THE FOMC MONETARY POLICY'S IMPACT ON BANKS' RISK-TAKING BEHAVIORS, GROWTH PLANS, AND OPERATING STRATEGIES UNDER ECONOMIC SHOCKS DURING THE PANDEMIC AND THE LATE 2000S

by

MAOYONG ZHENG

(Under the Direction of Cesar L. Escalante)

ABSTRACT

In the wake of the COVID-19 pandemic, as fears subside and the economy braces for a potential recession, the Federal Reserve Board is focused on controlling inflationary pressures to mitigate economic downturn risks. This dissertation investigates the challenges and implications posed by the pandemic and the Federal Reserve's monetary policies on the banking industry, with a focus on agricultural and non-agricultural banks. The research comprises three closely related chapters.

The first chapter employs a systematic dynamic panel data (DPD) analysis using the generalized method of moments (GMM) to analyze banks' risk-taking behaviors during the COVID-19 pandemic, factoring in the monetary policy adjustments made by federal authorities. This chapter details how the Federal Reserve's aggressive expansionary monetary policies helped banks address liquidity issues, although these measures also heightened asset risk profiles. The findings underscore the dual impact of uncontrolled economic shocks and discretionary portfolio decisions on banks' risk profiles. The pandemic's pervasive economic shocks compromised historical lending decisions, while expansionary policies provided relief but increased asset risk exposure. Small, specialized banks, particularly those focused on agricultural lending, were found to be more vulnerable due to their higher-risk asset portfolios and limited access to less volatile financial instruments.

The second chapter's insights, derived from a generalized difference-in-differences model, reveal variations in risk-taking behaviors across different banking groups, aiding policymakers in formulating targeted monetary policies and macroprudential regulations. The study shows that banks' risk-taking increased following the implementation of expansionary policies, with profitability ratios influencing their risk levels. Larger banks and those in concentrated markets managed risks better due to diversified portfolios and stronger capital bases.

The third chapter synthesizes findings from Seemingly Unrelated Regression (SUR) analyses, illustrating the resilience and adaptability of commercial banks across two significant economic downturns. Particularly, agricultural banks demonstrated stability in profit margins, suggesting sector-specific strategies for growth. The analysis highlights the importance of sector-specific factors and external economic pressures in shaping banking strategies and risk management.

INDEX WORDS: Economic Recession, Banking Industry, Agricultural Banks, Expansionary Monetary Policies, Risk-Taking Behaviors, COVID-19 Pandemic

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# DEDICATION

This dissertation is dedicated to my parents, my wife, and Charlie, for their unconditional love, joy, and support throughout these years.

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# CHAPTER 1

# INTRODUCTION

The COVID-19 pandemic led to extensive community lockdowns and severe restrictions on social mobility, causing a significant economic recession in the U.S. These disruptions forced many businesses, especially in manufacturing and retail, to close, contributing to the economic downturn. Travel bans, border controls, and medical checks severely limited social mobility. Consequently, the pandemic resulted in the loss of millions of jobs, surpassing previous unemployment records, and led to a substantial drop in wages and incomes due to high unemployment and furloughs. This scenario posed significant challenges for financial institutions, particularly concerning borrowers' loan repayment capacities and tighter capital sourcing opportunities.

In response, the Federal Open Market Committee (FOMC) took swift action to prevent a deeper recession. They reduced the benchmark federal funds rate to nearly zero and committed to substantial asset purchases, including Treasuries and mortgage-backed securities, aiming to lower long-term interest rates. Concurrently, the U.S. government launched federal initiatives amounting to trillions in spending to boost incomes. Although these monetary and fiscal policies helped revitalize the economy, the FOMC maintained a cautious stance, keeping the federal funds rate near zero for nearly two years to support economic resilience.

The FOMC's role in managing U.S. open market operations involves creating monetary policies that aim for full employment, stable prices, and moderate long-term interest rates. The committee's actions, particularly during economic downturns or high unemployment periods, typically involve reducing federal funds rates and expanding the supply of money to boost economic activity. In contrast, during periods of rapid economic growth or high inflation, the FOMC may implement contractionary policies by increasing interest rates and decreasing the money supply. A critical tool in the FOMC's monetary policy arsenal is the federal funds rate, which dictates short-term interest rates and influences wider financial conditions. By setting a target for the federal funds rate, the Federal Reserve can promote economic growth by reducing borrowing costs or curb inflation by increasing borrowing costs. These actions have profound effects on both the American economy and the worldwide financial landscape. As the world recovers from the COVID-19 pandemic, concerns about an impending recession evoke memories of the late 2000s financial crisis. The pandemic-induced economic challenges necessitated unprecedented fiscal and monetary policy measures, leading to significant liquidity injections and subsequent inflationary pressures. This backdrop highlights the importance of reevaluating banks' risk-taking behaviors, growth plans, and operational strategies.

To investigate the challenges and implications of the COVID-19 pandemic and the FOMC for the banking industry, as well as to recall the profound lessons of the late 2000s financial crisis—during which the Dodd-Frank Act reshaped the regulatory landscape—this dissertation conducts a thorough and detailed study of agricultural and non-agricultural banks during these two periods.

The first study, presented in the next chapter, employs a systematic dynamic panel data (DPD) analysis using the generalized method of moments (GMM) to analyze banks' risk-taking behaviors during the COVID-19 pandemic, factoring in the monetary policy adjustments made by federal authorities. This study examines the phase during the pandemic when the U.S. economy experienced a brief recession and the FOMC's expansionist monetary policy of maintaining low interest rates during the recovery period. The analysis spans two years before the pandemic through the recession and recovery phase before the FOMC's aggressive rate hikes to combat inflation. The focus is on assessing the impact of the initial economic shocks from the COVID-19 pandemic and the resulting monetary policy variables on banks' risk-taking behaviors.

To further understand the impact of monetary policy in different macroeconomic contexts, the second study in Chapter 3 uses a Generalized Difference-in-Differences modeling approach to understand how expansionary policies influenced the risk-taking stances of agricultural and non-agricultural banks. This research provides empirical evidence on the effects of monetary policy adjustments during economic turbulence on the banking industry, contributing to a nuanced understanding of risk propensity in different banking sectors. It aims to determine whether these policies have disparate impacts across various sectors, informing more tailored and effective policy interventions in the future. The study also investigates potential side effects of aggressive monetary easing, such as asset bubbles and financial instability, providing critical insights for central banks, investors, financial institutions, and policymakers.

The third study, presented in Chapter 4, employs the Sustainable Growth Challenge (SGC) model to examine the operational strategies of agricultural and non-agricultural banks during these periods of economic distress. Building on previous work on sustainable growth strategies during the late 2000s financial crisis, this study expands the scope to include the post-COVID-19 recessionary phase. By using Seemingly Unrelated Regression (SUR) techniques, the research aims to identify the factors influencing the sustainable growth challenge, providing a comparative analysis of banks' financial performance during these recessionary periods.

Ultimately, these three closely related chapters focus on different topics to compound the entire dissertation's research. The goal is to provide a comprehensive understanding of how banks' risk management and growth strategies impact their success amidst significant economic challenges, contributing to more informed, evidence-based policy decisions in times of economic recession.

# CHAPTER 2

# EXPANSIONARY FEDERAL MONETARY POLICY AND U.S. BANK RISK DURING THE COVID-19 RECESSION

## 2.1 Introduction

The mandatory and necessary community lockdowns and social mobility restraints imposed during the COVID-19 pandemic resulted in an economic recession in the U.S. due to the breakdown of the economy's supply side (Wray, 2022). Many businesses, especially manufacturing plants and retail stores, have been forced to close as regulations enforcing travel bans, border entry controls, and increased medical checks at all entry points significantly restricted social mobility (Dunkelberg, 2020). Among the pandemic's serious economic casualties has been the loss of 23 million jobs in the US surpassing even the worst unemployment record in the late 2000s financial crisis (Leith, 2023). Consequently, demand-side factors further boosted the recessionary pressure as wages and incomes dropped due to the worsening unemployment and work furloughs (Wray, 2022). Such recessionary conditions pose difficult challenges to financial institutions. One of their most serious concerns is the apparent deterioration of their existing borrowers' loan repayment capacities, in addition to tighter capital sourcing opportunities.

The Federal Open Market Committee (FOMC) responded promptly with remedial and preventive actions to prevent the U.S. economy from experiencing an economic recession. Monetary policy authorities lowered the benchmark federal funds rate to almost zero and pledged to engage in substantial asset acquisitions, including Treasuries and mortgage-backed securities (MBS), aiming to lower the long-term interest rates (Leith, 2023). The U.S. government simultaneously launched a series of income-boosting federal initiatives that released about $5 trillion in government spending (Vasquez, 2023). As both monetary and fiscal policies effectively revitalized the economy, FOMC still exercised caution and remained worried about the economy's resilience, thus continued to implement "emergency" federal funds rate cuts to maintain the rate at nearly zero for almost two years (Mitra, Curcio, and Tony, 2024).

This study focuses on such a phase of the pandemic when the U.S. economy plunges into a brief recession and the FOMC's consequent expansionist monetary policy of keeping a conservative stance of maintaining low interest rates during the recovery period. In fact, the federal funds rate remained near zero until February 2022 (Mitra, Curcio, and Tony, 2024). Specifically, our analysis extends from two years of the pre-pandemic period (2018-2019) and through the pandemic period's recession and recovery phase (2020 until early 2022) prior to the FOMC's eventual aggressive rate hiking policies intended to suppress the looming aggravating inflation problem. Our analysis aims to analyze the impact of the COVID-19 pandemic's initial economic shocks and the resulting monetary policy variables, capturing the FOMC's actions, on banks' risk-taking behaviors.

**2.2 Literature Review**

The following sections explain the monetary policy-making mechanism and present related empirical evidence from earlier studies. Moreover, the financial sector's predicament under the economic challenges during the pre-inflationary phase of the pandemic is discussed.

*2.2.1 The Federal Monetary Policy Authority*

The Federal Open Market Committee (FOMC) serves as the monetary policy-making authority of the Federal Reserve System which is responsible for managing the nation's open market operations (FOMC Policy Responsibility Act, 2018). The committee's fundamental task is to devise monetary policies aimed at promoting optimal employment rates, stable pricing, and reasonable long-term interest rates. This involves regulating the money supply within the economy through open market operations, which include the purchasing and selling of U.S. Treasury and federal agency securities (Chappell, McGregor and Vermilyea, 2005). FOMC's policies can vary based on prevailing economic circumstances. During periods of economic slowdown or high unemployment, the FOMC may choose to implement an expansionary monetary policy by imposing interest rate cuts and increasing the volume of money. Inversely, during periods of inflation or robust economic growth, the FOMC may adopt a contractionary approach, through raising interest rates and reducing the money supply to regulate growth.

*2.2.2 The Federal Funds Rate*

The federal funds rate is the FOMC's principal monetary policy instrument. This is the rate used by depository institutions in overnight lending and borrowing transactions involving their reserve balances. Consequently, the rate acts as a standard for numerous other short-term interest rates and influences broader financial conditions (Federal Reserve Bank of New York, 2023).

The Effective Federal Funds Rate (EFFR) is the rate in the overnight lending and borrowing transactions among banks and credit unions to satisfy their respective reserve requirements as stipulated by the Federal Reserve (Federal Reserve Bank of New York, 2023). The Federal Reserve guides the EFFR by establishing a target for the federal funds rate, which also serves as the rate used in these institutions' credit transactions with the Federal Reserve to fulfill their reserve obligations. The Fed can adjust the federal funds rate target by trading government securities in open market operations (Federal Reserve Bank of New York, 2023).

Changes in the federal funds rate target allow the Federal Reserve to control the reserve supply within the banking system, subsequently affecting the EFFR. If the economic imperative is to stimulate economic expansion, the Federal Reserve brings down the federal funds rate target, with the intended effect of lowering the cost of credit for consumers and businesses, thus encouraging spending and investing. Conversely, when the Federal Reserve needs to moderate inflation or avert asset bubbles, it adopts a contractionary stance by raising the federal funds rate target, which raises borrowing costs, induces an increased savings trend, discourages borrowing, and slows down economic activities.  Therefore, EFFR is a vital monetary policy tool that influences the supply and demand of reserves in the banking system.

*2.2.3 Monetary Policy Studies*

Friedman (1959) provides theoretical and empirical evidence on monetary policy's role in affecting the demand for money. Meltzer (1995) further explores the interplay between monetary policy decisions and credit transmission mechanisms. Meanwhile, Bernanke and Blinder (1988) present different theories about effective monetary policy and credit. Stein (1998) provides insights into the challenges faced by banks in managing their balance sheets and the implications for monetary policy.

Other studies focus on the banks' risk-taking strategies and decisions. Keeley (1990) contends that deposit insurance schemes may lead to market power in banks and affect their risk-taking behavior. As these aspects of research continue to evolve, more and more studies begin to focus on connections between banks' risk-bearing behavior and monetary policy transmission mechanisms. Dell'ariccia and Marquez (2006) assert that favorable lending environments tend to be associated with a decline in lenders' standards and could lead to higher default rates and financial instability. They conclude that policymakers should take measures to address the risks linked to lending booms.

The late 2000s financial crisis brought catastrophic consequences to the U.S. banking industry. Several studies analyze the effectiveness of the Fed's monetary policies on banks' risk-bearing capacities. Laeven and Levine (2009) highlight the importance of regulatory frameworks that promote transparency, accountability, and sound risk management practices and suggest that policymakers should prioritize measures that strengthen bank governance and regulation to promote financial stability. Borio and Zhu (2012) clarify that inadequate capital regulation may lead to increased banks' risk tolerance, which in turn undermines the effectiveness of the monetary policy. Another study examines the relationship between monetary policy, leverage, and bank risk-taking and concludes that monetary policy can allow banks to exhibit greater risk tolerance through its impact on funding costs and credit availability (Dell'ariccia, Laeven and Marquez, 2010). This research further clarifies the challenges faced by policymakers in managing the trade-offs between promoting economic growth and financial stability. Furthermore, another study examines the relationship between interest rates and banks' risk tolerance and finds that low interest rates can lead to increased risk-taking by banks, as banks may be incentivized to seek higher returns through riskier investments (Delis and Kouretas, 2011).

A number of more recent studies explore how monetary policy affects the risk-taking channel of banks. Delis, Hasan and Mylonidis (2017) identify a negative relationship between banks' risk tolerance and monetary policy using corporate loan data. Another study using a panel dataset of 27 emerging market economies claims that capital inflows are associated with increased bank risk-taking behavior, which can lead to increased financial instability (Bruno and Shin, 2015). In another study's findings, low interest rates and accommodative monetary policy are associated with increased bank risk-taking behavior, particularly for loans to small and medium-sized enterprises (SMEs) (Caglio, Darst, and Kalemli-Özcan, 2021).

*2.2.4 The COVID-19 Pandemic Effect*

The COVID-19 pandemic caused an unparalleled decline in consumer spending in the U.S. resulting in widespread business closures and layoffs. As a result, financial institutions faced significant challenges as millions of consumers struggled to repay loans and meet their financial obligations. As pandemic conditions progressed, the U.S. government pushed banks to provide more liquidity through the Paycheck Protection Program (PPP) (The U.S. Small Business Administration, 2020) and other government programs (Karakaplan, 2021). Under such a directive, banks began to increase lending as well as raise their loan standards due to an increase in loan risk. Consequently, borrowers with lower credit scores or seeking smaller loan amounts usually find it difficult to obtain loans. Additionally, some smaller banks encountered difficulties in lending because they relied more on commercial and personal loans rather than investment banking (Ennis and Jarque, 2021). As a result, the risk of loan defaults increased, which consequently significantly upsets the banking industry's stability.

Overall, the COVID-19 pandemic and the ensuing monetary policies created significant challenges for the banking industry, including increased loan defaults. This study presents a thorough investigation into the impact of monetary policy, the COVID-19 pandemic, and other macro and micro-level factors on bank risk-taking behavior, using dynamic panel data generalized moment method model. Notably, the conclusions of this research not only align with previous studies but also introduce additional insights that merit further consideration. Furthermore, policymakers and banking institutions can leverage these findings to take proactive actions to reduce risks and ensure the stability of the banking industry.

## 2.3 Methodology

Our analytical model employs systematic dynamic panel data (DPD) analysis by the generalized moment method (GMM) (Arellano and Bover, 1995; Blundell and Bond, 1998). The model is designed to estimate the impact of the COVID-19 pandemic and monetary policy on banks' loan operating decisions. The dynamic panel data model requires lagged items of dependent variables into explanatory variables, which may lead to endogeneity problems. Utilizing an OLS regression will lead to inconsistent estimation because one of the assumptions called the orthogonality condition between the error term and regressors is not satisfied. Therefore, more effective parameter estimators can be obtained by adopting the generalized moment method.

$$Y_{i,t} = \alpha Y_{i,t-1} + \beta X_{it} + u_i + \varepsilon_{it} \tag{2.1}$$

$$i = 1 \ldots N, \qquad t = 1 \ldots T$$

Arellano and Boverb (1995), and Blundell and Bond (1998) contend that the difference GMM estimator is affected by weak instrumental variables problem and existing small sample bias. Hence, Arellano and Bover (1995) propose a new method called system GMM, which merges both difference and level equations, while also incorporating a group of lagged difference variables as the corresponding instruments of the level equation. As such, the error term $\varepsilon_{it}$ and unobservable individual effect $u_i$ are assumed to be independently distributed across $i$ and can be expressed as equation (2.2). Another standard assumption that focuses on the initial conditions is shown in equation (2.3).

$$E(u_i \varepsilon_{it}) = 0 \tag{2.2}$$

$$E(u_i \Delta Y_{i2}) = 0 \tag{2.3}$$

Conditions (2.2) and (2.3) can provide an additional $(T-2)$ linear moment condition, as follows:

$$E\left(\Delta Y_{it-1}(Y_{it} - \alpha Y_{it-1})\right) = 0$$

$$t = 3, 4, \ldots T \tag{2.4}$$

This means that the first-order lagged difference item $\Delta Y_{it-1}$ is the instrumental variable for the lagged explained variable $\alpha Y_{i,t-1}$ in the level equation. Therefore, the new moment restrictions can be expressed as follows:

$$E(\boldsymbol{Z}_i' \boldsymbol{\varepsilon}_i^*) = 0 \quad \boldsymbol{\varepsilon}_i^* = (\Delta\varepsilon_{i3}, \ldots, \Delta\varepsilon_{iT})$$

$$\boldsymbol{Z}_i = \begin{bmatrix} Z_i & \cdots & 0 \\ \vdots & \ddots & \vdots \\ 0 & \cdots & \Delta Y_{it-1} \end{bmatrix} \tag{2.5}$$

To satisfy the requirements of GMM estimation, the Arellano-Bond (AB) test and Sargan test were employed to test the AR(1) and AR(2) autocorrelation of residuals, and the overidentified restrictions of instrumental variables, respectively. Technically, the difference in residuals will exhibit first-order autocorrelation due to the panel data's dynamic nature. However, the absence of second-order or higher-order autocorrelation would support the null hypothesis for no autocorrelation of residuals is failed to be rejected. The Sargan test can be utilized to indicate the validity of the instrument variables by failing to reject the null hypothesis.

The risk equation for this study's banking observations is constructed following the modeling ideas of Delis and Kouretas(2011). First, a benchmark model reflecting the relationship between monetary policy, the COVID-19 pandemic, and bank risk-taking behaviors is formulated:

$$RISK_{it} = \alpha + \delta(RISK_{i,t-1}) + \beta_1 MONE_{it} + \beta_2 COVID_{it} + \beta_3 b_{it} + \beta_4 c_{it} + \varepsilon_{it} \tag{2.6}$$

$RISK_{it}$ captures the risk level of the t-phase of $i^{th}$ bank. On the other hand, the previous risk level is expressed as $RISK_{i,t-1}$. In this analysis, we will employ two alternative measures of the bank's risk-taking behavior:

1) the ratio of non-performing loans (NPL) to total loans (*RISK_loan*)

2) the ratio of risk assets to total assets (*RISK_asset*).

The federal fund rate measure is used as a proxy for the monetary policy variable $MONE_{it}$, and a pandemic-level indicator variable will be included $COVID_{it}$. A set of control variables $b_{it}$ that include macroeconomic variables, bank size, agricultural bank identifier, and merger status are factored into the estimating equations. The model will also include loan-deposit ratio, profitability, asset management, and earning retention as financial structure control variables ($c_{it}$) to capture banks' risk management decisions.

In this study, the GMM model will have two variant equations with one equation for each risk variable. These equations are defined as follows:

$$RISK\_loan_{it} = \alpha + \delta(RISK\_loan_{i,t-1}) + \beta_1 EFFR_{t-1} + \beta_2 GDP_{t-1} + \beta_3 IR_{t-1} + \beta_4 COVID_t + \beta_5 ROE_{it} + \beta_6 ROA_{it} + \beta_7 LEV_{it} + \beta_8 DL_{it} + \beta_9 HHI_{it} + \beta_{10} SIZE_{it} + \beta_{11} AG + \varepsilon_{it} \quad (2.7)$$

$$RISK\_asset_{it} = \alpha + \delta(RISK\_asset_{i,t-1}) + \beta_1 EFFR_{t-1} + \beta_2 GDP_t + \beta_3 GDP_{t-1} + \beta_4 IR_{t-1} + \beta_5 COVID_t + \beta_6 COVID_{t-1} + \beta_7 ROE_{it} + \beta_8 LEV_{it} + \beta_9 DL_{it} + \beta_{10} HHI_{it} + \beta_{11} SIZE_{it} + \beta_{12} AG + \varepsilon_{it} \quad (2.8)$$

The above equations (2.7) and (2.8), $RISK\_loan$ and $RISK\_asset$ capture two aspects of the bank's risk profiles from two different perspectives: liability (loan portfolio risk represented by NPL's proportion to total outstanding loans) and asset (asset complement risk calculated as the proportion of risk assets to total bank assets) sections of the banks' balance sheets, respectively.

In the first risk-taking indicator, NPLs are outstanding accounts where borrowers have failed to repay on time or in full possibly due to economic downturns, default risk, or borrower insolvency. When this ratio is high, it indicates that the bank has taken on a significant amount of risk in its lending activities, thus translating to a higher likelihood that the bank might experience losses due to its inability to recover foregone expected profits from the loan transactions and outstanding credit exposures unpaid by their delinquent borrowers. On the other hand, a low ratio indicates that the bank has a lower risk of losses from its lending activities, as borrowers are more likely to repay their loans on time and possibly eventually in full.

For the second risk-taking indicator, the risk assets ratio is introduced to account for other sources of risks associated with banking asset decisions. Risk assets encompass a variety of asset types that are exposed to potential losses due to various forms of risk, including fluctuations in interest rates, changes in credit quality especially during economic downturns, and consequent effects on repayment risk. Key risk assets for banks include various types of loans, equities and corporate bonds, derivatives, foreign exchange positions, even government bonds. A higher risk-asset ratio indicates that a larger portion of bank assets is concentrated on such risk assets that are highly vulnerable to economic fluctuations. Notably, these assets generate relatively higher returns, but usually at the expense of high risk-bearing consequences for the banks. These risks can manifest as significant financial losses for the bank during periods of economic downturn or market instability.

On the right side of the equations, $EFFR$ is the Effective Federal Funds Rate obtained from the Federal Reserve Bank of New York (2023) and will serve as the model's proxy variable for the FOMC monetary policy. When the Federal Reserve needs to implement an expansionary policy that will boost the economy, it may decrease the target for the federal funds rate, which reduces the cost of borrowing for consumers and businesses, thereby encouraging spending and investment. In contrast, when the Federal Reserve wants to contain inflation or revert asset bubble trends, it can raise the federal funds rate target, which consequently increases the cost of borrowing, thus inducing the need for more prudent economic actions, such as more savings and cost-cutting measures.

$GDP$ is another macroeconomic variable gathered from the U.S. Bureau of Economic Analysis (BEA, 2023) to serve as the model's U.S. economic growth measure. Data on the consumer price index (CPI) retrieved from the U.S. Bureau of Labor Statistics (BLS, 2023) will account for inflationary effects. By tracking changes in the CPI, policymakers can assess the severity of inflation in the economy and may adjust monetary policy to maintain price stability. $COVID$ is the level of the COVID-19 pandemic in the United States during different periods (Centers for Disease Control and Prevention, 2023) measured as the natural logarithm of COVID-19 case numbers. This transformation stabilizes variance and reduces data skewness, aligning with the assumptions of the model. It also converts exponential growth into a linear form.

The model also includes several variables that capture the banks' financial conditions and operating strategies. Measures depicting the banks' profitability conditions include Return on assets (ROA) and return on equity (ROE) that account for the banks' ability to generate income given their existing assets and capital endowments. Earnings retention rate (ET) provides information on banks' prioritization of internal growth financing versus dividend distribution alternatives. The asset turnover ratio (AT) measures the banks' asset management decisions on asset acquisition, retention, and disposal that determine the relative productivity of their resulting asset complements. Deposit to liability ratio (DL) is the model's liquidity measure derived by calculating the percentage of total deposits to total loans. Leverage multiple (LEV) reflects the banks' capital sourcing decisions and indicates how much debt (relative to equity funds) has been utilized to finance its operations. A larger leverage ratio suggests that the bank is utilizing more debt to fund its operations, potentially enhancing returns but also elevating the risk of financial instability as the bank deals with increased debt commitments.

Structural variables are also included in the model to account for certain distinct characteristics and operating styles among banks. A loan portfolio diversification index (HHI) is also calculated as an indicator of how a bank's total loan portfolio is distributed or broken down into several categories of loans. In our analysis, the loan categories considered include agricultural, individual consumer, real estate, and commercial industrial loans. The loan diversification index HHI is calculated according to the Herfindahl index definition:

$$\text{HHI} = \sum_{i-1}^{n} (Loan\ share_i)^2 \qquad (2.9)$$

An HHI value of 1 indicates a highly specialized loan portfolio (involving full exposure to only one loan category) while smaller HHI values are associated with more diversified loan portfolios (Zheng and Escalante, 2020). The banks' asset base is used as the basis for the business size variable (SIZE), which is derived by taking the logarithm of total assets. The influence of agricultural lending in the banks' operating decisions is captured through a dummy variable (AG) that takes a value of 1 for banks classified as "specialized" agricultural banks and 0 for non-agricultural banks. In categorizing agricultural and non-agricultural banks in the dataset, the classification criterion suggested by the Federal Deposit Insurance Corporation (FDIC) was employed. Specifically, the FDIC defines agricultural banks as those whose portfolio of agricultural production and farmland-secured real estate loans constitutes over 25 percent of their aggregate loan and lease portfolio. (FDIC, 2018).

**2.4 Data**

This study utilized a panel dataset developed from a banking call report database published online by the Federal Financial Institutions Examinations Council (FFIEC) public data distribution website. This data source contains a Uniform Bank Performance Report (UBPR), which is released quarterly and contains updated information on earnings, asset quality indicators, liquidity conditions, and capital levels. Moreover, this study also collected macro-level datasets from several sources, including the Federal Reserve Bank, the U.S. Bureau of Economic Analysis, the U.S. Bureau of Labor Statistics, and the Center for Disease Control and Prevention. After compiling and organizing all data from various sources (and discarding observations with missing data), a balanced panel dataset of 2,570 commercial banks was developed for this analysis. With data spanning over eighteen quarters (from the first quarter of 2018 to the second quarter of 2022), this bank-level panel dataset (consisting of a total 46,260 observations) captures a range of economic and financial conditions prevailing at the pre-pandemic era and during the brief recession and recovery phases of the pandemic period (just before the onset of FOMC's aggressive inflation control monetary policy decisions). The examination of changes in various banking indicators, such as NPLs, profitability ratios, and liquidity measures across these two contrasting periods can provide valuable insights into how the pandemic's recessionary and economic recovery phases have affected the banking industry's performance and risk profile. Additionally, our analysis can help identify strategies and policies that have proven to be effective in offsetting the adverse effects of the pandemic's recessionary pressures on banks' operations and financial health. A descriptive statistical summary of the main variables is presented in Table 2.1.

The plots in Figure 2.1 present the intertemporal trends in the banks' risk profiles from the liability (NPL) and asset (risk assets) perspectives. In most of the pre-pandemic period (from the $2^{nd}$ quarter of 2018 until the last quarter of 2019), the banks maintained relatively lower risk profiles reflecting the relatively less volatile economic conditions at that time. NPLs started to accumulate earlier than risk assets as a sharp increase was recorded in the 1st quarter of 2020. Around this time, the general economic mood was dominated by concerns of instability as everyone worried about the uncertain duration, spread of virus infections, and lack of reliable, firm, and definitive remedies that could curtail the looming severity of the pandemic. The risk-asset ratio started to increase significantly by the 3rd quarter of 2020 and was an apparent reactionary consequence of the earlier stark rise in loan delinquency rates. As FOMC's monetary decisions kept interest rates at low levels around this time, this suggests that banks may have increased their holdings in riskier assets, potentially in pursuit of higher yields, before reducing such exposure as economic conditions changed. The plots indicate that periods of higher risk asset ratios seem necessarily to align with higher NPL, implying that some overlapping factors might be influencing the risk profile of banks' asset portfolios. In the third quarter of 2021, the two ratios started to decrease, which then reflects the effective mitigation effect of the U.S. government's commitment to boost incomes through the distribution of substantial fiscal economic relief.

**2.5 Results**

The estimation results of the DPD-GMM model for all banks are summarized in Tables 2.2 and 2.3. The Arellano-Bond and Sargan tests are used to test the validity of the instruments used in the GMM estimation. The GMM model is used to estimate parameters in the models when there are more instrumental than endogenous variables. The instruments are used to eliminate the endogeneity bias that can arise in econometric models. If the instruments employed in the GMM estimation are appropriate, the GMM estimator will be both consistent and efficient, meaning that the estimates of the parameters are unbiased and have minimum variance. Results of the Arellano-Bond and Sargan tests indicate that the GMM estimates are consistent by failing to reject the null hypothesis.

*2.5.1 Loan Portfolio Quality Risk*

In the first set of estimations (Table 2) focusing on loan portfolio quality risk using NPL as a risk indicator, results indicate that the lagged NPL ratio is significantly positively correlated with the current period's NPL ratio. This suggests a sustained deterioration in the banks' loan portfolio quality conditions as NPLs accumulate in the current period instead of being reduced. This reflects the difficult challenges persisting during this study's period when economic shocks only lead to more depressed incomes and borrowers' diminished repayment capabilities.

The significant negative GDP coefficient result confirms the debilitating effect of an economic slowdown on the bank's loan portfolio quality. The significant positive COVID-19 coefficient further corroborates the worsening pandemic situation. As COVID-related health concerns compounded, stricter and more elaborate social mobility constraints were imposed, and the consequential economic and financial repercussions persisted.

The EFFR variable is significantly negative, which confirms FOMC's efforts to reinvigorate the economy. Consistent with the FOMC's policy actions during the late 2000s recession, it again adopted its expansionary policy stance of inducing borrowing cost reductions by setting EFFR as close to zero as possible. Given that EFFR trends indirectly reflect the prevailing economic conditions, a downward trend in EFFR levels indicates sluggish economic conditions that, in turn, have a negative effect on the quality of the bank's loan portfolio through higher NPL ratios.

The significant negative coefficient result for the liquidity proxy measure (Deposit-Liability Ratio) suggests that the diminishing quality of the bank's loan portfolio is associated with the bank's difficulty in attracting more deposits from an equally liquidity-constrained clientele. The banks' depleting (or stagnant) deposit base could have deprived banks of opportunities to make available cheaper credit alternatives to their clients and reduced the probabilities of new NPL additions to their loan portfolios.

The loan diversification index (HHI) coefficient result suggests that banks' tendency to concentrate (specialize) their loan transactions to a particular client (industry) segment or loan accommodation category may have detrimental effects on their resulting loan portfolio quality. Notably, the AG variable is insignificant, hence implying that the banks' specialization inclination did not involve agricultural clients.

*2.5.2 Risk Asset Acquisition and Disposal Decisions*

The coefficient results for the EFFR, GDP, and COVID-19 variables for the Risk Asset equation (Table 3) mirror the earlier results for the loan portfolio quality (NPL) equation. These three results reinforce each other: a slowdown in overall economic activity (negative GDP) due to the imposition of stricter social mobility constraints as the number of COVID-19 infections continues to increase would precipitate FOMC's expansionist policy stance by reducing EFFR and keeping the level to as close to zero as possible. Under these conditions, the banks' risk asset holdings become larger relative to their total asset complements. Banks' risk assets are technically highly vulnerable to interest rate volatility and changes in credit and repayment risks. The EFFR effect confirms that the low-interest rate regime ushered in by FOMC's actions somehow assured banks to maintain higher proportions of risk assets, although their speculative instincts (mindful of the greater uncertainty on the pandemic's tenure and gravity) might temper these decisions.

Increases in holdings of such assets as the economy deals with pandemic-related recessionary pressures and recovery efforts during this study's time period can be better understood through the results of two financial conditions variables. The liquidity variable (Deposit-Liability ratio) is significantly negative, thus establishing the bank's difficulty in attracting clientele deposits under overall gloomy economic conditions. During such liquidity-constrained situations, banks tended to resort to incurring more debts as a coping mechanism (significant positive LEV result). Specifically, during the pandemic, there was a notable trend of banks holding more government bonds, held-to-maturity (HTM) securities, and mortgage-backed securities (MBS), (like Silicon Valley Bank). Banks also explored various funding avenues such as borrowing from institutional investors, issuing commercial paper, and engaging in repurchase agreements (repos), in addition to accessing the Federal Reserve's discount window (Krainer and Paul, 2023). Thus, these fund-sourcing remedies led to increases in banks' risk asset holdings.

The significant positive loan diversification variable result confirms that a more specialized loan portfolio will lead the bank to accumulate a higher level of risk assets for the sake of yielding to business viability pressures. Moreover, smaller banks, usually those classified as agricultural banks, would usually end up with larger risk asset portfolios as these banks usually find it difficult to compete with larger, non-agricultural banks in acquiring less risky assets in the financial market.

### 2.6 Conclusion

This article lays out the economic predicament of banks in the first two years of the pandemic period when the economy navigated through challenging physical, medical, social, and economic hurdles as the general population struggled with anxieties and despair over uncertainties and losses. The significant economic slowdown caused by the restrictive social mobility conditions during the early stages of the pandemic has exerted enormous pressure on banking institutions to survive and maintain their economic composure. The pandemic caused business shutdowns, which subsequently led to declining household incomes, which immediately led to higher loan risk exposure (increasing loan default risk) for banks as NPLs accumulate in both absolute and monetary terms. Bank's liquidity conditions deteriorated as depressed incomes curtailed the banks' deposit generation capability.

With the Fed implementing a range of aggressive, expansionary monetary policies to inject liquidity into financial markets, banks have had to increase credit standards to reduce potential risks. Under a regime of lower interest rates ushered in by FOMC's monetary policies, banks resolved their liquidity issues through several decisions that involved, increased holdings of, among others, government bonds, held-to-maturity (HTM) securities, and mortgage-backed securities (MBS) while incurring loans from institutional investors and accessing the Federal Reserve's discount window. Just like the banks' loan portfolio risk aggravated by higher NPLs, such asset acquisition decisions increased the riskiness of their asset complement.

This study's findings clarify that increases in the banks' overall risk profiles can be driven by both historical (uncontrolled) and current (discretionary) portfolio decisions. Abrupt, pervasive economic shocks, such as the pandemic, are uncontrolled, unexpected events that could suddenly corrupt historical lending decisions, once regarded as sound and most possibly optimal. The economic shocks of the pandemic were practically pervasive and affected even the most creditworthy clients. On the other hand, the FOMC's expansionist stance provided relief for banks to use their discretion in resolving their compounding liquidity issues. As these seemingly inevitable business decisions could nonetheless increase their risk exposure on the asset side of their balance sheet, banks needed to exercise caution and continually make reliable speculations of future market and economic directions.

In the face of such a highly risky operating environment, this study identifies certain more vulnerable elements of the banking industry. Highly specialized lending operations that concentrate only on a singular type of (or highly homogeneous) clientele are usually more prone to greater risk exposure in both loan portfolio and risk asset terms. Small banks, including those leaning more towards agricultural lending, may not have more problematic loan portfolios like their larger peers but are usually more susceptible to maintaining significantly higher-risk asset portfolios. This trend only confirms the actual dynamics in the financial (capital) markets where business size determines market power or the enjoyment of competitive access to more preferred, less volatile (but more expensive) financial instruments. Smaller agricultural banks would usually be relegated to residual, riskier financial instruments that will only exacerbate the riskiness of their asset holdings.

The pandemic-induced recession sheds light on several important realizations. Prompt and swift monetary policies, quickly supplemented by sizeable federal income relief, can collectively manage to contain recessionary pressures in a shorter period. Notably, the federal monetary policy maintained its expansionary stance for about two years, even when indicators started to indicate economic recovery. This formula also helps regulate banking risks through gradual, indirect easing of loan portfolio risks and provides affordable tools that moderate liquidity concerns. Policy experts, however, might have to revisit equity issues in financial markets to ensure increased access for smaller firms (as well as constrained agricultural banks) to preferred capital sources mostly available to larger peers.

Table 2.1. Summary statistics of main variables

| Variable | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|
| Loan Portfolio Risk (RISK-loan), % | 1.343 | 0.920 | 0.000 | 30.000 |
| Asset Complement Risk (RISK-asset), % | 18.225 | 12.826 | 3.213 | 1054.78 |
| Effective Federal Funds Rate(%) | 1.051 | 0.974 | 0.060 | 2.410 |
| GDP(%) | 5.935 | 12.560 | -32.410 | 38.730 |
| Producer Price Index | 3.933 | 3.918 | -0.700 | 11.700 |
| Inflation Rate(%) | 3.283 | 2.417 | 0.600 | 8.500 |
| COVID-19 | 9.223 | 8.358 | 0.000 | 18.286 |
| ROA | 0.062 | 0.180 | -1.931 | 15.253 |
| ROE | 0.007 | 0.056 | -0.118 | 4.340 |
| Leverage Multiple | 10.826 | 4.052 | 2.054 | 135.986 |
| Deposit to Liability Ratio | 0.947 | 0.068 | 0.025 | 1.000 |
| Herfindahl-Hirschman Index | 0.620 | 0.175 | 0.231 | 1.000 |
| Size | 13.05 | 1.655 | 8.905 | 21.969 |
| Ag Bank Indicator | 0.033 | 0.179 | 0.000 | 1.000 |

Table 2.2. DPD-GMM results for Banks' risk-taking by non-performance loans, Q1 2018-Q2 2022

| **Dependent Variable: Risk for Loans** | Coefficient | Standard errors |
|---|---|---|
| Intercept | -1.575 | 2.406 |
| Risk for Loans t-1 | 1.324*** | 0.272 |
| Effective Federal Funds Rate t-1 | -0.119* | 0.065 |
| GDP t-1 | -0.007* | 0.003 |
| Inflation Rate t-1 | -0.063 | 0.051 |
| COVID-19 | 0.023*** | 0.006 |
| ROE | -3.945 | 2.485 |
| ROA | 26.618 | 19.072 |
| Leverage Multiple | 0.037 | 0.067 |
| Deposit to Liability Ratio | -11.567** | 4.952 |
| Herfindahl-Hirschman Index | 14.403* | 8.332 |
| Size | 0.008 | 0.089 |
| Ag Bank Indicator | -2.042 | 10.122 |
| Sargan test P-value | 0.578 | |
| AB-AR(1) P-value | 0.038** | |
| AB-AR(2) P-value | 0.124 | |

Notes: *, **, *** denote the significance of the difference between the means at the 10%, 5%, and 1% confidence levels, respectively.

Table 2.3. DPD-GMM results for Banks' risk-taking by risk-based Capital, Q1 2018-Q2 2022

| **Dependent Variable: Risk for Assets** | | |
|---|---|---|
| | Coefficient | Standard errors |
| Intercept | 43.212 | 47.199 |
| Risk for Assets t-1 | 0.392 | 0.299 |
| Effective Federal Funds Rate t-1 | -1.166** | 0.575 |
| GDP | -0.115** | 0.059 |
| GDP t-1 | -0.059 | 0.003 |
| Inflation Rate t-1 | -0.063 | 0.042 |
| COVID-19 | 0.168 | 0.160 |
| COVID-19 t-1 | 0.404* | 0.221 |
| ROE | 11.008 | 9.120 |
| Leverage Multiple | 2.510* | 1.515 |
| Deposit to Liability Ratio | -167.780* | 90.942 |
| Herfindahl-Hirschman Index | 184.2334** | 91.614 |
| Size | -3.037** | 1.315 |
| Ag Bank Indicator | 182.362* | 108.391 |
| Sargan test P-value | 0.562 | |
| AB-AR(1) P-value | 0.0001*** | |
| Ab-AR(2) P-value | 0.653 | |

Notes: *, **, *** denote the significance of the difference between the means at the 10%, 5%, and 1% confidence levels, respectively.

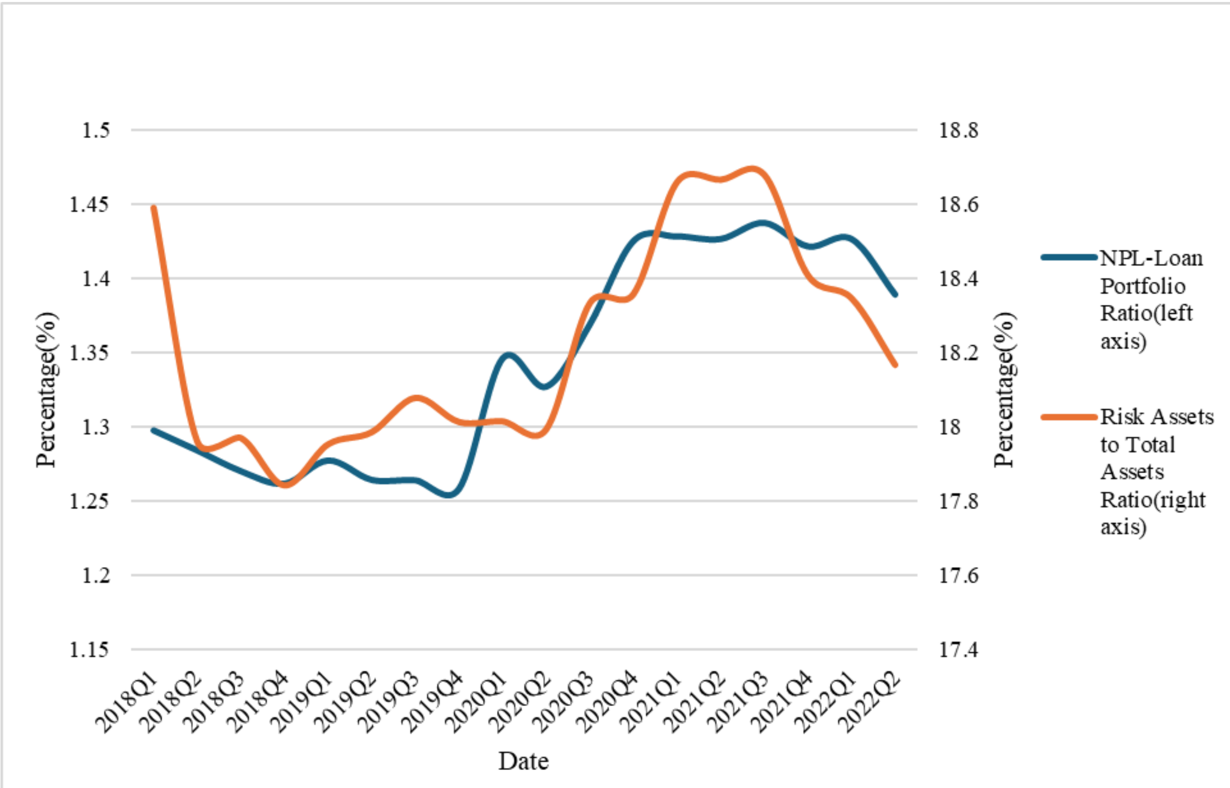


Figure 2.1. Comparison of Risk-Taking Behavior for Commercial Banks, 2018-2022

# CHAPTER 3

# RISK-TAKING BEHAVIORS OF BANKS: A COMPARATIVE ANALYSIS OF THE LATE 2000S AND COVID-19 RECESSIONS

## 3.1 Introduction

The dark cloud over the United States and global economies has shifted from the COVID-19 pandemic to high inflationary pressures, the Fed made huge efforts to curb inflation. However, the aggressive monetary policy brings fears and worries to the financial markets. The Federal Open Market Committee acted promptly with remedial and preventive actions to prevent the U.S. economy from plunging into an economic downturn. Monetary policy decision-makers slashed the benchmark fed funds rate to almost zero and pledged to expand the Fed's balance sheet by more than twice its size. This was to be achieved through substantial asset purchases of Treasuries and mortgage-backed securities, intended to depress longer-run interest rates. This tactic was reminiscent of the Federal Reserve's strategy during the late 2000s financial crisis. Considering expansionary policy during the pandemic as a quasi-natural experiment, this study can provide empirical evidence that can help understand how monetary policy can influence the risk-taking stances of agricultural and non-agricultural banks by employing a Generalized Difference-in-difference modeling approach. This study's implications are far-reaching, contributing to a more nuanced understanding of how monetary policy adjustments, particularly those executed during periods of economic turbulence, influence risk propensity in different sectors of the banking industry. It further seeks to understand whether such policies cause disparate impacts across various sectors, potentially informing more tailored and effective policy interventions in the future. Furthermore, this investigation may also illuminate the potential side effects of aggressive monetary easing, including asset bubbles and financial instability. These insights are not only critical for central banks but also for investors, financial institutions, and policymakers who need to weigh the trade-offs between economic stimulation and financial stability. In conclusion, by examining the impact of the Federal Reserve's bold measures during the pandemic, this study aims to enrich our understanding of monetary policy's multifaceted effects on the banking sector, ultimately contributing to more informed, evidence-based policy decisions in times of economic distress.

*3.1.1 Federal Open Market Committee (FOMC) Monetary Policy*

The Federal Open Market Committee (FOMC) is instrumental in overseeing the United States open market operations The committee consists of twelve members: seven from the Federal Reserve System's Board of Governors, the president of the Federal Reserve Bank of New York, and four other Reserve Bank presidents who serve on a rotating basis (FOMC Policy Responsibility Act, 2018). The FOMC's main role involves the creation of monetary policies that aim for maximum employment, stable prices, and moderate long-term interest rates. These objectives are pursued by controlling the money supply in the economy via open market operations, which involve purchasing and selling U.S. Treasury and federal agency securities(Chappell, McGregor and Vermilyea, 2005). The specific monetary policies put into action by the FOMC are influenced by the current economic conditions. In periods of economic downturn or high unemployment, the FOMC might implement an expansionary monetary policy, typically characterized by reducing interest rates and boosting the money supply to encourage economic growth. Conversely, in times of rapid economic growth or high inflation, the FOMC might lean towards a contractionary monetary policy. The policy generally involves increasing interest rates and cutting the money supply to cool down the overheated economy.

Beyond formulating monetary policy, the FOMC is also actively involved in guiding the future direction of interest rates. The committee regularly releases statements regarding its views on the economic outlook and the appropriate timing and direction of future policy changes. These releases, known as 'forward guidance', have become an essential tool for shaping market expectations and guiding economic decision-making. The FOMC's role and actions are thus central to the functioning of the U.S. economy, with its decisions having wide-ranging implications for financial markets, businesses, and households. By carefully managing monetary policy and providing clear forward guidance, the FOMC strives to maintain economic stability and foster sustainable growth in the United States.

A key tool in the arsenal of the FOMC's monetary policy is the federal funds rate, in which depository institutions lend reserve balances to one another overnight. This rate typically guides short-term interest rates and affects wider financial conditions. The Effective Federal Funds Rate (EFFR), a particular form used by the Federal Reserve in implementing monetary policy is the rate at which banks and credit unions lend and borrow overnight funds amongst themselves to satisfy reserve requirements set by the Federal Reserve (Federal Reserve Bank of New York, 2023). By setting a target for the federal funds rate, the Federal Reserve influences EFFR. When the Federal Reserve aims to boost economic growth, it can lower this target rate, thereby reducing borrowing costs and promoting spending and investment. Conversely, to curb inflation or prevent asset bubbles, it can raise the federal funds rate target, which increases borrowing costs and fosters saving. Changes in the federal funds rate can significantly affect the economy. In situations of economic slowdown or below-target inflation, the FOMC may decide to lower the federal funds rate. This move reduces the cost for banks to borrow reserves, promotes lending, stimulates economic activities, and can potentially increase inflation. On the other hand, raising the federal funds rate can increase the cost of borrowing, which may reduce lending activities and potentially slow down the economy. This is often used as a strategy to prevent the economy from overheating and to keep inflation in check.

When the FOMC lowers the rate, borrowing costs for banks decrease. This reduction often trickles down to consumers and businesses, making loans like mortgages and business credit more affordable. Such a scenario generally encourages consumer spending and business investment, driving economic growth. The FOMC, through its management of the federal funds rate, exerts significant influence over the economy's growth rate, employment levels, and inflation. It's a delicate balance, requiring careful assessment of various economic indicators and conditions. The role of the FOMC in setting this rate cannot be understated - their decisions have significant repercussions not only for the American economy but also for the worldwide financial system.

## 3.2 Literature Review

### *3.2.1 FOMC Monetary Policy*

A substantial body of research examining the relationship between monetary policy, financial crises, and financial markets has been developed over many decades. Foundational studies by early monetarist economists, including Friedman (1959) established a significant connection between monetary policy interest rates and their impact on financial markets, with a particular focus on money demand. Taylor (1993) developed policy assessment studies on monetary policy rules in a policymaking setting and suggested that effective policy rules often necessitate alterations in the federal funds rate in reaction to variations in the price level or shifts in real income. Further investigations, such as Meltzer (1995), delved into the complex interactions between monetary policy and credit transmission mechanisms. Around the same time, Bernanke and Blinder (1988) contributed differing theories on the efficacy of monetary policy and credit. Stein (1998) offered a different perspective, focusing on the challenges banks face in balance sheet management and the resulting implications for monetary policy. Concurrently, the formulation of monetary policy within the constraints of low inflation and the nominal interest rates' zero lower bound was further investigated (Orphanides, 1999). Iturriaga (2000) provided more evidence that the credit channel could be a plausible method for the dissemination of decisions related to monetary policy. Nelson (2003) illustrated the importance of money for overall demand due to the various asset price-driven substitution effects of monetary policy. Svensson (2003) improves the theory of the role of money in the transmission mechanism of monetary policy. Studies by Romer and Romer (Romer and Romer, 2004)suggested that FOMC policy significantly influences both output and inflation, with these effects being considerable and occurring swiftly.

*3.2.2 Risk-taking Behavior in the Bank Industry*

As research in this field continued to grow, scholars began to investigate the link between bank risk-taking and monetary policy transmission mechanisms. studies like Keeley (1990) started exploring the banks' risk-taking behavior, particularly in relation to deposit insurance schemes. As research in this field continued to grow, scholars began to investigate the link between bank risk-taking and monetary policy transmission mechanisms. A seminal work by Dell'ariccia and Marquez (2006) posited that lending booms could result in a decline in lending standards, potentially leading to higher default rates and financial instability.

The devastating financial crisis of the late 2000s prompted a shift in literature toward the effectiveness of the Federal Reserve's monetary policy transmission and bank risk-taking behavior. This change is evident in studies like Laeven and Levine (2009), which stressed the importance of regulatory frameworks that foster transparency, accountability, and robust risk management practices. In the same vein, Borio and Zhu (2012) suggested that insufficient capital regulation could stimulate risky behavior in banks, thereby diminishing the effectiveness of monetary policy. Dell'ariccia, Laeven, and Marquez (2010) further examined this complex interplay and established that monetary policy can influence bank behavior via its impact on funding costs and credit availability. This relationship between low interest rates and increased risk-taking by banks was investigated, providing additional evidence that banks might pursue riskier investments in a low-interest-rate environment (Delis and Kouretas, 2011).

More recent studies, such as Delis, Hasan, and Mylonidis (2017), used corporate loan data to identify a negative relationship between bank risk-taking and monetary policy. Bruno and Shin (2015) examined the role of capital inflows in increasing bank risk-taking in a study of 27 emerging economies. The latest research, like Caglio, Darst, and Kalemli-Özcan (2021), affirms the association between low-interest rates, accommodative monetary policy, and increased bank risk-taking, especially concerning loans to small and medium-sized enterprises.

### 3.3 Methodology

#### *3.3.1 Generalized Difference in Difference Model*

Evaluating policy impacts, particularly those with differential effects on a study's entities, necessitates an analytical approach that accommodates such heterogeneity. Conventional methods, such as the Difference in Difference (DD) model(Blundell and Dias, 2002; Wooldridge, 2005), often fall short in this respect due to their foundational assumptions of strictly demarcated treatment and control groups (Bertrand, Duflo and Mullainathan, 2004). Recognizing these limitations, this study employs the Generalized Difference-in-Differences (GDD) model (Lee, 2015). The GDD model, with its inherent capacity to account for nuanced impacts, offers a more sophisticated and robust econometric framework for evaluating the causal impact of an intervention or treatment on an outcome variable over time (Bai and Jia, 2016). It shines particularly in situations involving observational data, as it skillfully navigates potential pitfalls by controlling for both time-constant unobserved heterogeneity and time trends that could otherwise confound the estimated treatment effect. In general, the zero selection-effect condition is very critical to the DD model. Suppose the impact of a specific policy on a certain group (treatment group) needs to be estimated while using another group (control group) for comparison. $D_{it}$ and $Y_{it}$ are treatment variable and dependent variable for individual $i$ at period $t$ respectively. Let the treatment group $P_i = 1$, while the control group $P_i = 0$ is not treated for the whole period. Let the treatment or policy be applied at the beginning $t = 2$. Suppose that $Y_{it}^0$ and $Y_{it}^1$ are potential untreated and treated dependent variables can be given by,

$$Y_{it} = (1 - D_{it})Y_{it}^0 + D_{it}Y_{it}^1$$

Thence it follows that,

$$Y_{i2} = (1 - D_{it})Y_{i2}^0 + D_{it}Y_{i2}^1$$

$$Y_{it} = Y_{it}^0 \; for \; t \leq 2$$

$D_{it} = 1$ only happens when $t = 2$ the policy is applied and stays in zero otherwise:

$$D_{it} \equiv P_i 1[t = 2]$$

So, define the simple DD model:

$$Y_{it}^1 = \gamma + Y_{it}^0 \; and \; Y_{it}^0 = 0$$

It can be followed by,

$$Y_{it} = \gamma P_i 1[t = 2] + \varepsilon_{it}$$

$$\Delta Y_{i2}^{0} = \Delta \varepsilon_{i2}$$

$$\Delta Y_{i2} = \gamma P_i + \Delta \varepsilon_{i2}$$

The $\gamma$ is a treatment effect and $\varepsilon_{it}$ is the error term. So $\Delta Y_{i2}$ is the difference in difference:

$$E(\Delta Y_2 \mid P = 1) - E(\Delta Y_2 \mid P = 0) = \gamma + (E(\Delta \varepsilon_2 \mid P = 1) - E(\Delta \varepsilon_2 \mid P = 0))$$

$$Constant\ selection\ effect = (E(\Delta \varepsilon_2 \mid P = 1) - E(\Delta \varepsilon_2 \mid P = 0))$$

In the traditional DD model, the assumption that the constant selection effect is zero holds. In contrast, the assumption of selection effect or pretreatment gap in the GDD model does not need to be zero. In other words, this nuanced control mechanism of the GDD model lends itself beneficially to this case—analyzing the impact of monetary policy on banks' loan operations during two distinct periods of economic upheaval: the COVID-19 pandemic and the late 2000s financial crisis. The model is formally expressed as follows:

$$y_{it} = \alpha + \delta intensity_i * Post_i + u_i + \lambda_i + \eta' x_{it} + \varepsilon_{it} \quad (3.1)$$

The equation (3.1), $y_{it}$ represents the bank's risk-taking behavior measurement variable for bank $i$ in period $t$, $intensity_i$ measures the heterogeneous impact intensity of the policy on each bank, and $Post_i$ is a dummy variable that distinguishes between the periods before and after the implementation of the FOMC monetary policy. The model further incorporates $u_i$ to denote individual fixed effects that control for time-invariant characteristics of each bank, and $\lambda_i$ to represent time-fixed effects, thus accounting for common shocks in each period that could influence all banks simultaneously. Finally, $x_{it}$ signifies a vector of other control variables, $\eta$ is the coefficients of the control variables, and $\varepsilon_{it}$ stands for the idiosyncratic error term. Through its effective handling of heterogeneity and time-specific variations, the GDD model thus allows for a comprehensive, nuanced, and accurate evaluation of the monetary policy impacts on the banking sector across these pivotal periods.

In this study, the GDD model includes two equations with one equation for each risk-taking behavior explained variable. These equations are defined as follows:

$$RISK\_loan_{it} = \alpha + \delta Intensity_i * Post_t + \beta X + u_i + \lambda_t + \varepsilon_{it} \tag{3.2}$$

$$RISK\_asset_{it} = \alpha + \delta intensity_i * Post_t + \beta X + u_i + \lambda_t + \varepsilon_{it} \tag{3.3}$$

The measurements $RISK_{loan\,it}$ and $RISK_{asset\,it}$ represent two facets of a bank's risk-taking behavior, as assessed through the ratios of non-performing loans and risk assets respectively. Non-performing loans in the first measurement are those that have not been repaid in a timely or complete manner, which could be due to factors such as economic downturns, default risk, or borrower bankruptcy. A high ratio here suggests that the bank has assumed considerable risk in its lending activities, with an elevated likelihood of incurring losses due to borrower default. Conversely, a low ratio suggests a reduced risk of losses as borrowers are more likely to fulfill their repayment obligations promptly and fully. In the second measurement, the risk assets ratio represents the potential of bank defaulting due to loans given to high-risk borrowers or investments in volatile securities. A high-risk assets ratio implies that a larger share of the bank's assets is vulnerable to potential losses, hence escalating the overall risk level of the bank. In other words, the bank is assuming greater risks to achieve higher returns. Therefore, these dual risk-taking measures can offer a thorough assessment of a bank's operational and risk management strategies. The term $intensity_i * Post_t$ symbolizes the interaction between the policy impact intensity specific to each bank and the dummy variable representing policy treatment.

In this research, identifying a suitable measure for intensity presents both a priority and a challenge. To address this, an intensity impact-scoring model is introduced. Further details regarding this model will be explained in the following chapter. The model also incorporates several other financial metrics such as net income ratio, return on equity, deposit to liability ratio, the Herfindahl index, and the scale of the bank, denoted as $\beta X$. The specific equations are defined as follows:

$$RISK\_loan_{it} = \alpha + \delta Intensity_i * Post_t + \beta_1 NI + \beta_2 ROE + \beta_3 HHI + \beta_4 SIZE + \varepsilon_{it} \quad (3.4)$$

$$RISK\_asset_{it} = \alpha + \delta intensity_i * Post_t + \beta_1 DL + \beta_2 ROE + \beta_3 HHI + \beta_4 SIZE + \varepsilon_{it} \quad (3.5)$$

The net income ratio ($NI$) is a key profitability indicator, expressing net income as a percentage of revenues, that captures the efficiency of a bank in generating profits. Return on equity ($ROE$) is another profitability indicator, demonstrating the financial return on the equity capital invested in the bank. The deposit-to-liability ratio ($DL$) encapsulates the liquidity position of the bank, signifying the proportion of total deposits relative to the total loans of the bank. The Herfindahl index ($HHI$), often used to evaluate market concentration, is utilized here as a measure of loan portfolio diversity. This index is calculated using the sum of the squares of each loan category's share in the total loan portfolio, namely:

$$\text{HHI} = \sum_{i-1}^{n} (Loan\ share_i)^2 \quad (3.6)$$

Higher values of the index indicate less loan diversification, whereas lower values suggest a more varied loan portfolio(Zheng and Escalante, 2020). The size of the bank denoted as $SIZE$ is evaluated by taking the natural logarithm of the bank's total assets. The scale of the bank is crucial as it often correlates with a bank's risk profile and operational capabilities. Meanwhile, the GDD model controls individual fixed effects, $u_i$, and $\lambda_t$ time-fixed effects for each period.

*3.3.2 Impact-Scoring Model*

In the complex interplay between monetary policy and bank performance, quantifying the effects of policy changes on banking operations can be a daunting task. To address this challenge, the first step is to find the intensity of FOMC policy impact for each bank. In this study, an impact-scoring model was built according to the previous study of borrower credit-scoring models (Barry, Escalante and Ellinger, 2002). To illustrate the FOMC policy impact intensity, build a comprehensive score model for assessing banks' policy reactions in response to policies enacted by the Federal Open Market Committee. The model segments the broad scope of banking operation indicators into five distinct but interrelated dimensions: Liquidity, Profitability, Repayment Capacity, Capital Adequacy, and Growth. Each dimension is represented by carefully selected financial key factors that capture the inherent characteristics and policy-impacted aspects relevant to that category. By synthesizing these dimensions through a weighted scoring system, the model creates a robust and comprehensive quantification of the intensity of policy impacts. The relationship between these indicators and the impact of FOMC policy cannot be a consistent correlation, and it is crucial to understand the opposite effects of each indicator by monetary. A brief explanation of how each component could be affected by FOMC policy is stated below:

*3.3.2.1 Liquidity: Deposit to Liability Ratio*

The influence of FOMC policy changes on the cost of funding and banks' liquidity positions is an essential aspect of banking operations. The deposit to liability ratio serves as a reliable indicator of a bank's liquidity, which may be directly affected by changes in monetary policy. A higher ratio typically suggests that the bank primarily relies on deposits for its funding, which are often more stable and less vulnerable to interest rate fluctuations. Thus, banks with a higher deposit-to-liability ratio may be less affected by changes in FOMC policy, reflecting a more stable liquidity profile in the face of monetary policy shifts.

*3.3.2.2 Profitability: Return on Equity and Net Income Ratio*

Profitability, another key dimension of bank performance, that could be affected by changes in monetary policy, is assigned a higher weight if profitability is a significant concern in this research. The return on equity and the net income ratio serves as insightful metrics in this regard. ROE evaluates how efficiently a bank uses shareholders' equity to produce profits. Any changes in monetary policy that influence a bank's net income could affect its ROE. For instance, in a scenario of tightened monetary policy where interest rates are raised, a bank's net interest margin could decrease, leading to a lower ROE.

Similarly, the net income ratio, which denotes the proportion of net income relative to total revenue, can reflect changes in a bank's operational efficiency following a policy shift. Therefore, these metrics collectively provide a nuanced view of a bank's profitability under changing monetary conditions. Notably, changes in FOMC policy could have a direct bearing on this ratio. For example, an expansionary monetary policy, designed to stimulate the economy by reducing interest rates, could decrease the bank's interest expenses if it relies heavily on interest-bearing liabilities for its operations. This decrease could raise the bank's net income, leading to a higher net income ratio. Therefore, it could be conjectured that there is a positive correlation between changes in FOMC policy and the net income ratio.

*3.3.2.3 Repayment Capacity: Gross Loss to Average Total Loan Ratio and Loan Loss Provision Ratio*

The FOMC's policy adjustments can influence banks' loan portfolios, affecting their repayment capacity. The gross loss to average total loan ratio and the loan loss provision ratio are key indicators for evaluating this aspect. The gross loss to average total loan ratio measures the total amount of loans written off by a bank, concerning its average total loans. This ratio can indeed be sensitive to FOMC policy changes. A higher gross loss to average total loan ratio means borrowers find it more difficult to service their debts. In such a scenario, defaults may increase, resulting in higher gross losses for banks. Therefore, banks with higher gross loss levels, already grappling with significant loan defaults, might view further changes in monetary policy, especially those introducing higher interest rates or encouraging riskier lending, as additional challenges to their already strained repayment capacity.

The Provision for Loan and Lease Losses (PLL) as a percentage of average assets is an alternative measure to represent credit risk management in the assessment model. This ratio reflects the bank's provisions for potential losses on loans and leases as a proportion of its average assets, providing insights into the bank's risk management practices. The loan loss provision ratio, representing the proportion of a bank's loans for which it has established provisions in anticipation of potential defaults, could also exhibit sensitivity to FOMC policy shifts. In an environment where expansionary policy leads to lower interest rates, banks may extend credit to riskier borrowers, given the lower cost of capital. This could increase the loan loss provision ratio as banks make allowances for potential future loan defaults. Conversely, during contractionary policy periods, the loan loss provision ratio might decrease as higher interest rates could deter riskier borrowers from seeking loans.

*3.3.2.4 Capital Adequacy*

Capital adequacy is a crucial indicator of a bank's financial strength and resilience, with the leverage ratio playing a key role in its assessment. The leverage ratio measures the extent to which a bank's operations are financed by debt, providing a crucial lens through which to view the bank's financial risk. A lower leverage ratio is typically preferred, as it indicates a lesser reliance on borrowed funds to finance the bank's operations. Banks with lower leverage ratios have a stronger equity base, providing a greater buffer against potential losses. This increased capital cushion aids in absorbing losses without destabilizing the bank, enhancing the bank's stability and reducing its susceptibility to insolvency. Changes in FOMC policy can affect the leverage ratio. In periods of expansionary monetary policy, when interest rates are low, banks might be tempted to increase their leverage, as borrowing costs are reduced.

*3.3.2.5 Bank Growth*

The growth of a bank can be critically assessed through the lens of its Total Asset Annual Change, which quantifies the percentage change in a bank's total assets from one year to the next. This metric serves as a proxy for the overall growth rate of the bank, encapsulating the evolution of both its loan portfolio and other asset classes. The expansion or contraction of a bank's asset base can be sensitive to changes in FOMC policy. During periods of expansionary monetary policy, characterized by lower interest rates, banks may find it more appealing to expand their asset bases. This is because lower interest rates decrease the cost of borrowing and can stimulate demand for loans among customers, contributing to an increase in the bank's total assets. Consequently, the total asset annual change might increase during these periods.

In conclusion, the impact-scoring model leverages five key indicators - deposit to liability ratio, return on equity, net income ratio, gross loss to average total loan ratio, leverage ratio, and total asset annual change - each of which offers a distinct perspective on a bank's operational and financial health. These indicators capture different facets of a bank's performance including liquidity, profitability, repayment capacity, capital adequacy, and growth. The selection of these indicators underscores the comprehensive approach taken in this study to capture the varying effects of FOMC policy changes on banks. It recognizes that the impact of monetary policy changes can manifest in multiple areas of a bank's operations, necessitating a multi-dimensional approach to its assessment. This model is structured to quantify the impacts of FOMC policy changes on banks, understanding that these impacts can differ greatly based on the unique characteristics and circumstances of each bank. Thus, this impact-scoring model serves as a valuable tool for initiating this important analysis.

*3.3.3 Normalize the Measures*

To standardize the different financial ratios or metrics used in our impact-scoring model and ensure comparability across banks, we employ min-max normalization. It results in a variable with a mean of 0 and a standard deviation of 1. The formula for min-max normalization is:

$$Normalized\ Value = (Value - Min) / (Max - Min)$$

This technique rescales the value of each financial metric to a standard range of 0-1. With the normalized scores, a bank that exhibits potential policy impact for a given metric will have a higher score, while a lower policy impact bank will have a lower score. Once the indicators are normalized, we assign weights to each of the five categories of the impact-scoring model: liquidity, profitability, repayment capacity, capital adequacy, and growth. These weights reflect the relative importance of each category in determining a bank's sensitivity to FOMC policy changes. The sum of these weights equals 1, ensuring that the final policy impact score for each bank, which is the aggregate of the weighted scores for each category, also lies within the range of 0-1. To calculate the overall score for each category, each normalized score within that category by the corresponding category weight is multiplied. Then, Summed the weighted scores to obtain the overall category score. Figure 3.1 presents each category's weight in the model. Finally, the overall category scores to compute the final policy impact score for each bank. This score represents the bank's overall sensitivity to FOMC policy changes, with higher scores denoting greater sensitivity.

To further classify banks based on their sensitivity to policy changes, the banks divided them into three classes. Class 1 consists of banks with the least policy impact intensity (those least sensitive to policy changes), Class 2 includes banks with moderate policy impact intensity, and Class 3 comprises banks with the most policy impact intensity (those most sensitive to policy changes). Table 3.1 presents the Policy Intensity Impact-Scoring Model used in this study. The interval ranges for these measures are set in a way to classify them into three levels, and each level is associated with a corresponding score. In constructing the interval ranges, a statistical approach was employed that centered around the division of the dataset into quartiles to delineate interval ranges that categorize banks by their responsiveness to shifts in the policies of the Federal Open Market Committee. This stratification process divided the aggregated impact scores, derived from a comprehensive evaluation of banks' performance metrics, into four distinct segments.  Based on the aggregated scores from all categories, the banks are further classified into three intensity score classes. The classification from Class 1 to Class 3 signifies the increasing intensity of policy impact, with Class 1 banks being the least affected by policy changes and Class 3 banks being the most affected. The lower quartile encompasses entities demonstrating minimal susceptibility to policy adjustments, hereby classified under Class 1. Entities positioned within the intermediary ranges—specifically, the second and third quartiles—were ascribed to Class 2, indicating a moderate level of impact susceptibility. Conversely, the upper quartile, embodying the highest scores, signified entities with maximal sensitivity, classified as Class 3. This quartile methodology facilitates an equitable and methodical classification, ensuring an even representation across varying degrees of policy impact sensitivity. This method of normalization, weighting, and aggregation provides a comprehensive, standardized measure of a bank's sensitivity to FOMC policy changes, facilitating clear comparisons across banks and assisting in the identification of those most likely to be affected by such changes.

**3.4 Data**

This study utilizes panel datasets under consideration that have been acquired from the online data distribution service provided by the FFIEC (Federal Financial Institutions Examinations Council). It encompasses quarterly call reports of nationwide commercial banks, offering up-to-date statistics regarding earnings, balance sheets, asset quality, liquidity, and capital. Furthermore, data from the Uniform Bank Performance Report (UBPR), another set of quarterly reports, has been incorporated into this research. This report outlines similar financial parameters, providing an alternative lens to evaluate the banks' financial conditions and performance. To amplify the scope and depth of this study, several macro-level datasets have also been included. These datasets, derived from national institutions such as the Federal Reserve Bank, and the U.S. Bureau of Economic Analysis, provide valuable context and background to the bank-level data. Figure 3.2 and Figure 3.3 illustrate the Effective Federal Funds Rate trends during these two periods obtained from the Federal Reserve Bank of New York (2023) to represent the FOMC monetary policy. The chronological breadth of this dataset encompasses two distinctive periods, 2006-2010 and 2018-2022. This division has been implemented to capture the juxtaposing scenarios before and during the application of an expansionary monetary policy for these two economic recession periods.

Important indicator variables within the impact intensity scoring model for the two distinct periods are outlined in Tables 3.2 and 3.3. The first period corresponds to the FOMC's decision to lower the effective federal funds rate to zero during the COVID-19 pandemic (Q1

2020), while the second period marks the same policy shift during the late 2000s financial crisis (Q4 2008). The cross-sectional datasets for these two crucial time points serve as a basis to evaluate the impact intensity of FOMC policy on individual banks.

The first panel data set, which comprises data from 2570 commercial banks, stretches over eighteen quarters from Q1 2018 to Q2 2022. Similarly, the second-panel dataset, sourced from 6295 commercial banks, expands over twenty quarters from Q1 2006 to Q4 2010. These panel datasets offer a comparative snapshot of a myriad of economic and financial conditions, including the pre-pandemic era, the ongoing pandemic, before, during, and after the late 2000s financial crisis. By scrutinizing changes in several banking indicators, such as non-performing loans, profitability ratios, and liquidity measures, throughout these periods, it is possible to glean insights into the pandemic's effects on the banking industry's performance and risk profile.

Additionally, these datasets may guide the identification of strategies and policies that have been effective in mitigating the pandemic's adverse effects on banks' operations and financial health. The first dataset encompasses 46,260 observations, while the second dataset includes 125,900 observations. The descriptive summary statistics of the primary variables are presented in Tables 3.4 and 3.5, respectively, for each dataset.

**3.5 Results**

This chapter presents and discusses the results of the generalized difference-in-differences (GDD) analysis on banks' risk-taking behavior. The estimation results for all banks obtained from the GDD model are summarized in Tables 3.6. The study analyzes two separate time frames: Q1 2018 - Q2 2022 and Q1 2006 - Q4 2010. For each dependent variable, the estimated coefficients and their standard errors are reported. Two indicators were chosen to reflect the banks' risk-taking behavior: the ratio of non-performing loans to total loans and the risk-taking behavior concerning risk assets.

During the COVID-19 pandemic, the interaction term of the policy treatment dummy variable and policy impact intensity serve as the policy assessment indicator variable. The coefficient of this term in relation to loan risk-taking is positive and statistically significant at the 1% level. This finding suggests that following the Federal Open Market Committee's (FOMC) implementation of expansionary policy, banks' loan risk-taking behavior significantly increased. For the other control variables, the return on equity and the net income ratio present a negative relationship with risk for loans, both significant at the 1% level. This suggests that higher profitability ratios correspond with lower risk-taking in loans. The Herfindahl-Hirschman Index, a measure of market concentration, is not statistically significant. However, the scale of the bank shows a negative and significant relationship with risk for loans, indicating that larger banks tend to take less risk.

Regarding risk-taking concerning risk assets, the Post*Intensity interaction term is positive and significant at the 1% level. This suggests an increase in banks' asset risk-taking behavior after the federal funds rate was lowered to zero. The deposit-to-liability ratio exhibits a significantly negative correlation with risk for assets, suggesting that higher profitability leads to lower asset risk. Interestingly, the return on equity has a significantly positive coefficient. A possible explanation is that higher ROE may indicate a higher capital buffer or excess capital, which can be deployed towards riskier assets. Finally, the Herfindahl-Hirschman Index and bank size show a negative and significant relationship with asset risk, indicating that larger banks and those in more concentrated markets tend to take less asset risk.

During the late 2000s financial crisis, the policy treatment*Intensity interaction term is statistically significant and positive at the 1% level for both risk for loans and risk for assets, with coefficients of 2.094 and 8.639 respectively. This signifies that banks' risk-taking behavior concerning both loans and assets significantly increased after the expansionary policy change during this period. The return on equity and net income ratio shows a negative and significant relationship with loan risk-taking. Similar to the findings for the period between 2018 and 2022, the Herfindahl-Hirschman Index is not statistically significant. Bank size continues to show a negative and significant relationship with the risk for loans. When considering the model for risk assets, the return on equity displays a positive and significant relationship, consistent with the period of the COVID-19 pandemic. The deposit-to-liability ratio is not significant, suggesting it may not have a distinct influence on asset risk-taking during this period. The Herfindahl-Hirschman Index and bank size both display a negative and significant relationship, which is consistent with the findings from the 2018-2022 period.

These findings provide empirical evidence that an expansionary FOMC monetary policy can lead to an increase in the bad performance loan ratio and risk assets ratio for a bank. When the FOMC reduces the federal funds rate, it effectively reduces short-term interest rates in the economy. This reduction makes borrowing more affordable for both individuals and businesses, potentially increasing the demand for loans. In response, banks may relax their lending standards to approve more loans and grow their loan portfolio. Consequently, they might approve loans for borrowers with lower credit scores or weaker financial profiles, thereby increasing the likelihood of bad loans in the portfolio. Additionally, lower interest rates may incentivize banks to take more risks in search of higher returns. This could involve lending to riskier borrowers or increasing their exposure to riskier assets, subsequently raising the risk-assets ratio for the bank.

A decrease in interest rates reduces the interest income that banks earn from their loans, potentially leading to lower profitability and pushing banks to take on more risks to maintain their profit margins. Overall, a decrease in the federal funds rate by the FOMC can increase the bad performance loan ratio and risk assets ratio for banks. This increase is due to the heightened demand for loans, relaxed lending standards, increased risk-taking, and diminished profitability on loans.

**3.6 Conclusion**

The findings of this study offer significant insights into the variation in risk-taking behaviors across different banking groups, aiding policymakers in the formulation of more targeted monetary policies and macroprudential regulations. Additionally, the comparative robust analysis offers a nuanced examination of the financial performance of commercial banks that operated during two recessionary periods: the late 2000s financial crisis and the anticipated economic downturns induced by the COVID-19 pandemic.

The analysis has demonstrated that banks significantly altered their risk-taking behaviors in response to the expansionary monetary policies implemented during the two examined periods. The results indicate that banks' risk-taking behavior, in terms of non-performing loans and risk assets, tended to increase following the onset of expansionary policies. This was particularly the case when the federal funds rate decreased, which led to increased demand for loans, relaxed lending standards, and heightened risk-taking activities.

The findings also reveal a significant relationship between banks' profitability ratios and their risk-taking behaviors. Specifically, higher return on equity and net income ratio were associated with lower risk-taking in loans, suggesting that banks with higher profitability are less prone to take on risky loans. These results are consistent with previous research indicating that profitable banks can maintain a lower level of risk due to their capacity to absorb losses. Furthermore, the size of the bank and market concentration, as measured by the Herfindahl-Hirschman Index, were found to significantly influence risk-taking behaviors. Larger banks and those operating in more concentrated markets were found to take on less risk. This finding implies that larger banks, due to their diversified portfolios and stronger capital bases, can better manage and absorb risks compared to smaller institutions. Despite these important findings, this study acknowledges the limitations associated with the reliance on quantitative data and the generalized difference-in-differences model. While these methods provide robust estimates, they do not account for unobservable factors that may influence banks' risk-taking behaviors. Thus, future research should consider incorporating qualitative data or adopting a mixed-methods approach to provide a more holistic understanding.

In summary, this study adds to the current body of knowledge by offering empirical evidence of how expansionary monetary policy influences banks' risk-taking behavior, thereby informing the development of effective monetary policies and regulatory measures. Policymakers and regulators should take these findings into consideration when designing and implementing policies to promote financial stability, particularly during periods of economic downturn. By doing so, it will be possible to mitigate the risk associated with banks' responses to such policies, enhancing the resilience of the banking sector, and by extension, the broader economy.

Table 3.1. Policy Intensity Impact-Scoring Model

| Variables (Measures)/Classes | Interval Ranges | Weights |
|---|---|---|
| **LIQUIDITY** | | |
| *Deposit-to-liability ratio* | | |
| 1 | > 0.99 | |
| 2 | 0.9 - 0.99 | |
| 3 | < 0.9 | ___ × 0.35 = ___ |
| **PROFITABILITY** | | |
| *Return on Equity* | | |
| 1 | < 0.16 | |
| 2 | 0.16 - 0.17 | |
| 3 | > 0.17 | ___ × 0.25 = ___ |
| *Net Income Ratio* | | |
| 1 | < 0.11 | |
| 2 | 0.11 - 0.12 | |
| 3 | > 0.12 | ___ × 0.10 = ___ |
| **REPAYMENT CAPACITY** | | |
| *Gross Loss to Average Total Loan Ratio* | | |
| 1 | < 0.001 | |
| 2 | 0.001 - 0.013 | |
| 3 | > 0.013 | ___ × 0.05 = ___ |
| *Loan Loss Provision Ratio* | | |
| 1 | < 0.91 | |
| 2 | 0.91 - 0.99 | |
| 3 | > 0.99 | ___ × 0.05 = ___ |
| **CAPITAL ADEQUACY** | | |
| *Tier 1 Leverage ratio* | | |
| 1 | > 0.92 | |
| 2 | 0.89- 0.92 | |
| 3 | < 0.89 | ___ × 0.10 = ___ |
| **GROWTH** | | |
| *Annual change in total assets* | | |
| 1 | < 0.07 | |
| 2 | 0.07 - 0.083 | |
| 3 | > 0.083 | ___ × 0.10 = ___ |
| **INTENSITY SCORE CLASSES** | | |
| Class 1 | | 0 - 0.04 |
| Class 2 | | 0.04 - 0.80 |
| Class 3 | | 0.80 - 1.00 |

Table 3.2. Summary Statistics of Indicator Variables in Impact-Scoring Model, Q1 2020

| Variable | Obs | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| Deposit to Liability Ratio | 2565 | 0.94 | 0.07 | 0.07 | 1.00 |
| Return on Equity | 2565 | 9.35 | 22.95 | -202.01 | 1078.86 |
| Net Income Ratio | 2565 | 0.25 | 1.72 | -10.99 | 83.08 |
| Gross Loss to Average Total Loan Ratio | 2565 | 0.22 | 0.64 | 0.00 | 13.73 |
| Loan Loss Provision Ratio | 2565 | 0.21 | 0.56 | -2.10 | 13.67 |
| Tier 1 Leverage Ratio | 2565 | 11.25 | 4.03 | 2.77 | 88.96 |
| Annual change in total assets | 2565 | 8.54 | 21.11 | -53.01 | 710.80 |

Table 3.3. Summary Statistics of Indicator Variables in Impact-Scoring Model, Q4 2008

| Variable | Obs | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| Deposit to Liability Ratio | 6295 | 0.91 | 0.10 | 0.00 | 1.00 |
| Return on Equity | 6295 | 6.73 | 11.61 | -220.79 | 171.04 |
| Net Income Ratio | 6295 | 0.14 | 0.38 | -8.54 | 18.04 |
| Gross Loss to Average Total Loan Ratio | 6295 | 0.52 | 1.08 | 0.00 | 37.12 |
| Loan Loss Provision Ratio | 6295 | 0.43 | 0.85 | -1.23 | 27.38 |
| Tier 1 Leverage Ratio | 6295 | 10.42 | 4.05 | 0.90 | 86.62 |
| Annual change in total assets | 6295 | 9.12 | 24.00 | -83.05 | 915.49 |

Table 3.4. Summary Statistics of Main Variables, 2018-2022

| Variable | Obs | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| Post*Intensity | 46260 | 0.06 | 0.08 | 0.00 | 1.00 |
| Risk for Loans | 46260 | 1.34 | 0.92 | 0.00 | 30.00 |
| Risk for Assets | 46260 | 18.15 | 10.97 | 3.21 | 290.82 |
| Net Income Ratio | 46260 | 0.24 | 0.70 | -36.97 | 96.00 |
| Return on Equity | 46260 | 0.06 | 0.18 | -1.93 | 15.25 |
| Deposit to Liability Ratio | 46260 | 0.95 | 0.07 | 0.02 | 1.00 |
| Herfindahl-Hirschman Index | 46260 | 0.62 | 0.18 | 0.23 | 1.00 |
| Size | 46260 | 13.05 | 1.66 | 8.91 | 21.97 |

Table 3.5. Summary Statistics of Main Variables, 2006-2010

| Variable | Obs | Mean | Std. Dev | Min | Max |
|---|---|---|---|---|---|
| Post*Intensity | 125900 | 0.09 | 0.13 | 0.00 | 1.00 |
| Risk for Loans | 125900 | 1.52 | 1.51 | 0.00 | 100.00 |
| Risk for Assets | 125900 | 17.17 | 21.89 | -13.35 | 5102.43 |
| Net Income Ratio | 125900 | 0.15 | 0.60 | -112.34 | 28.13 |
| Return on Equity | 125900 | 0.04 | 0.34 | -85.30 | 1.60 |
| Deposit to Liability Ratio | 125900 | 0.92 | 0.09 | 0.00 | 1.00 |
| Herfindahl-Hirschman Index | 125900 | 0.57 | 0.18 | 0.21 | 1.00 |
| Size | 125900 | 11.96 | 1.33 | 7.71 | 21.29 |

Table 3.6. Generalized Difference in Difference Results for Banks' Risk-taking, (Q1 2018 - Q2 2022 vs. Q1 2006 - Q4 2010)

| | **Q1 2018 - Q2 2022** | | **Q1 2006 - Q4 2010** | |
|---|---|---|---|---|
| | Coefficient | Standard errors | Coefficient | Standard errors |
| ***Dependent Variable: Risk for Loans*** | | | | |
| Post*Intensity | 1.373*** | 0.049 | 2.094*** | 0.055 |
| Return on Equity | -0.119*** | 0.017 | -0.169*** | 0.007 |
| Net Income Ratio | -0.027*** | 0.002 | -0.209*** | 0.004 |
| Herfindahl-Hirschman Index | 0.043 | 0.037 | -0.072 | 0.056 |
| Size | -0.392*** | 0.012 | -0.375*** | 0.016 |
| ***Dependent Variable: Risk for Assets*** | | | | |
| Post*Intensity | 2.119*** | 0.696 | 8.639*** | 1.357 |
| Return on Equity | 1.285*** | 0.230 | 0.669*** | 0.162 |
| Deposit to Liability Ratio | -7.969*** | 0.645 | 0.313 | 1.532 |
| Herfindahl-Hirschman Index | -1.713*** | 0.516 | -11.692*** | 1.371 |
| Size | -4.860*** | 0.171 | -10.340*** | 0.388 |

Notes: *, **, *** denote significance of the difference between the means at the 10%, 5%, 1% confidence levels, respectively.

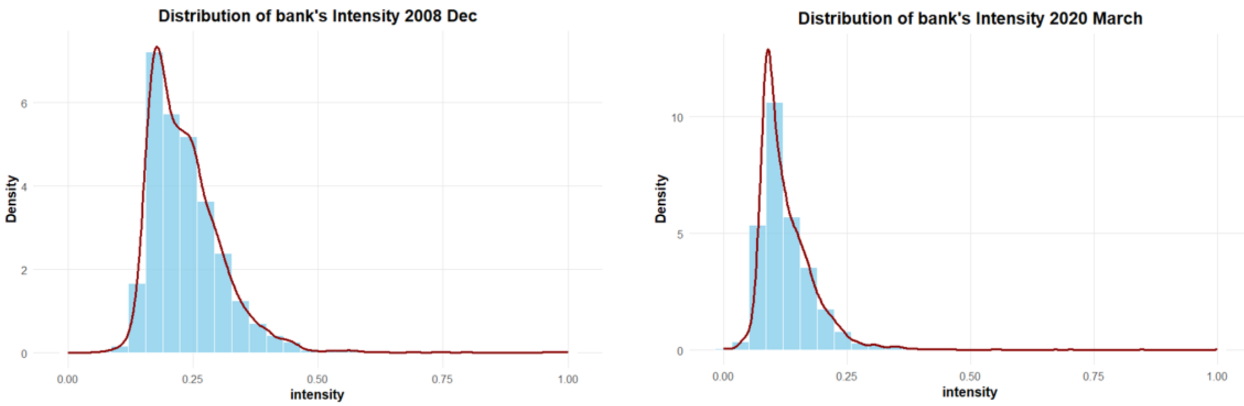


Figure 3.1. Policy Intensity Impact-Scoring Model: Intensity Score Distribution Comparison (December 2008 vs. March 2020)

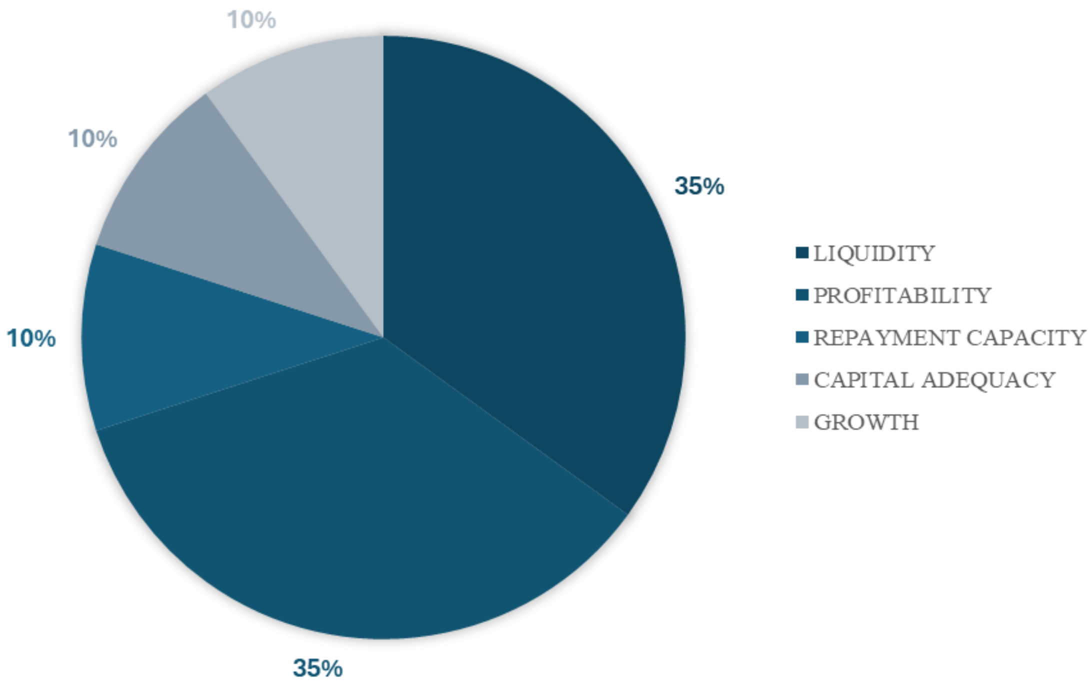


Figure 3.2. Policy Intensity Impact-scoring Model

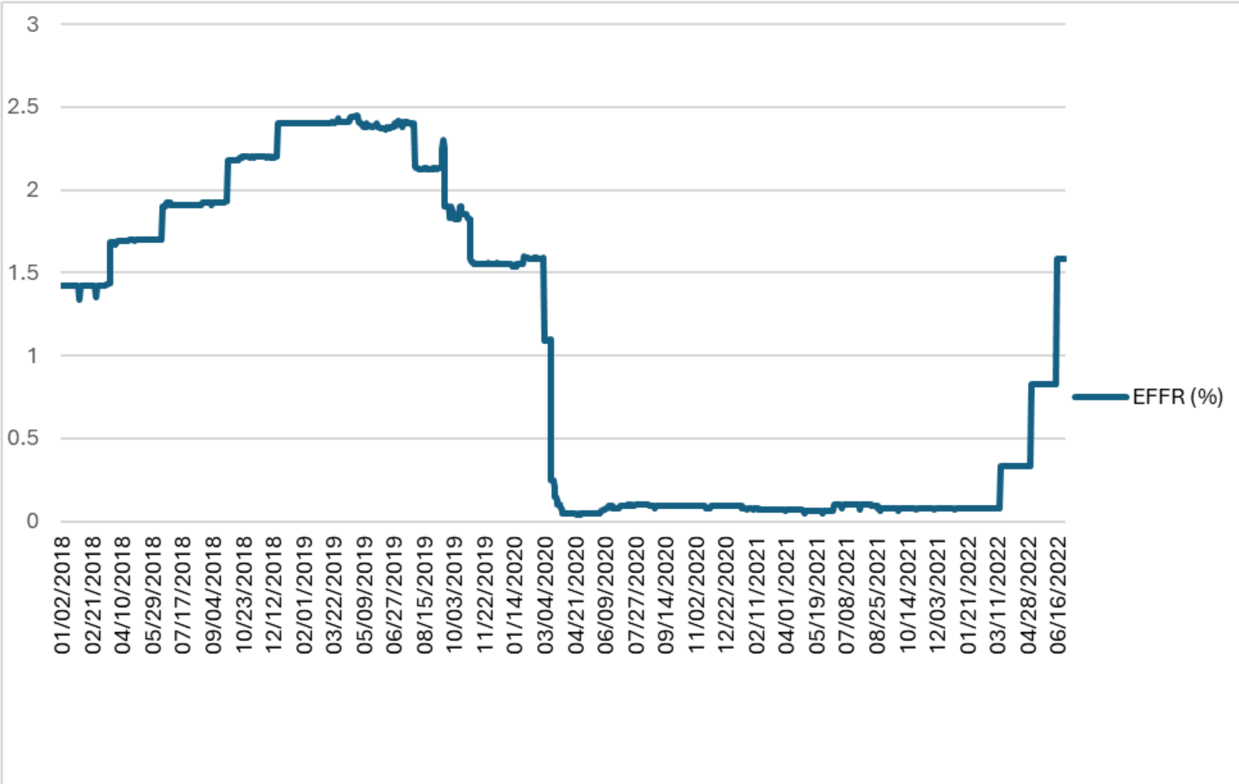


Figure 3.3. Effective Federal Funds Rate (%), Q1 2018 - Q2 2022

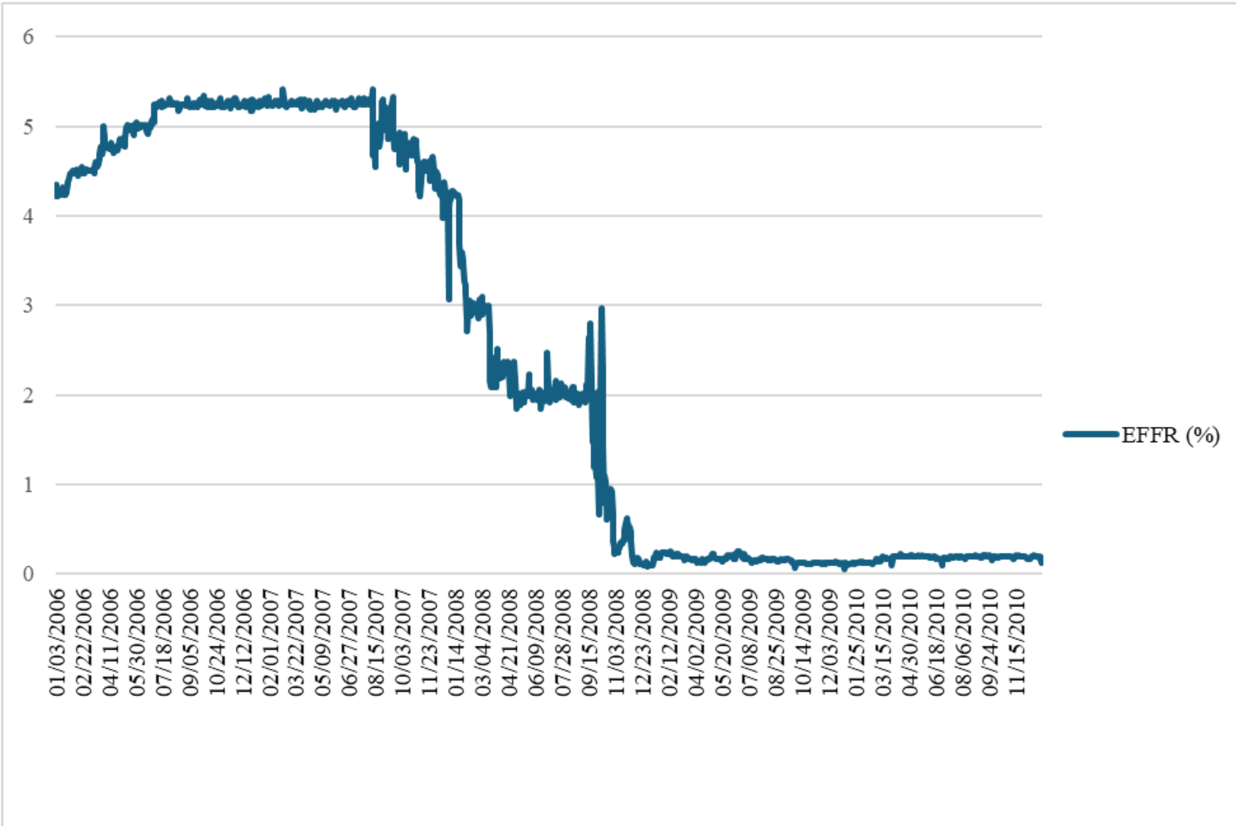


Figure 3.4. Effective Federal Funds Rate (%), Q1 2006 – Q4 2010

# CHAPTER 4

# SUSTAINABLE GROWTH STRATEGIES OF AGRICULTURAL AND NON-AGRICULTURAL BANKS

## 4.1 Introduction

As the world recovers during the aftermath of the COVID-19 pandemic, a currently impending recession evokes recollections of the Late 2000s financial crisis marked by significant bank failures in the U.S. In response to that crisis, the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 was enacted to strengthen financial stability, enhance regulatory oversight, and reduce systemic risk. This backdrop makes it imperative to reevaluate the sustainability of banking growth strategies. In the era of the COVID-19 outbreak and the subsequent post-pandemic period, several key factors have increasingly raised concerns about the imminent threat of an economic recession. At the outset of the crisis, lockdown measures implemented to curb the spread of the virus precipitated a sudden and sharp cessation of economic activities. The pandemic wreaked havoc on global supply chains as well as the tourism, hotel, and retail sectors, which faced unprecedented losses due to travel restrictions and social distancing measures. This resulted in widespread layoffs and furloughs, catapulting unemployment rates to their highest levels since the Great Depression. Consequently, Gross Domestic Product (GDP) in many countries contracted significantly, marking the most severe global recession in decades. For example, the U.S. economy contracted at an annual rate of 32.9% in the second quarter of 2020, the most substantial decline since records began in 1958 (U.S. Bureau of Economic Analysis, 2020).

Faced with these daunting challenges, central banks, and governments around the globe enacted unprecedented fiscal and monetary policy action to support the economy. These measures included lowering interest rates and initiating quantitative easing programs. As liquidity surged, the retreat of the pandemic's immediate impact was swiftly followed by soaring inflation rates, reaching their highest levels in 40 years, and prompting the Federal Reserve to adopt the most aggressive rate hikes since the 1980s (The Federal Reserve, 2022). The shock of the pandemic, persistently high inflation rates, volatility in the energy markets, strained geopolitical tensions, and the uncertainty of central bank economic policies have left economists and policymakers uneasy about the global economy's resilience and the pathway to recovery. The intricate interplay of various factors during the pandemic period has laid the groundwork for discussions surrounding the looming possibility of an economic recession.

This research employs the Sustainable Growth Challenge (SGC) model to illuminate the operational strategies of agricultural and non-agricultural banks during these two significant periods of economic distress. Building upon the foundational work of Zheng and Escalante (2020) on banks' sustainable growth strategies during the late 2000s financial recession, this paper broadens the investigative lens to encompass the looming recessionary phase post-COVID-19. By employing the SGC model, the study offers a comparative analysis of the financial performance of agricultural and non-agricultural banks during these recessionary periods, each marked by distinct macroeconomic influences. Regulatory reforms following the 2008 crisis, particularly the Dodd-Frank Act, also reshaped banks' risk practices and strategic decisions. Rooted in the sustainable growth paradigm, this study delves into the key factors driving growth, encompassing strategies around profitability, earnings retention, asset productivity, and financial leverage. The research methodology hinges on Seemingly Unrelated

Regression (SUR) techniques, aimed at pinpointing the factors influencing sustainable growth challenge—essentially, the disparity between actual and sustainable growth rates. Key variables like bank size, loan diversification, liquidity, and merger activities are considered in this analysis.

The key point of this paper lies in examining sustainable growth rates as benchmarks for ideal bank growth, aligned with their financial, operational, and business resources. By contrasting these with actual growth rates, the research seeks to assess the banks' SGC levels, aiming to unearth pivotal insights into how banks' growth strategies impact their success in business growth strategies. Ultimately, this study aims to provide an exhaustive understanding of bank survival and growth strategies amidst significant economic challenges.

**4.2 Literature Review**

This study embarks on a novel exploration of banking strategies in the wake of economic downturns, specifically focusing on the comparative analysis of agricultural and non-agricultural banks' survival tactics during the late 2000s financial crisis and the more recent COVID-19 pandemic. It differentiates itself from prior research by applying the Sustainable Growth Challenge (SGC) model to assess and compare the growth trends and strategic responses of these banks during times of economic distress.

Prior literature on bank operations, particularly during financial crises, has extensively examined the determinants of bank collapses, management decisions leading to failure, and the influence of various operational aspects. For instance, Belongia & Gilbert (1987) found that failed banks tended to allocate a higher proportion of assets to riskier agricultural loans. Demirgüç-Kunt et al. (2003) highlighted the positive impact of stringent regulations and market structures on banking survival. Further studies, such as DeYoung & Hasan (1998), discussed the challenges faced by newer banks in achieving profitability and the consequences of excess capacity and reliance on substantial deposits. Moreover, research by Jin et al. (2011) showcased the protective effect of high-quality audits against bank failure, while Cole & Gunther (1995) utilized a split-population model to separate determinants of bank failure from survival durations. Another notable study by Li & Escalante (2016) recognized the negative impact of loan delinquencies on banks' survival during the late 2000s crisis, with Kahn & Papanikolaou employing dynamic methodologies to identify factors that precipitated the recent financial turmoil. However, this study extends the dialogue to the growth strategies of banks that have weathered economic crises.

Another prior research scrutinizes the conflict between the risk preferences of bank managers and owners (Laeven & Levine, 2009), the responses of banks to liquidity shocks (Berger & Bouwman, 2017; Cornett et al., 2011), and the relevance of corporate governance in risk management (Aebi et al., 2012). Additionally, Berger & Bouwman (2013) explored the role of capital in aiding small banks in survival and market share growth during financial crises. These studies offer critical insights into banks' operational strategies. The recent study by Caglio, Darst, and Kalemli-Özcan (2021) advances the understanding of banking risk, demonstrating a clear association between low-interest rate policies and increased bank risk-taking, particularly in lending to SMEs. Another study provides an in-depth examination of the correlation between aggressive business expansion approaches and the incidence of bank failures, offering valuable lessons from one of the most challenging economic periods in recent history (Zheng et al., 2020).

In the literature review of banking operations and strategies of different types, a critical distinction emerges between agricultural and non-agricultural banks, particularly in the context of structural and operational differences. Agricultural banks are often characterized by their specialized lending practices, focusing primarily on agricultural loan portfolios. This specialization is both a strength and a weakness. This constraint is primarily due to funding limitations that stem from the volatile nature of agricultural product prices, leading to greater risks and uncertainty. In the realm of predicting bank failures by banks' operation strategies, Li et al. (2013) conducted a comparative analysis of the vulnerability of agricultural and non-agricultural banks to failure, concluding that operations in the agricultural sector do not inherently increase failure risk. The resilience of agricultural banks during economic downturns prompts a broader discussion on the factors contributing to their survival ability. Pre-recession operational efficiencies and judicious input allocation decisions play a crucial role in bolstering the robustness of agricultural banks. Specifically, this resilience can be attributed to their cautious investment strategies, notably their limited participation in the commercial real estate industry and avoidance of the structured securities that suffered significant devaluations during crises (Li et al., 2018). Despite these challenges, during times of financial crisis, agricultural banks have demonstrated stronger financial health relative to many commercial banks (Zheng & Escalante, 2020).

This study's distinctive approach lies in applying the sustainable growth model to analyze the financial and operational growth strategies of different banks that have not only survived but also managed to grow during these challenging periods. This model, which offers a dynamic perspective on growth compared to the earlier DuPont analysis, provides a more contemporary and proactive lens for assessing strategic decisions. By highlighting the impact of equity growth constraints and leverage regulations, our research aligns with earlier works such as Vasiliou & Karkazis (2002), Escalante et al. (2009), and Zheng et al. (2020), yet it carves a unique niche by investigating the role of agricultural lending in commercial banks' growth strategies during volatile economic conditions.

In conclusion, this study offers fresh perspectives to the existing body of literature by concentrating on the operational growth strategies of various banking groups during two significant periods of economic challenge. It places a special emphasis on the dynamic and forward-looking sustainable growth model. This approach not only enriches academic literature but also provides practical insights for bank management and policy formulation. These insights are geared towards enhancing resilience and fostering strategic growth in the face of economic adversity.

## 4.3 Methodology

### *4.3.1 The Sustainable Growth Paradigm*

Understanding the alignment between a company's growth and its financial resources is a cornerstone of corporate finance strategy. Firms relying solely on internal capital for growth may miss out on larger opportunities, whereas those excessively leaning on external financial sources for expansion could face heightened financial risks or even insolvency. Traditional measures like revenue growth rate, profitability, and dividend growth offer insights into a company's developmental potential and proficiency, but these static indexes primarily reflect historical business expansion within a specified timeframe. They fall short in guiding firms about investment decisions, growth strategies, and optimal capital structuring. This is where the concept of the sustainable growth rate (Higgins, 1977), emerges as a critical tool. It serves as a dynamic indicator, complementing traditional financial indicators, to ensure that a company's growth aligns with its financial capabilities, defined by its available financial resources. It guides enterprises in making informed decisions regarding investment options, growth strategies, and achieving an optimal capital structure. The essence of this approach is to ensure that a company's expansion is in harmony with its financial resources. Thus, the sustainable growth rate emerges not just as an alternative but as a necessary supplement to traditional financial evaluation indicators, aiding financial institutions in navigating their growth strategies more prudently.

In this Chapter, the financial performance and decisions of banks that survived before, during, and after the COVID-19 pandemic were examined. Additionally, the comparative analysis with the late 2000s financial crisis was also included, exploring these parameters from several different perspectives. This study aims to introduce the application of the Sustainable Growth Challenge (SGC) model (Higgins, 1977) as a conceptual framework, and to employ this model in estimating the sustainable growth rates of the U.S. commercial banks in two datasets. The Sustainable Growth Paradigm (Higgins, 2012) was utilized to explore the relationship between financial strategies in the agricultural sector and the incidence of bank failures. By analyzing A key aspect of our analysis is the examination of the banks' sustainable growth challenge levels, as the disparity between ideal, sustainable growth rates and the banks' actual growth rates. This comparison offers valuable insights into the actual growth strategies of these banks and their implications for the likelihood of business success or failure. While traditional indicators like revenue growth rate, profitability, and return on equity are useful in assessing a bank's developmental capabilities, they provide only a partial view of a bank's financial health and are limited in guiding operational strategies and risk management. This research posits that these traditional indicators, while essential, should be complemented with additional measurements, particularly the sustainable growth rate. This rate is instrumental in understanding the operational decisions of banks from various aspects of the operational decisions made by banks that either went bankrupt or survived during the COVID-19 pandemic, and how these differ from the situation during the late 2000s financial crisis. According to the Higgins model, the sustainable growth rate can be conceptualized as an increase in revenue, further quantifiable as a percentage change in equity under specific assumptions.

$$g_s = \frac{\Delta Revenue}{Revenue} = \frac{\Delta Equity}{Equity_{beg}} \tag{4.1}$$

The sustainable growth rate is framed within a fundamental condition. Here, the initial premise is that the bank refrains from utilizing external equity financing. This means any increase in equity is attributed solely to the rise in retained earnings. Following the structure laid out in equation (4.1), it's possible to further elaborate on the definition of specific terms (as shown in equation (4.2) and proceed with making appropriate substitutions. This approach helps to clarify the relationship between revenue changes, equity changes, and their impact on sustainable growth rate under the given assumptions.

$$\Delta \text{Equity} = Equity_{end} - Equity_{beg} = Net\ Income - Dividends \tag{4.2}$$

Change in equity is calculated as the period-end equity minus period-begin equity which equals Net income minus dividends. Then expanding this further, the equation can be represented as equation (4.3).

$$\frac{\Delta Equity}{Equity_{beg}} = \frac{\Delta Equity}{Equity_{beg}} \times \frac{Net\ Income}{Net\ Income} \times \frac{Revenue}{Revenue} \times \frac{Total\ Assets}{Total\ Assets} \tag{4.3}$$

Then substituting the equation (4.2) into equation (4.3) leads to the equation (4.4)

$$\frac{\Delta Equity}{Equity_{beg}} = \frac{Net\ Income - Dividends}{Equity_{beg}} \times \frac{Total\ Assets}{Net\ Income} \times \frac{Net\ Income}{Revenue} \times \frac{Revenue}{Total\ Assets} \tag{4.4}$$

This rearrangement of equation (4.4) forms the basis of equation (4.5). The sustainable growth rate dissects equity returns into four distinct growth levers: profit margin, earnings retention rate, asset turnover, and financial leverage (represented as the ratio of assets to beginning equity).

Notably, this ratio is more of a forward-looking measure of potential growth rather than a retrospective indicator of past performance. It's important to point out that the financial leverage ratio uses the beginning equity, rather than the year-end level, to reflect the financial resources available more accurately at the start of the analyzed year. Thus, the equation for the sustainable growth rate can be transformed as detailed in the following steps.

*4.3.2 The Sustainable Growth Rate (SGR)*

$$SGR = \left[\frac{Net\ Income}{Revenue}\right] \times \left[\frac{Net\ Income - Dividends}{Net\ Income}\right] \times \left[\frac{Revenue}{Total\ Assets}\right] \times \left[\frac{Total\ Assets}{Euity_{beg}}\right] \tag{4.5}$$

Thus, the four finance indicators can be expressed as:

$$\text{Profit margin} = \frac{Net\ Income}{Revenue}$$

$$\text{Retention ratio} = \frac{Net\ Income - Dividends}{Net\ Income}$$

$$\text{Assets turnover} = \frac{Revenue}{Total\ Assets}$$

$$\text{Financial leverage} = \frac{Total\ Assets}{Equity_{beg}}$$

In the Sustainable Growth Rate (SGR) framework, four critical financial indicators emerge as drivers of a bank's growth, each symbolizing various strategic operational choices. These determinants are often considered by decision-makers and board members as levers to tune operational strategies. The profit margin is for evaluating financial performance and is integral to understanding sustainable growth rates. A straightforward aspect of the model is the direct relationship between profit margins and growth. Banks, for instance, can enhance their sustainable growth by optimizing cost control, which in turn boosts profit margins. This improvement in margins feeds into greater equity via retained earnings, bolstering the bank's financial capacity for further growth. The Earnings retention rate significantly impacts sustainable growth. A higher earnings retention rate amplifies the profitability effect, increasing the pool of financial resources available for banks to meet growth objectives. Moreover, a robust retention rate not only supports revenue growth through retained earnings but also underpins the bank's capacity for debt financing and risk management.

Asset turnover ratio is a measure of how efficiently a bank manages its assets and is a crucial component of the SGR equation. It reflects the ability of the bank's assets to generate revenue. Analyzing this ratio offers insights into the composition of the bank's assets, distinguishing between those that are productive and contribute to revenue generation and those that are less effective. In general, a higher asset turnover indicates more efficient asset utilization, a factor closely monitored by shareholders and bank managers to gauge asset management and income potential. Theoretically, this coefficient is indicative of the financial risk associated with debt. Banks typically operate by accepting deposits and extending loans, which often results in a higher level of financial leverage compared to other industries. This leverage reflects the proportion of debt in the bank's capital structure and has implications for its risk profile.

Each of these elements plays a distinctive role in the SGR framework, collectively providing a comprehensive view of a bank's financial health and strategic direction. By analyzing these metrics, banks can better align their growth strategies with their financial capabilities and market conditions.

*4.3.3 The Sustainable Growth Challenge (SGC)*

The Sustainable Growth Challenge (SGC) is defined as the variance between the actual revenue growth and the sustainable growth rate. This concept is encapsulated in the following equation:

$$\mathrm{SGC} = \ln\left(\frac{Revenue_t}{Revenue_{t-1}}\right) - g_s \tag{4.6}$$

When the SGC is greater than zero, it signifies a necessity to enhance the sustainable growth rate to bring it closer to, or equal to, zero. The sustainable growth rate correlates positively with profit margin, asset turnover, and financial leverage, but negatively with the dividend payout rate. To augment profitability, banks can adopt strategies such as cost reduction, dividend reduction, boosting asset turnover, or increasing financial leverage. The choice of strategy can vary, ranging from a singular focus to a combination of multiple financial and operational adjustments. When the Sustainable Growth Challenge (SGC) yields a negative value, it indicates that the actual revenue growth rate falls short of the sustainable growth rate. This scenario suggests that the bank may possess excess financing capacity. In response, the bank might consider various operational and financial adjustments, such as decreasing financial leverage, lowering earnings retention, or reducing the asset turnover rate.

Recognizing potential growth challenges early is crucial for banks, especially in the context of an impending financial crisis. To navigate these challenges effectively, banks must proactively and deliberately act in anticipation of unforeseen events. The capability to foresee and adapt by making appropriate adjustments towards a balanced growth scenario is a key differentiator between successful and unsuccessful banking institutions. Strategic decisions in operations, finance, and investment that are tailored to adjust the SGR or SGC are vital. Banks that are more adaptable and responsive to increasing demands are generally more likely to thrive. The strategic use of earnings retention, financial leverage, profit margins, and asset turnover to regulate growth not only leads to balanced growth but is also critical in preventing bank failure. Conversely, inappropriate strategies in managing these growth levers can be detrimental to achieving balanced and sustainable growth.

In this study, the application of the sustainable growth model was applied to banking institutions using seemingly unrelated regression (SUR) techniques to compare the two economic recessionary. The SUR model is utilized to assess the importance of the four performance levers and to explore the factors influencing banks' strategic choices. An additional dimension was also introduced to our analysis by comparing the operating strategies of agricultural banks to non-agricultural banks, providing a broader perspective on the varied strategic approaches in the banking industry.

*4.3.4 Seemingly Unrelated Regression (SUR）*

In this research, each unit is modeled with its own linear regression, and for each observation i across M cross-sectional units, we assume $X_i$ exhibits strict exogeneity and homoscedasticity as per Greene's guidelines (2007). To analyze the combined impact of endogenous variables, we employ a Seemingly Unrelated Regression (SUR) system, represented by equation (4.7) as follows:

$$y_{ij} = X_{ij}\beta_j + \varepsilon_{ij}, \qquad where\ \ i = 1, \dots, N, \qquad j = 1, \dots, M \tag{4.7}$$

Ordinary Least Squares (OLS) regression requires the error terms to be uncorrelated to prevent heteroscedasticity. Should this condition be violated, OLS estimations become unreliable. The SUR model addresses this by accommodating non-zero covariance between error terms, as shown in equation (4.8):

$$\mathrm{E}(\varepsilon_{it}, \varepsilon_{js}) = \begin{cases} \sigma_{ij}, & t = s \\ 0, & t \neq s \end{cases} \tag{4.8}$$

This study employs the SUR model to identify factors influencing each of the four growth indicators and the Sustainable Growth Challenge (SGC). Then the asymptotically efficient, feasible generalized least-squares (GLS) algorithm was applied. This GLS approach effectively handles autocorrelation and heteroscedasticity concerns, with the GLS estimator outlined in equation (4.10):

$$\beta = [X'\Omega^{-1}X]^{-1}X^{-1}\Omega^{-1}y \Rightarrow \beta = [X'(\Sigma^{-1}\otimes I)X]^{-1}X^{-1}(\Sigma^{-1}\otimes I)y \tag{4.9}$$

$$\text{where } \Omega = \Sigma\otimes I \Rightarrow \Omega^{-1} = \Sigma^{-1}\otimes I$$

The SUR model encompasses five equations (4.10) - (4.14), each representing one of the four financial performance growth levers or the SGC. These equations include a lagged dependent variable and the SGC among independent variables, as well as structural and financial indicators. Additionally, the last equation, where the SGC is the explained variable considers year-to-year changes in each growth lever and other variables for a comprehensive analysis.

$$PM_t = \beta_{01} + \beta_{11}PM_{t-1} + \beta_{21}SGC_t + \beta_{31}HHI_{t-1} + \beta_{41}DL_{t-1} + \beta_{51}SIZE_{t-1} + \beta_{61}MER_t + \beta_{71}AG_t + \varepsilon_1 \tag{4.10}$$

$$ER_t = \beta_{02} + \beta_{12}ER_{t-1} + \beta_{22}SGC_t + \beta_{32}MER_t + \beta_{42}AG_t + \varepsilon_2 \tag{4.11}$$

$$AT_t = \beta_{03} + \beta_{13}AT_{t-1} + \beta_{23}SGC_t + \beta_{33}DL_{t-1} + \beta_{43}SIZE_{t-1} + \beta_{53}MER_t + \beta_{63}AG_t + \varepsilon_3 \tag{4.12}$$

$$LEV_t = \beta_{04} + \beta_{14}LEV_{t-1} + \beta_{24}SGC_t + \beta_{34}DL_{t-1} + \beta_{44}SIZE_{t-1} + \beta_{54}MER_t + \beta_{64}AG_t + \varepsilon_4 \tag{4.13}$$

$$SGC_t = \beta_{05} + \beta_{15}\Delta PM_{t-1tot} + \beta_{25}\Delta ER_{t-1tot} + \beta_{35}\Delta AT_{t-1tot} + \beta_{45}\Delta LEV_{t-1tot} + \beta_{55}HHI_{t-1} + \beta_{65}DL_{t-1} + \beta_{75}SIZE_{t-1} + \beta_{85}MER_t + \beta_{95}AG_t + \varepsilon_5 \tag{4.14}$$

In the equations, key financial determinants are represented as follows: PM stands for Profit Margin, ER denotes Earnings Retention Rate, AT signifies the Asset Turnover Ratio, and LEV represents Financial Leverage, also known as the asset-beginning equity ratio. Additionally, the AG variable functions as an agricultural loan weight ratio for bank type. The Herfindahl Index (HHI) is employed as an indicator for loan diversification. DL represents the deposit to liability ratio, MER measures the bank's merger activity, and SIZE is an indicator of bank size. The symbol Δ in the fifth equation indicates the quarter-to-quarter variation of these variables.

The deposit to liability ratio is a crucial measure for assessing a bank's liquidity, comparing its total deposits to its total liabilities over a specified timeframe. A lower ratio may suggest insufficient liquidity for meeting unexpected financial demands from creditors, including depositors, while a higher ratio indicates a stronger liquidity position. The size of a bank, typically gauged by its total assets, is often correlated with its financial performance.

The Herfindahl Index measures loan diversification, providing insight into the distribution of a bank's total loan portfolio across various loan types (Escalante & Barry, 2016). A lower index value in this context signals greater diversification in the loan portfolio. This index is calculated based on the squared share of each loan type in the total loan portfolio, encompassing categories like agricultural loans, individual loans, real estate loans, and leasing financing receivables.

$$\text{HHI} = \sum_{i-1}^{n} (Loan\ share_i)^2 \tag{4.15}$$

The SUR model is applied across three datasets: a comprehensive dataset incorporating all bank observations, and two separate subsets focusing on agricultural and non-agricultural banks. The significance of the Breusch and Pagan test results suggests a notable contemporaneous correlation among the error terms in the system of equations, reinforcing the relevance of the SUR model in this analysis.

**4.4 Data**

This study utilizes comprehensive panel datasets provided by the Federal Financial Institutions Examination Council (FFIEC), comprising extensive data from nationwide commercial banks. This dataset is inclusive of quarterly call reports and the Uniform Bank Performance Report (UBPR), which collectively offer a rich tapestry of insights into key financial metrics such as earnings, balance sheets, asset quality, liquidity, and capital. Spanning two distinct and economically challenging periods, 2006-2010 and 2018-2022, the datasets are instrumental in facilitating a nuanced analysis of banks' sustainable growth strategies amidst major recessionary phases. The data compilation for this research meticulously includes six critical financial metrics: net income, total assets, equity capital, gross revenue, preferred dividends, and common dividends. These metrics are indispensable in the computation of sustainable growth model components, such as profit margin, earnings retention ratio, asset turnover, and financial leverage. The dividends, comprising both preferred and common dividends, are particularly significant as they represent the withdrawal of earnings within the framework of the sustainable growth equation.

The study is underpinned by two robust datasets, each offering a window into different economic landscapes shaped by global events. The first dataset, encompassing 44,694 observations from 2,483 commercial banks over eighteen quarters from Q1 2018 to Q2 2022, focuses specifically on the period marked by the COVID-19 pandemic. This dataset is crucial in understanding the banking sector's response and resilience during an unprecedented global health crisis. The second dataset, with a staggering 112,500 observations from 5,625 commercial banks spanning twenty quarters from Q1 2006 to Q4 2010, provides an in-depth look at the banking sector during the late 2000s financial crisis, a period marked by significant economic turmoil and bank instability. Together, these datasets offer a comparative analysis of a range of economic and financial conditions, shedding light on the banking sector's performance, risk profiles, and strategic responses during these critical periods. The data encompasses the prelude to the crises, their peak periods, and the subsequent recovery phases, thereby providing a comprehensive view of the banking sector's operational and strategic dynamics in the face of economic challenges.

Moreover, this study's datasets serve as a valuable resource in identifying effective strategies and policies that can mitigate the adverse effects on banks' operations and financial health, particularly during tumultuous times like the COVID-19 pandemic. The detailed descriptive statistics, illustrated in Tables 4.1 and 4.2 for each dataset, contribute significantly to the understanding of the banking industry's performance under stress and the effectiveness of its countermeasures. The insights gleaned from this analysis are not only academically enriching but also have practical implications for banking sector policy and strategy formulation, aimed at enhancing resilience and ensuring sustainable growth in the face of future economic crises.

## 4.5 Results

### *4.5.1 Bank-level Descriptive Summary*

Figure 4.1 presents the trends in the mean values of the financial indicators during a period marked by the late 2000s financial crisis. The profit margin, indicated in yellow, shows an initial decline followed by stabilization towards the latter part of this period, suggesting a rebound in profitability after the initial shock of the recession. Asset turnover, in green, maintains a relatively steady trajectory, indicating a consistent revenue generation from assets despite economic headwinds. Interestingly, the retention ratio, dotted in blue, displays an overall decline, which could reflect a strategic decision to distribute more earnings to shareholders during this period. Financial leverage, marked in red, experiences a notable drop, aligning with the trend of de-leveraging during the post-crisis period as banks sought to solidify their balance sheets. Figure 4.2 graphically the trends in the four financial determinants of the sustainable growth model during the recent economic uncertainty period. In Figure 4.2, a stark contrast to the earlier period with profit margins initially increasing and then leveling off, suggesting a period of growth followed by stabilization was observed. Asset turnover rates show a slight increase, while the retention ratio sees a minor uptick. Notably, financial leverage undergoes a significant increase, potentially indicative of a more aggressive growth strategy or a relaxing of capital restrictions in the post-recession recovery phase.

Figure 4.3 presents a striking narrative of the recession's impact. It shows a sharp decline in both actual revenue growth rates and sustainable growth rates, reflecting the immediate effects of the financial crisis. The dotted line representing the sustainable growth rate dips and then begins to recover, while the actual revenue growth rates, in blue, show a more pronounced and sustained decline. The sustainable growth challenge (SGC), in red, dips into negative territory, indicating that banks were growing at a rate below their sustainable threshold. In contrast to the earlier recession, Figure 4.4 portrays a more muted impact on actual revenue and sustainable growth rates during the studied period. Both metrics decline but not as drastically as in the previous crisis, suggesting a more resilient banking sector or a less severe economic downturn. The SGC remains negative, echoing the earlier period's theme of growth rates lagging the sustainable model, but the deviation appears less severe.

Across all figures, the data illustrates the resilience and response strategies of commercial banks to economic stress. The profit margin's recovery post-crisis, as seen in Figure 4.2, and the less severe decline in the sustainable growth rate in Figure 4.4 suggest that banks may have adapted to maintain stability in challenging times. The consistent negative SGC across both periods highlights a cautious approach to growth, potentially reflecting a risk-averse strategy in the wake of economic uncertainty. These visual trends provide a roadmap for understanding how commercial banks navigate financial crises. The changes in profit margins, retention ratios, and leverage decisions underscore the strategic shifts banks make in response to economic conditions. The persistent negative SGC suggests banks are operating below their growth potential, which may be a deliberate choice to maintain financial stability during uncertain times.

Figures 4.5 and 4.6 present the trajectories of actual revenue growth rates, sustainable growth rates, and the sustainable growth challenge (SGC) for agricultural and non-agricultural banks during the economic periods of 2006-2010 and 2018-2022, respectively. In the period leading up to and during the 2008 financial crisis, both Ag and Non-Ag banks show a steep decline in actual revenue growth rates. However, non-Ag banks appear to experience a less precipitous drop, suggesting a more conservative approach during this volatile period. The sustainable growth rate for Ag banks remains relatively stable compared to the more volatile pattern for non-Ag banks, indicating that Ag banks possibly adhered closer to sustainable growth principles. The SGC for Ag banks trends looks like non-Ag banks. The Ag banks' negative SGC after 2007, lightly noted than that of non-Ag banks, suggests they were potentially pursuing more aggressive growth strategies that exceeded sustainable thresholds.

During the 2018-2022 period, encompassing the COVID-19 pandemic. The Ag banks still demonstrate a more aggressive stance with a notable upward trend in their revenue growth rate, while the non-Ag banks show a flattening curve. This implies that during the pandemic, Ag banks may have embraced more growth opportunities or risks. The sustainable growth rate for non-Ag banks shows a slight increase, but their actual revenue growth remains subdued, suggesting a more conservative approach in this period. The SGC for both bank types is negative, but the gap narrows significantly for non-Ag banks compared to Ag banks, which indicates a convergence towards more conservative strategies.

During the late 2000s financial crisis, non-agricultural banks maintained a more conservative growth strategy relative to agricultural banks, as evidenced by their more stable revenue growth and SGC rates. Besides, during the COVID-19 pandemic period, agricultural banks displayed a slightly more aggressive approach, with an upward trend in revenue growth surpassing that of non-agricultural banks. The shift in strategies across both bank types during these periods reflects a dynamic adjustment to the economic challenges posed by each crisis, with agricultural banks showing a capacity to pivot their growth strategies according to the prevailing economic conditions.

*4.5.2 Estimated Results*

This section of the results chapter will detail the findings from the Seemingly Unrelated Regression (SUR) analyses conducted on data from Nationwide Commercial Banks for two distinct periods, 2006-2010 and 2018-2022, as illustrated in Table 4.3.

For the profit margin, the SUR results indicate a significant positive relationship between the lagged profit margin and the current profit margin for both periods, suggesting a continuing impact of past profitability on current figures. This enduring impact of past profitability on current figures highlights the momentum factor in banking operations, where historical performance significantly influences present financial health. Interestingly, the relationship between the sustainable growth challenge (SGC) and profit margins varies across the two periods. In 2006-2010, a higher SGC correlated negatively with profit margins, implying that ambitious growth targets might impede profitability. However, the period 2018-2022 shows a reversal of this trend, suggesting an evolution in how banks' balance growth aspirations with profitability. Furthermore, the consistently positive effect of bank size on profit margins across both periods indicates that larger banks, possibly due to their scale and resource base, tend to achieve higher profitability.

In the retention ratio, the earnings retention ratio is significantly and positively correlated with itself across periods, illustrating a persistent effect of retained earnings on growth. The results also find a significant interplay between mergers, the Herfindahl index (a measure of loan diversification), and the retention ratio. Mergers and the Herfindahl index also exhibit significant relationships with the retention ratio, suggesting that consolidation activities and loan diversification strategies are closely linked with how banks manage and retain earnings. These findings suggest that strategic decisions such as mergers and diversification tactics are closely linked to how banks manage their earnings, potentially impacting their long-term growth and stability.

Asset turnover rates display a substantial positive connection with themselves in both periods, suggesting that past asset management efficiency translates into current performance. Interestingly, the deposit to liabilities ratio demonstrates a significant negative relationship, particularly in the 2006-2010 period, indicating that higher liquidity might be associated with lower asset turnover.

The analysis of financial leverage reveals a compelling pattern: decisions made in the past about leverage have a pronounced positive impact on the current financial structures. This trend is especially marked in the 2006-2010 period. Additionally, a significant positive relationship between SGC levels and financial leverage suggests that banks with more aggressive growth strategies, as reflected in higher SGCs, are inclined to adopt higher financial leverage. This finding is crucial as it points to a potential risk factor in banks' growth strategies, where higher leverage might be indicative of a more aggressive, and possibly riskier, approach to expansion.

The SGC is influenced by various factors, including profit margin changes and asset turnover rates. The results indicate that positive developments in these areas can propel banks towards higher actual growth rates as compared to their sustainable growth rates, with this trend being particularly prominent among non-agricultural banks. Furthermore, the Breusch-Pagan test validates the SUR model's application by confirming significant contemporaneous correlations among the equation system's error terms.

*4.5.3 Agricultural Banks vs Non-Agricultural Banks*

The exploration of the agricultural loan ratio's impact on bank financial metrics through regression analyses over two distinct periods, 2006-2010 and 2018-2022, reveals interesting insights into the role of agricultural lending in shaping bank performance and strategic operation. The findings emphasize a period-specific influence of agricultural loans on profitability, asset management, and growth strategies, reflecting the complex dynamics at play within agricultural banking. Notably, the agricultural loan ratio positively correlates with profit margins in the earlier period, suggesting that a greater focus on agricultural loans potentially enhances profitability due to the specialized property of agricultural banking. However, this relationship inversely shifts in the latter period, with a significant negative impact observed, indicative of evolving market conditions, increased competition, or heightened volatility within the agricultural sector affecting loan profitability.

Further analysis reveals a consistently negative effect of the agricultural loan ratio on the retention ratio across both periods, albeit with a decreasing impact over time. This pattern suggests a strategic shift in earnings distribution, potentially driven by the cyclical demands of the agricultural industry and the need for adaptable capital management strategies. Additionally, the relationship between the agricultural loan ratio and asset turnover illustrates a positive yet diminishing influence, highlighting a potential diversification in bank assets or evolving efficiencies in agricultural operations that impact asset utilization differently across the studied timelines.

The agricultural loan ratio's relationship with financial leverage and the sustainable growth challenge (SGC) further elucidates the strategic nuances of agricultural banking. Initially, a significant negative correlation with financial leverage points to cautious risk management strategies aligned with the perceived volatility of the agricultural market. This significance fades in the later period, suggesting a recalibration of leverage strategies or regulatory changes. Similarly, the initial negative impact on SGC indicates constraints imposed by agricultural lending on bank growth capabilities, a relationship that becomes insignificant later, reflecting a possible strategic adaptation or altered economic environment affecting agricultural lending's influence on growth.

Collectively, these findings provide comprehensive evidence of the shifting landscape in agricultural banking, influenced by price variability, the cyclical nature of agriculture, and the sector's specialized operational focus. These observations affirm and reinforce the conclusions drawn from previous literature. The changes in the significance of the agricultural loan ratio's effects highlight broader economic transformations, adjustments in agricultural lending practices, and strategic adaptations by banks in response to evolving market conditions and regulatory frameworks. This analysis enriches our understanding of the role of agricultural banking within the wider banking sector and underscores the importance of adaptable, informed strategies to navigate the complexities of financial markets.

In summary, the SUR analysis provides a multi-faceted view of the financial determinants impacting Nationwide Commercial Banks. The observed patterns and correlations offer insights into how different financial levers and market conditions have influenced bank performance over the two periods, with clear distinctions between agricultural and non-agricultural banks. The empirical evidence showcases the resilience and adaptability of the banking sector, with agricultural banks demonstrating a quicker recovery in profit margins post-crisis. The varying impacts of bank size, liquidity, and loan diversification strategies between the two types of banks underscore the complexity of banking operations and the necessity for tailored financial strategies. The findings highlight the importance of historical performance, asset management efficiency, and strategic decisions such as mergers and diversification in shaping current and future financial outcomes for banks. These insights can inform strategic planning, risk management, and regulatory policy in the banking sector, especially in preparing for and responding to economic downturns.

**4.6 Conclusion**

The study embarked upon a rigorous empirical journey to analyze the financial strategies and outcomes of commercial banks across two significant economic downturns, specifically the late-2000s global financial crisis and the recent economic perturbations due to the COVID-19 pandemic. This conclusion synthesizes the key findings and implications from the Seemingly Unrelated Regression (SUR) analyses, while also considering the broader context within which these financial institutions operate. The findings reveal a nuanced narrative of resilience and adaptability within the banking sector. Throughout the periods studied, commercial banks demonstrated a robust ability to navigate economic headwinds, albeit with varying degrees of success. Agricultural banks showcased a remarkable propensity for maintaining stability in profit margins, even during tumultuous financial epochs. This suggests a possible sector-specific agility approach to growth that could serve as a model for other segments within the industry. The analysis of actual revenue growth, sustainable growth rates, and the SGC for agricultural and non-agricultural banks across two contrasting economic periods provides illuminating insights into the strategic responses of these institutions to economic adversity. In both periods, these banks demonstrated a nimble ability to adapt their growth strategies to the immediate economic environment, balancing risk and opportunity. The resulting shifts in strategy across agricultural and non-agricultural banks underscores the importance of sector-specific factors and external economic pressures in shaping institutional behavior and strategic decision-making in the banking sector.

The evidence suggests that the strategic levers of profit margin, earnings retention, asset turnover, and financial leverage play pivotal roles in shaping the banks' trajectories. The consistent positive correlation between the lagged profit margin and current figures highlights the momentum of past profitability and its enduring influence on present financial health. Meanwhile, the earnings retention ratio emphasizes the strategic use of retained earnings to fuel growth and buffer against economic shocks. Asset management efficiency has emerged as a cornerstone for sustained operational success, with past asset turnover efficiency persisting through time. Interestingly, liquidity, as measured by the deposit to liabilities ratio, displayed an inverse relationship with asset turnover, prompting a reconsideration of liquidity management strategies.

The study also found that financial leverage decisions carry lasting implications for banks' capital structures. Banks with aggressive growth strategies, reflected in higher SGC levels, exhibited higher financial leverage ratios, indicating a penchant for risk-taking that may have long-term ramifications. The negative SGC values observed across both periods suggest a cautious approach to growth, potentially indicative of a risk-averse strategy or an acknowledgment of the constraints posed by the sustainable growth model. However, the less severe deviation from the sustainable growth rate in the most recent period implies that the sector may have absorbed lessons from the past, building resilience and more robust financial planning into their operational ethos.

This research has significant implications for policymakers and banking executives. Insights into the financial determinants of bank performance can guide the development of regulatory frameworks aimed at fostering stability and growth within the banking sector. For practitioners, understanding the interplay of financial levers can inform strategic decisions that balance growth ambitions with risk management. In the ever-evolving landscape of global finance, the adaptability and strategic foresight of banks are paramount. As the industry faces new challenges, such as technological disruption, environmental concerns, and shifting consumer behaviors, the lessons drawn from these recessionary periods will be invaluable. The banking sector must continue to evolve, leveraging both historical insights and forward-looking strategies to navigate the uncertain waters of the future.

In conclusion, the journey of commercial banks through the studied periods is one of cautious growth, strategic resilience, and an enduring quest for stability. It is a tale that underscores the critical importance of sound financial management and the ability to adapt to the unpredictable ebbs and flows of the economic tides. As the sector moves forward, it will undoubtedly continue to draw on the rich well of experience and knowledge encapsulated in studies such as this study.

Table 4.1. Descriptive Statistics of Financial Performance and Structural Variables, Nationwide Commercial Banks, 2018-2022

| Variable | Observations | Mean | Standard Deviation |
|---|---|---|---|
| Sustainable growth rate | 44,694 | 0.0387 | 0.0865 |
| **Dependent Variables** | | | |
| Profit margin | 44,694 | 0.2516 | 0.1594 |
| Earnings retention ratio | 44,694 | 0.6152 | 0.5184 |
| Assets turnover | 44,694 | 0.0270 | 0.0170 |
| Financial leverage | 44,694 | 10.2871 | 3.0162 |
| SGC | 44,694 | 0.0178 | 0.7797 |
| **Independent Variables** | | | |
| Lagged profit margin | 44,694 | 0.2504 | 0.1599 |
| Lagged earnings retention ratio | 44,694 | 0.6150 | 0.5196 |
| Lagged assets turnover | 44,694 | 0.0260 | 0.0165 |
| Lagged financial leverage | 44,694 | 10.0874 | 2.6376 |
| Lagged deposits to liabilities ratio | 44,694 | 0.9488 | 0.0586 |
| Lagged bank size | 44,694 | 13.0968 | 1.6570 |
| Lagged Herfindahl index | 44,694 | 0.6192 | 0.1744 |
| Agricultural loan ratio | 44,694 | 0.0471 | 0.2119 |
| Change in profit margin | 44,694 | 0.0008 | 0.9727 |
| Change in earnings retention rate | 44,694 | 0.0001 | 3.4317 |
| Change in assets turnover | 44,694 | 0.0011 | 0.0515 |
| Change in financial leverage | 44,694 | 0.2913 | 15.3830 |

Table 4.2. Descriptive Statistics of Financial Performance and Structural Variables, Nationwide Commercial Banks, 2006-2010

| Variable | Observations | Mean | Standard Deviation |
|---|---|---|---|
| Sustainable growth rate | 112,500 | 0.0112 | 0.1547 |
| **Dependent Variables** | | | |
| Profit margin | 112,500 | 0.1521 | 0.2802 |
| Earnings retention ratio | 112,500 | 0.5704 | 0.7842 |
| Assets turnover | 112,500 | 0.0291 | 0.0156 |
| Financial leverage | 112,500 | 10.1868 | 2.6782 |
| SGC | 112,500 | 0.0373 | 0.7950 |
| **Independent Variables** | | | |
| Lagged profit margin | 112,500 | 0.1627 | 0.2621 |
| Lagged earnings retention ratio | 112,500 | 0.5661 | 0.7810 |
| Lagged assets turnover | 112,500 | 0.0279 | 0.0150 |
| Lagged financial leverage | 112,500 | 10.2000 | 2.6674 |
| Lagged deposits to liabilities ratio | 112,500 | 0.9227 | 0.0818 |
| Lagged bank size | 112,500 | 11.9735 | 1.3244 |
| Lagged Herfindahl index | 112,500 | 0.5747 | 0.1785 |
| Agricultural loan ratio | 112,500 | 0.0672 | 0.2504 |
| Change in profit margin | 112,500 | -0.0111 | 0.6173 |
| Change in earnings retention rate | 112,500 | 0.1025 | 35.5864 |
| Change in assets turnover | 112,500 | 0.0011 | 0.0286 |
| Change in financial leverage | 112,500 | -0.0044 | 2.2793 |

Table 4.3. Seemingly Unrelated Regression Results, Nationwide Commercial Banks for Two Periods, 2006-2010, 2018-2022

| Variables | 2006-2010 | | 2018-2022 | |
|---|---|---|---|---|
| | Coefficient | Standard errors | Coefficient | Standard errors |
| ***Dependent Variable: Profit margin*** | | | | |
| Intercept | 0.0462*** | (0.00910) | -0.0130* | (0.00777) |
| Lagged profit margin | 0.858*** | (0.00181) | 0.862*** | (0.00239) |
| Sustainable growth challenge | -0.0161*** | (0.000592) | 0.00965*** | (0.000473) |
| Herfindahl index | -0.0530*** | (0.00288) | -0.0199*** | (0.00218) |
| Deposits to liabilities ratio | 0.00779 | (0.00635) | 0.0235*** | (0.00652) |
| Bank size | -0.00123*** | (0.000415) | 0.00277*** | (0.000239) |
| Merger | 0.00739*** | (0.00107) | 0.00859*** | (0.000754) |
| Agricultural loan ratio | 0.0361*** | (0.00490) | -0.0228*** | (0.00351) |
| ***Dependent Variable: Retention ratio*** | | | | |
| Intercept | 0.328*** | (0.00337) | 0.249*** | (0.00368) |
| Lagged retention ratio | 0.420*** | (0.00272) | 0.575*** | (0.00385) |
| Sustainable growth challenge | -0.0222*** | (0.00267) | 0.00174 | (0.00257) |
| Merger | 0.0592*** | (0.00478) | 0.0412*** | (0.00406) |
| Agricultural loan ratio | -0.130*** | (0.0212) | -0.0772*** | (0.0186) |
| ***Dependent Variable: Assets turnover*** | | | | |
| Intercept | 0.00207*** | (0.000412) | 0.00264*** | (0.000745) |
| Lagged assets turnover | 1.038*** | (0.00193) | 0.999*** | (0.00280) |
| Sustainable growth challenge | 0.0237*** | (3.61e-05) | 0.0215*** | (5.73e-05) |
| Deposits to liabilities ratio | -0.00188*** | (0.000288) | -0.00220*** | (0.000636) |
| Bank size | -9.71e-05*** | (1.84e-05) | 3.20e-05 | (2.28e-05) |
| Merger | -0.000619*** | (4.85e-05) | -0.000958*** | (7.34e-05) |
| Agricultural loan ratio | 0.00209*** | (0.000225) | 0.000730** | (0.000350) |
| ***Dependent Variable: Financial leverage*** | | | | |
| Intercept | 0.710*** | (0.0582) | -1.274*** | (0.125) |
| Lagged financial leverage | 0.923*** | (0.00114) | 1.034*** | (0.00231) |
| Sustainable growth challenge | -0.0221*** | (0.00375) | 0.0540*** | (0.00784) |
| Deposits to liabilities ratio | -0.114*** | (0.0403) | 1.126*** | (0.107) |
| Bank size | 0.0107*** | (0.00258) | 0.00202 | (0.00388) |
| Merger | 0.234*** | (0.00679) | 0.0806*** | (0.0126) |
| Agricultural loan ratio | -0.276*** | (0.0303) | 0.0329 | (0.0571) |
| ***Dependent Variable: Sustainable growth challenge*** | | | | |
| Intercept | -0.195*** | (0.0347) | 0.0111 | (0.0726) |
| Change in profit margin | 0.00784*** | (0.00287) | 0.0180*** | (0.00353) |

| | | | | |
|---|---|---|---|---|
| Change in retention ratio | -0.000188*** | (4.97e-05) | 0.000134 | (0.000999) |
| Change in assets turnover | 18.56*** | (0.0624) | 5.481*** | (0.0666) |
| Change in financial leverage | 0.0191*** | (0.000777) | -0.00326*** | (0.000223) |
| Herfindahl index | 0.0280*** | (0.0108) | -0.00576 | (0.0202) |
| Deposits to liabilities ratio | 0.138*** | (0.0243) | -0.0107 | (0.0608) |
| Bank size | 0.00640*** | (0.00159) | 0.000549 | (0.00218) |
| Merger | 0.00362 | (0.00407) | 0.0198*** | (0.00704) |
| Agricultural loan ratio | -0.119*** | (0.0187) | -0.000548 | (0.0325) |
| Breusch Pagan Test of Independence ($\chi^2$) | 8462.117*** | | 1007.638*** | |

**Notes**: *, **, *** denote the significance at the 10%, 5%, and 1% confidence levels, respectively.

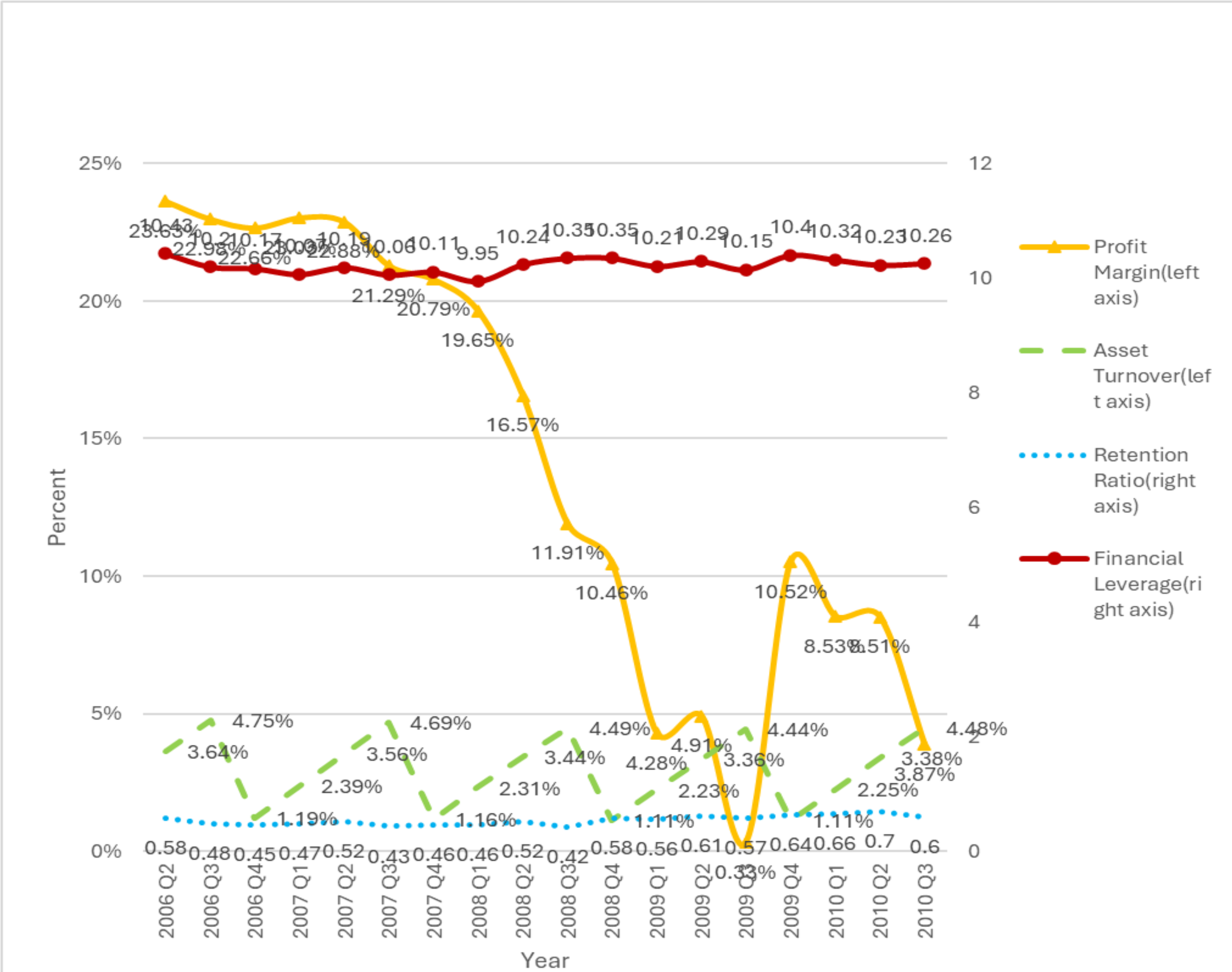


Figure 4.1. Growth Levers of the Sustainable Growth Rate for Commercial Banks, 2006-2010

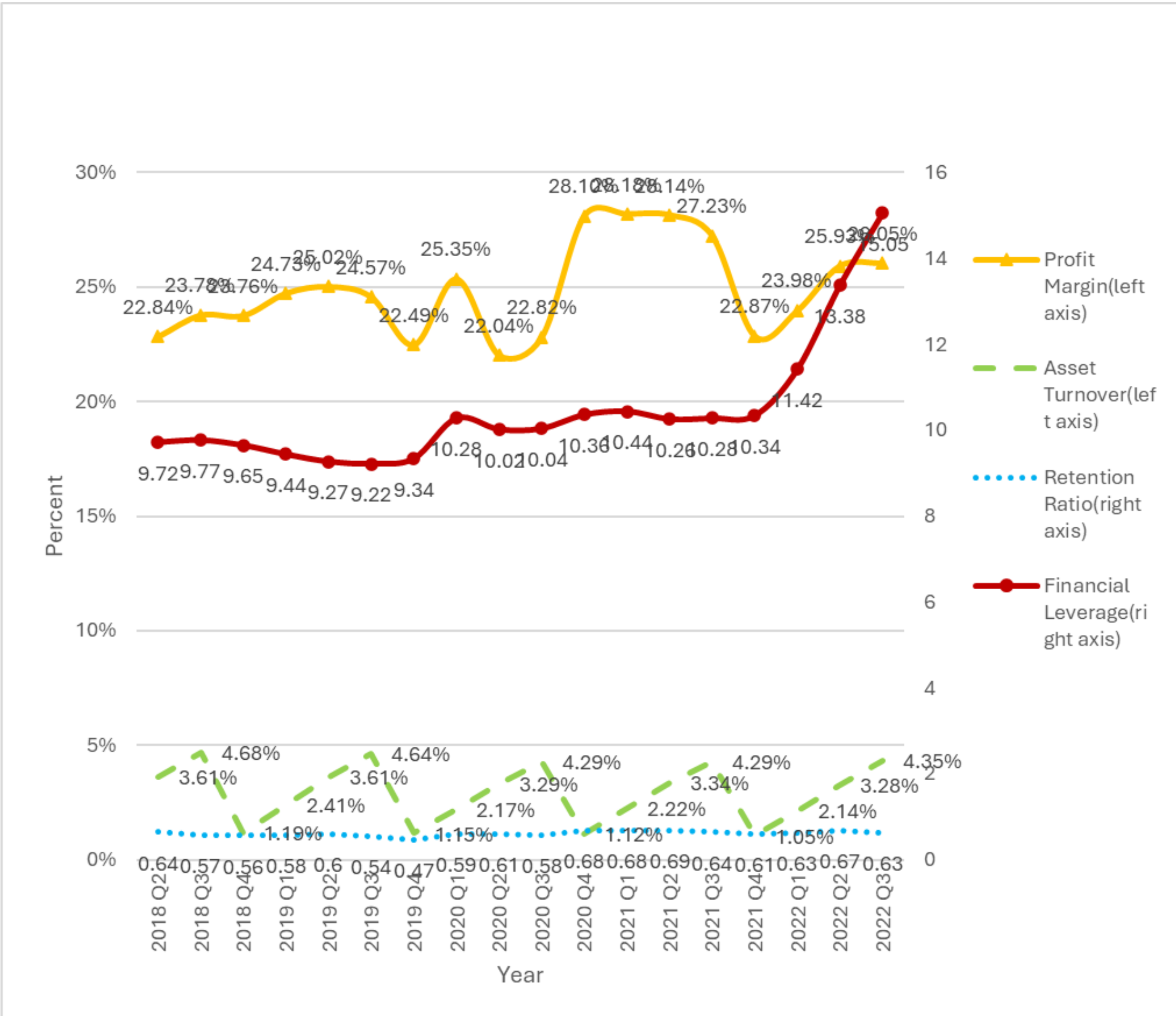


Figure 4.2. Growth Levers of the Sustainable Growth Rate for Commercial Banks, 2018-2022

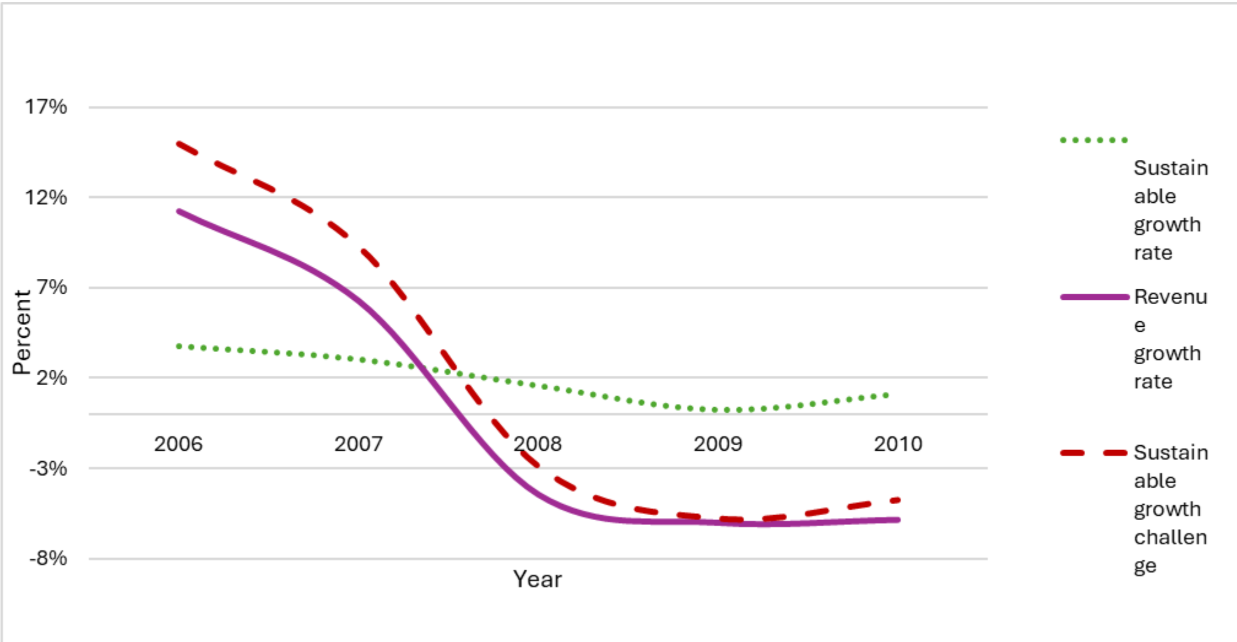


Figure 4.3. Rates of actual revenue, growth, sustainable growth rate, and SGC for commercial banks, 2006-2010

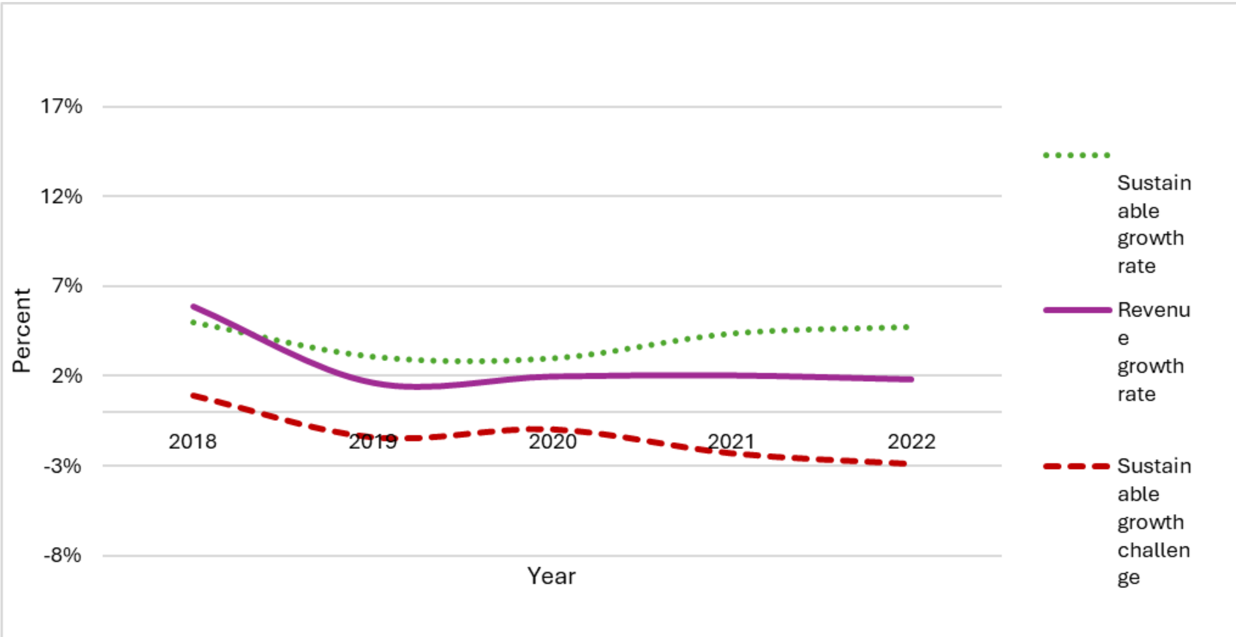


Figure 4.4. Rates of actual revenue, growth, sustainable growth rate, and SGC for commercial banks, 2018-2022


Figure 4.5. Rates of actual revenue, growth, sustainable growth rate, and SGC for Ag and Non-Ag banks, 2006-2010

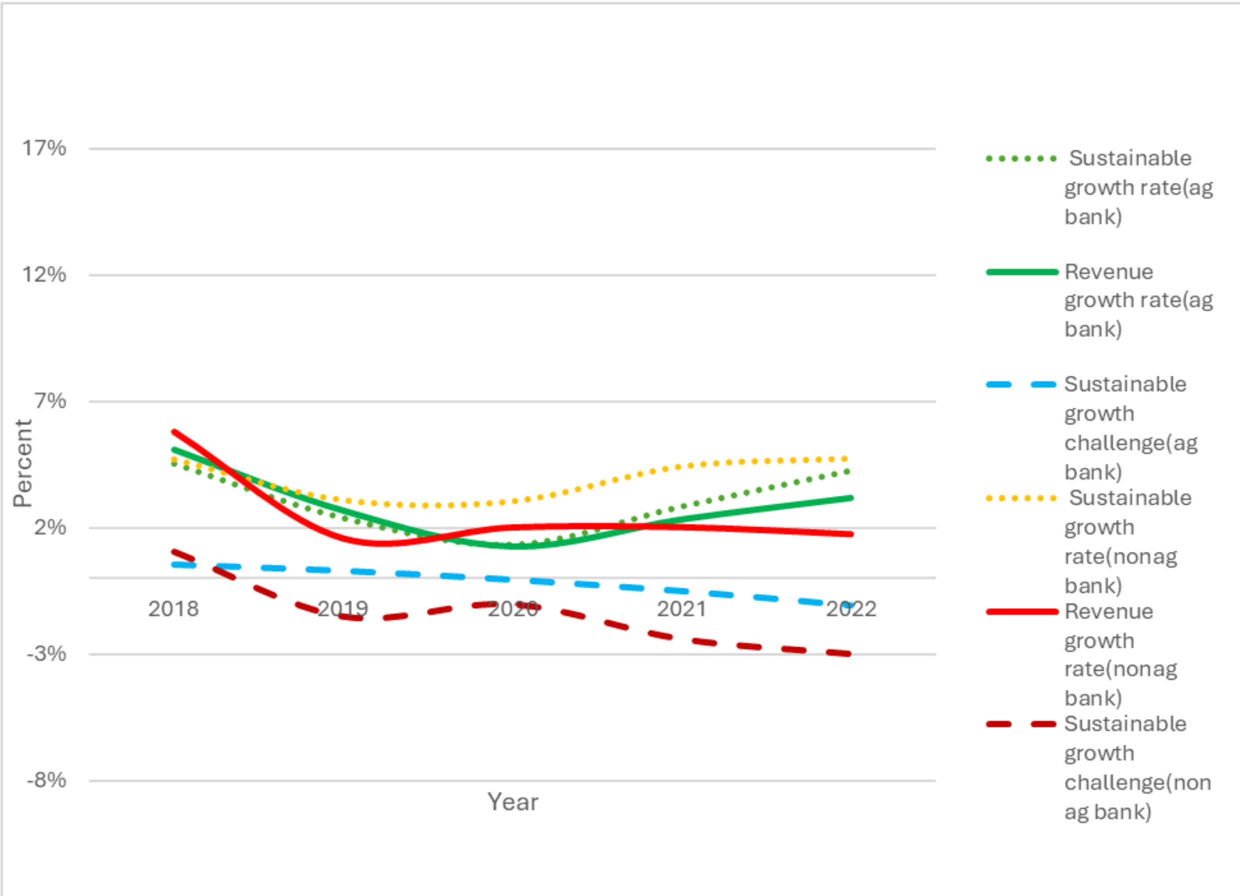


Figure 4.6. Rates of actual revenue, growth, sustainable growth rate, and SGC for Ag and Non-Ag banks, 2018-2022

# CHAPTER 5

# CONCLUSIONS

This dissertation provides a comprehensive analysis of the economic challenges faced by banks during the COVID-19 pandemic and the implications of the Federal Reserve's monetary policies. The studies conducted offer significant insights into the risk-taking behaviors and financial strategies of agricultural and non-agricultural banks during periods of economic distress, drawing on lessons from both the late-2000s financial crisis and the pandemic-induced recession.

The first study details the economic challenges banks faced in the initial two years of the pandemic, highlighting the severe pressures on banking institutions due to restrictive social mobility conditions. Business shutdowns and declining household incomes led to increased loan default risks and deteriorating liquidity conditions. The Federal Reserve's aggressive expansionary monetary policies, aimed at injecting liquidity into financial markets, required banks to adopt stricter credit standards and increase their holdings in government bonds, held-to-maturity securities, and mortgage-backed securities. These measures, while addressing liquidity issues, also heightened the risk profiles of banks' asset portfolios.

The second comparative study in Chapter 3 reveals that banks significantly altered their risk-taking behaviors in response to expansionary monetary policies between the late 2000s financial crisis and the COVID-19 pandemic. The findings indicate that banks' risk-taking behavior increased with the onset of expansionary policies, particularly when the federal funds rate was decreased.  The relationship between banks' profitability ratios and their risk-taking behaviors was also examined, revealing that higher profitability is associated with lower risk-taking in loans. Larger banks and those in more concentrated markets were found to take on less risk, suggesting that diversified portfolios and stronger capital bases enable better risk management. This study adds to the existing literature by empirically demonstrating how expansionary monetary policy influences banks' risk-taking behavior. Policymakers and regulators should consider these findings when designing and implementing policies to promote financial stability, particularly during economic downturns.

The last study uses the Sustainable Growth Challenge (SGC) model to examine the operational strategies of agricultural and non-agricultural banks during the late-2000s financial crisis and the COVID-19 pandemic. The analysis highlights the resilience and adaptability of commercial banks, with agricultural banks demonstrating stability in profit margins even during economic downturns. The study emphasizes the importance of profit margins, earnings retention, asset turnover, and financial leverage in shaping banks' financial trajectories. It also underscores the inverse relationship between liquidity management and asset turnover efficiency, prompting a reconsideration of liquidity strategies.

The evidence suggests that strategic financial levers, such as profit margin, earnings retention, asset turnover, and financial leverage, play crucial roles in banks' growth and stability. Banks with aggressive growth strategies exhibited higher financial leverage ratios, indicating a propensity for risk-taking. The observed negative SGC values suggest a cautious approach to growth, reflecting either a risk-averse strategy or the constraints posed by sustainable growth models. The less severe deviations from the sustainable growth rate in recent periods indicate that banks have absorbed lessons from past crises, building resilience and robust financial planning into their operations.

These findings have significant implications for policymakers and banking executives. Understanding the financial determinants of bank performance can guide the development of regulatory frameworks aimed at fostering stability and growth within the banking sector. For practitioners, insights into the interplay of financial levers can inform strategic decisions that balance growth ambitions with risk management.

In summary, this dissertation highlights the critical importance of sound financial management and the ability to adapt to economic uncertainties. The journey of commercial banks through the studied periods is one of cautious growth, strategic resilience, and an enduring quest for stability. As the banking sector faces new challenges, such as technological disruption, environmental concerns, and shifting consumer behaviors, the lessons drawn from these recessionary periods will be invaluable. The sector must continue to evolve, leveraging historical insights and forward-looking strategies to navigate future economic challenges. This study contributes to a deeper understanding of banks' growth strategies and risk management, ultimately aiding in the development of more informed, evidence-based policy decisions in times of economic challenge.

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