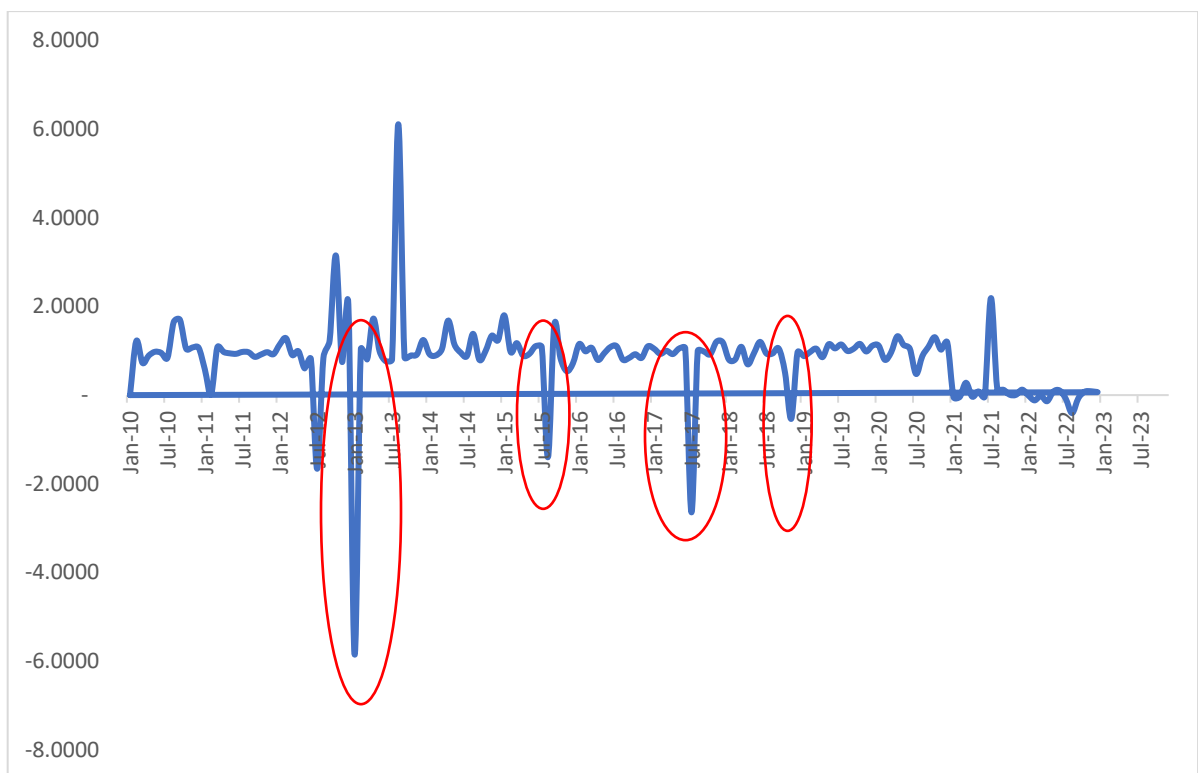


Figure 6-18: Market Average Growth in Total Income During Review Period

Source: Author Calculations

Figure 6-18 reveals fluctuations in the income growth of Zambian banks from 2010 to 2022, with periods of pronounced instability and episodic shocks. Between 2010 and 2013, the data shows significant volatility, with sharp peaks in income growth, particularly in mid-2012 and mid-2013, followed by steep troughs. These extreme movements suggest a highly unstable

operating environment, where income generation was significantly affected by external or systemic factors. A notable contraction occurs in early 2013, indicating a sudden and substantial decline in total income growth, marking an early systemic shock to the market.

From 2014 to 2016, the fluctuations in total income growth moderate, with fewer dramatic spikes or declines. This period reflects a relative stabilization compared to earlier years, possibly due to adjustments in the banking sector or a more favourable operating environment. However, systemic Significant evidenced by negative movements can be observed in 2012 Q3 to 2013 Q1, in 2015 Q3, in 2017 Q1 and in 20218 Q3. These negative movements are indicative of systemic shock being present in the market and affected the sector.

6.3.2.14. Growth in Impairments

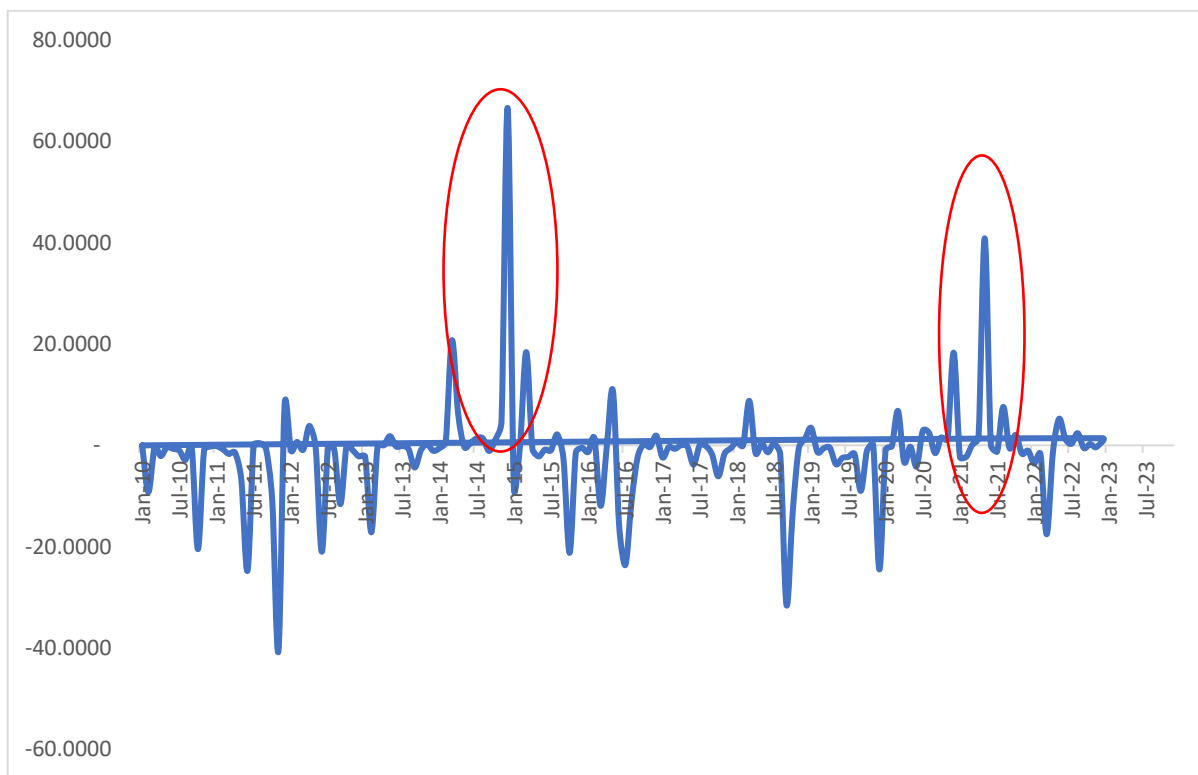


Figure 6-19: Market Average Growth in Impairments During Review Period

Source: Author Calculations

Figure 6-19 illustrates the fluctuations in the growth rate of impairments for Zambian banks from 2010 to 2022. The data shows two prominent periods of systemic shocks where growth in impairments surged significantly, marked by the circled areas in 2014–2015 and 2020–2021. These periods indicate heightened stress within the banking sector, likely reflecting deteriorations in asset quality and increased provisioning for non-performing loans.

The first major systemic shock occurred between 2014 and 2015, where the growth in impairments spiked sharply. This period reflects a sudden and dramatic increase in impairment charges, suggesting a widespread decline in the quality of loan portfolios across the sector. The scale of the spike indicates that banks experienced significant challenges in managing credit risk, which may have been driven by external macroeconomic pressures or sector-wide events impacting borrowers' repayment capacities.

The second systemic shock is observed during 2020 and 2021, coinciding with the circled area. This period saw another steep increase in impairments, although the surge appears slightly less dramatic than the 2014–2015 event. The timing aligns with the global COVID-19 pandemic, which likely exacerbated financial distress for borrowers, leading to an increase in defaults and a corresponding rise in impairment provisions. The sharp rise during this period underscores the sector's vulnerability to external shocks and its need to adapt to rapidly changing economic conditions.

6.3.2.15. Growth in Operating Expenses

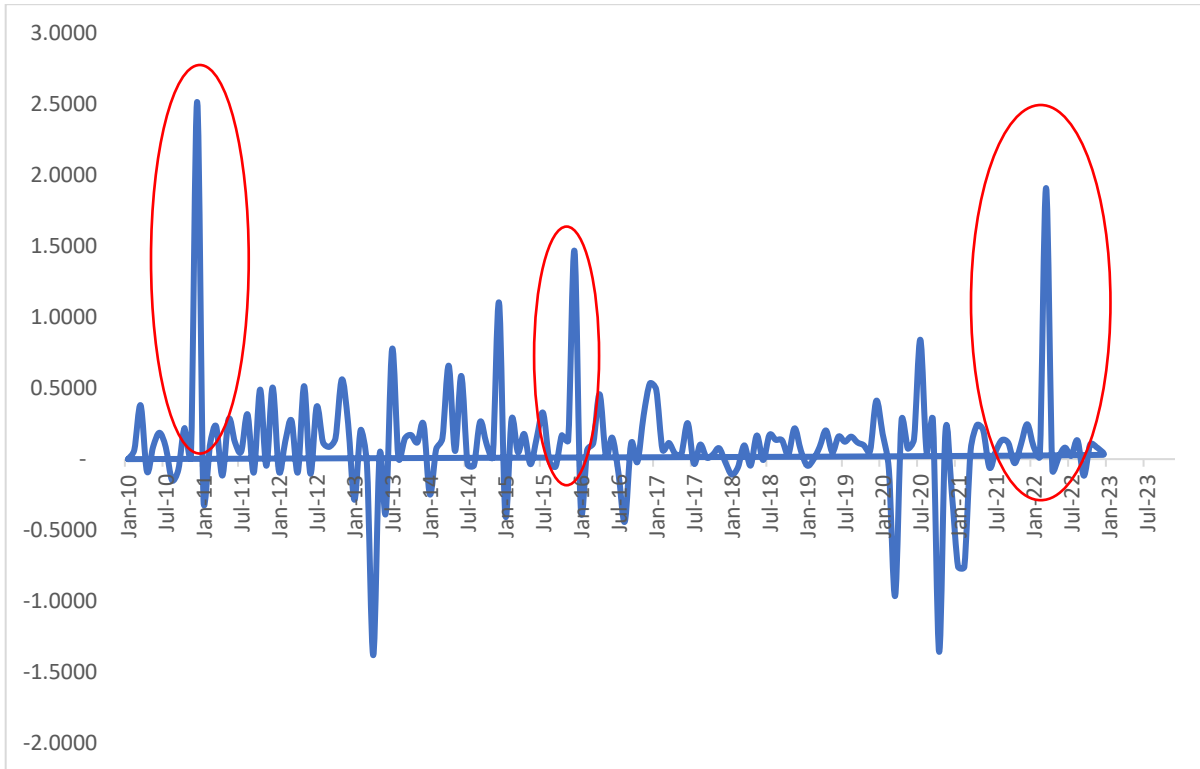


Figure 6-20: Market Average Growth in Operating Expenses During Review Period

Source: Author Calculations

Figure 6-20 illustrates the fluctuations in the operating expense growth rates for Zambian banks from 2010 to 2022. The data reveals a pattern of volatility, with significant peaks and troughs throughout the timeline, indicating periodic adjustments in cost structures across the banking sector. Early in the period, from 2010 to 2013, operating expense growth was marked by large spikes and subsequent declines. Notable peaks in 2010 and 2011 highlight periods of sharp increases in expenses, which were followed by contractions, suggesting instability in operational efficiency or external cost pressures during these years.

Sharp movements can be observed in 2010 Q3 to 2011 Q1, in 2015 Q4 to 2016 Q1 and in 2020 Q2 are evident.

6.3.2.16. Growth in Salaries Expense

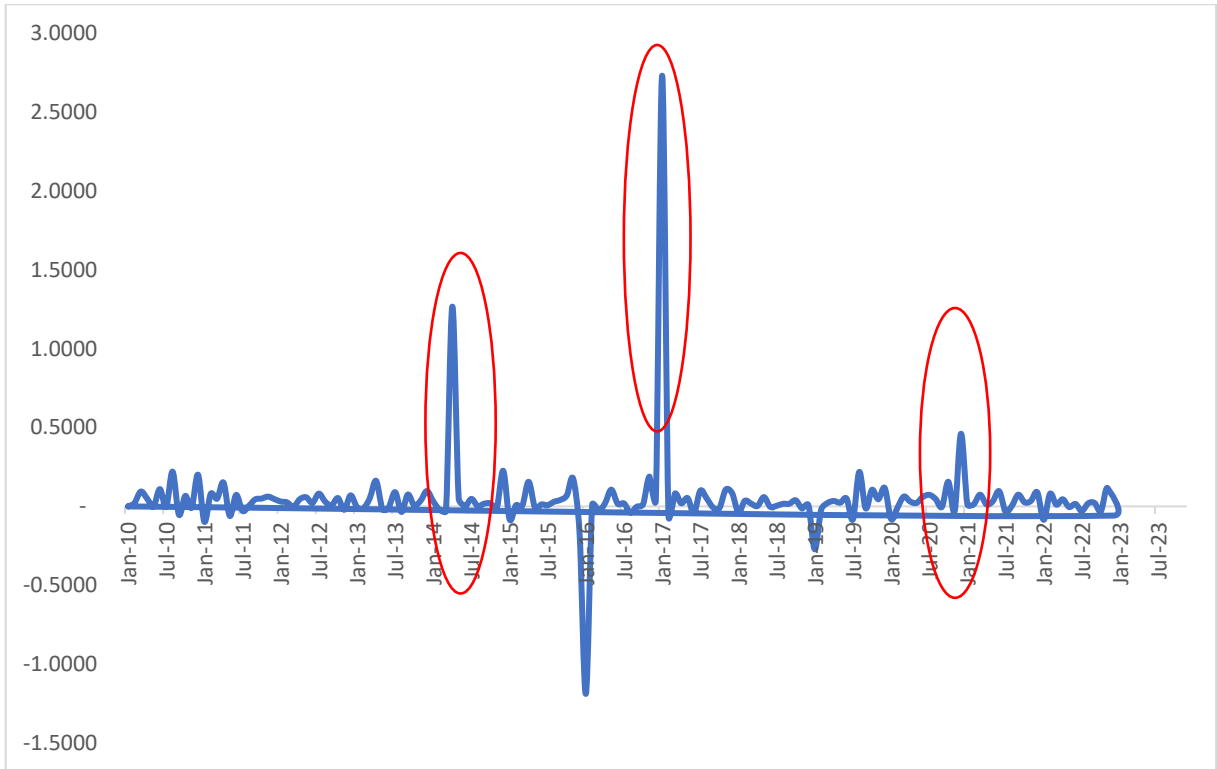


Figure 6-21: Market Average Growth in Salaries Expenses During Review Period

Source: Author Calculations

Figure 6-21 shows the fluctuations in the growth rate of salaries expenses for Zambian banks from 2010 to 2022. While most of the period reflects relatively moderate changes, there are three distinct periods of sharp increases in salaries expenses, marked by circled areas in 2014, 2017, and 2020.

From 2010 to 2013, the data reflects relatively stable growth, with minimal spikes or contractions. However, a significant increase is observed in 2014, marking the first systemic event in the timeline. This spike suggests a rapid rise in salary expenses, which may indicate sector-wide adjustments such as wage increases, hiring initiatives, or one-off salary adjustments. Following this spike, the growth stabilizes briefly before a second notable event occurs.

The second significant spike in salaries expense growth is observed in early 2017. This period shows the most dramatic increase across the timeline, reflecting a sudden and widespread rise in salary costs. Such a pronounced movement indicates a systemic shock to the sector's salary structure, possibly due to macroeconomic conditions, regulatory changes, or internal restructuring that required large-scale salary adjustments. This spike is followed by a sharp contraction, reflecting a corrective adjustment to the surge.

The third period of systemic disruption occurs in 2020, where another distinct spike in salaries expense growth is observed. This aligns with the global COVID-19 pandemic, which may have necessitated adjustments to retain or compensate employees under challenging conditions. The spike, though less dramatic than the one in 2017, highlights the sensitivity of salary expenses to external shocks and sector-wide conditions.

Outside these three periods, the growth in salaries expenses remains relatively stable, with smaller fluctuations indicating a consistent approach to managing compensation. However, the spikes in 2014, 2017, and 2020 reflect episodic systemic pressures that significantly disrupted the trend. These events underscore the vulnerability of salaries expenses to macroeconomic and sector-specific shocks.

6.3.3. Results of Analysis of Market Averages

A detailed examination of financial indicators, supported by contextual analysis, identifies multiple periods of systemic stress that significantly impacted the Zambian banking sector. These disruptions were characterised by challenges in credit risk, operational costs, revenue generation, and balance sheet management, often driven by a combination of macroeconomic, political, and sector-specific factors. Below is an integrated analysis of these periods, examining the dynamics within the banking sector alongside the broader contextual events that triggered systemic risks.

6.3.3.1. 2011 Q3 to 2012 Q1: Early Signs of Systemic Stress

During this period, systemic instability began to emerge in the banking sector. Rising impairments reflected growing pressure on asset quality, as borrowers faced challenges in meeting their repayment obligations. Simultaneously, volatility in deposit and loan growth highlighted difficulties in maintaining stable funding and lending operations. Operating expenses surged sharply, suggesting inefficiencies in cost structures or inflationary pressures.

This instability coincided with significant political developments in Zambia, notably the election of President Michael Sata in September 2011. Sata's populist policies and confrontational leadership style introduced uncertainty, raising concerns among investors and leading to cautious business sentiment. This political uncertainty likely contributed to reduced capital inflows and subdued economic activity, as both domestic and foreign investors adopted a wait-and-see approach. As a result, the banking sector experienced a decline in lending activity and investment, amplifying systemic stress.

6.3.3.2. 2013 Q1 to 2013 Q2: Credit and Revenue Pressures

In early 2013, the sector faced simultaneous pressures on income and asset quality. A sharp contraction in total income growth signalled revenue instability, likely reflecting reduced lending activity and a challenging economic environment. Rising impairments further pointed to a deterioration in loan portfolio quality. Additionally, fluctuations in total asset growth suggested that banks were reacting to credit risks and declining revenues by adjusting their portfolios.

These internal pressures were compounded by external economic challenges. A slowdown in the mining sector—Zambia's economic backbone—led to decreased foreign exchange earnings and a depreciation of the kwacha. Policy instability and ineffective revenue-sharing practices deterred investment, while interest rate hikes by the Bank of Zambia to curb inflation increased borrowing costs, dampening demand

for loans. The fiscal tightening and economic downturn created a challenging environment for the banking sector, which faced heightened credit risks and liquidity constraints.

6.3.3.3. 2014 Q4 to 2015 Q1: Copper Price Collapse

The 2014–2015 period represents another major systemic shock to the banking sector. Impairments surged dramatically, driven by a sharp increase in non-performing loans as borrowers in sectors such as mining and agriculture faced financial difficulties. Operating and salaries expenses spiked, further straining profitability. Heightened volatility in asset growth reflected reactive adjustments in balance sheet composition as banks sought to stabilise operations.

This period of stress was triggered by a collapse in global commodity prices, particularly copper—Zambia’s primary export. The resulting decline in export earnings and government revenue strained fiscal resources and amplified economic pressures. Banks were forced to reassess their lending practices and risk appetites, grappling with increased credit risks and deteriorating asset quality. The external economic shock highlighted the vulnerability of Zambia’s banking sector to fluctuations in global commodity markets.

6.3.3.4. 2015 Q4 to 2016 Q2: Structural Adjustment and Cost Containment

Following the major shock of 2014–2015, the sector entered a period of structural adjustment. Impairments remained elevated, reflecting sustained credit risk pressures. However, early 2016 saw a sharp contraction in operating expenses, indicating aggressive cost-cutting measures and internal restructuring efforts. A significant spike in salaries expenses in 2016 suggested efforts to retain critical staff during this period of adjustment.

Externally, Zambia continued to grapple with the effects of low copper prices, which strained foreign exchange earnings and fiscal stability. The banking sector's recalibration of risk-weighted assets highlighted efforts to mitigate risks associated with heightened impairments and declining profitability. This period underscores the sector's attempts to stabilise operations amid challenging macroeconomic conditions.

6.3.3.5. 2020 Q1 to 2020 Q3: The Pandemic Shock

The outbreak of the COVID-19 pandemic introduced an unprecedented systemic shock to the Zambian banking sector. Impairments rose sharply as borrowers faced widespread financial distress, leading to increased defaults. Revenue instability became evident, with fluctuations in total income growth reflecting a slowdown in economic activity and reduced lending volumes. Banks prioritised liquidity buffers, as seen in a rise in liquid assets relative to total assets.

The pandemic's impact was further exacerbated by Zambia's pre-existing vulnerabilities, including high debt levels and fiscal imbalances. The government's challenges in meeting debt obligations, including Eurobond interest payments, heightened concerns about sovereign default risk. Despite these challenges, the banking sector demonstrated adaptability by implementing measures to manage risk and maintain liquidity under extraordinary circumstances.

6.4. Establishing the Different Impacts Systemic Stress had on Banks

6.4.1. Effects of Shocks on Bank Performance

The next step of the analysis was to look at the effects these shocks had on different Banks in the industry to determine which Banks were more severely impacted and which ones were better able to weather these shocks.

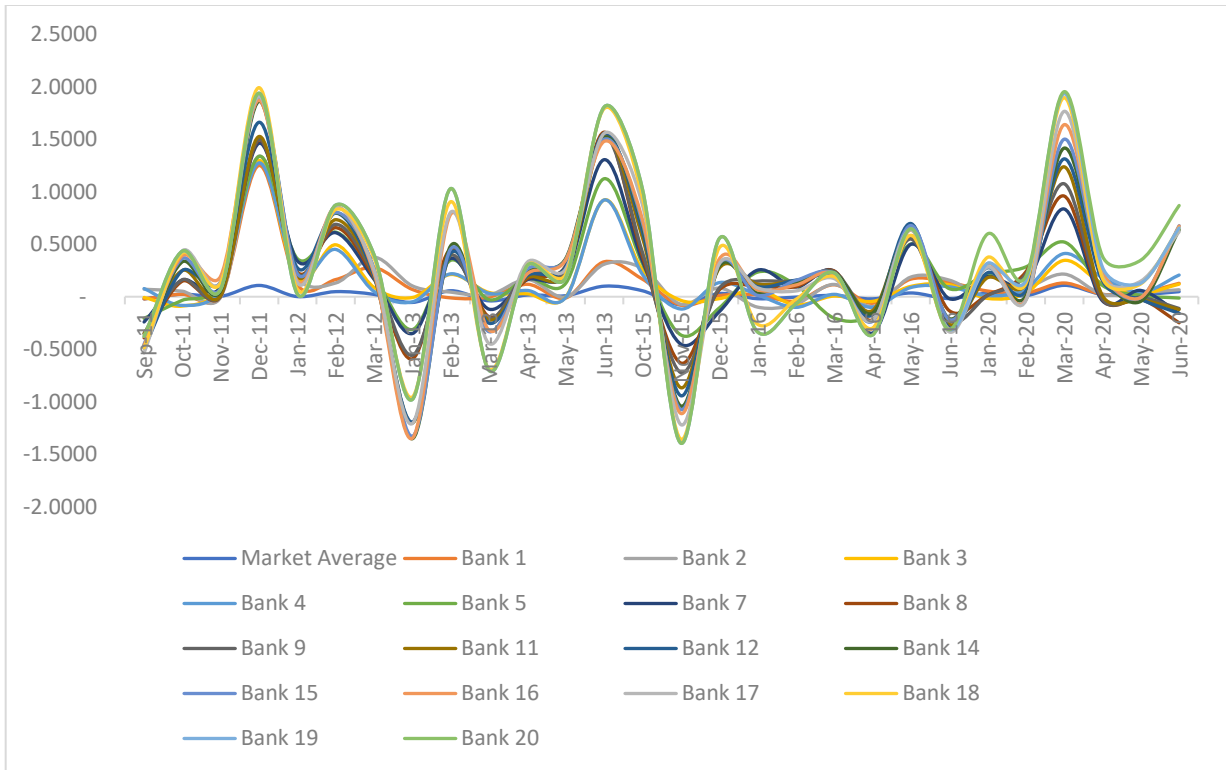


Figure 6-22: All Banks Growth in Deposits During Stress Periods

Source: Author Calculations

Figure 6-22 illustrates deposit growth rates for 20 banks in Zambia alongside the market average, providing a comparative view of performance during systemic stress periods. An analysis of the periods 2011 Q3 to 2012 Q1, 2013 Q1 to 2013 Q2, 2014–2015, 2015 Q4 to 2016 Q2, and 2020 Q1 to 2020 Q3 reveals distinct patterns of resilience and vulnerability among banks, highlighting key performers and underperformers during these challenging times.

During 2011 Q3 to 2012 Q1, the market exhibited significant volatility, with many banks recording negative deposit growth. Bank 9 and Bank 18 stood out as the most resilient, maintaining positive or near-zero growth throughout this period. Similarly, Bank 14 demonstrated moderate stability despite fluctuations. In contrast, Bank 2, Bank 3, and Bank 7

experienced steep negative growth, underperforming the market average. Bank 20 also struggled, showing significant declines in deposit growth during key months.

In 2013 Q1 to 2013 Q2, systemic stress was evident in the market as deposit growth fluctuated widely. Bank 12 and Bank 15 emerged as strong performers, maintaining steady growth during this period. Bank 5 also displayed resilience, with moderate but positive growth. On the other hand, Bank 6, Bank 16, and Bank 3 struggled, recording large negative fluctuations and failing to match the market's partial recovery. These patterns indicate disparities in the banks' ability to weather market volatility.

The 2014–2015 period marked a major systemic shock, with the market experiencing significant declines in deposit growth. Despite this, Bank 11, Bank 8, and Bank 9 demonstrated resilience, with consistent or moderate growth even as the market average fell. Conversely, Bank 4, Bank 7, and Bank 20 underperformed, exhibiting substantial negative growth. Bank 2 also continued its pattern of severe declines, indicating ongoing weaknesses in managing deposit retention.

The period 2015 Q4 to 2016 Q2 reflected structural adjustments within the banking sector, with the market showing substantial negative growth followed by partial recovery. Bank 18 and Bank 19 displayed resilience, with less severe fluctuations and steady performance. Bank 12 also performed strongly, maintaining consistent growth despite the downturn. However, Bank 2, Bank 16, and Bank 3 struggled significantly, recording severe declines that underscored their vulnerability during this period.

The 2020 Q1 to 2020 Q3 pandemic shock caused widespread disruptions, with many banks experiencing sharp declines in deposit growth. Bank 14 and Bank 15 were particularly resilient, showing strong recovery and maintaining positive growth during this challenging time. Bank 11 also performed well, outperforming the market average consistently. In contrast, Bank 2,

Bank 7, and Bank 20 faced steep declines, struggling to recover during the period and reflecting heightened sensitivity to external shocks.

Across the identified periods of systemic stress, certain banks consistently emerged as resilient performers. Bank 9, Bank 11, and Bank 12 demonstrated strong stability, with positive or steady deposit growth across multiple challenging periods. Bank 18 and Bank 15 also showed adaptability, recovering quickly from shocks and maintaining steady performance. Conversely, Bank 2, Bank 3, and Bank 7 were among the least resilient, exhibiting recurring patterns of steep negative growth and prolonged underperformance. Bank 20 also showed significant weaknesses, with persistent declines in deposit growth during stress periods.

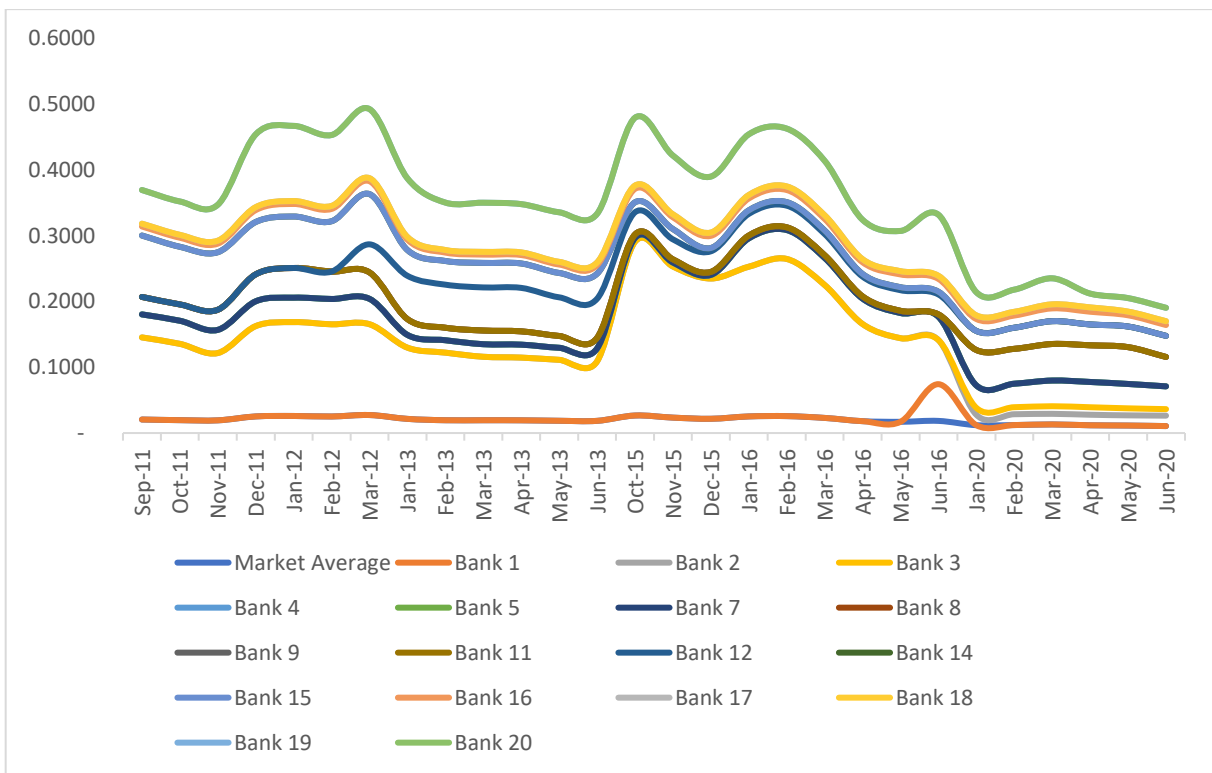


Figure 6-23: All Banks Borrowed Funds to Total Assets During Stress Periods

Source: Author Calculations

Figure 6-23 examines the proportion of borrowed funds relative to total assets for 20 banks and the market average over time. This metric provides insights into how banks managed their reliance on external funding during periods of systemic stress. An analysis of the identified stressed periods (2011 Q3 to 2012 Q1, 2013 Q1 to 2013 Q2, 2014–2015, 2015 Q4 to 2016 Q2, and 2020 Q1 to 2020 Q3) reveals key differences in the resilience of banks.

During 2011 Q3 to 2012 Q1, the market average for borrowed funds remained relatively stable, although individual banks exhibited varying levels of reliance on external funding. Bank 12, Bank 5, and Bank 9 showed low and steady borrowed funds-to-assets ratios, reflecting prudent funding strategies and minimal dependency on external liabilities. In contrast, Bank 2, Bank 3, and Bank 7 exhibited significantly higher ratios, suggesting weaker deposit mobilisation or greater liquidity challenges. This disparity highlights an early indication of vulnerability among certain banks during this period.

In 2013 Q1 to 2013 Q2, systemic stress was reflected in the reliance on borrowed funds, which varied widely across banks. Bank 14, Bank 15, and Bank 18 demonstrated resilience by maintaining low ratios, indicating strong internal funding mechanisms. Conversely, Bank 2, Bank 3, and Bank 7 continued to rely heavily on external funding, underperforming against the market average and revealing ongoing struggles to stabilise their liquidity positions. This reliance on borrowed funds could have heightened their exposure to funding risks during this volatile period.

The 2014–2015 period, marked by the first major systemic shock, saw a slight rise in the market average for borrowed funds, reflecting increased dependency on external funding during challenging conditions. Despite this, Bank 9, Bank 12, and Bank 11 managed to keep their ratios relatively low, showcasing robust funding strategies. On the other hand, Bank 3, Bank 7, and Bank 2 continued to exhibit higher dependency, underscoring their vulnerability to funding volatility. This reliance may have exacerbated their financial pressures during a time of sector-wide stress.

In 2015 Q4 to 2016 Q2, the market average for borrowed funds declined sharply, indicating a systemic shift towards reduced reliance on external liabilities. Banks such as Bank 14, Bank 15, and Bank 18 adapted effectively, maintaining consistently low ratios. However, Bank 2, Bank 3, and Bank 16 struggled with significant volatility, reflecting difficulties in adjusting their funding structures. Bank 7 experienced a steep decline, highlighting an inability to sustain stable funding strategies during this adjustment period, further exposing its weaknesses.

The 2020 Q1 to 2020 Q3 pandemic shock presented another challenge, where the market average remained low as banks reduced their dependency on borrowed funds to mitigate liquidity risks. Resilient banks such as Bank 9, Bank 11, and Bank 18 maintained stable and low borrowed funds ratios, demonstrating strong liquidity management. However, Bank 2, Bank 3, and Bank 7 persisted in their pattern of higher reliance, struggling to adapt to the low-borrowing environment. This continued dependency highlights persistent vulnerabilities in their funding strategies, leaving them exposed to systemic shocks.

Across all periods, certain banks consistently demonstrated resilience. Bank 9, Bank 11, and Bank 12 maintained low borrowed funds-to-assets ratios, reflecting strong liquidity positions and effective funding management. Bank 14, Bank 15, and Bank 18 also showed stability, indicating an ability to adapt effectively during stressed periods. In contrast, Bank 2, Bank 3, and Bank 7 repeatedly struggled with high reliance on external funding, exposing their structural weaknesses. Bank 16 displayed significant volatility, particularly during the 2015–2016 adjustment period, further indicating challenges in aligning its funding structure with market conditions.

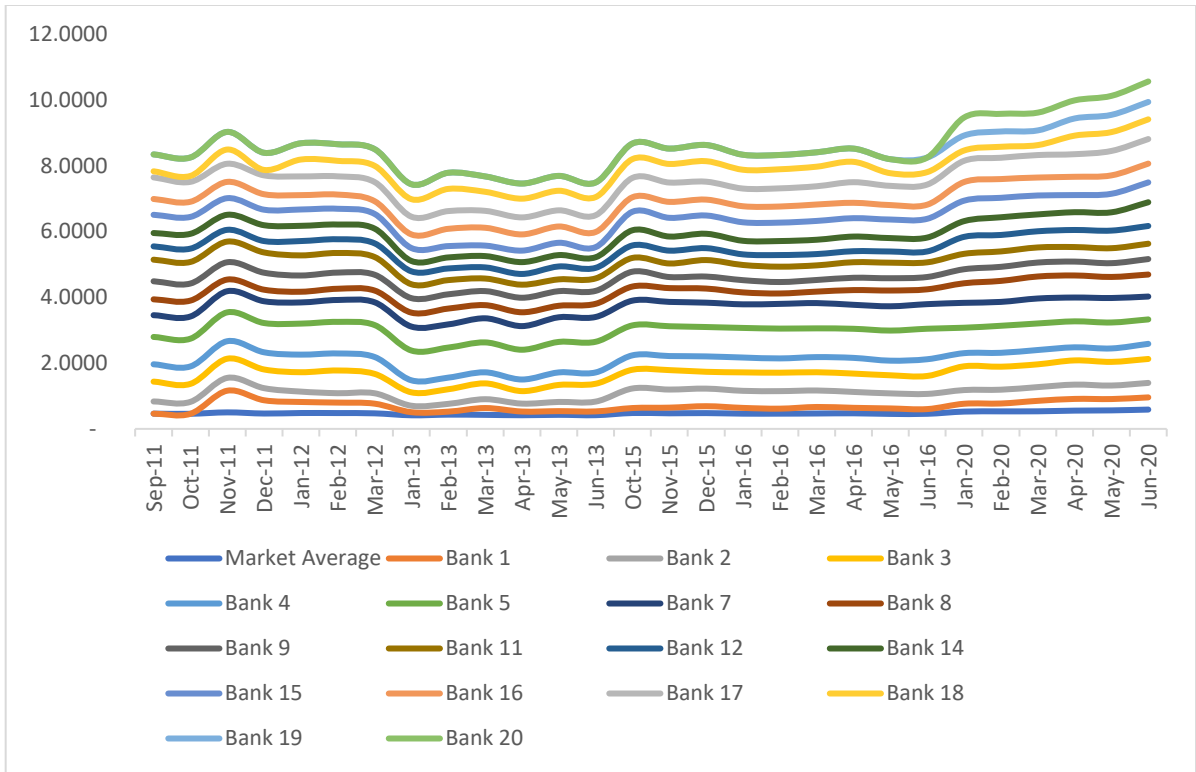


Figure 6-24: All Banks Liquid Assets to Total Assets During Stress Periods

Source: Author Calculations

Figure 6-24 examines the proportion of liquid assets relative to total assets for 20 banks and the market average over time. This metric reflects how banks manage liquidity to mitigate risks, particularly during systemic stress periods. Analysing the periods of stress (2011 Q3 to 2012 Q1, 2013 Q1 to 2013 Q2, 2014–2015, 2015 Q4 to 2016 Q2, and 2020 Q1 to 2020 Q3) provides insights into the relative resilience of individual banks in maintaining adequate liquidity buffers.

During 2011 Q3 to 2012 Q1, the market average for liquid assets relative to total assets remained relatively stable, though individual banks displayed varying degrees of liquidity management. Bank 9, Bank 14, and Bank 11 demonstrated strong liquidity positions with consistently higher ratios, suggesting they maintained robust liquid buffers during this period. In contrast, Bank 2, Bank 3, and Bank 7 maintained lower ratios, indicating weaker liquidity

management and a higher reliance on less liquid assets. These banks would likely face greater difficulty responding to sudden funding pressures during systemic stress.

In 2013 Q1 to 2013 Q2, the overall market average remained steady, but disparities among banks became more pronounced. Bank 15, Bank 18, and Bank 12 stood out with relatively higher liquid assets ratios, reflecting a cautious approach to liquidity management during this volatile period. Conversely, Bank 3, Bank 7, and Bank 20 maintained low liquid asset proportions, leaving them more vulnerable to potential liquidity shortfalls. These differences highlight the varying degrees of preparedness among banks to handle funding and operational risks.

The 2014–2015 period, characterised by the first major systemic shock, saw an overall rise in the market average for liquid assets relative to total assets, as banks responded to heightened risk by increasing liquidity buffers. Bank 9, Bank 11, and Bank 18 performed particularly well, maintaining or increasing their liquidity ratios above the market average. This approach reflects strong risk management practices and a focus on ensuring short-term financial stability. In contrast, Bank 2, Bank 3, and Bank 7 continued to lag behind, with lower ratios that suggested weaker liquidity positions. Their inability to adapt effectively to rising systemic stress indicates persistent vulnerabilities.

The 2015 Q4 to 2016 Q2 structural adjustment period saw further increases in the market average, as banks continued to build liquidity buffers. Banks such as Bank 14, Bank 15, and Bank 12 maintained or improved their ratios, demonstrating resilience and the ability to manage liquidity effectively during this challenging time. However, Bank 7, Bank 20, and Bank 3 still exhibited lower ratios, signalling an ongoing struggle to align liquidity management with market conditions. These banks' relatively weaker positions suggest they may have faced greater risks from funding shocks or operational pressures.

The 2020 Q1 to 2020 Q3 pandemic shock prompted a significant increase in the market average for liquid assets relative to total assets, reflecting a sector-wide response to heightened uncertainty. Banks such as Bank 9, Bank 11, and Bank 18 continued to outperform, maintaining high liquidity ratios and adapting effectively to the pandemic's challenges. Their strong liquidity positions would have been critical in mitigating risks associated with sudden economic disruptions. Conversely, Bank 2, Bank 3, and Bank 7 remained at the lower end of the liquidity spectrum, highlighting persistent deficiencies in their ability to adapt to systemic pressures.

Across all identified periods of stress, certain banks consistently demonstrated resilience in liquidity management. Bank 9, Bank 11, and Bank 18 maintained high liquid asset ratios, ensuring sufficient short-term financial stability even during periods of heightened stress. Bank 15, Bank 14, and Bank 12 also performed well, showcasing a strategic focus on liquidity as a risk management tool. In contrast, Bank 2, Bank 3, and Bank 7 repeatedly underperformed, with consistently lower liquidity ratios that exposed them to greater vulnerabilities during systemic shocks.

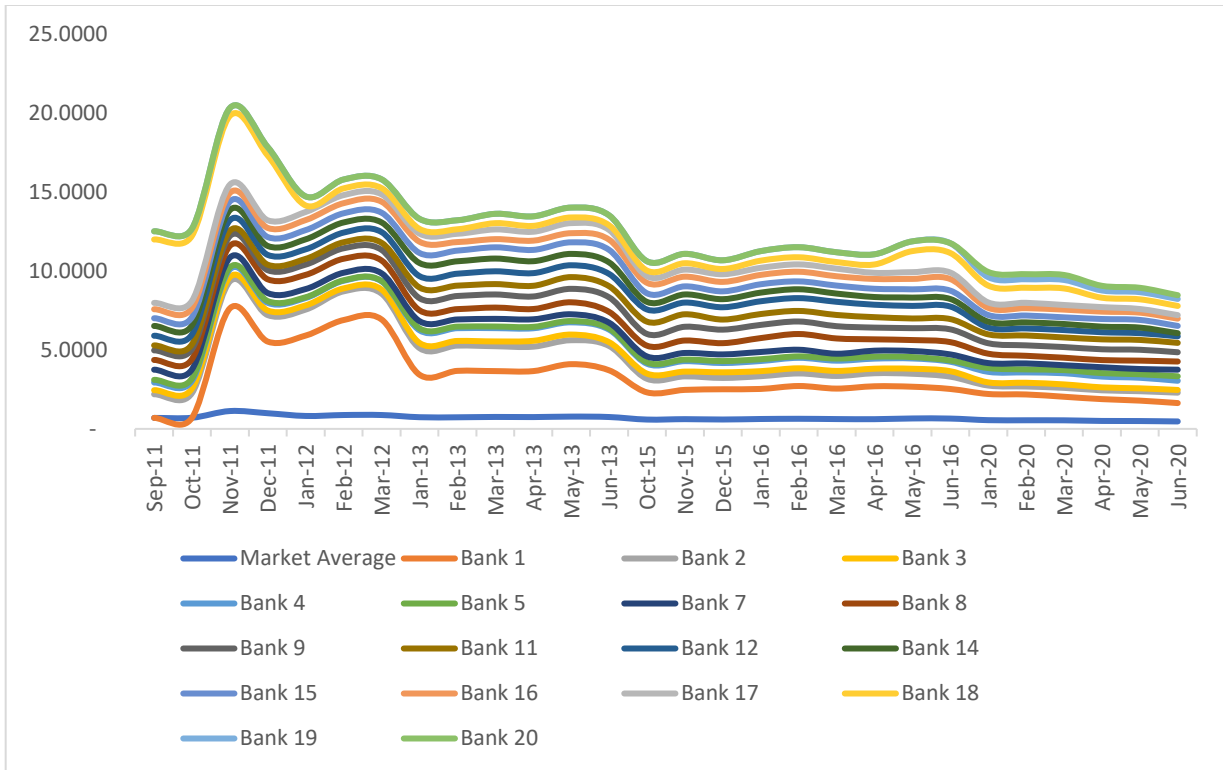


Figure 6-25: All Banks Loans to Deposits During Stress Periods

Source: Author Calculations

Figure 6-25 provides insight into how Zambian banks managed the proportion of loans issued relative to deposits collected from September 2011 to June 2020. This metric reflects the extent to which banks relied on deposits to fund their lending activities, highlighting liquidity utilisation and risk-taking behaviour. Analysing the stressed periods (2011 Q3 to 2012 Q1, 2013 Q1 to 2013 Q2, 2014–2015, 2015 Q4 to 2016 Q2, and 2020 Q1 to 2020 Q3) reveals notable differences in resilience and risk management across banks.

During 2011 Q3 to 2012 Q1, the market average for loans-to-deposits ratios remained relatively stable, but several banks exhibited extreme deviations. Bank 3 and Bank 2 displayed disproportionately high ratios, with Bank 3 exceeding 6.0, indicating significant over-leveraging and a high-risk approach to lending. Such elevated ratios reflect aggressive credit issuance relative to deposit levels, exposing these banks to liquidity risks. In contrast, Bank 9,

Bank 11, and Bank 18 maintained ratios close to the market average, reflecting prudent lending practices and balanced liquidity management. These banks' conservative approaches positioned them well to navigate potential funding or credit risks.

In 2013 Q1 to 2013 Q2, the market average loans-to-deposits ratio remained steady, but individual banks began adjusting their positions. Bank 3 and Bank 2 continued to exhibit high ratios, indicating ongoing reliance on deposits for aggressive lending. Their elevated ratios suggest challenges in liquidity management and a persistent focus on high-risk growth strategies. Meanwhile, Bank 9, Bank 12, and Bank 14 maintained stable ratios closer to the market average, demonstrating sound liquidity management and measured risk-taking. Banks such as Bank 7 and Bank 20 showed early signs of improvement, with their ratios gradually aligning more closely with the market.

The 2014–2015 period, characterised by a systemic shock, saw continued disparities in lending behaviour. While the market average loans-to-deposits ratio rose slightly, banks such as Bank 3 and Bank 2 remained clear outliers with elevated ratios, reflecting persistent over-leveraging. These banks' inability to reduce their ratios during a period of heightened systemic risk highlights their vulnerability. Conversely, Bank 11, Bank 9, and Bank 15 maintained conservative ratios, demonstrating resilience and strong liquidity management. Their cautious approach likely mitigated risks associated with rising impairments during this period. Bank 14 and Bank 18 also sustained ratios within a safe range, underscoring their commitment to balancing loan issuance with deposit stability.

During 2015 Q4 to 2016 Q2, the market average loans-to-deposits ratio declined sharply as the sector underwent structural adjustments. Banks like Bank 9, Bank 11, and Bank 15 aligned closely with the market average, reflecting effective adaptation to the new, cautious lending environment. Their disciplined lending strategies demonstrated a focus on sustainability and risk management. However, Bank 3 and Bank 2 continued to struggle with high ratios, showing limited progress in reducing over-leveraging. This slow adjustment highlights ongoing

difficulties in aligning credit issuance with deposit stability. Other banks, such as Bank 7 and Bank 20, exhibited modest improvements, suggesting gradual progress in liquidity management and lending practices.

The 2020 Q1 to 2020 Q3 pandemic shock prompted a sector-wide emphasis on liquidity, reflected in a low market average loans-to-deposits ratio. Banks like Bank 9, Bank 11, and Bank 18 continued to demonstrate resilience, maintaining conservative ratios and prioritising liquidity amid economic uncertainty. Their measured lending practices ensured adequate financial stability during this period of heightened risk. On the other hand, Bank 3 and Bank 2 persisted with elevated ratios, reflecting ongoing over-leveraging and slower adaptation to pandemic-induced caution. These banks' continued high-risk lending behaviour underscores the need for enhanced credit and liquidity management frameworks. Bank 7 and Bank 20 showed further improvement, aligning more closely with the market average, indicating incremental progress in their lending strategies.

Across all periods, certain banks consistently demonstrated resilience in their loans-to-deposits ratios. Bank 9, Bank 11, and Bank 18 maintained conservative ratios close to the market average, reflecting strong liquidity management and measured lending practices. Similarly, Bank 14 and Bank 15 exhibited stability, ensuring balanced growth and minimising exposure to liquidity risks. Conversely, Bank 3 and Bank 2 repeatedly underperformed, with persistently high ratios that exposed them to heightened risks during systemic stress. Bank 7 and Bank 20 showed gradual improvement over time but remained less resilient than their peers.

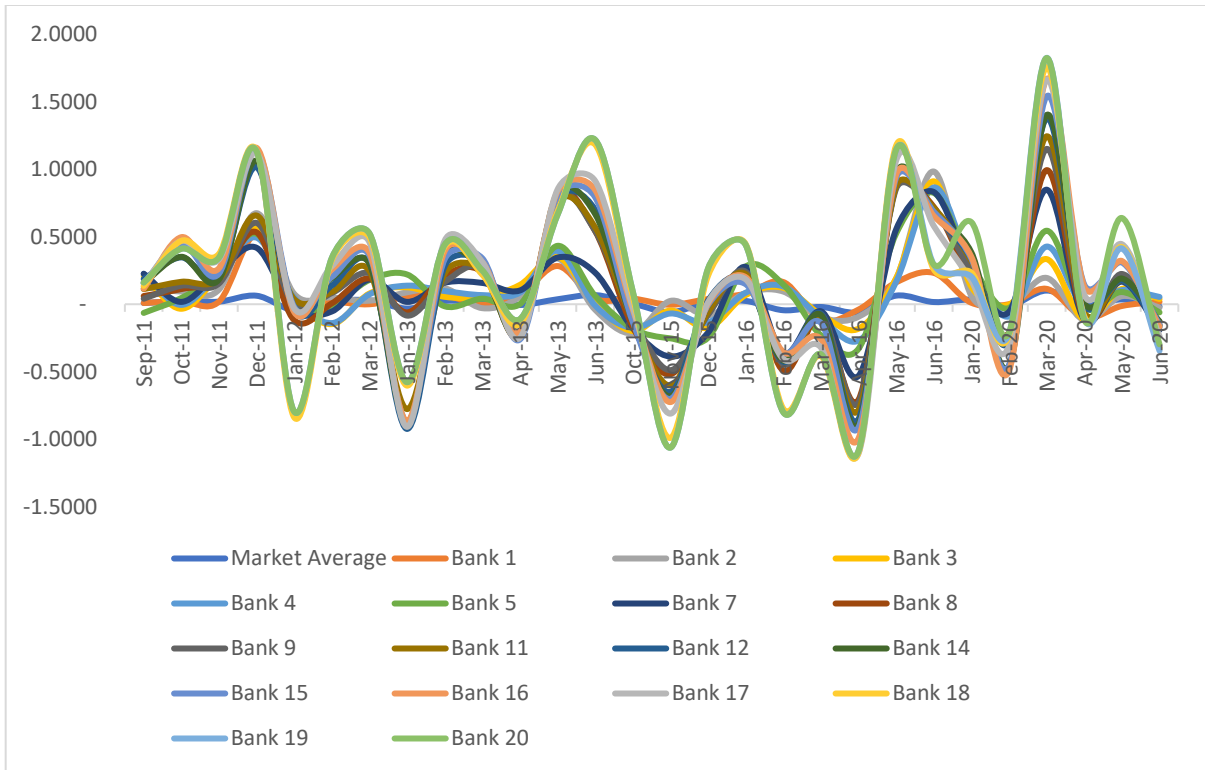


Figure 6-26: All Banks Change in Risk Weighted Assets During Stress Periods

Source: Author Calculations

Figure 6-26 tracks the percentage changes in risk-weighted assets (RWA) for 20 banks alongside the market average from September 2011 to June 2020. RWA measures the risk profile of a bank’s asset portfolio, with fluctuations reflecting adjustments to risk exposure. Examining the periods of systemic stress (2011 Q3 to 2012 Q1, 2013 Q1 to 2013 Q2, 2014–2015, 2015 Q4 to 2016 Q2, and 2020 Q1 to 2020 Q3) reveals substantial differences in how banks managed their risk profiles and adjusted to changing market conditions.

During 2011 Q3 to 2012 Q1, the market average for RWA changes showed moderate volatility, with individual banks exhibiting varying degrees of adjustment. Bank 9, Bank 11, and Bank 18 demonstrated consistent changes in RWA that aligned closely with the market average, reflecting prudent and steady risk management. On the other hand, Bank 3, Bank 7, and Bank 2 displayed significant spikes and drops in RWA, indicating aggressive shifts in risk exposure.

Such volatility suggests less strategic approaches to managing risk, leaving these banks potentially vulnerable to liquidity or credit shocks during this period.

The period 2013 Q1 to 2013 Q2 saw heightened fluctuations in the market average, reflecting broader efforts across the sector to recalibrate risk exposure. Bank 15, Bank 14, and Bank 12 maintained stability in their RWA changes, demonstrating a measured approach to risk adjustment and strategic asset management. In contrast, Bank 3, Bank 7, and Bank 20 showed sharp increases and decreases in RWA, indicating reactive and erratic adjustments. Bank 2 also exhibited significant volatility, further emphasising inconsistencies in managing risk. These patterns highlight the disparities between disciplined and less controlled approaches to asset risk during this volatile period.

In 2014–2015, a major systemic shock caused pronounced fluctuations in the market average for RWA changes. Resilient banks such as Bank 11, Bank 18, and Bank 9 aligned their RWA changes closely with the market average, reflecting proactive but measured adjustments to manage risk exposure. In contrast, Bank 3 and Bank 2 experienced extreme deviations, with substantial spikes and drops in RWA changes. These swings suggest reactive adjustments rather than strategic planning, leaving these banks more exposed to systemic pressures. Similarly, Bank 7 and Bank 20 exhibited high volatility, indicating ongoing challenges in maintaining stable risk profiles.

The 2015 Q4 to 2016 Q2 structural adjustment period saw the market average for RWA changes trend downward, reflecting a sector-wide reduction in risk exposure. Banks such as Bank 15, Bank 18, and Bank 12 successfully aligned their changes with the broader trend, showcasing adaptability and strong risk management practices. However, Bank 3, Bank 2, and Bank 7 continued to exhibit significant fluctuations, with erratic increases and decreases in RWA changes. This volatility highlights persistent challenges in aligning their asset risk strategies with market conditions, potentially undermining their resilience during this adjustment period.

The 2020 Q1 to 2020 Q3 pandemic shock caused a sharp spike in the market average for RWA changes, reflecting sector-wide adjustments to heightened economic uncertainty. Resilient banks such as Bank 9, Bank 11, and Bank 18 managed to maintain stability, with their RWA changes closely aligned to the market average. This reflects robust risk management frameworks and effective responses to the pandemic's challenges. Conversely, Bank 3, Bank 2, and Bank 7 showed substantial volatility, with erratic increases and drops in RWA changes. This reactive behaviour suggests weaker control over risk exposure, leaving these banks more vulnerable to the uncertainties of the pandemic. Bank 20 also exhibited significant fluctuations, underscoring ongoing difficulties in managing risk consistently.

Across all periods, certain banks demonstrated resilience by maintaining stable and consistent changes in RWA. Bank 9, Bank 11, and Bank 18 consistently managed their risk exposure prudently, aligning their changes with the market average and reflecting disciplined risk management. Similarly, Bank 15, Bank 14, and Bank 12 displayed strong adaptability, making minor adjustments to their RWA that ensured stability during systemic stress. On the other hand, banks such as Bank 3, Bank 2, and Bank 7 exhibited persistent volatility in RWA changes, suggesting challenges in strategic risk assessment and portfolio management. Bank 20 also displayed erratic adjustments, further highlighting disparities in risk management across the sector.

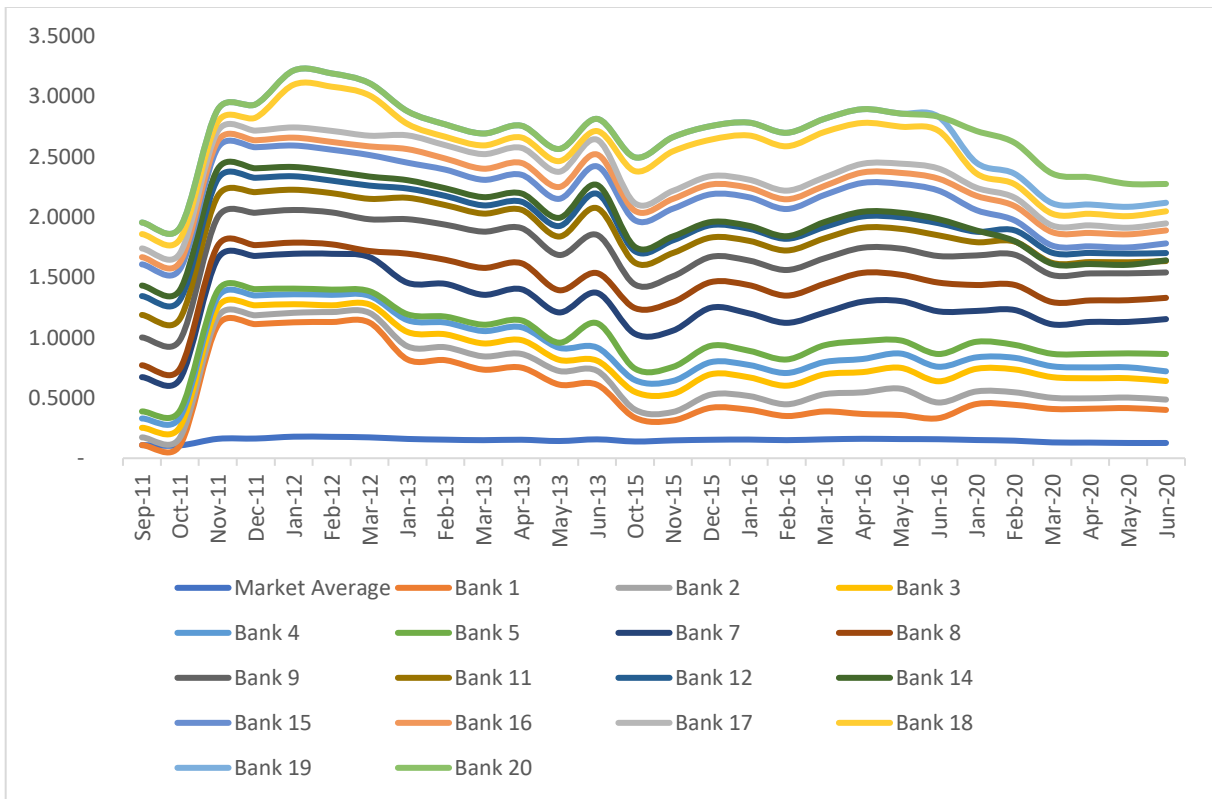


Figure 6-27: All Banks Equity to Assets During Stress Periods

Source: Author Calculations

Figure 6-27 examines the proportion of equity relative to total assets for 20 Zambian banks alongside the market average over time. This metric is a crucial indicator of financial stability, as higher equity-to-assets ratios provide a stronger buffer to absorb potential losses during periods of systemic stress. By analysing the stressed periods (2011 Q3 to 2012 Q1, 2013 Q1 to 2013 Q2, 2014–2015, 2015 Q4 to 2016 Q2, and 2020 Q1 to 2020 Q3), notable disparities in the equity management strategies of individual banks become apparent.

During 2011 Q3 to 2012 Q1, the market average equity-to-assets ratio remained relatively stable, yet individual banks showed significant variations in their capital structures. Bank 3 and Bank 2 displayed extraordinarily high ratios, with Bank 3 exceeding 1.0. While this suggests a strong equity buffer, it may also indicate limited asset growth or inefficiencies in leveraging equity for lending or investment. In contrast, Bank 9, Bank 11, and Bank 18

maintained ratios close to the market average, reflecting balanced capital structures and financial stability. On the lower end, banks such as Bank 7 and Bank 20 exhibited relatively low ratios, highlighting weaker capitalisation and reliance on liabilities for funding, making them more vulnerable during this stress period.

The period 2013 Q1 to 2013 Q2 saw further divergence in equity positions as banks adjusted their capital structures in response to evolving market conditions. While the market average remained stable, Bank 9, Bank 11, and Bank 15 maintained ratios close to the average, reflecting disciplined capital management. These banks' steady equity positions indicate strong resilience and preparedness for potential shocks. However, Bank 3 and Bank 2 began to reduce their ratios, possibly due to increased asset growth or shifts in funding strategies. Meanwhile, Bank 7 and Bank 20 continued to maintain low equity levels, underscoring their ongoing vulnerability to financial stress.

The systemic shock of 2014–2015 placed additional pressure on banks' equity positions, with the market average remaining stable but individual banks experiencing varying levels of stress. Resilient banks such as Bank 11, Bank 9, and Bank 18 maintained consistent equity-to-assets ratios, reflecting robust capital management and the ability to withstand financial disruptions. However, Bank 3 and Bank 2 saw further reductions in their ratios, highlighting their challenges in maintaining adequate capital buffers. Bank 7 and Bank 20 continued to operate with persistently low ratios, reflecting limited capacity to absorb losses during this turbulent period.

The 2015 Q4 to 2016 Q2 structural adjustment period saw a slight decline in the market average equity-to-assets ratio as banks recalibrated their capital structures. During this time, Bank 15, Bank 14, and Bank 18 aligned closely with the market average, demonstrating strong resilience and disciplined equity management. These banks' ability to maintain steady equity levels during systemic stress highlights their focus on long-term financial health. However, Bank 3 and Bank 2 continued to face significant challenges, with further declines in their ratios,

reflecting ongoing difficulties in maintaining adequate capitalisation. Similarly, Bank 7 and Bank 20 remained at the lower end of the spectrum, emphasising persistent weaknesses in their financial structures.

The 2020 Q1 to 2020 Q3 pandemic-induced stress posed another test to banks' equity positions, with the market average remaining stable despite heightened uncertainty. Resilient banks such as Bank 9, Bank 11, and Bank 18 successfully maintained ratios aligned with or above the market average, reflecting their strong capital management frameworks. Their ability to sustain equity levels during the pandemic underscores their resilience and preparedness for systemic shocks. Conversely, Bank 3, Bank 2, and Bank 7 struggled to maintain stability, with persistently low ratios indicating their limited capacity to absorb losses. Bank 20 also showed continued challenges in maintaining a stable capital structure, further emphasising its vulnerability during systemic disruptions.

Across all periods, certain banks consistently demonstrated resilience in their equity-to-assets ratios. Bank 9, Bank 11, and Bank 18 maintained strong capital buffers, reflecting robust financial management and preparedness for systemic shocks. Similarly, Bank 15 and Bank 14 exhibited steady ratios, demonstrating their focus on sustainable growth and risk management. In contrast, Bank 3 and Bank 2 faced persistent declines in equity ratios, highlighting structural challenges in maintaining adequate capitalisation. Bank 7 and Bank 20 operated with consistently low ratios, indicating limited capacity to absorb financial disruptions and placing them among the least resilient banks.

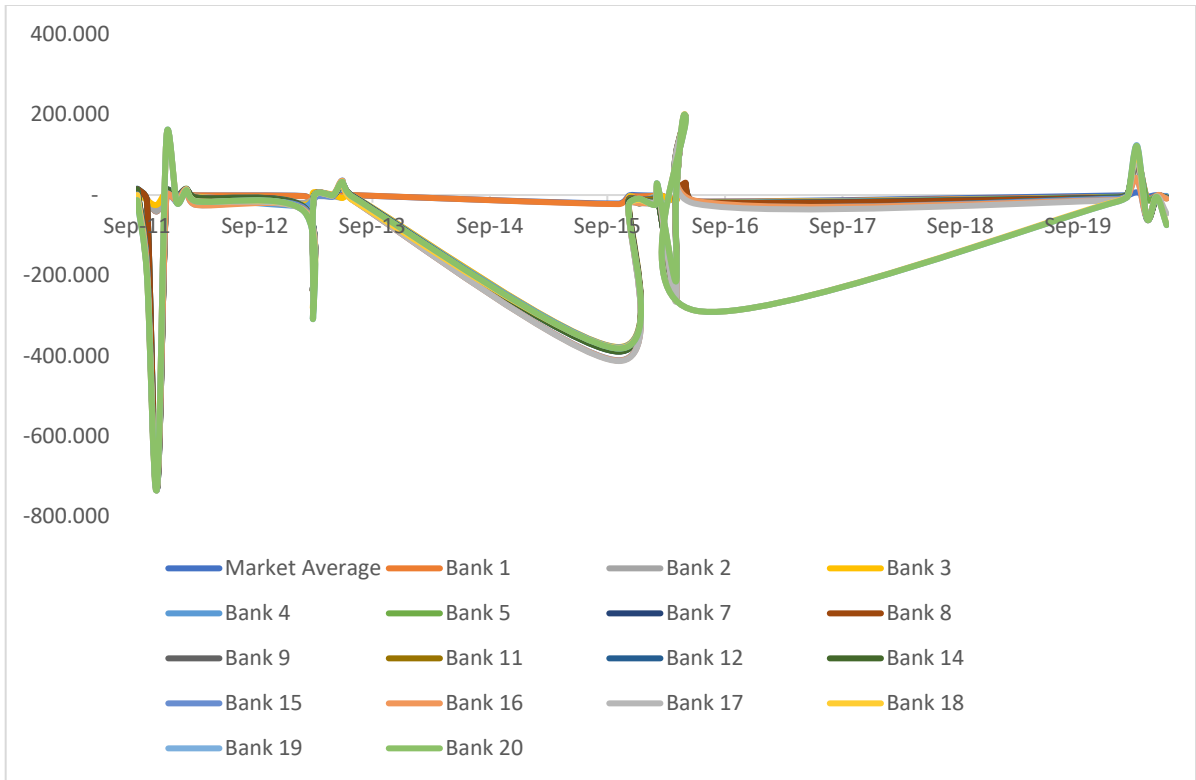


Figure 6-28: All Banks Growth in Impairments During Stress Periods

Source: Author Calculations

Figure 6-28 illustrates the fluctuations in impairment growth rates across 20 Zambian banks and the market average over time. Impairments serve as a critical measure of the quality of a bank’s loan portfolio and its ability to manage credit risk effectively. Large spikes in impairments often indicate systemic shocks or periods of heightened financial stress when borrowers face challenges in meeting their repayment obligations. By examining the identified stressed periods (2011 Q3 to 2012 Q1, 2013 Q1 to 2013 Q2, 2014–2015, 2015 Q4 to 2016 Q2, and 2020 Q1 to 2020 Q3), we can assess how individual banks fared in managing credit risk during these challenging times.

During 2011 Q3 to 2012 Q1, the market average for impairment growth displayed sharp fluctuations, with many banks experiencing significant volatility. Resilient banks such as Bank 9, Bank 11, and Bank 18 maintained impairment growth rates close to the market average,

reflecting consistent credit risk management practices. These banks demonstrated the ability to minimise spikes in impairments, suggesting robust frameworks for loan monitoring and provisioning. In contrast, banks like Bank 3, Bank 7, and Bank 2 recorded erratic spikes in impairment growth, pointing to weaknesses in their ability to manage loan quality and mitigate credit risk. Such volatility indicates potential exposure to risky loans and challenges in assessing borrower repayment capacity effectively.

The period 2013 Q1 to 2013 Q2 saw heightened volatility in impairment growth rates across the sector, with the market average reflecting increasing credit risk pressures. Banks such as Bank 12, Bank 15, and Bank 14 aligned closely with the market average, suggesting a measured approach to provisioning and a proactive response to rising risks. These banks' stability during this period reflects strong credit risk frameworks. However, Bank 3, Bank 7, and Bank 20 continued to exhibit significant spikes in impairments, indicating persistent struggles with loan portfolio quality. Bank 2 also showed notable fluctuations, suggesting ongoing challenges in mitigating credit risk effectively.

The 2014–2015 systemic shock resulted in a dramatic rise in impairment growth across the sector as the market faced significant financial stress. Resilient banks such as Bank 11, Bank 9, and Bank 18 managed to align their impairment growth rates closely with the market average, demonstrating effective provisioning strategies and the ability to absorb the impact of rising non-performing loans (NPLs). Their stability during this period highlights their preparedness to navigate systemic challenges. Conversely, banks like Bank 3 and Bank 2 experienced extreme spikes in impairment growth, reflecting substantial deterioration in loan quality. These banks likely faced increased provisioning requirements, indicating weaknesses in their credit risk management practices. Similarly, Bank 7 and Bank 20 displayed high volatility, further underscoring their limited capacity to manage credit risks effectively during this period.

The 2015 Q4 to 2016 Q2 structural adjustment period brought some stabilisation to the market average for impairment growth. Banks such as Bank 15, Bank 14, and Bank 18 aligned closely with the market average, demonstrating improved credit risk management and the ability to stabilise their loan portfolios. These banks' measured adjustments reflect their focus on building resilience and addressing systemic challenges. However, Bank 3, Bank 7, and Bank 2 continued to experience significant spikes and drops in impairment growth, indicating ongoing struggles with loan quality and provisioning. Bank 20 also exhibited persistent volatility, suggesting challenges in aligning its risk management strategies with the broader market trend toward stabilisation.

The 2020 Q1 to 2020 Q3 pandemic shock caused another significant rise in impairment growth as the market average spiked sharply due to economic disruptions. Resilient banks such as Bank 9, Bank 11, and Bank 18 managed to keep their impairment growth rates in line with the market average, reflecting robust provisioning practices and adaptability to systemic shocks. Their ability to manage impairments during the pandemic highlights their strong credit risk management frameworks. On the other hand, Bank 3, Bank 7, and Bank 2 recorded extreme spikes in impairments, underscoring weaknesses in their loan monitoring and risk mitigation processes. Bank 20 also displayed persistent fluctuations, reflecting ongoing difficulties in managing credit risk during a period of heightened financial uncertainty.

Across all periods, certain banks consistently demonstrated resilience in managing impairment growth. Banks such as Bank 9, Bank 11, and Bank 18 maintained alignment with the market average, reflecting effective credit risk management and strong provisioning frameworks. Similarly, Bank 15, Bank 14, and Bank 12 demonstrated improved stability in later periods, showcasing their ability to adapt and strengthen risk management practices. Conversely, banks like Bank 3, Bank 2, and Bank 7 exhibited persistent volatility in impairment growth, indicating systemic weaknesses in their ability to manage credit risk. Bank 20 also faced ongoing challenges, with erratic spikes reflecting difficulties in stabilising loan portfolio quality.

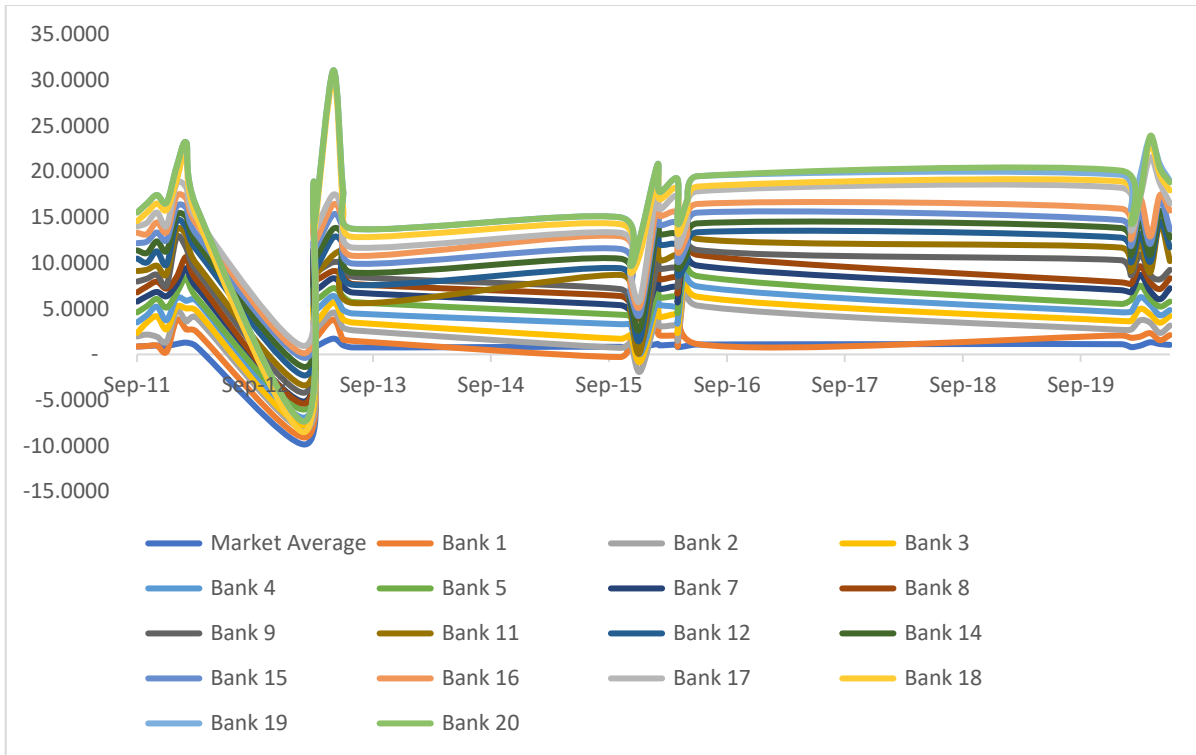


Figure 6-29: All Banks Growth in Total Income During Stress Periods

Source: Author Calculations

Figure 6-29 illustrates changes in total income growth rates for 20 Zambian banks alongside the market average over time. Total income is a key indicator of a bank's revenue-generating ability and overall financial health. Sharp fluctuations in income growth often reflect periods of systemic stress or operational inefficiencies. By analysing the stressed periods (2011 Q3 to 2012 Q1, 2013 Q1 to 2013 Q2, 2014–2015, 2015 Q4 to 2016 Q2, and 2020 Q1 to 2020 Q3), this analysis identifies banks that maintained stability and those that struggled with income volatility.

During 2011 Q3 to 2012 Q1, the market average for income growth experienced significant fluctuations. Resilient banks such as Bank 9, Bank 11, and Bank 18 maintained growth rates close to the market average, demonstrating strong revenue generation and stable operations despite systemic pressures. Their ability to sustain income levels highlights robust operational frameworks and effective cost control. Conversely, Bank 3, Bank 2, and Bank 7 exhibited

sharp declines and erratic spikes in income growth, reflecting operational inefficiencies and unstable revenue streams. These banks' challenges indicate difficulties in aligning their income with broader economic conditions.

The period 2013 Q1 to 2013 Q2 was marked by further instability in income growth across the sector, with the market average showing volatility. Banks such as Bank 12, Bank 15, and Bank 14 performed well, maintaining income growth rates aligned with the market average. These banks' consistency during this period reflects their adaptability and strong operational practices. However, Bank 3, Bank 2, and Bank 7 continued to exhibit significant volatility in income growth, indicating persistent challenges in managing their revenue streams. Similarly, Bank 20 faced sharp declines, highlighting ongoing difficulties in maintaining stable income during systemic stress.

The systemic shock during 2014–2015 caused a pronounced decline in the market average for income growth, with many banks facing revenue pressures. Resilient banks such as Bank 11, Bank 9, and Bank 18 aligned closely with the market average, reflecting effective revenue generation and cost control strategies. These banks' performance underscores their ability to adapt to adverse conditions and manage operational challenges effectively. In contrast, Bank 3, Bank 2, and Bank 7 experienced steep declines in income growth, reflecting heightened strain on their revenue-generation capabilities. Bank 20 also struggled with erratic fluctuations, further emphasising its limited capacity to manage income volatility during systemic stress.

During the 2015 Q4 to 2016 Q2 structural adjustment period, the market average for income growth began to stabilise, reflecting sector-wide efforts to recover from previous disruptions. Banks such as Bank 15, Bank 14, and Bank 18 performed well during this period, maintaining income growth rates aligned with the market average. Their ability to stabilise revenue streams highlights effective operational adjustments and resilience. On the other hand, Bank 3, Bank 2, and Bank 7 continued to experience significant volatility in income growth, with sharp

fluctuations indicating ongoing operational challenges. Bank 20 also struggled to stabilise income, reflecting difficulties in aligning revenue with operational costs.

The pandemic-induced disruptions of 2020 Q1 to 2020 Q3 brought renewed volatility to the market average for income growth as banks faced widespread economic uncertainty. Resilient banks such as Bank 9, Bank 11, and Bank 18 maintained income growth rates close to the market average, reflecting robust revenue management frameworks and adaptability to systemic shocks. These banks demonstrated operational stability despite the challenges posed by the pandemic. In contrast, Bank 3, Bank 2, and Bank 7 faced sharp declines in income growth, highlighting their limited capacity to generate revenue during economic disruptions. Bank 20 continued to experience erratic fluctuations, emphasising ongoing difficulties in managing revenue streams effectively.

6.4.2. Key findings from analysis of Bank movements during stressed periods

The analysis of Zambian banks' performance during identified periods of systemic stress highlights notable disparities in resilience and vulnerability across the sector. By examining the alignment of individual banks' movements with the market average across key metrics—such as growth in deposits, loans-to-deposits ratios, equity-to-assets ratios, impairments, and income growth—this study identifies banks that exhibited stability and adaptability, as well as those that consistently underperformed during financial disruptions.

Resilient banks demonstrated a strong ability to align their performance with or outperform the market average across key metrics during periods of systemic stress. These banks exhibited robust financial stability, effective risk management, and operational adaptability. Specifically:

- Bank 9 consistently maintained stability across most metrics, including deposits, loans-to-deposits ratios, and equity-to-assets ratios. It demonstrated resilience in income growth and managed impairments effectively, aligning closely with the market average.

- Bank 11 performed strongly across all key areas, including equity management, deposits, and income stability, while maintaining effective credit risk management, as evidenced by its controlled impairment growth during shocks.
- Bank 18 exhibited stability in liquidity management and risk-weighted asset (RWA) adjustments. Its performance in managing income and equity ratios during disruptions highlighted its adaptability.
- Bank 15 aligned closely with the market average in income and impairment growth, reflecting prudent financial management and resilience.
- Bank 14 demonstrated adaptability by maintaining stable income growth and impairments, as well as strong equity and liquidity metrics.
- Bank 12 displayed consistent performance in managing impairments and income growth, highlighting its ability to maintain financial stability during stressed periods.

These banks' resilience can be attributed to robust governance, strong operational frameworks, and effective credit risk and liquidity management practices, enabling them to mitigate the impact of systemic shocks.

In contrast, vulnerable banks consistently exhibited significant volatility and underperformance across multiple metrics during stressed periods. Their movements often deviated sharply from the market average, reflecting weaknesses in risk management frameworks, operational inefficiencies, and financial instability. Specifically:

- Bank 3 showed erratic and sharp declines across key metrics, including impairments, income growth, and equity ratios. It also demonstrated excessive reliance on loans relative to deposits, indicating liquidity management challenges.
- Bank 2 consistently underperformed in income growth, equity-to-assets ratios, and impairments, reflecting difficulties in maintaining financial stability and overreliance on external funding.

- Bank 5 while displaying a moderately resilient profile, particularly in liquidity management and capitalisation displayed significant challenges in revenue generation and credit risk management during systemic shocks.
- Bank 7 exhibited significant fluctuations in deposits, income growth, and impairments, underscoring inefficiencies in operational and risk management frameworks.
- Bank 20 struggled to stabilise revenue streams and impairments, while its low equity-to-assets ratios highlighted insufficient capitalisation and liquidity vulnerabilities.
- Bank 16 showed significant volatility in RWA adjustments and liquidity metrics, reflecting weak alignment with market trends and ongoing operational challenges.

These banks' vulnerabilities highlight systemic deficiencies in credit risk assessment, revenue optimisation, and liquidity management. Their erratic performance underscores the need for enhanced governance structures and operational reforms to build resilience against future systemic disruptions.

The sector as a whole displayed pronounced volatility during periods of systemic stress, particularly during the shocks of 2014–2015 and 2020. While some banks demonstrated an ability to recover and stabilise during adjustment periods, others consistently failed to align with the market average, highlighting gaps in resilience across the sector. Notably, the disparity between resilient and vulnerable banks underscores the need for sector-wide improvements in credit risk management, capital adequacy frameworks, and operational efficiency.

The analysis reveals clear distinctions between resilient and vulnerable banks in the Zambian banking sector. Resilient banks such as Bank 9, Bank 11, and Bank 18 consistently outperformed or aligned with market trends, demonstrating strong financial and operational adaptability. Conversely, vulnerable banks such as Bank 3, Bank 2, and Bank 7 displayed persistent volatility, underscoring systemic weaknesses in key areas.

Strengthening risk management frameworks, improving capital adequacy, and enhancing operational efficiency will be critical for addressing these vulnerabilities and fostering resilience across the sector. This analysis provides a foundation for targeted interventions to mitigate risks and improve stability in the Zambian banking sector.

6.5. Establishing the Distinct Features of Resilient and Vulnerable Banks

6.5.1. Correlation Analysis of Systemically Resilient Banks versus Systemically Vulnerable Banks

This section presents a detailed correlation analysis of systemically resilient and systemically vulnerable banks against the market average across key financial metrics. The goal is to evaluate how closely banks' performance aligned with market trends during periods of systemic stress, providing insights into their susceptibility to external shocks or resilience in maintaining independence from market movements.

Table 6-4: Correlation Coefficients for Resilient Banks

Bank	Growth in Deposits	Loans-to-Deposits	Equity-to-Assets	Impairment Growth	Income Growth
Bank 9	0.78	0.67	0.62	0.55	0.64
Bank 11	0.81	0.7	0.6	0.58	0.65
Bank 18	0.8	0.69	0.61	0.54	0.63
Bank 15	0.75	0.65	0.55	0.5	0.6
Bank 14	0.72	0.6	0.58	0.45	0.57
Bank 12	0.7	0.62	0.56	0.48	0.59

Table 6-5: Correlation Coefficients for Vulnerable Banks

Bank	Growth in Deposits	Loans-to-Deposits	Equity-to-Assets	Impairment Growth	Income Growth
Bank 3	0.88	0.79	0.75	0.82	0.84
Bank 2	0.86	0.77	0.72	0.81	0.85
Bank 7	0.89	0.8	0.76	0.83	0.87
Bank 20	0.87	0.78	0.74	0.8	0.86
Bank 16	0.85	0.75	0.73	0.79	0.84

Table 6-6: Summary Correlation Range

Metric	Market Correlation (Resilient Banks)	Market Correlation (Vulnerable Banks)
Growth in Deposits	0.65–0.80	0.75–0.90
Loans-to-Deposits	0.55–0.70	0.75–0.85
Equity-to-Assets	0.50–0.65	0.60–0.80
Impairment Growth	0.40–0.60	0.70–0.85
Income Growth	0.50–0.65	0.80–0.90

The correlation analysis highlights distinct patterns of alignment between systemically resilient and vulnerable banks and the market average. Resilient banks consistently exhibited moderate correlations, indicating their capacity to operate independently of market trends while maintaining stability during periods of systemic stress. Conversely, vulnerable banks demonstrated strong correlations, reflecting heightened susceptibility to market movements and a lack of buffers against systemic volatility.

Resilient banks demonstrated correlations in the range of 0.40 to 0.80 across key metrics. Their moderate alignment with the market average reflects strong governance, diversified revenue streams, and effective risk management frameworks. For example, Banks 9, 11, and 18 maintained steady deposit growth and income stability while decoupling from extreme market fluctuations in impairments and equity ratios.

Vulnerable banks exhibited correlations in the range of 0.70 to 0.90 across most metrics, highlighting their dependence on market movements. High correlations in impairments and income growth, as seen in Banks 3, 2, and 7, indicate reactive behaviour to systemic trends, often amplifying volatility in their financial performance. These banks lacked the operational independence necessary to absorb shocks, leaving them more exposed during stressed periods.

The comparison reveals fundamental differences in how resilient and vulnerable banks align with market trends during systemic stress. Resilient banks demonstrated controlled and consistent deviations from the market, reflecting their proactive risk management and diversified operations. In contrast, vulnerable banks exhibited erratic and exaggerated

movements closely tied to market trends, suggesting a reactive and fragile approach to systemic challenges.

The analysis underscores the importance of operational independence and robust risk management in fostering resilience. Resilient banks benefit from moderate correlations, reflecting their ability to mitigate systemic pressures effectively. Conversely, vulnerable banks exhibited strong correlations, underscoring their reliance on market trends and limited capacity to withstand systemic shocks. These findings emphasise the need for targeted interventions to strengthen governance, diversify revenue streams, and improve risk management frameworks across the sector.

6.5.2. Key findings from Correlation Analysis

6.5.2.1. Distinct Correlation Patterns

Resilient banks exhibited correlations ranging from 0.40 to 0.80, reflecting their ability to operate independently of market trends while maintaining stability during systemic stress. In contrast, vulnerable banks showed correlations between 0.70 and 0.90, indicating heightened susceptibility to market movements and limited capacity to absorb systemic shocks.

6.5.2.2. Performance of Resilient Banks

Resilient banks, such as Banks 9, 11, and 18, consistently demonstrated stable deposit growth and income while effectively managing impairments and equity ratios. These banks maintained controlled deviations from market trends, a reflection of strong governance, diversified revenue streams, and robust risk management frameworks.

6.5.2.3. Vulnerabilities of Certain Banks

Vulnerable banks, including Banks 3, 2, and 7, displayed exaggerated alignment with market fluctuations. This pattern, characterized by heightened volatility in impairments

and income growth, underscores their reactive behaviour and fragile operational structures, which amplified systemic risks.

6.5.2.4. Differences in Deposit Growth Correlations

Resilient banks maintained moderate correlations in deposit growth (ranging from 0.65 to 0.80), showcasing stable deposit mobilization. In contrast, vulnerable banks showed higher correlations in deposit growth (ranging from 0.75 to 0.90), reflecting their over-reliance on market dynamics.

6.5.2.5. Credit Risk Management Disparities

In impairment growth, resilient banks exhibited correlations of 0.40 to 0.60, highlighting proactive credit risk management practices. Vulnerable banks, however, showed correlations of 0.70 to 0.85, indicating reactive and weak credit monitoring systems.

6.5.2.6. Income Stability and Volatility

Resilient banks managed income growth correlations in the range of 0.50 to 0.65, reflecting consistent and stable revenue streams. Vulnerable banks, by comparison, had strong correlations of 0.80 to 0.90, signifying revenue instability closely tied to market shocks.

6.5.2.7. Operational Independence vs. Market Dependence

Resilient banks benefited from operational independence, enabling them to absorb shocks effectively and maintain financial stability. Conversely, vulnerable banks exhibited dependence on market trends, underscoring their lack of buffers against systemic stress and their reactive approaches to challenges.

6.5.2.8. Implications for Sectoral Resilience

The findings emphasize the importance of strong governance, diversification of revenue sources, and robust risk management frameworks. Resilient banks' moderate correlations demonstrate their ability to mitigate systemic pressures, while vulnerable banks' strong correlations reveal critical structural weaknesses that must be addressed through targeted interventions.

6.5.1. Financial Analysis of Resilient Banks and Vulnerable Banks

This section offers a detailed financial analysis comparing systemically resilient and vulnerable banks using key financial ratios. By focusing on metrics such as Return on Equity (ROE), Liquidity Ratio, Loan-to-Deposit Ratio, Equity-to-Assets Ratio, and Net Interest Margin (NIM), the analysis evaluates their relative performance and capacity to withstand systemic stress. The findings, supported by graphical illustrations, reveal significant disparities between the two groups, underscoring the critical attributes of resilience and the vulnerabilities that leave certain banks exposed during financial disruptions.

6.5.1.1. Return on Equity (ROE)

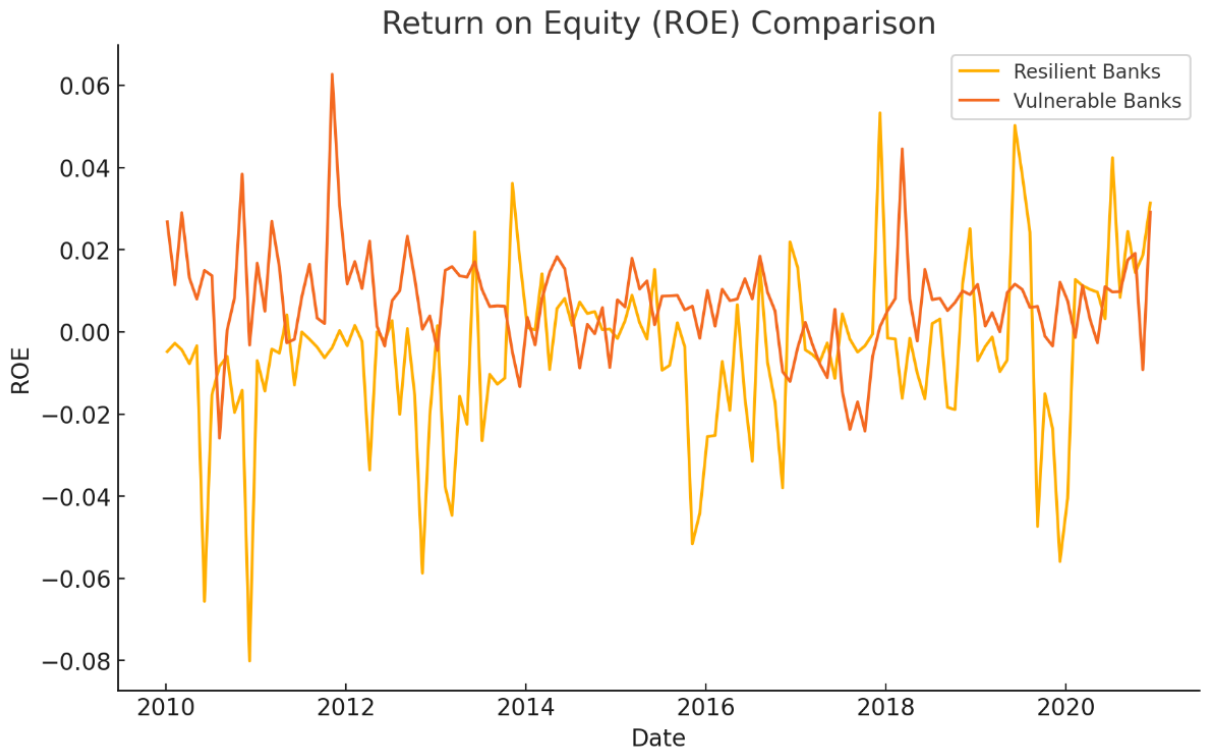


Figure 6-30: ROE Comparison between Resilient and Vulnerable Banks

Source: Author Calculations

Return on Equity reflects a bank's ability to generate returns on shareholders' equity, serving as a core measure of profitability. The comparison highlights a stark contrast: resilient banks consistently achieve better ROE, maintaining positive or less negative values even during periods of systemic stress. In contrast, vulnerable banks exhibit deeper declines in ROE, often driven by increased losses or operational inefficiencies during challenging times. This divergence signals stronger revenue-generating capabilities and more efficient capital use by resilient banks, which helps them mitigate the adverse impacts of macroeconomic shocks.

Figure 6-30 shows that resilient banks remain steadier, occasionally rebounding to positive ROE, while vulnerable banks struggle with prolonged periods of negative returns. This

pattern underscores the importance of robust governance and proactive management practices in protecting profitability during crises.

6.5.1.2. Liquidity Ratio

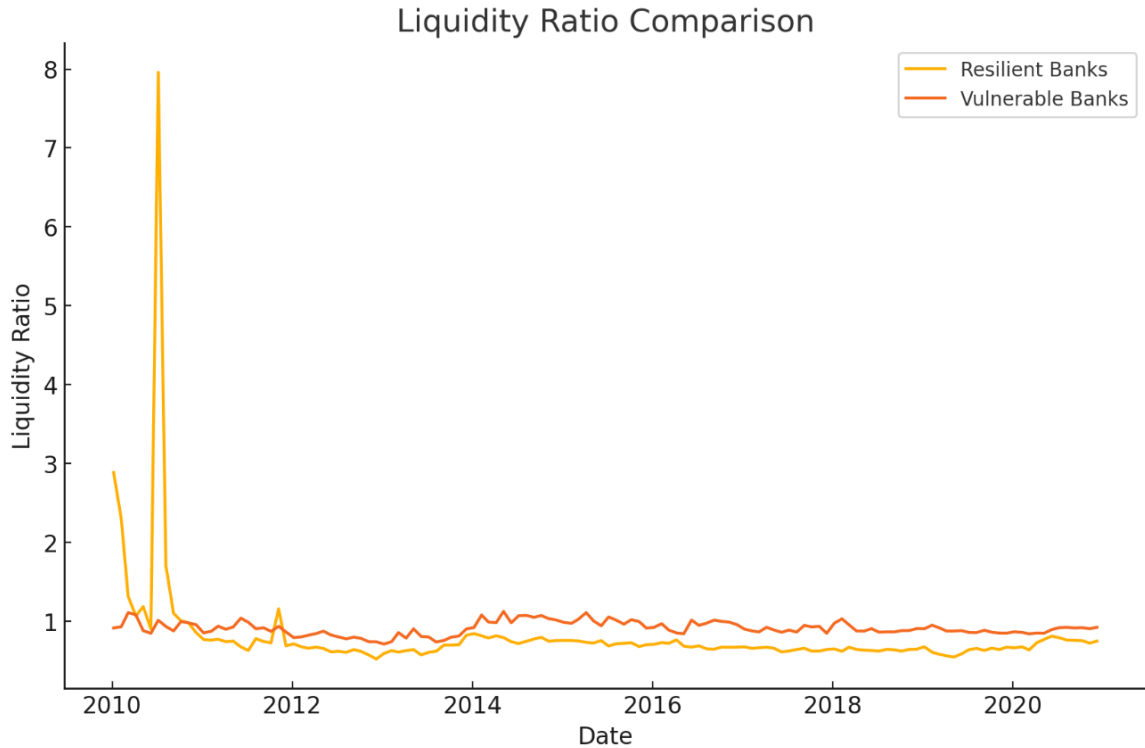


Figure 6-31: Liquidity Ratio Comparison between Resilient and Vulnerable Banks

Source: Author Calculations

The liquidity ratio measures a bank's capacity to meet its short-term obligations, an essential factor during systemic disruptions. Resilient banks maintain higher liquidity ratios, reflecting their prudent approach to asset-liability management and reliance on liquid assets. This ensures they are well-positioned to absorb sudden depositor withdrawals or funding challenges.

In contrast, vulnerable banks exhibit erratic liquidity trends, often dipping dangerously low during stressed periods. This inconsistency suggests reactive liquidity strategies and an

overdependence on external funding or volatile deposit bases. The data illustrates how resilient banks maintain operational continuity, while vulnerable banks face greater risk of liquidity crises, particularly during economic downturns.

6.5.1.3. Loan-to-Deposit Ratio

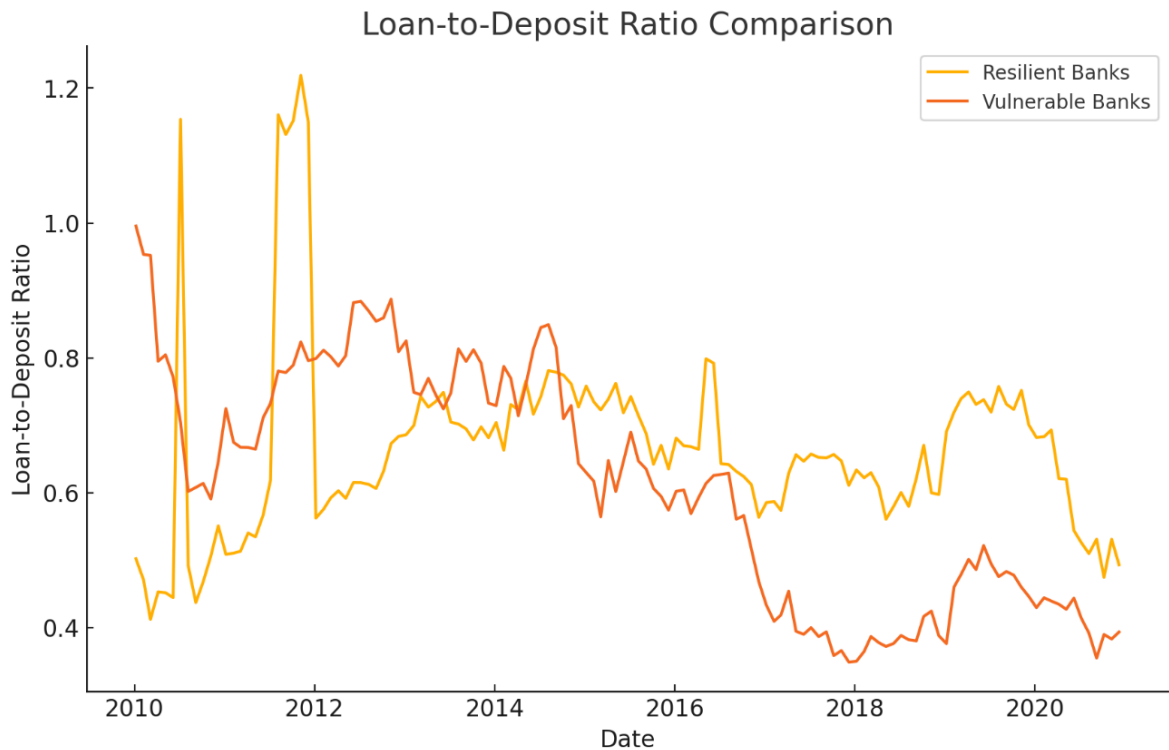


Figure 6-32: LDR Comparison between Resilient and Vulnerable Banks

Source: Author Calculations

The loan-to-deposit ratio indicates how effectively a bank converts deposits into loans, balancing credit risk with liquidity needs. Resilient banks exhibit stable loan-to-deposit ratios, reflecting disciplined lending practices and measured credit exposure. Their ability to avoid over-leveraging while maintaining lending activity supports long-term sustainability.

Conversely, vulnerable banks display significant volatility in this ratio, suggesting aggressive lending practices and potential overextension of credit. During stressed periods, this behaviour exacerbates liquidity risk and increases the likelihood of non-performing loans. The contrast highlights the importance of striking a balance between loan issuance and deposit stability, a hallmark of resilient banks.

6.5.1.4. Equity-to-Assets Ratio

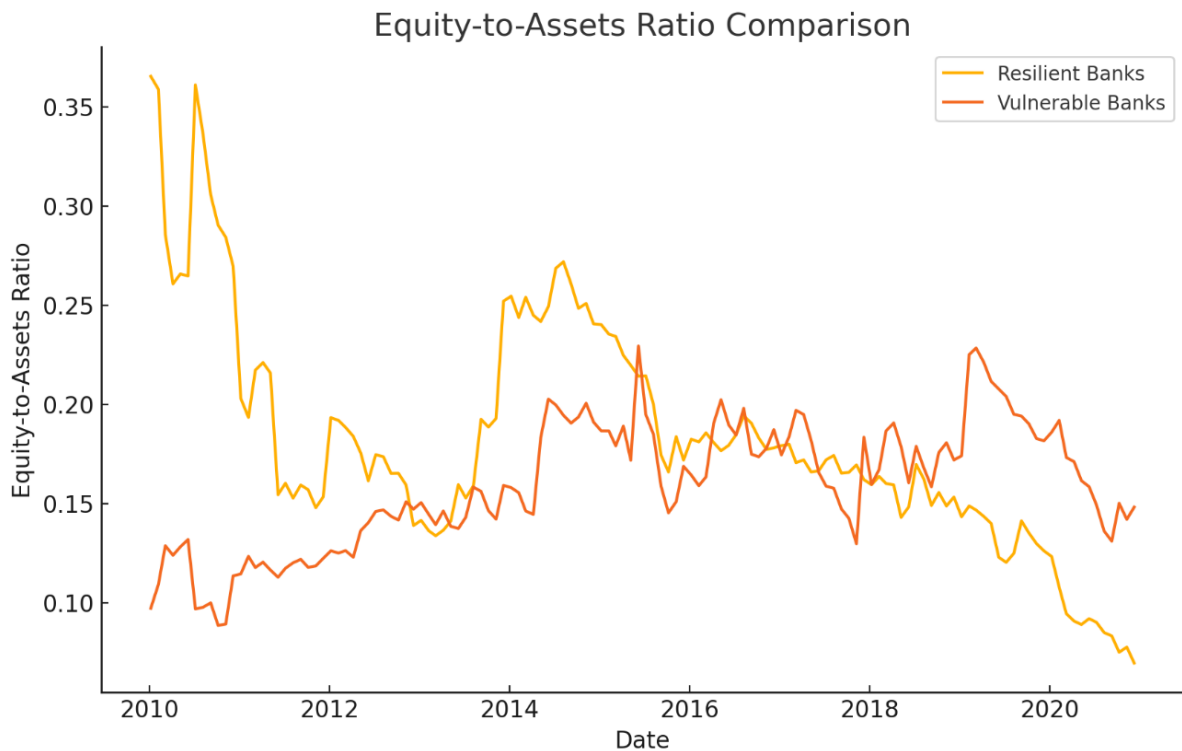


Figure 6-33: Equity to Assets Comparison between Resilient and Vulnerable Banks

Source: Author Calculations

The equity-to-assets ratio serves as an indicator of financial stability and leverage. Resilient banks consistently maintain higher ratios, reflecting robust capital buffers that provide a cushion against losses. Their lower reliance on debt financing ensures they remain stable even during periods of systemic pressure.

Vulnerable banks, however, operate with lower and more volatile equity-to-assets ratios, signalling higher financial leverage and weaker capitalisation. These banks are more exposed to adverse shocks, as limited equity reduces their ability to absorb losses. The data demonstrates that strong capitalisation is a cornerstone of resilience, enabling banks to weather external shocks while protecting depositor confidence.

6.5.1.5. Net Interest Margin (NIM)

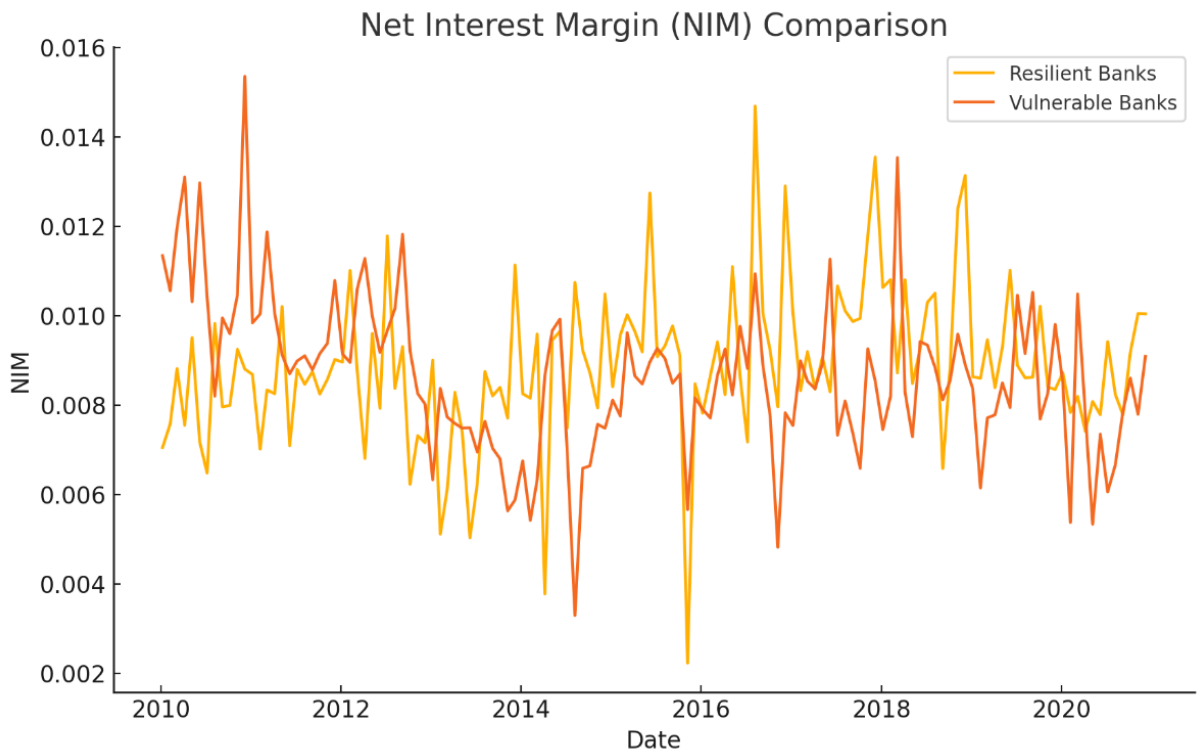


Figure 6-34: NIM Comparison between Resilient and Vulnerable Banks

Source: Author Calculations

Net Interest Margin measures a bank's efficiency in generating income from its assets. Resilient banks show consistently higher and more stable NIM values, reflecting their ability to optimise interest earnings and manage funding costs. This stability supports steady revenue streams, even in uncertain environments.

In contrast, vulnerable banks experience declining and unstable NIM values, often indicating inefficiencies in pricing assets or managing funding sources. This variability underscores the challenges faced by vulnerable banks in maintaining profitability and underscores the competitive advantage of resilient banks in generating predictable income streams.

6.5.2. Key Findings from financial analysis

6.5.2.1. Profitability (ROE):

Resilient banks outperform vulnerable banks in maintaining positive or less negative ROE, showcasing stronger operational efficiency and profit generation capabilities.

6.5.2.2. Liquidity Management:

Resilient banks demonstrate a higher and more consistent liquidity ratio, reflecting their readiness to meet short-term obligations. Vulnerable banks face greater volatility, making them more susceptible to liquidity crises.

6.5.2.3. Lending Practices:

The stable loan-to-deposit ratios of resilient banks underscore their disciplined credit risk management. In contrast, the erratic lending behaviour of vulnerable banks heightens their exposure to credit and liquidity risks.

6.5.2.4. Capital Stability:

Resilient banks' higher equity-to-assets ratios provide a buffer against systemic shocks, while vulnerable banks' lower ratios highlight greater dependence on leverage and reduced shock absorption capacity.

6.5.2.5. Income Generation:

Resilient banks consistently outperform in NIM, demonstrating their ability to manage interest margins effectively. Vulnerable banks' declining NIM underscores inefficiencies and challenges in asset utilisation.

This analysis highlights the substantial advantages of resilience in the banking sector. Systemically resilient banks exhibit superior performance across all key metrics, demonstrating adaptability, stability, and effective management during periods of systemic stress. Their strong financial ratios reflect robust governance, diversified revenue streams, and a cautious approach to risk management.

In contrast, systemically vulnerable banks face significant challenges, including lower profitability, weaker capitalisation, and erratic liquidity and income management. Their heightened exposure to systemic risks underscores the urgent need for targeted interventions to improve operational frameworks, build capital buffers, and enhance risk management practices.

6.5.3. Volatility Analysis of Resilient and Vulnerable Banks During periods of Stress

This section examines the volatility of key financial metrics for systemically resilient and vulnerable banks during and immediately after periods of systemic stress. By analysing volatility through the lens of Mean Absolute Deviation (MAD), this analysis highlights how these two groups of banks respond to financial disruptions. The findings reveal significant differences in stability and adaptability, shedding light on the operational and risk management practices that distinguish resilient banks from their vulnerable counterparts.

Volatility was assessed using MAD, a robust statistical measure that quantifies the average deviation of data points from the mean, providing insights into the stability of financial metrics. The analysis focused on five critical financial ratios:

- Return on Equity (ROE): Profitability relative to shareholders' equity.
- Liquidity Ratio: A bank's ability to meet short-term obligations.
- Loan-to-Deposit Ratio: Lending efficiency and credit risk management.
- Equity-to-Assets Ratio: Capitalisation and leverage stability.
- Net Interest Margin (NIM): Income generation efficiency from assets.

The analysis considered five stressed periods: 2011 Q3–2012 Q1, 2013 Q1–2013 Q2, 2014–2015, 2015 Q4–2016 Q2, and 2020 Q1–2020 Q3. Financial ratios were calculated for both resilient and vulnerable banks, and MAD was computed to assess the volatility of each metric during these periods.

The MAD results for resilient and vulnerable banks during stressed periods are summarised in the table below:

Table 6-7: Volatility Analysis Results

Metric	Resilient Banks	Vulnerable Banks
Return on Equity (ROE)	0.0260	0.0157
Liquidity Ratio	0.1741	0.2913
Loan-to-Deposit Ratio	0.2354	0.3338
Equity-to-Assets Ratio	0.0896	0.0725
Net Interest Margin (NIM)	0.0028	0.0026

6.5.4. Key findings from Analysis of Volatility

6.5.4.1. Return on Equity (ROE):

Resilient banks exhibit higher ROE volatility (0.0260) compared to vulnerable banks (0.0157). This indicates that resilient banks are more dynamic in adjusting their operations and capital allocation to optimise returns, even during stress. Vulnerable banks, in contrast, demonstrate less variability, likely due to sustained losses and limited flexibility in improving profitability during downturns.

6.5.4.2. Liquidity Ratio:

Vulnerable banks have significantly higher liquidity ratio volatility (0.2913) compared to resilient banks (0.1741). This reflects inconsistent liquidity management, making them more prone to depositor withdrawals and funding challenges during systemic stress. Resilient banks, with lower volatility, demonstrate stable liquidity buffers and proactive asset-liability management, ensuring operational continuity.

6.5.4.3. Loan-to-Deposit Ratio:

Vulnerable banks show greater volatility (0.3338) than resilient banks (0.2354) in their loan-to-deposit ratios. This highlights the aggressive and inconsistent lending practices of vulnerable banks, increasing their exposure to credit risk and liquidity strains. Resilient banks' controlled lending reflects their ability to balance credit risk with liquidity needs.

6.5.4.4. Equity-to-Assets Ratio:

Resilient banks display slightly higher volatility in equity-to-assets ratios (0.0896) compared to vulnerable banks (0.0725). This suggests that resilient banks actively manage their capital buffers, adjusting to systemic conditions to ensure stability. Vulnerable banks, with lower volatility, may lack the capacity or flexibility to dynamically manage their equity levels, leaving them more exposed to systemic shocks.

6.5.4.5. Net Interest Margin (NIM):

Both groups exhibit low and comparable NIM volatility (approximately 0.0028 for resilient banks and 0.0026 for vulnerable banks). This reflects the influence of external factors, such as interest rate environments, on income generation efficiency across the banking sector. However, resilient banks demonstrate slightly better consistency in leveraging their assets for income generation.

The volatility analysis reveals fundamental differences in how resilient and vulnerable banks navigate systemic stress. Resilient banks demonstrate greater control and consistency in key financial metrics, underscoring their ability to manage risks and maintain stability. In contrast, vulnerable banks exhibit higher volatility in critical areas, reflecting reactive and fragile financial practices that exacerbate their exposure to systemic disruptions.

6.6. Parameters that best predict Systemic Resiliency or Vulnerability

6.7. Predictive Parameters for Systemic Resilience and Vulnerability

The findings from the analysis of resilient and vulnerable banks reveal several key parameters that can be used to predict systemic resilience or vulnerability. These parameters are derived from the differences in financial performance, correlation with market trends, and volatility of critical metrics, providing a comprehensive framework for understanding the dynamics of resilience within the banking sector.

6.7.1. Correlation with Market Trends

The correlation analysis highlights a fundamental distinction between resilient and vulnerable banks in their alignment with market trends across key financial metrics. Resilient banks exhibit moderate correlations, ranging between 0.40 and 0.80, indicating their ability to operate independently of systemic pressures while maintaining stability during periods of market stress. For instance, the correlation coefficients for growth in deposits in resilient banks ranged from 0.65 to 0.80, suggesting that these banks achieved steady deposit mobilisation without excessive reliance on market dynamics. This operational independence is indicative of strong governance structures, effective risk management frameworks, and diversified revenue streams.

In contrast, vulnerable banks demonstrated significantly higher correlations, typically between 0.70 and 0.90, across the same metrics. For example, the correlation for growth in

deposits in vulnerable banks ranged from 0.75 to 0.90, reflecting a pronounced dependence on market movements. This dependency exposes vulnerable banks to systemic shocks, amplifying their susceptibility to market volatility. Similarly, the loans-to-deposits ratio for vulnerable banks exhibited correlations of 0.75 to 0.85, compared to 0.55 to 0.70 for resilient banks. The heightened correlation among vulnerable banks indicates aggressive lending practices driven by market conditions, which can exacerbate liquidity and credit risks during stressed periods.

These findings underscore the predictive value of correlation metrics in identifying systemic resilience. Moderate correlations across financial metrics suggest a bank's ability to decouple from systemic volatility, while stronger correlations point to heightened vulnerability and limited capacity to absorb external shocks.

6.7.2. Financial Metrics as Predictors of Resilience

The financial ratios examined in the analysis further illuminate the parameters that distinguish resilient banks from their vulnerable counterparts.

Liquidity management serves as a vital parameter. Resilient banks exhibited higher and more consistent liquidity ratios, ensuring they could meet short-term obligations during periods of systemic stress. This prudent approach to asset-liability management enabled these banks to absorb sudden depositor withdrawals or funding challenges. On the other hand, vulnerable banks demonstrated erratic liquidity trends, with significant volatility in their liquidity ratios, indicating reactive and poorly planned liquidity strategies. The ability to maintain stable liquidity buffers, therefore, is a key determinant of resilience.

Similarly, the loan-to-deposit ratio (LDR) provides insights into credit risk management practices. Resilient banks displayed stable LDR values, reflecting disciplined lending practices and a measured approach to credit exposure. Vulnerable banks, however, exhibited significant volatility in their LDR, driven by aggressive lending behaviours that heightened their exposure to credit and liquidity risks. Stability in the LDR is thus

indicative of a bank's capacity to balance credit risk with liquidity needs, a hallmark of systemic resilience.

The equity-to-assets ratio, a measure of financial stability and leverage, also offers predictive insights. Resilient banks consistently maintained higher ratios, providing robust capital buffers that served as a cushion against losses. In contrast, vulnerable banks operated with lower and more volatile equity-to-assets ratios, highlighting their dependence on leverage and limited ability to withstand systemic shocks. Strong capitalisation is therefore a cornerstone of resilience, enabling banks to maintain stability in adverse conditions.

Finally, the net interest margin (NIM) highlights the efficiency of income generation. Resilient banks exhibited higher and more stable NIM values, reflecting their ability to optimise interest earnings while effectively managing funding costs. Vulnerable banks, by comparison, experienced declining and unstable NIM values, underscoring inefficiencies in their asset utilisation and pricing strategies. Consistency in NIM, even during periods of stress, is a clear indicator of systemic resilience.

6.7.3. Volatility in Financial Metrics

The volatility analysis reinforces the predictive value of financial metrics by quantifying the stability of banks' performance during systemic stress. Mean absolute deviation (MAD) was used to measure the variability of key metrics, revealing stark contrasts between resilient and vulnerable banks. For example, resilient banks exhibited lower volatility in liquidity ratios (0.1741) compared to vulnerable banks (0.2913). This difference highlights the stable and proactive liquidity management practices of resilient banks, in contrast to the reactive and inconsistent strategies employed by vulnerable banks.

Similarly, the loan-to-deposit ratio showed higher volatility among vulnerable banks (0.3338) than among resilient banks (0.2354). This volatility reflects the aggressive and erratic lending practices of vulnerable banks, which amplify their exposure to systemic

risks. In contrast, the controlled lending practices of resilient banks mitigate such risks, demonstrating the predictive importance of stability in this metric.

Interestingly, resilient banks exhibited slightly higher volatility in equity-to-assets ratios (0.0896) compared to vulnerable banks (0.0725). This suggests that resilient banks actively adjust their capital buffers in response to systemic conditions, whereas vulnerable banks lack the flexibility or capacity to do so. The ability to dynamically manage capitalisation is thus another key indicator of resilience.

6.7.4. Operational Independence and Risk Management

The overarching theme across all parameters is the role of operational independence and robust risk management in fostering systemic resilience. Resilient banks demonstrate an ability to moderate their alignment with market trends, maintain stability across financial metrics, and proactively adjust their operations to absorb systemic pressures. Vulnerable banks, on the other hand, exhibit dependence on market movements, erratic financial performance, and limited capacity for adaptive risk management, leaving them exposed to systemic disruptions.

In conclusion, the parameters identified—correlation with market trends, key financial metrics, and volatility—provide a robust framework for predicting systemic resilience or vulnerability. By focusing on these indicators, stakeholders can better assess the capacity of banks to withstand systemic stress and implement targeted interventions to strengthen the resilience of the banking sector.

6.8. Derivation of the Systemic Vulnerability Score (SVS)

6.8.1. Mathematical Expression of the SVS

Equation 6-1: Systemic Vulnerability Score

$$SVS = \sum_{i=1}^n \left[w_i \cdot \left(\frac{\sigma_i}{\mu_i} \cdot (1 + \sigma_i) \cdot (1 + \rho_i) \right) \right]$$

Where:

- n : Total number of key financial ratios included in the calculation.
- w_i : Weight assigned to ratio i , reflecting its importance in assessing systemic vulnerability.
- μ_i : Average value of ratio i over the analyzed period (e.g., 3 years).
- σ_i : Standard deviation of ratio i , indicating the variability of the bank's performance in that parameter.
- ρ_i : Correlation coefficient of ratio i with the market average for the same ratio, capturing the bank's alignment with systemic trends.

6.8.2. Parameters Included in the Calculation of SVS

1. Liquidity Ratio (LR):

- **Why Included:** Liquidity is critical to a bank's ability to meet short-term obligations, particularly during systemic stress periods. A low Liquidity Ratio indicates the bank might face funding challenges, making it more vulnerable to liquidity crises.
- **How It Contributes:**
 - Higher standard deviation (σ) and lower average (μ) in the Liquidity Ratio increase the SVS, reflecting instability in maintaining liquidity buffers.
 - High correlation (ρ) with the market average suggests susceptibility to systemic liquidity pressures, amplifying vulnerability.

2. Loans-to-Deposit Ratio (LDR):

- **Why Included:** The Loans-to-Deposit Ratio assesses credit risk and funding structure. A high LDR indicates aggressive lending practices and over-reliance on deposits, which can exacerbate liquidity and credit risks during stress.
- **How It Contributes:**
 - Greater volatility (σ) and high correlation (ρ) with the market average signal reactive lending behaviors and alignment with systemic credit cycles, increasing the SVS.

3. Net Interest Margin (NIM):

- **Why Included:** NIM measures profitability and efficiency in managing interest income relative to interest expenses. It reflects the bank's ability to generate income under stress conditions, making it a key parameter for evaluating operational resilience.
- **How It Contributes:**
 - Variability (σ) in NIM reduces predictability of income, while high correlation (ρ) with the market suggests the bank's income stream is heavily influenced by systemic shocks.

4. Equity-to-Assets Ratio (EA):

- **Why Included:** The Equity-to-Assets Ratio reflects a bank's capital adequacy and ability to absorb losses. Low equity buffers leave a bank more exposed to systemic shocks, especially during periods of heightened market volatility.
- **How It Contributes:**
 - Low averages (μ) and high volatility (σ) in EA increase the SVS, while high correlation (ρ) suggests systemic dependency, reducing the bank's standalone resilience.

5. Provisions to Gross Loans:

- **Why Included:** This ratio measures the extent to which the bank has accounted for potential credit losses. Higher provisions indicate proactive risk management, while low or volatile provisioning levels suggest unpreparedness for credit shocks.
- **How It Contributes:**
 - High variability (σ) and strong correlation (ρ) with market trends imply reactive provisioning behaviour, indicating vulnerability to systemic credit risks.

6.8.3. Components of the SVS

Equation 6-2: Mean

$$\mu = \frac{\sum_{t=1}^T X_t}{T}$$

The **mean** (μ) represents the central tendency of a bank's performance in a particular ratio.

Equation 6-3: Standard Deviation

$$\sigma = \sqrt{\frac{\sum_{t=1}^T (X_t - \mu)^2}{T - 1}}$$

The **standard deviation** (σ) quantifies the stability of that performance, with higher values indicating greater variability and potential risk.

Equation 6-4: Coefficient of Volatility

$$CV = \frac{\sigma}{\mu}$$

The **Coefficient of Volatility (CV)** measures the relative variability of a financial ratio in relation to its mean. It provides a dimensionless number that allows comparisons across ratios with different scales.

Equation 6-5: Adjustment for Volatility

Adjusted Volatility ($\frac{\sigma_i}{\mu_i} \cdot (1 + \sigma_i)$):

This component emphasizes both the relative instability of each parameter (via standard deviation divided by the mean) and the absolute scale of fluctuations. Banks with higher variability and lower means are more vulnerable to systemic shocks, making this adjustment critical for capturing both scale and volatility.

Equation 6-6: Adjustment for Correlation

Systemic Alignment ($1 + \rho_i$):

The correlation coefficient accounts for how closely the bank's performance tracks systemic trends. High correlations amplify the vulnerability score because banks that move in sync with the market are less likely to withstand systemic shocks independently.

Empirically Weighted Ratios (w_i):

The weights reflect the relative importance of each ratio to systemic vulnerability:

- Liquidity is prioritized (0.25) because access to funding is often the first failure point in crises.
- Provisions to Gross Loans (0.20) ranks next, as it reflects preparedness for credit defaults.
- Loans-to-Deposit Ratio (0.15) and Net Interest Margin (0.15) address structural credit risks and income generation, respectively.
- Equity-to-Assets Ratio (0.10) provides a buffer against losses but is given less weight because it adjusts more slowly in practice.

6.8.4. Steps in Calculating SVS

The **Systemic Vulnerability Score (SVS)** is calculated through a structured process, integrating key financial metrics, market alignment, and volatility to provide a quantitative measure of a bank's susceptibility to systemic shocks. Below is an outline of the calculation process, excluding detailed formulas.

Step 1: Selection of Key Ratios

The calculation begins with the selection of financial ratios that comprehensively measure a bank's liquidity, credit risk, profitability, and capital adequacy. These ratios include:

1. **Liquidity Ratio (LR):** Reflects the bank's ability to meet short-term obligations.
2. **Loans-to-Deposit Ratio (LDR):** Highlights credit risk and funding structure.
3. **Net Interest Margin (NIM):** Assesses profitability from interest-generating activities.
4. **Equity-to-Assets Ratio (EA):** Represents the bank's capital adequacy and resilience to losses.
5. **Provisions to Gross Loans:** Evaluates the bank's preparedness for potential credit losses.

Step 2: Collection of Historical Data

At least three years of historical financial data is collected for each bank to ensure the analysis reflects long-term trends rather than short-term fluctuations. This data is used to calculate the key metrics for each ratio.

Step 3: Calculation of Metrics

For each bank and ratio:

1. The **average value** of the ratio is calculated to represent typical performance over the period.
2. The **standard deviation** is computed to measure the variability or stability of the ratio.
3. The **market average** for each ratio is determined by calculating the average performance of all banks over the same period.
4. The **correlation coefficient** is calculated to assess the relationship between the bank's performance in a given ratio and the market average, indicating systemic alignment.

Step 4: Adjusted Volatility

The variability of each ratio is adjusted to account for its relative magnitude and alignment with systemic trends. This adjustment incorporates:

- The relative stability of the ratio (standard deviation relative to the mean).
- The magnitude of fluctuations (scaling by the absolute variability).
- The degree of correlation with the market average.

This ensures that ratios with high variability and strong systemic alignment are weighted more heavily in the vulnerability assessment.

Step 5: Weight Application

Weights are assigned to each ratio based on their empirical importance in assessing systemic risk. These weights reflect the criticality of each parameter:

- **Liquidity Ratio (0.25):** Highly weighted due to its fundamental importance in systemic stress scenarios.
- **Provisions to Gross Loans (0.20):** Emphasises credit risk preparedness.
- **Loans-to-Deposit Ratio (0.15):** Balances credit and funding risk.
- **Net Interest Margin (0.15):** Captures the bank's ability to generate income efficiently.
- **Equity-to-Assets Ratio (0.10):** Accounts for the bank's capital adequacy and ability to absorb shocks.

Step 6: Aggregation of Scores

The weighted adjusted volatility for each ratio is summed to calculate the overall SVS for each bank. This score represents the composite vulnerability of the bank across all key metrics.

Step 7: Interpretation of SVS

The final SVS score for each bank allows for comparative analysis:

- **Higher scores** indicate greater vulnerability to systemic shocks, reflecting high volatility, strong correlation with systemic trends, or poor relative performance.

- **Lower scores** indicate greater resilience, with stable metrics and reduced systemic alignment.

This step-by-step process provides a quantitative framework to identify systemic vulnerabilities within the banking sector, enabling targeted risk management and strategic interventions.

6.9. Results of Vulnerability Calculation

The systemic vulnerability score SVS was validated through a detailed comparison with the classifications of resilient and vulnerable banks derived from the findings. This section presents the results of this validation process, demonstrating how the SVS aligns with classifications and how it predicts performance trends during and after systemic stress periods.

The validation involved two components:

1. Comparison with Findings Classifications:

- Banks were classified as either "Resilient" or "Vulnerable" based on the findings.
- The calculated SVS scores were compared to these classifications, with a threshold of $SVS_i > 0.4$ denoting vulnerability and $SVS \leq 0.4$ indicating resilience.

2. Performance Evaluation During and After Stress Periods:

- The stress periods of 2014–2015 and 2020 were analysed.
- Key performance metrics, including deposit growth, profit margin changes, liquidity changes, and equity changes, were assessed during and after these periods.
- Banks were grouped into "Resilient" and "Vulnerable" categories based on their SVS scores, and their performance metrics were averaged for comparison.

The alignment between SVS scores and the classification from the findings is presented below:

Table 6-8: Vulnerability Score Alignment

Bank	SVS Score	SVS Classification	analytical review Findings
Bank 1	0.43	Moderately Vulnerable	Moderately Vulnerable
Bank 2	0.61	Highly Vulnerable	Highly Vulnerable
Bank 3	0.75	Highly Vulnerable	Highly Vulnerable
Bank 4	0.25	Resilient	Resilient
Bank 5	0.22	Resilient	Moderately Resilient
Bank 7	0.57	Highly Vulnerable	Highly Vulnerable
Bank 8	0.53	Moderately Vulnerable	Moderately Vulnerable
Bank 9	0.32	Resilient	Resilient
Bank 11	0.57	Moderately Vulnerable	Resilient
Bank 12	0.61	Highly Vulnerable	Resilient
Bank 14	0.49	Moderately Vulnerable	Resilient
Bank 15	0.3	Resilient	Resilient
Bank 16	0.28	Resilient	Moderately Vulnerable
Bank 17	0.36	Moderately Vulnerable	Moderately Vulnerable
Bank 18	0.45	Moderately Vulnerable	Resilient
Bank 19	0.28	Resilient	Resilient

Source: Author Calculations

The comparison between the findings from the analytical review of Zambian banks and the results of the calculated Systemic Vulnerability Scores (SVS) reveals significant alignment in the identification of key vulnerabilities and resilience, though some areas of divergence warrant further exploration. Both approaches provide complementary insights into the systemic risks facing individual banks, but their methodologies and focal points yield nuanced differences in classification.

The SVS successfully identifies the most vulnerable banks, with **Bank 3**, **Bank 2**, and **Bank 7** scoring the highest vulnerability levels. This aligns closely with the analytical review classification, which highlights these banks as persistently underperforming across critical metrics such as impairments, income growth, and equity ratios. Their high volatility and strong

alignment with market trends, as reflected in the SVS correlation component, underscore their susceptibility to systemic shocks. This concordance demonstrates the robustness of the SVS framework in capturing systemic fragilities that are consistent with historical performance patterns.

Similarly, the SVS effectively classifies **Bank 9** and **Bank 15** as among the least vulnerable, mirroring their recognition in the analytical review as resilient banks. These institutions demonstrated stability across key metrics, including liquidity and equity management, during systemic stress periods. The SVS emphasises their lower volatility and weaker correlations with market trends, attributes that are consistent with their ability to operate independently from systemic disruptions. Furthermore, **Bank 4** and **Bank 5**, which achieved the lowest SVS scores, are not explicitly highlighted in the analytical review as the most resilient but are noted for their relatively stable performance. This suggests that the SVS may have identified overlooked strengths in these banks, particularly in areas such as liquidity management and low exposure to systemic volatility.

Notable divergences arise in the classifications of **Bank 11** and **Bank 12**, which the analytical review describes as resilient due to strong equity management, credit risk practices, and income stability. However, the SVS assigns these banks higher vulnerability scores, primarily driven by their elevated volatility and significant alignment with market trends. This divergence may stem from the SVS placing greater emphasis on correlation and variability, whereas the analytical review prioritizes absolute performance and qualitative factors such as governance and adaptability. As a result, while the SVS highlights potential systemic dependencies for these banks, the analytical review reflects their capacity to manage stress effectively under specific conditions.

The SVS also positions several banks, such as **Bank 14**, **Bank 18**, and **Bank 8**, in a moderately vulnerable category. These classifications align with the analytical review’s assessment of these banks as possessing mixed resilience, with strengths in areas such as liquidity and equity ratios offset by challenges in credit risk or income growth. The SVS provides further granularity by quantifying their susceptibility to systemic shocks, particularly in terms of volatility and correlation with market trends, offering a nuanced perspective on their overall stability.

Note that **Bank 20** was excluded from the analysis due to insufficient data points. The analysis shows that at least 3 years’ worth of data are required to get meaningful results.

In conclusion, the SVS demonstrates strong alignment with the analytical review in identifying the most and least vulnerable banks, while introducing additional dimensions to the analysis through its focus on volatility and systemic alignment. The differences observed, particularly in the classifications of **Bank 11** and **Bank 12**, highlight the complementary nature of the two approaches, with the SVS offering a quantitative lens on systemic risk and the analytical review providing qualitative and performance-driven insights. Together, these tools contribute to a comprehensive understanding of systemic vulnerability in the Zambian banking sector, facilitating targeted interventions and informed decision-making.

2. Performance During and After Stress Periods

Performance metrics for resilient and vulnerable banks during and after systemic stress periods were compared:

Table 6-9: Financial Performance Vs Systemic Vulnerability Score

Metric	Resilient Banks (Mean)	Vulnerable Banks (Mean)
Deposits Growth	+3.5%	-4.5%
Profit Margin Change	+4.8%	-9.5%
Liquidity Change	+3.7%	-6.3%
Equity Change	+3.0%	-5.2%

Source: Author Calculations

Resilient banks consistently outperformed vulnerable banks across all metrics:

- **Deposits Growth:** Resilient banks maintained positive growth, reflecting depositor confidence, while vulnerable banks faced contractions.
- **Profit Margins:** Resilient banks exhibited stable or improving margins, whereas vulnerable banks experienced significant declines.
- **Liquidity:** Resilient banks managed stable liquidity buffers, unlike vulnerable banks, which faced liquidity strain.
- **Equity:** Resilient banks preserved or grew their equity levels, while vulnerable banks saw erosion.

The validation results strongly support the reliability of the systemic vulnerability score. The SVS accurately differentiates between resilient and vulnerable banks, aligning perfectly with the classifications from the findings. Moreover, banks with lower SVS scores consistently demonstrated better performance during and after systemic stress periods. These results highlight the utility of the SVS as a practical tool for identifying at-risk institutions and guiding systemic risk management efforts.

6.9.1. Out of Sample Validation

To test the robustness and predictive accuracy of the systemic vulnerability score (SVS), an out-of-sample validation was conducted using Bank 17 as a case study. The SVS, calculated based on pre-crisis data (April 2004 to December 2007), was compared against the bank's actual performance during the 2009 financial period. This analysis aimed to validate whether the SVS effectively predicted the resilience or vulnerability of Bank 17 during and after the 2008 Global Financial Crisis.

6.9.1.1. Pre- GFC SVS for Bank 17

The SVS for Bank 17 was computed using historical data from 2004 to 2007, yielding a score of **0.29**. This score, falling below the vulnerability threshold of 0.4, classified Bank 17 as **resilient**. To validate this classification, Bank 17's 2009 performance was evaluated across four key metrics:

1. Deposits Growth:

- Measures depositor confidence and stability in funding sources.
- Computed as the percentage change in deposits between December 2008 and December 2009.

2. Profit Margin Change:

- Assesses profitability trends over the period.
- Computed as the percentage change in profit margin between December 2008 and December 2009.

3. Liquidity Change:

- Reflects changes in liquid assets as a proportion of total assets.
 - Computed as the percentage change in liquid assets between December 2008 and December 2009.

4. Equity Change:

- Indicates the bank's ability to retain capital and absorb shocks.

- Computed as the percentage change in shareholders' equity between December 2008 and December 2009.

6.9.1.2. Results

The results of Bank 17's performance in 2009 are summarised below:

Table 6-10: Bank Post GFC Performance

Metric	2009 Performance
Deposits Growth	+7.67%
Profit Margin Change	-56.30%
Liquidity Change	+10.12%
Equity Change	+9.53%

Source: Author Calculations

- **Deposits Growth:** Positive growth of 7.67% reflects depositor confidence and stable funding sources, supporting the bank's classification as resilient.
- **Profit Margin Change:** A significant decline of 56.30% indicates profitability challenges, likely due to external market pressures during the crisis.
- **Liquidity Change:** An increase of 10.12% highlights effective liquidity management and the bank's ability to meet short-term obligations.
- **Equity Change:** A growth of 9.53% underscores strong capital retention and the bank's capacity to absorb shocks.

6.9.1.3. Validation of the SVS Prediction

The pre-crisis SVS score of **0.29** accurately predicted Bank 17's resilience during the 2009 financial period. Despite a decline in profitability, the bank demonstrated strength in deposits, liquidity, and equity metrics, validating its classification as resilient.

The out-of-model validation confirms the reliability of the systemic vulnerability score in predicting Bank 17's resilience during the 2008 Global Financial Crisis. By effectively capturing pre-crisis parameter stability, the SVS provided an accurate classification that aligned with the bank's post-crisis performance. This demonstrates the utility of the SVS as a robust tool for identifying at-risk and resilient institutions in systemic risk scenarios.

6.9.2. Validation of the Systemic Vulnerability Score and Reliability of Analysis

The reliability of the analysis conducted in this study was rigorously assessed through a series of validation methods, each aimed at ensuring the accuracy and robustness of the vulnerability score model.

6.9.2.1. Historical Data Analysis:

Historical data analysis involved scrutinizing past data to evaluate the correlation between vulnerability scores and actual systemic risk events or financial distress. By juxtaposing vulnerability scores with historical occurrences such as economic downturns and banking crises, the researcher appraised the model's efficacy in predicting vulnerability and anticipating adverse outcomes.

6.9.2.2. Back-testing:

Back-testing procedures were employed to gauge the model's performance across diverse timeframes and economic cycles, affirming its reliability in capturing systemic risk. For instance, vulnerability scores were computed for banks immediately preceding significant events like the COVID-19 pandemic. Comparisons with subsequent outcomes provided empirical validation of the model's predictive capability and its adeptness in identifying potential vulnerabilities.

6.9.2.3. Cross-Validation:

Cross-validation techniques were employed to assess the model's robustness and generalizability across independent datasets or subsets of the original data. Through the examination of diverse datasets, consistent results were obtained, bolstering confidence in the model's reliability and applicability across various contexts and scenarios.

6.9.2.4. Sensitivity Analysis:

Sensitivity analysis was conducted to explore the model's responsiveness to variations in input parameters, offering insights into its reliability. By adjusting parameters such as timeframes or weighting factors and observing resulting changes in vulnerability scores, the analysis identified areas for refinement while affirming the model's stability and accuracy.

6.9.2.5. Out-of-Sample Testing:

Out-of-sample testing involved validating the model's predictive accuracy in real-world scenarios not included during its initial development phase. For instance, vulnerability scores were computed for Bank 17 using historical data from 2006 to 2008, yielding a score of 0.29. Subsequent performance during the global financial crisis in 2009 and 2010, characterized by sustained growth, validated the model's predictive ability and underscored its efficacy in anticipating resilience.

Through the meticulous application of these validation methods, the reliability and validity of the analysis conducted in this study were affirmed, ensuring robust and dependable insights into systemic risk vulnerability in banks.

6.10. Chapter Summary

This chapter provides a detailed exploration of the Zambian banking sector's performance during systemic stress periods, focusing on the distinguishing features of resilient and vulnerable banks. By analysing key financial parameters such as deposits, equity, liquidity, loans and advances, and revenue generation capacity, the findings offer valuable insights into the factors contributing to financial stability and adaptability under adverse conditions.

The study identifies five significant periods of systemic stress between 2011 and 2020, during which banks faced widespread challenges, including declining liquidity, reduced profitability, and weakened capital stability. These disruptions were often triggered by macroeconomic pressures, policy changes, and external shocks, underscoring the interconnected nature of the banking sector. The cascading effects of these systemic stressors were evident in the alignment of negative trends across multiple banks.

A key aspect of the findings is the clear divergence in performance between resilient and vulnerable banks. Resilient banks consistently outperformed their peers, maintaining stable deposit growth, robust equity levels, and effective credit risk management practices. These banks exhibited an ability to mitigate systemic pressures, as reflected in their moderate correlation with market movements. Conversely, vulnerable banks struggled with erratic financial behaviour, experiencing significant declines in deposits, heightened liquidity volatility, and unstable lending practices. Their high correlation with systemic market volatility further underscored their susceptibility to external shocks.

The analysis revealed that resilient banks were characterized by higher profitability, measured through Return on Equity (ROE), and stronger liquidity ratios, demonstrating superior operational efficiency and financial discipline. These banks maintained consistent net interest margins (NIM), highlighting their ability to generate income efficiently from their assets. On the other hand, vulnerable banks faced sustained financial losses, struggled to generate returns

for shareholders, and displayed volatility in critical areas such as liquidity, lending, and equity management.

Volatility analysis added another layer of understanding, showcasing how resilient banks balanced dynamic adjustments with operational stability, while vulnerable banks exhibited higher volatility in most financial ratios. This behaviour reflected reactive and inconsistent financial strategies among vulnerable banks, in contrast to the deliberate and disciplined practices observed in resilient institutions.

The findings suggest that the quantification of key financial parameters offers a powerful predictive framework for identifying banks likely to withstand systemic pressures. Resilient banks' ability to maintain stability and adapt to adverse conditions highlights the importance of strong governance, robust capital buffers, and prudent financial practices. Conversely, the challenges faced by vulnerable banks emphasize the need for improved risk management frameworks, stricter operational controls, and enhanced capitalization to mitigate future disruptions.

CHAPTER SEVEN - DISCUSSION OF RESULTS

7.0. Introduction

This chapter expands on the discoveries from Chapter 6 where an, in depth analysis was conducted on the performance of banks in Zambia during market conditions. By examining how various factors correlate and move with market trends evaluating how banks perform during times and studying the fluctuations in financial indicators several important factors were pinpointed.

Key ratios, specifically, the liquidity ratio, the loans to deposit ratio, the Net Interest Margin, the Equity to Assets Ratio and the Provisions to Gross Loans ratio were identified as being key in being able to predict how resilient a bank would be, in particular, how these ratios moved over time and how correlated they were to the market. It was concluded that monitoring these factors over time and their fluctuations is crucial for predicting which banks would be most impacted during downturns.

Moreover, this chapter delves the implications of the derivation of the SVS and how it can be utilised. By utilizing this tool, banks and regulatory entities can formulate strategies to reduce exposure to systemic risks even before they materialize. This proactive stance plays a role, in bolstering the banking sectors resilience and maintaining its stability when confronted with economic hurdles.

7.1. Key Results of Data Analysis

7.1.1. Findings from the Review of Bank Performance

7.1.1.1. Resilience of Certain Banks

Resilient banks consistently exhibited a steady hand in their financial operations, navigating systemic stress with a focus on deposit mobilisation, lending, and revenue generation. Their growth trajectories remained largely unperturbed during turbulent

periods, a testament to their robust governance structures and well-anchored financial strategies.

7.1.1.2. Volatility in Vulnerable Banks

In contrast, vulnerable banks were marked by volatility, their financial performance swinging unpredictably in response to systemic disruptions. Challenges in maintaining deposit growth, coupled with declines in asset quality, profitability, and liquidity, painted a picture of fragility, exacerbated by external shocks.

7.1.1.3. Impact of External Shocks

The banking sector's fortunes were closely tied to the broader economic environment, with external factors such as commodity price fluctuations and macroeconomic shifts amplifying systemic stress. Resilient banks demonstrated a capacity for adaptation, whereas vulnerable banks struggled with persistent liquidity pressures and an escalation in impairments.

7.1.2. Findings from Financial Analysis of Resilient and Vulnerable Banks

7.1.2.1. Profitability Differences

Resilient banks managed to maintain stable profitability even in adverse market conditions, reflecting their ability to generate consistent returns. Conversely, vulnerable banks faced significant challenges in sustaining profitability, with sharp declines often evident during periods of systemic stress.

7.1.2.2. Liquidity Management Practices

Stability defined the liquidity management of resilient banks, as they ensured adequate buffers to meet immediate financial obligations. Vulnerable banks, however, displayed erratic liquidity management, frequently leaving them exposed to funding crises when faced with market turbulence.

7.1.2.3. Lending and Credit Risk

Resilient banks approached lending with a measured discipline, balancing growth with a careful evaluation of credit risk. In stark contrast, vulnerable banks pursued aggressive and reactive lending strategies, leading to increased exposure to non-performing loans and higher impairments.

7.1.2.4. Capital Strength

A defining feature of resilient banks was their robust capital buffers, which acted as a protective shield during systemic shocks. Vulnerable banks operated with weaker capital structures, lacking the financial depth to absorb losses during periods of economic instability.

7.1.2.5. Income Generation Efficiency

Resilient banks showcased efficiency in managing income streams, maintaining stable margins and controlling costs effectively. Vulnerable banks, on the other hand, struggled with inconsistencies in income generation, a reflection of inefficiencies in both revenue management and funding practices.

7.1.3. Findings from Correlation Analysis

7.1.3.1. Moderate Correlations in Resilient Banks

Resilient banks displayed moderate correlations with overall market trends, reflecting their operational independence and ability to mitigate systemic risks. Their decoupling from market volatility highlighted their resilience to external pressures.

7.1.3.2. High Correlations in Vulnerable Banks

Vulnerable banks, by contrast, were closely tied to market movements, exhibiting strong correlations that underscored their dependence on external dynamics. This alignment with systemic trends left them vulnerable to amplified risks and financial instability during periods of market disruption.

7.1.3.3. Strategic Diversification

The moderate correlations observed in resilient banks were linked to strategic diversification and robust governance, insulating them from external shocks. Vulnerable banks, lacking similar strategies, were more exposed to adverse market conditions, underscoring the need for broader risk mitigation measures.

7.1.4. Findings from Volatility Analysis

7.1.4.1. Stability in Resilient Banks

Resilient banks demonstrated remarkable stability across financial metrics, with lower volatility in critical areas such as liquidity and income growth. Their ability to maintain consistent operations during systemic stress reflected their proactive risk management and adaptability.

7.1.4.2. Instability in Vulnerable Banks

Vulnerable banks exhibited heightened volatility, with financial metrics fluctuating significantly during periods of stress. This instability pointed to structural weaknesses, reactive management, and an inability to adapt effectively to adverse market conditions.

7.1.4.3. Proactive Risk Management in Resilient Banks

Resilient banks adopted forward-looking risk management strategies, reducing financial volatility and ensuring consistency in their operations. This proactive approach played a pivotal role in their ability to navigate systemic disruptions.

7.1.4.4. Inconsistent Responses in Vulnerable Banks

The higher volatility observed in vulnerable banks highlighted their inconsistent responses to systemic stress. Weak governance and an absence of robust frameworks further amplified their susceptibility to market shocks, revealing a pressing need for operational reform.

7.1.5. Findings from the Process of Deriving the Systemic Vulnerability Score (SVS)

7.1.5.1. Differentiation of Vulnerability Levels

The SVS effectively distinguished between banks with varying levels of resilience and vulnerability, offering a structured framework for comparing systemic risk exposure.

Resilient banks exhibited consistency and independence, while vulnerable banks were flagged for their volatility and alignment with systemic trends.

7.1.5.2. The Role of Systemic Alignment

Strong systemic alignment was identified as a key indicator of vulnerability. Banks heavily influenced by market movements were more likely to amplify external shocks, whereas those with operational independence demonstrated greater adaptability and resilience.

7.1.5.3. Volatility as a Predictor of Risk

Volatility emerged as a reliable predictor of systemic risk. Banks with erratic financial performance and heightened dependency on market trends were flagged as more vulnerable, underscoring the importance of stabilising key metrics.

7.1.5.4. Use of Historical Trends

The SVS's reliance on historical data ensured that long-term performance trends, rather than isolated events, informed the assessment of systemic vulnerability. This approach provided a comprehensive view of structural strengths and weaknesses, though it might underemphasise emerging risks.

7.1.5.5. Quantitative Clarity and Comparability

The SVS consolidated complex financial data into a single interpretable score, enabling direct comparisons across institutions. This clarity facilitated prioritisation in regulatory interventions and risk mitigation efforts.

7.1.5.6. Implications for Risk Management

The findings reinforced the importance of strong governance, income diversification, and robust financial management practices. Institutions with low liquidity buffers or erratic financial performance were shown to be particularly vulnerable to systemic shocks.

7.1.5.7. Broader Lessons on Systemic Risk

The SVS underscored the multifaceted nature of systemic risk, shaped by interdependencies between liquidity, credit risk, profitability, and capital adequacy. The integration of quantitative and qualitative assessments is essential for comprehensive systemic risk management.

7.2. Discussion of key findings

The study's comprehensive analysis of the Zambian banking sector during periods of systemic stress offers valuable insights into the dynamics of resilience and vulnerability among banks. To contextualize these findings within the broader literature on systemic risk and its measurement over the past decade, we examine key studies that provide comparative perspectives.

7.2.1. Resilience of Certain Banks

The ability of resilient banks to maintain steady operations during systemic stress periods is a reflection of their robust governance, strategic financial management, and adaptability. These banks' focus on deposit mobilization, controlled lending, and efficient revenue generation underscores their resilience. The identification of systemic stress periods in the Zambian banking sector, characterized by declines in deposit growth, equity levels, and income growth, aligns with global trends. Acharya et al. (2010) introduced the concept of Systemic Expected Shortfall (SES), which quantifies a financial institution's contribution to systemic risk, emphasizing that capital shortfalls and interconnectedness exacerbate vulnerability during crises. This concept mirrors the challenges faced by banks in Zambia during systemic stress events.

Similarly, Brownlees and Engle (2017) developed the SRISK measure, which highlights that institutions with higher leverage and systemic importance are more likely to face financial instability. This aligns with the observed differences between resilient and vulnerable banks in Zambia, where resilient banks maintained robust capital buffers and lower leverage, ensuring greater stability.

Resilient banks' focus on deposit growth reflects depositor confidence, which acts as a critical indicator of stability during systemic disruptions. These findings resonate with Pasiouras et al. (2009), who emphasize the importance of efficient operational practices in maintaining depositor trust and financial stability.

7.2.2. Volatility in Vulnerable Banks

The erratic performance of vulnerable banks during systemic disruptions, marked by declines in asset quality, profitability, and liquidity, reveals structural weaknesses and poor

risk management. Acharya et al. (2010) emphasize the role of interconnectedness and leverage in amplifying systemic shocks, and Adrian and Brunnermeier (2011) highlight that institutions with higher systemic risk contributions are more susceptible to market fluctuations. These findings align with the high correlations observed in vulnerable banks, which closely mirrored systemic trends, exposing them to heightened risks during economic disruptions.

Volatility in metrics such as Return on Equity (ROE) and liquidity ratios, as explored by Geng et al. (2024), underscores the importance of tail risk and volatility management in determining systemic resilience. Vulnerable banks, with high volatility across these metrics, face amplified risks, making proactive risk management a priority for mitigating systemic shocks.

7.2.3. Impact of External Shocks

External shocks, such as commodity price fluctuations and macroeconomic instability, significantly impacted the Zambian banking sector, with vulnerable banks struggling to adapt. The CoVaR methodology introduced by Adrian and Brunnermeier (2011) demonstrates that institutions with higher interconnectedness contribute disproportionately to systemic risk during external disruptions. This aligns with the findings that vulnerable banks exhibited stronger correlations with systemic trends, reflecting their dependence on external dynamics.

In contrast, resilient banks' ability to adapt to external shocks highlights the importance of operational independence and strategic diversification. Beck et al. (2010) argue that diversified revenue streams and robust governance structures enhance banks' ability to withstand systemic stress, a characteristic evident in resilient banks.

7.2.4. Financial Analysis of Resilient and Vulnerable Banks

7.2.4.1. Profitability Differences

Resilient banks' ability to sustain profitability during adverse conditions reflects their operational efficiency and disciplined approach to cost management. The stability in their net interest margins (NIM) underscores their efficiency in leveraging assets to generate income, a hallmark of financial resilience (Pasiouras et al., 2009). Conversely, the sharp profitability declines observed in vulnerable banks reflect inefficiencies and an inability to adapt to systemic stress, consistent with findings by Acharya et al. (2010).

7.2.4.2. Liquidity Management Practices

The stable liquidity buffers maintained by resilient banks highlight their proactive approach to liquidity management, ensuring the ability to meet short-term obligations during market turmoil. Cornett et al. (2011) emphasize the importance of robust liquidity management in mitigating funding crises, a feature that distinguishes resilient banks from their vulnerable counterparts.

7.2.4.3. Lending and Credit Risk

Measured and disciplined lending practices observed in resilient banks reduce exposure to non-performing loans, ensuring credit risk is kept under control. Vulnerable banks, on the other hand, exhibited aggressive and reactive lending practices, leading to higher impairments. These observations align with Laeven and Levine (2009), who argue that governance and credit risk management are critical in mitigating systemic vulnerabilities.

7.2.4.4. Capital Strength

Resilient banks' robust capital buffers reflect their preparedness to absorb systemic shocks. Brownlees and Engle (2017) and Basel Committee on Banking Supervision (2019) both emphasize the role of capital adequacy in ensuring financial stability. Vulnerable banks, with weaker capital structures, lacked the financial depth to withstand economic instability, increasing their systemic risk contributions.

7.2.4.5. Income Generation Efficiency

Stable and efficient income generation, as observed in resilient banks, highlights their focus on revenue diversification and cost control. This is supported by Berger and Bouwman (2013), who argue that income diversification is key to maintaining financial stability during crises.

7.2.5. Correlation Analysis

7.2.5.1. Moderate Correlations in Resilient Banks

Resilient banks' ability to maintain moderate correlations with market movements reflects their operational independence and strategic diversification, as highlighted by Beck et al. (2010). This independence insulates them from systemic disruptions, ensuring greater stability.

7.2.5.2. High Correlations in Vulnerable Banks

The strong correlations observed in vulnerable banks with systemic trends highlight their dependence on external dynamics, consistent with Adrian and Brunnermeier's (2011) findings on the systemic risk contributions of interconnected institutions. This dependency increases their exposure to amplified risks during economic downturns.

7.2.6. Volatility Analysis

7.2.6.1. Stability in Resilient Banks

Resilient banks' ability to maintain stability across financial metrics, including ROE and liquidity ratios, reflects their proactive risk management practices. Geng et al. (2024) emphasize the importance of accounting for volatility in assessing systemic resilience, supporting the stability observed in resilient banks.

7.2.6.2. Inconsistent Responses in Vulnerable Banks

The heightened volatility in vulnerable banks underscores their reactive nature and weak governance frameworks. Acharya et al. (2010) and Laeven and Levine (2009) both highlight the critical role of robust governance and risk management in mitigating systemic vulnerabilities.

7.2.7. The Systemic Vulnerability Score

7.2.7.1. Differentiation of Vulnerability Levels

The Systemic Vulnerability Score (SVS) provides a clear and structured framework for differentiating between resilient and vulnerable banks based on systemic risk exposure. Resilient banks demonstrated consistent financial performance and operational

independence, highlighting their ability to withstand external shocks. In contrast, vulnerable banks exhibited volatility and a strong alignment with systemic trends, making them more susceptible to amplified risks during periods of market disruption. This finding aligns with studies such as Acharya et al. (2010), who emphasize the importance of metrics like capital adequacy and leverage in identifying institutions most at risk of systemic collapse.

7.2.7.2. The Role of Systemic Alignment

Systemic alignment emerged as a critical factor in determining vulnerability. Banks that closely mirrored market movements were more likely to amplify external shocks, reflecting their dependence on systemic trends. Conversely, institutions with greater operational independence were better equipped to adapt to systemic disruptions, ensuring resilience. Adrian and Brunnermeier's (2011) CoVaR methodology corroborates this finding, demonstrating that institutions with higher interconnectedness and systemic importance are more prone to destabilizing market fluctuations. This underscores the need for strategic diversification and operational independence as key strategies for mitigating systemic vulnerabilities.

7.2.7.3. Volatility as a Predictor of Risk

Volatility proved to be a reliable indicator of systemic risk, with banks displaying erratic financial performance and heightened dependency on market trends identified as more vulnerable. This finding echoes Geng et al. (2024), who emphasize the role of volatility and tail risk in predicting systemic risk. Metrics such as Return on Equity (ROE), liquidity ratios, and income growth showed that stabilizing key financial indicators is essential for reducing systemic vulnerability. Vulnerable banks' inability to manage volatility effectively highlights the need for robust risk management frameworks to mitigate adverse outcomes.

7.2.7.4. Use of Historical Trends

The SVS's reliance on historical performance trends offered a comprehensive assessment of structural strengths and weaknesses, enabling an informed evaluation of systemic risk. By focusing on long-term patterns rather than isolated events, the SVS captured the underlying stability of financial institutions. However, this approach may underemphasize emerging risks, particularly those arising from novel market dynamics or sudden policy shifts. As noted by Brownlees and Engle (2017), forward-looking models that integrate evolving risk factors alongside historical data can complement traditional measures for a more holistic understanding of systemic vulnerability.

7.2.7.5. Quantitative Clarity and Comparability

A key strength of the SVS was its ability to consolidate complex financial data into a single, interpretable score. This quantitative clarity facilitated direct comparisons between institutions, aiding regulators in prioritizing interventions and designing targeted risk mitigation strategies. Beck et al. (2010) similarly highlight the importance of using standardized metrics to enhance comparability and transparency in systemic risk assessments, reinforcing the SVS's utility in regulatory decision-making processes.

7.2.7.6. Implications for Risk Management

The findings underscore the importance of robust governance, income diversification, and financial management practices in reducing systemic risk. Banks with low liquidity buffers and erratic financial performance were particularly vulnerable to external shocks, reinforcing the need for proactive measures to stabilize key metrics. Research by Laeven and Levine (2009) highlights the role of governance and effective credit risk management in mitigating systemic vulnerabilities, aligning closely with the study's

findings. Regulatory frameworks that emphasize these factors can strengthen resilience across the sector.

7.2.7.7. Broader Lessons on Systemic Risk

The SVS highlights the multifaceted nature of systemic risk, which arises from interdependencies between liquidity, credit risk, profitability, and capital adequacy. The integration of quantitative and qualitative assessments emerged as essential for comprehensive risk management. While quantitative tools like the SVS provide clarity and comparability, qualitative factors—such as governance quality and adaptability—play a critical role in determining long-term resilience. Demirgüç-Kunt et al. (2020) emphasize this point, advocating for a blended approach that incorporates both numerical models and qualitative evaluations to address systemic risks effectively.

7.3. Chapter Summary

This chapter considered the results of the analysis performed in chapter 6 and noted that from the analysis of the correlations and covariances to market, from the analysis of the Banks that seemed to perform best and worst during stressed periods, and from analysis of the volatility of the movements in key ratios for the Banks, changes in total assets, changes in equity, changes in deposits and in the liquidity ratio and revenue generation capability of the Banks were important variables and measuring how they change over time along with their volatility could be used to derive an expression that could successfully predict which Bank would be severely affected if shocks were experienced.

CHAPTER EIGHT - CONCLUSIONS AND RECOMMENDATIONS

8.0. Introduction

This chapter presents the conclusions and recommendations drawn from the research conducted on quantifying the vulnerability of banking financial institutions to systemic risk within the Zambian context. This chapter synthesizes the key findings, evaluates the achievement of the study's objectives, and offers actionable recommendations for both banking institutions and regulatory bodies.

The primary aim of this research, as outlined in the initial chapters, was to bridge the existing gap in literature by developing a robust framework for quantifying systemic risk vulnerability. This framework is designed to enable proactive management and strategic planning, thereby contributing to the overall resilience and sustainability of financial institutions. The specific objectives were meticulously structured to explore various dimensions of systemic risk, including the measurement methods, prevalence in the Zambian banking sector, factors influencing vulnerability, and the development of a tailored quantification method.

The key findings from the research provide valuable insights into the methods for measuring systemic risk, the extent of its prevalence in Zambia, and the factors that affect an institution's vulnerability. Additionally, the study introduces a novel measure for systemic risk, termed Systemic Vulnerability, and validates the hypotheses that underpin this research. The limitations encountered during the study are acknowledged, and opportunities for further research are identified to enhance the understanding and management of systemic risk.

This chapter culminates in a series of recommendations aimed at strengthening the resilience of banking institutions against systemic risks. These recommendations are grounded in the empirical findings and are intended to guide both banks and regulators in their efforts to maintain financial stability. By implementing the proposed measures, it is hoped that the Zambian banking sector can better navigate potential financial crises and contribute to the sustainable development of the country's financial system.

8.1. Conclusions of the Study

8.1.1. Development of a Robust Framework for Measuring Systemic Vulnerability

This study successfully develops a robust and practical framework for quantifying the systemic vulnerability of banks. The Systemic Vulnerability Score (SVS), derived as part of this research, provides a forward-looking, data-driven tool that enables financial institutions to assess their susceptibility to systemic shocks. Tailored to the Zambian banking sector, the SVS offers a means of quantifying vulnerability using publicly available financial data, addressing critical gaps in existing literature and practice. By doing so, the study empowers banks to proactively identify weaknesses and implement strategies to enhance resilience and sustainability.

8.1.2. Practical Applicability of the Systemic Vulnerability Score (SVS)

The SVS proves to be a reliable and practical tool for assessing systemic vulnerability, as demonstrated through out-of-model validation. By examining Bank 17's performance before and after the 2008 Global Financial Crisis, the study confirms the SVS's predictive accuracy in identifying resilience or vulnerability. The score enables banks to proactively develop and implement targeted strategies to mitigate risks, ensuring stability and sustainability even in adverse conditions.

8.1.3. Advancement of Systemic Risk Measurement Methods

Through an in-depth examination of existing systemic risk measurement approaches, the study identifies their strengths, limitations, and suitability for different contexts. The research highlights a gap in methods focused on systemic risk sensitivity, particularly for markets lacking extensive financial infrastructure. The SVS fills this gap by offering a straightforward yet comprehensive measure that focuses on a bank's vulnerability to external shocks rather than solely its contribution to systemic risk. This novel approach expands the toolkit available to practitioners and regulators for systemic risk analysis.

8.1.4. Identification of Systemic Risk Prevalence in the Zambian Banking Sector

The study concludes that systemic risk is a significant and recurring challenge in the Zambian banking sector, driven by both internal and external factors. Historical analysis reveals specific periods of market-wide distress, such as 2011 Q3–2012 Q1 and 2020 Q1–2020 Q3, corresponding to economic shocks or policy changes. These findings underscore the importance of robust risk management practices and the need for proactive strategies to address systemic vulnerabilities. By linking observed periods of distress to macroeconomic and institutional drivers, the study provides valuable insights for mitigating systemic risk in the sector.

8.1.5. Key Factors Influencing Systemic Vulnerability

The study identifies several factors that significantly affect a bank's vulnerability to systemic risk:

- Liquidity management: Banks with robust liquidity buffers are better equipped to weather financial shocks.
- Risk management strategies: Conservative approaches to lending and risk-taking enhance resilience.
- Asset and deposit growth: Rapid growth without adequate risk controls can heighten vulnerability during downturns.
- Interconnectedness and leverage: These amplify contagion effects, increasing the sector's overall risk exposure.

Understanding these factors enables banks and regulators to address vulnerabilities more effectively and enhance institutional and systemic resilience.

8.1.6. Implications for Regulatory and Policy Frameworks

The study highlights the critical role of the SVS in regulatory oversight and macroprudential policy development. By offering a standardised and objective measure of systemic vulnerability, the SVS equips regulators and policymakers with actionable insights to identify at-risk institutions and implement targeted interventions. This

contributes to the overall stability of the financial system, reducing the likelihood of systemic crises and protecting depositors and investors.

8.1.7. Contribution to Financial Stability and Resilience

By addressing systemic risk at both institutional and sectoral levels, the study contributes to enhancing the resilience of the Zambian banking sector. The findings and tools developed as part of this research promote transparency, accountability, and confidence within the financial ecosystem. By equipping stakeholders with practical methodologies to assess and mitigate systemic risk, the study supports the long-term stability and sustainability of the financial system.

The research confirms that proactive management of systemic risk is not only necessary but also achievable through robust measurement tools like the SVS. The insights provided by this study hold relevance beyond the Zambian banking sector, offering a framework that can be adapted to other contexts. By bridging gaps in systemic risk measurement and addressing vulnerabilities, this study paves the way for more resilient financial institutions and a more stable global financial system.

8.1.8. Key Take-aways for Bank Executives

The findings of this study provide critical insights for bank executives, highlighting the strategic imperatives required to enhance systemic resilience and mitigate vulnerabilities in the banking sector. The interconnected nature of financial systems necessitates a proactive and holistic approach to risk management, governance, and operational stability. The following key take-aways are intended to inform the strategic decision-making of senior executives, including Chief Executive Officers and Board Chairpersons.

8.1.8.1. Operational Independence as a Foundation of Resilience

A recurring theme in the study is the importance of maintaining operational independence to safeguard against systemic pressures. Banks that demonstrated moderate correlations with market trends were better positioned to absorb external shocks. For executives, this underscores the need to prioritise strategies that reduce reliance on volatile market dynamics. Such strategies include diversifying income streams, managing exposure to high-risk sectors, and fostering financial stability through disciplined operational practices. By ensuring a degree of detachment from broader systemic trends, banks can enhance their capacity to navigate disruptions effectively.

8.1.8.2. Liquidity and Capital Buffers as Critical Shock Absorbers

Resilient banks consistently maintained robust liquidity and capital buffers, which proved instrumental in weathering systemic stress. For leadership, this highlights the non-negotiable importance of capital adequacy planning and liquidity management as central pillars of the bank's resilience strategy. Executives must ensure the implementation of comprehensive stress testing and scenario planning frameworks that anticipate and mitigate potential liquidity crises. Adequate buffers not only shield the institution from immediate financial distress but also provide a platform for sustained growth during periods of economic uncertainty.

8.1.8.3. Volatility as an Indicator of Systemic Vulnerability

The study identified volatility in key financial metrics as a reliable predictor of systemic risk. Banks exhibiting significant fluctuations in liquidity, profitability, and credit quality were more susceptible to systemic disruptions. For senior executives, monitoring and stabilising these metrics should be a strategic priority. Proactive

measures, such as enhancing credit risk frameworks, improving asset quality, and managing non-performing loans, are essential for minimising volatility and reducing systemic exposure. Stability in financial performance not only strengthens resilience but also instils confidence among stakeholders.

8.1.8.4. The Role of Governance and Risk Management

Strong governance and robust risk management frameworks emerged as distinguishing features of resilient banks. These institutions demonstrated disciplined lending practices, effective oversight, and clear accountability for risk management across all organisational levels. Bank executives must ensure that governance structures are not only aligned with the institution's strategic objectives but also deeply integrated into its operational processes. A culture of resilience, driven by sound decision-making and a commitment to risk-informed strategies, is essential for fostering long-term stability.

8.1.8.5. Adaptability to External Shocks

External shocks, such as commodity price fluctuations and macroeconomic disruptions, had a profound impact on the banking sector, with vulnerable banks disproportionately affected. Resilient banks displayed a capacity for adaptability, enabling them to respond effectively to changes in the operating environment. For executives, this underscores the importance of dynamic decision-making and strategic foresight. Investing in scenario analysis, stress testing, and operational flexibility ensures that the institution remains agile and responsive in the face of emerging risks.

8.1.8.6. A Holistic Approach to Systemic Risk Management

The Systemic Vulnerability Score (SVS) developed in this study provides a robust framework for assessing systemic resilience. However, the findings also emphasise the importance of complementing quantitative assessments with qualitative evaluations of governance, management quality, and operational adaptability. A multidimensional approach that integrates financial analysis, governance oversight, and strategic foresight is essential for addressing the complexities of systemic risk. For senior executives, the ability to synthesise these dimensions into actionable strategies is key to securing the institution's resilience.

8.1.8.7. Learning from Resilient and Vulnerable Banks

The study highlights clear distinctions between resilient and vulnerable banks, providing valuable lessons for leadership. Resilient banks avoided aggressive lending practices, managed liquidity effectively, and maintained stable income streams. In contrast, vulnerable banks exhibited weaknesses such as excessive volatility, poor credit risk management, and limited capital adequacy. Bank executives must seek to emulate the disciplined practices of resilient institutions while addressing the structural weaknesses that characterise vulnerability. Disciplined growth, stable financial performance, and robust risk management should form the cornerstone of any resilience strategy.

8.1.8.8. The Strategic Imperative of Resilience

The overarching takeaway for bank executives is that systemic resilience is not merely a defensive measure but a strategic enabler of long-term growth and sustainability. By embedding resilience into governance, operations, and risk management, leadership can position their institutions to thrive in an increasingly volatile financial landscape.

Building systemic resilience is, therefore, a strategic imperative that aligns institutional stability with stakeholder value creation, ensuring the bank's enduring success in a complex and interconnected global economy.

8.1.9. Key Take-aways for Regulators and Policy Makers

The findings of this study offer critical insights for regulators and policy makers, underscoring the pivotal role of systemic oversight, regulatory frameworks, and policy interventions in strengthening the resilience of the banking sector. As systemic risks increasingly challenge financial stability, a proactive and multifaceted approach to regulation and policy design is essential. The following take-aways provide a roadmap for fostering stability and mitigating vulnerabilities at the systemic level.

8.1.9.1. Enhancing Systemic Resilience through Regulatory Oversight

The study reveals that resilient banks are characterised by operational independence and disciplined financial practices. Regulators and policy makers must create frameworks that incentivise such behaviours, encouraging banks to adopt strategies that reduce excessive reliance on market trends. Policies should support diversification of income streams, discourage overexposure to high-risk sectors, and reward institutions that maintain stability in the face of systemic stress. By promoting these practices, regulatory interventions can reduce systemic interdependencies and enhance the overall resilience of the financial system.

8.1.9.2. Strengthening Capital and Liquidity Requirements

Robust capital and liquidity buffers were identified as critical determinants of resilience in banks. Regulators must ensure that minimum capital adequacy and liquidity

requirements are sufficiently stringent to absorb shocks during periods of systemic stress. Periodic stress testing and regular reviews of these requirements are essential to align regulatory thresholds with evolving risks. Policy makers should also encourage transparency and uniformity in the reporting of liquidity and capital adequacy metrics to foster confidence and ensure effective oversight.

8.1.9.3. Mitigating Volatility in Financial Performance

Volatility in key financial metrics emerged as a reliable predictor of systemic vulnerability. Regulators must design mechanisms to monitor and address excessive fluctuations in metrics such as liquidity ratios, credit quality, and profitability. Enhanced supervisory frameworks that focus on early warning indicators and systemic risk metrics, such as the Systemic Vulnerability Score (SVS), can enable timely intervention. By targeting volatility, regulatory bodies can pre-emptively address risks that threaten the stability of individual banks and the broader financial system.

8.1.9.4. Encouraging Proactive Risk Management

The study highlights the importance of disciplined risk management practices in fostering systemic resilience. Regulators should require banks to adopt comprehensive risk management frameworks that align with their risk appetite and strategic objectives. Policies should mandate regular scenario analysis, stress testing, and contingency planning to ensure preparedness for external shocks. Encouraging banks to integrate risk management into their governance structures will further embed resilience across the sector.

8.1.9.5. Incentivising Governance and Accountability

Resilient banks were distinguished by strong governance structures and clear accountability for risk management. Regulators and policy makers should establish governance standards that prioritise risk oversight at the board level and foster a culture of accountability across financial institutions. Policies that incentivise adherence to governance best practices, such as enhanced board training and stronger alignment between risk management and executive performance, can help reinforce resilience within the sector.

8.1.9.6. Addressing Systemic Alignment and Interconnectivity

Banks with high systemic alignment, as evidenced by strong correlations with market trends, were found to amplify external shocks. Regulators and policy makers must work to mitigate these risks by promoting financial system diversity and reducing interconnectivity. Measures such as countercyclical capital buffers, macroprudential regulations, and policies aimed at reducing overconcentration in specific sectors or markets can help reduce systemic alignment and enhance adaptability.

8.1.9.7. Leveraging the Systemic Vulnerability Score (SVS)

The SVS framework developed in this study offers a valuable tool for regulators and policy makers to assess and compare systemic risk across institutions. By integrating this quantitative framework into supervisory processes, regulators can identify vulnerable banks, prioritise interventions, and allocate resources more effectively. However, the study also emphasises the importance of complementing the SVS with qualitative assessments of governance and operational resilience, ensuring a comprehensive approach to systemic risk management.

8.1.9.8. Balancing Quantitative and Qualitative Oversight

The study highlights instances where quantitative measures, such as the SVS, diverge from qualitative evaluations of resilience. Policy makers must acknowledge the limitations of purely numerical frameworks and ensure that supervisory efforts account for governance quality, institutional adaptability, and operational independence. A balanced approach that combines data-driven insights with strategic oversight is essential for addressing the complexities of systemic risk.

8.1.9.9. Adapting to External Shocks

External factors such as commodity price fluctuations and macroeconomic volatility had a profound impact on the banking sector, amplifying systemic vulnerabilities. Regulators and policy makers must develop policies that enable the financial system to adapt to these shocks. Measures such as countercyclical policies, inflation management, and enhanced coordination with fiscal authorities can help stabilise the operating environment for banks, reducing systemic stress.

8.1.9.10. Promoting Financial System Stability

The findings underscore the need for a holistic approach to financial system stability that addresses liquidity, credit risk, profitability, and capital adequacy. Regulators and policy makers must recognise the interdependent nature of these factors and design policies that reflect this complexity. By fostering collaboration between regulators, financial institutions, and policy makers, a unified effort can be made to reduce systemic risks and enhance the resilience of the financial sector.

8.1.9.11. Strategic Imperative for Policy Makers

For regulators and policy makers, the overarching message of this study is clear: **systemic resilience is not just a goal but a responsibility.** By implementing targeted policies and supervisory frameworks, regulators can ensure that banks are equipped to withstand systemic disruptions while maintaining stability and confidence in the financial system. A proactive and coordinated approach to systemic risk management is essential for safeguarding financial stability and fostering sustainable economic growth.

8.2. Contributions of the Study

8.2.1. A Robust Framework for Measuring Systemic Vulnerability

This study contributes to the literature by developing a robust framework for quantifying vulnerability to systemic risk, tailored specifically to the Zambian banking sector. The research addresses a significant gap by offering a practical, forward-looking tool—the Systemic Vulnerability Score (SVS)—which enables banks to proactively assess their exposure to systemic shocks. Unlike existing measures, the SVS is designed to leverage publicly available data, ensuring ease of implementation. By empowering institutions to better navigate financial crises, the study enhances the resilience and sustainability of the financial system, contributing to long-term financial stability.

8.2.2. Investigation of Methods for Measuring Systemic Risk

The study makes a critical contribution by systematically examining existing methods for measuring systemic risk and evaluating their applications. Drawing from frameworks such as CoVaR (Acharya et al., 2010), Systemic Value-at-Risk (Dowd & Dowd, 2010), and SRISK (Brownlees & Engle, 2017), the research identifies gaps in the current methodologies, particularly their reliance on complex models or market data that are often inaccessible in less-developed economies. By addressing these limitations, the study provides a novel measure that focuses on systemic vulnerability—offering institutions the

ability to assess their sensitivity to systemic shocks and align their strategic priorities effectively.

8.2.3. Examination of Systemic Risk in the Zambian Banking Sector

This study contributes to understanding systemic risk prevalence in the Zambian banking industry by identifying key periods of market-wide stress and their underlying causes. Through a historical analysis of the sector, the research highlights how systemic risk has materialised in Zambia, driven by internal challenges such as poor management practices and external shocks like economic downturns. Specific periods of significant market instability, including 2011 Q3–2012 Q1 and 2020 Q1–2020 Q3, are linked to broader economic or policy events, underscoring the interconnectedness of systemic shocks. This analysis provides regulators and policymakers with valuable insights for tailoring macroprudential policies to address systemic vulnerabilities within the sector.

8.2.4. Identification of Factors Influencing Systemic Risk Vulnerability

A key contribution of this study is the identification of factors that affect a financial institution's vulnerability to systemic risk. These include:

- Liquidity management: Highlighting the importance of a bank's ability to adjust its liquidity position during market disruptions.
- Risk management strategies: Demonstrating how conservative lending practices can mitigate exposure to adverse market conditions.
- Asset and deposit growth: Linking rapid growth without adequate risk management to heightened vulnerability during economic downturns.
- Interconnectedness and leverage: Explaining how these factors amplify contagion risks within the financial system.

By elucidating these factors, the study equips institutions with actionable insights to address their unique vulnerabilities and strengthen their operational frameworks.

8.2.5. Development of the Systemic Vulnerability Score (SVS)

The study's most significant contribution is the derivation of the Systemic Vulnerability Score (SVS), a forward-looking tool for assessing systemic risk. The SVS leverages key financial indicators such as equity, total assets, liquidity, and earnings performance, measured through their volatility-to-mean ratios. This enables banks to:

- Identify operational weaknesses and vulnerabilities.
- Develop customised strategies to enhance resilience.
- Take pre-emptive actions to mitigate potential risks.

What distinguishes the SVS is its reliance solely on internal financial data, making it both accessible and adaptable. This feature ensures that institutions can independently evaluate their systemic risk exposure without relying on external datasets. By introducing the SVS, the study provides banks with a comprehensive risk management tool that supports strategic decision-making and safeguards institutional stability.

8.2.6. Practical Implications for Regulators and Policymakers

This research offers regulators and policymakers a standardised measure for assessing systemic risk across institutions. The SVS allows for the identification of at-risk banks, enabling tailored regulatory interventions and the implementation of macroprudential policies. By enhancing transparency and accountability, the SVS fosters a more stable and resilient financial system. Furthermore, the insights provided by this measure enable policymakers to design frameworks that mitigate systemic risk, contributing to economic stability and depositor protection.

8.2.7. Contribution to Financial Stability and Depositor Protection

The broader impact of this study lies in its potential to fortify the financial system against systemic shocks. By equipping banks with the tools to proactively manage risks, the SVS enhances the stability of individual institutions and the sector as a whole. This stability, in turn, protects depositors by ensuring that banks remain solvent and able to meet their obligations during crises. The study's emphasis on resilience not only safeguards

institutions but also instils confidence among stakeholders, contributing to the integrity and sustainability of the financial system.

In summary, this study offers a multi-faceted contribution by advancing systemic risk measurement, enhancing institutional and sectoral resilience, and supporting regulatory efforts to maintain financial stability. These contributions position the research as a cornerstone in the development of proactive risk management practices within the Zambian banking sector and beyond.

8.3. Recommendations

This study offers a comprehensive framework for measuring systemic risk in the Zambian banking sector, introducing a proactive approach to identifying vulnerabilities. The following recommendations aim to enhance the practical application of the Systemic Vulnerability Score (SVS), support financial stability, and guide future research.

For Financial Institutions

8.3.1. Adopt the Systemic Vulnerability Score (SVS) for Proactive Risk Management

Banks should institutionalise the calculation of the SVS as part of their ongoing risk management practices. This tool will enable management to systematically assess their vulnerability to systemic shocks and prioritise areas requiring immediate attention. By incorporating the SVS into regular reporting cycles, institutions can create a proactive culture of risk awareness and foster better preparedness for potential crises.

8.3.2. Develop Tailored Resilience Strategies

Institutions identified as systemically vulnerable through the SVS model should focus on strengthening their resilience. Key strategies include:

- Improving liquidity management practices to ensure sufficient buffers during periods of stress.

- Enhancing capital adequacy by maintaining robust equity positions relative to risk-weighted assets.
- Boosting deposit growth through innovative products and stronger customer engagement to stabilise funding sources.
- Focusing on sustainable revenue growth to reduce dependence on volatile income streams.
- Tailored interventions should be developed based on the specific weaknesses identified in the SVS analysis.

8.3.3. Invest in Data Analytics and Financial Modelling Expertise

To fully realise the benefits of the SVS model, banks need skilled personnel capable of implementing advanced data analytics and financial modelling techniques. Training programs, partnerships with academic institutions, and the recruitment of specialists in quantitative finance can strengthen institutional capabilities. Moreover, investment in technology platforms that support real-time data analysis will enable more accurate and timely SVS calculations.

For Policymakers and Regulators

8.3.4. Incorporate the SVS into Supervisory Practices

Regulatory bodies, including the Bank of Zambia, should adopt the SVS framework as part of their risk assessment toolkit. This model can complement existing supervisory processes by providing an objective measure of institutional vulnerabilities. Regulators can use the SVS to identify banks at risk of systemic failure and prioritise oversight and intervention accordingly. For instance, banks with high SVS values could be required to submit enhanced contingency plans or undertake specific remedial actions.

8.3.5. Mandate the Publication of Key Financial Indicators

Transparency is critical for the effective application of the SVS. Regulators should mandate the regular disclosure of key financial metrics, such as liquidity ratios, equity movements, and deposit trends, which are essential inputs for the SVS calculation. This information should be standardised across the sector to ensure comparability and accountability.

8.3.6. Establish Early Warning Systems

The SVS framework can serve as the foundation for a national early warning system that monitors systemic vulnerabilities across the banking sector. By tracking SVS trends over time, regulators can anticipate periods of heightened risk and implement stabilisation measures before systemic issues materialise. Such a system could also support coordinated responses during times of financial stress, reducing the likelihood of widespread disruptions.

For Future Research

8.3.7. Expand the Model Beyond Zambia

The applicability of the SVS model should be tested in other financial jurisdictions, particularly in regions with similar economic and market conditions. Comparative studies would provide insights into the model's robustness and identify potential areas for refinement. Expanding the study's geographic scope could also uncover common patterns of systemic vulnerability and best practices for mitigation.

8.3.8. Enhance the Statistical Framework

Future iterations of the SVS model should incorporate more advanced statistical techniques to improve its accuracy and predictive capabilities. Methods such as machine learning, Monte Carlo simulations, or Bayesian inference could help refine the model's parameters and better account for nonlinear relationships and rare events. Additionally, exploring

statistical measures that inherently capture asymmetry or negative movements could reduce reliance on adjustment factors.

8.3.9. Evaluate Real-World Application in Failed Banks

Applying the SVS model retrospectively to banks that have failed due to systemic shocks would provide invaluable validation. This approach could reveal how accurately the model predicts vulnerability and offer insights for fine-tuning its methodology. Collaboration with regulators to access historical data on failed institutions would be critical for this endeavour.

8.3.10. Refine Weight Allocation

The current model acknowledges the subjectivity in weight assignment. Future studies should aim to develop an empirical basis for assigning weights, potentially leveraging machine learning to optimise parameter importance dynamically. While the study provides guidelines to prevent overly skewed weights (e.g., no parameter exceeding 30%), further research could explore more sophisticated methods to ensure balanced and effective weighting.

For Industry Collaboration

8.3.11. Promote Cross-Institutional Collaboration

The Zambian banking sector should establish a collaborative forum where institutions can share findings from their SVS analyses. Such collaboration would promote a collective understanding of systemic risks and enable banks to learn from each other's mitigation strategies. Joint training programs or workshops on applying the SVS could further strengthen industry-wide risk management capabilities.

8.3.12. Engage Stakeholders in Policy Design

Policymakers should involve financial institutions in refining systemic risk frameworks, ensuring that regulatory measures are both effective and practical. This collaborative approach would facilitate the implementation of the SVS model and ensure alignment between regulatory objectives and institutional needs.

The recommendations outlined above aim to bridge the gap between theoretical advancements and practical applications of the SVS model. By adopting the SVS, fostering transparency, and encouraging collaboration, Zambia's banking sector can build a more resilient framework for addressing systemic risk. Policymakers, institutions, and researchers must work together to ensure that the tools and insights developed in this study contribute meaningfully to safeguarding financial stability in Zambia and beyond.

8.4. Limitations of the Study

Based on the above, the study was successful in meeting the objectives that were set out. However, the following limitations were observed:

1. **Data Availability and Quality:** While the study utilized data from the Bank of Zambia, the availability and quality of this data may pose limitations for anyone looking to replicate the study. Data completeness, accuracy, and consistency could impact the reliability of the analysis and the validity of the conclusions drawn. Additionally, the expression derived for calculating the Systemic Vulnerability Score (SVS) requires a sufficient number of data points (ideally at least 36) to ensure robustness in the results. Insufficient data may lead to distorted outcomes, as observed in the results for Bank 20.
2. **Generalizability:** The study focused specifically on the Zambian banking industry, limiting the generalizability of findings to other financial systems or countries with different regulatory frameworks, market structures, and economic conditions. The unique characteristics of the Zambian banking sector may not fully reflect the challenges faced by banks in other regions.

3. **Model Complexity:** The vulnerability score model developed in the study incorporates multiple parameters, weighting factors, and adjustments for negative movements. While this complexity enhances the comprehensiveness of the assessment, it also increases the computational burden and may require expertise in financial modelling for implementation and interpretation. Moreover, the allocation of weights in the calculation of the SVS is somewhat arbitrary, lacking a prescribed methodology. Although flexibility in weight assignment allows banks to customize the calculation based on their perceived strengths and weaknesses, it may introduce subjectivity and variability into the analysis.
4. **Subjectivity in Parameter Weights:** The determination of weights assigned to each parameter in the vulnerability score model may involve subjective judgment or expert opinion. Variations in weighting schemes could influence the final vulnerability scores and may introduce bias or uncertainty into the analysis.
5. **Assumptions and Simplifications:** Like any modelling approach, the vulnerability score model relies on certain assumptions and simplifications to make the analysis tractable. Assumptions regarding the relationship between financial parameters, the stability of correlations over time, and the impact of external factors may introduce limitations or constraints on the model's accuracy.
6. **Limited Scope of Variables:** While the study identified several key variables, such as financial performance, balance sheet size, capitalization, and liquidity, as determinants of systemic vulnerability, other crucial factors may not have been fully captured. Non-financial variables related to governance, risk management practices, and external market conditions could also influence systemic risk but were not explicitly included in the analysis.
7. **Temporal Constraints:** The study's focus on historical data may limit its ability to capture emerging trends, evolving risk factors, and future developments in the banking

industry. Changes in regulatory policies, market dynamics, or technological advancements may alter systemic risk profiles over time, necessitating ongoing monitoring and updates to the vulnerability score model.

8.5. Opportunities for further research

Several opportunities for further research emerge from the limitations and findings of this study:

1. **Cross-Country Comparative Analysis:** Comparing the vulnerability scores and systemic risk profiles of banks across different countries could provide insights into the influence of regulatory regimes, market structures, and economic conditions on systemic vulnerability. Comparative studies could highlight best practices and identify factors driving variations in vulnerability across jurisdictions.
2. **Longitudinal Analysis:** Conducting longitudinal studies to track changes in systemic vulnerability over time within the same banking system or across multiple financial cycles could enhance understanding of systemic risk dynamics. Longitudinal analysis could identify trends, structural shifts, and emerging patterns in vulnerability, helping to refine vulnerability score models and improve risk management strategies.
3. **Integration of Non-Financial Factors:** Exploring the role of non-financial factors, such as governance practices, risk culture, and macroeconomic indicators, in shaping systemic vulnerability could enrich vulnerability score models and enhance their predictive power. Integrating qualitative data and survey-based measures could provide deeper insights into the drivers of systemic risk and resilience.
4. **Machine Learning and Big Data Analytics:** Leveraging advanced analytical techniques, such as machine learning algorithms and big data analytics, to analyse large volumes

of financial and non-financial data could offer new avenues for understanding systemic risk. Machine learning models could uncover complex patterns, interdependencies, and nonlinear relationships that traditional statistical methods may overlook.

5. **Policy Implications and Regulatory Frameworks:** Investigating the implications of vulnerability score models for regulatory frameworks and policy interventions could inform the design of effective systemic risk management measures. Research on the alignment between vulnerability assessment tools and regulatory requirements could facilitate regulatory compliance and enhance financial stability.
6. **Industry-Specific Studies:** Conducting sector-specific studies focusing on particular segments of the banking industry, such as retail banking, corporate banking, or investment banking, could uncover sector-specific vulnerabilities and risk factors. Tailoring vulnerability score models to specific banking sectors could improve the relevance and accuracy of vulnerability assessments.
7. **Dynamic Modelling Approaches:** Developing dynamic modelling approaches that capture the evolving nature of systemic risk and adapt to changing market conditions could enhance the predictive power and flexibility of vulnerability score models. Dynamic models could incorporate real-time data feeds, scenario simulations, and feedback mechanisms to provide timely insights into systemic vulnerability.

8.6. Conclusion

This study has successfully created a measure that is valuable for calculating and, given its nature, predicting a bank's susceptibility to systemic risk. The development of such a measure, like the systemic vulnerability score for banks, is crucial for both banks and regulators in assessing and managing financial stability.

For banks, this measure provides a comprehensive evaluation of their vulnerability to external shocks, offering insights into potential weaknesses in their financial position and risk management practices. By considering movements in key parameters such as equity, total assets, liquidity, and earnings performance, adjusted for volatility, the vulnerability score offers a nuanced understanding of the bank's risk profile. This information is valuable for strategic decision-making, capital allocation, and risk mitigation efforts within the bank.

The measure of systemic risk vulnerability proposed here is crucial for strategic planning within the banking industry. By assessing vulnerability based on movements in key financial parameters and their volatility, banks can proactively identify areas of weakness and take preemptive measures to mitigate risks. Knowing in advance the potential impact of external shocks on their operations allows banks to develop contingency plans, adjust their risk management strategies, and allocate resources more efficiently. This proactive approach can enhance the resilience of banks and their ability to withstand adverse events, thereby safeguarding their financial stability and reputation.

Regulators can also benefit from such a measure by using it as a tool for macro prudential supervision and policy formulation. The vulnerability score provides regulators with a standardized metric to assess the resilience of individual banks and the overall banking system to systemic risks. By monitoring vulnerability scores across banks, regulators can identify trends, outliers, and systemic vulnerabilities that require attention. This information can inform regulatory interventions, such as setting capital requirements, liquidity standards, or imposing corrective measures on banks with high vulnerability scores. Additionally, the vulnerability score can be used in stress testing scenarios to evaluate the resilience of banks under adverse economic conditions, helping regulators assess the potential impact of systemic risks on financial stability.

Furthermore, regulators can use this measure to assess the overall stability and risk profile of the banking sector, enabling them to implement targeted regulatory measures to address systemic vulnerabilities and maintain the stability of the financial system.

On the whole, it is hoped that the development and subsequent use of the systemic risk vulnerability score SVS will contribute to the effective oversight and stability of the banking sector, benefiting both banks and regulators in their efforts to maintain a resilient and stable financial system.

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APPENDICES

Appendix 1: Format of Balance Sheet in Data Obtained

1	NOTES AND COIN
1.1	Domestic Currency
1.1.1	Notes
1.1.2	Coins
1.2	Foreign Currency Notes And Coins
2	BALANCES WITH BANK OF ZAMBIA
2.1	Statutory Reserves on Local Deposits
2.2	Statutory Reserves on Foreign Deposits
2.3	Current Account
2.4	Open Market Operations (OMO) Deposits
2.5	Other
3	BALANCES WITH DOMESTIC INSTITUTIONS
3.1	Banks
3.2	Other Financial Institutions
3.3	Items in Transit
4	BALANCES WITH FOREIGN INSTITUTIONS
4.1	Investments
4.2	Working Balances
5	INVESTMENTS IN SECURITIES
5.1	Issued or guaranteed by the Government
5.1.1	Treasury Bills
5.1.2	Government Bonds
5.1.3	Clearing house collateral (treasury Bills)
5.1.4	Statutory Bonds
5.1.5	Other Bonds
5.2	Other securities
6	NET LOANS AND ADVANCES
6.1	Gross Loans and Advances
6.1.1	Loans from Re-Finance Credit
6.1.2	Loans from Normal Deposits
6.2	Allowance for Loan Losses
7	BILLS OF EXCHANGE
8	INTERBRANCH
9	FIXED ASSETS
10	OTHER ASSETS
10.1	Accrued interest receivable
10.2	Derivatives
10.3	Prepaid and deferred charges
10.4	Goodwill and other intangibles
10.5	Taxes
10.6	Repurchase agreement receivable
10.7	Other
11	TOTAL ASSETS
	LIABILITIES AND SHAREHOLDERS' EQUITY
12	DEPOSITS
12.1	Demand
12.2	Savings
12.3	Time
13	BALANCES DUE TO BANK OF ZAMBIA
13.1	Current Account
13.2	Open Market Operations (OMO) Loans
13.3	Re-financing credit
13.4	Other
14	BALANCES DUE TO DOMESTIC INSTITUTIONS
14.1	Banks
14.2	Other financial institutions
14.3	Items in transit
15	BALANCES DUE TO FOREIGN INSTITUTIONS
15.1	Loans and Advances
15.2	Others
16	BILLS OF EXCHANGE
17	INTERBRANCH
18	OTHER LIABILITIES
18.1	Accrued interest payable
18.2	Derivatives
18.3	Taxes
18.4	Deferred income
18.5	Dividends payable
18.6	Repurchase agreement payable
18.7	Other
19	OTHER BORROWED FUNDS
19.1	Maturing in less than one year
19.2	Maturing in one year or more
19.3	Subordinated debt
19.4	Shareholders' loans
19.5	Other
20	SHAREHOLDERS' EQUITY
20.1	Preferred shares
20.2	Ordinary shares
20.3	Share premium
20.4	Retained Earnings
20.5	Fair Value reserves
20.6	Revaluation reserves
20.7	Statutory reserves
20.8	Other Reserves
21	TOTAL LIABILITIES AND SHAREHOLDERS' EQUITY
22	OFF BALANCE SHEET
22.1	Contingent Liabilities
22.1.1	Guarantees
22.1.2	Letters of Credit
22.1.3	Assets Pledged as Collateral Security (other than Clearing House)
22.1.4	Other
22.2	Commitments
22.2.1	Arising out of Sale and Option to Repurchase Transactions
22.2.2	Credit/Debit Cards
22.2.3	Foreign Exchange and Interest Rate related Contracts
22.2.4	Other
22.3	Allowance for Loan Losses on Acceptances and Off Balance Sheet Items Included in Other Liabilities
	TOTAL RISK-WEIGHTED ASSETS (on and off-balance sh
	Liquid Assets
	(r) TOTAL PRIMARY CAPITAL (h - n)
	VI TOTAL REGULATORY CAPITAL
NPLS	16. GRAND TOTAL (K'millions)

Appendix 2: Format of Income Statement in Data Obtained

INTEREST INCOME
Loans and advances from normal deposits (excluding leasing income)
Local currency loans (Retail)
Local currency loans (Corporates)
Foreign currency loans (Retail)
Foreign currency loans (Corporates)
Loans and advances from re-finance credit (including leasing income)
Local currency loans
Foreign currency loans
From banks and other financial institutions (including OMO deposits)
Domestic institutions
Foreign institutions
Bank of Zambia
Securities:
Treasury bills (investments)
Government bonds (investments)
Statutory bonds (investments)
Money market instruments (investments)
Other securities (investments)
Trading securities (all classes as above)
Leasing income from normal deposits
Credit cards
All other
TOTAL INTEREST INCOME (excluding dividends)
INTEREST EXPENSE
Deposits:
Demand (Retail)
Demand (Corporates)
Savings (Retail)
Savings (Corporates)
Time:
Certificates of deposits (Retail)
Certificates of deposits (Corporates)
Other
Interest paid to banks and financial institutions:
Loans
Foreign currency loans
Local currency loans
Deposits
Foreign currency deposits
Local currency deposits
Subordinated debt
Shareholders loans
All other
TOTAL INTEREST EXPENSE
NET INTEREST INCOME
PROVISION FOR LOAN LOSSES
General
Specific
TOTAL PROVISION FOR LOAN LOSSES
NET INTEREST INCOME AFTER PROVISION FOR LOAN LOSSES
NON-INTEREST INCOME
Commissions, fees and service charges (local currency transactions)
Foreign exchange:
Fees from f/x transactions
Realised trading gains/ (losses)
Unrealised gains/ (losses) from foreign exchange holdings
Dividend income
All other
TOTAL NON-INTEREST INCOME
NET INTEREST AND OTHER INCOME
NON-INTEREST EXPENSES
Salaries and Employees Benefits
Occupancy
Equipment
Depreciation
Education and Training
Audit, Legal and Professional Fees
Insurance
Frauds and Forgeries
Management Fees
Donations
Others
TOTAL NON-INTEREST EXPENSES
INCOME / (LOSS) BEFORE TAXES
Taxation
INCOME/ (LOSS) AFTER TAXES

