The cause and Interaction between banking crises and the business cycle

Bodunrin, Olalekan Samuel

University of Bath, Bath, United Kingdom

14 January 2023

WORKING PAPER SERIES

THE CAUSE AND INTERACTION BETWEEN BANKING CRISES AND THE BUSINESS CYCLE.

Bodunrin, Olalekan Samuel

University of Bath

ABSTRACT

This paper analyzed the interplay between banking crises and the business cycle behaviour and its implication for the wider macroeconomy. Firstly, the business cycle of the economies was estimated using Hodrick & Prescott's (1997) filter as a standard smoothing technique. Next, the turning points were identified, and the cycle was dated using the Harding & Pagan (2003) algorithm, an extension from Bry and Boschan (1971), with the aid of the Philippe Bracke (2011) SBBQ Stata module. Finally, after identifying the peak and trough phase, the distance between the duo was further labelled, and the entire stretch of the economies' business cycle was classified into six phases, namely recovery, expansion, peak, recession, depression, and trough. The aim is; to ascertain the reactivity between banking crises and the individual business cycle phases and their implications for the aggregate economy. This objective is in addition to; exploring the relationship between banking crises and the cyclical behaviour of the business cycle; ascertaining the probability of banking crises induced by the cyclical behaviour of the business cycle; and establishing the gaps generated by the interactions between banking crises and; the output, the industrial production and the credit gaps. The panel vector autoregressive (pVAR) model was employed. Also, the logistic regression model and the Harding & Pagan (2003) concordance index were applied with diagnostic tests and the adaptive LASSO for robustness checks. The result found three broader categories of banking crises. These are banking crises made possible by; liquidity pressure during economic expansions, excessive leverage(boom and bust) and economic downturns. Banking crises severely contracted the business cycle, via the trough, depression, and recovery phases, with feedback mechanisms lasting about four years. The business cycle caused banking crises in its extreme region- the topmost peak phase, the lowest trough phase, and the recovery phase. The result further confirmed that *b*anking crises naturally occur on the Depression, Recovery, Trough phases and weakly on the Expansion phases (in that order). Nations slipped from peak to trough during banking crises, but none moved from trough to peak. These results emphasised the importance of macro-financial linkages and their vulnerabilities, suggesting needs for policy synergy and considering the business cycle phases in designing and implementing economic policies.

JEL Code: C11, E32, E50, G01, N00, N20

Keywords: Banking crises, Business Cycle

TABLE OF CONTENT

1.0 INTRODUCTION 1

1.1 Defining Business Cycle And Banking Crises 3

1.2 Research Objectives 6

1.3 Summary Statistics 6

2.0 RELATED LITERATURE 8

2.1 Theories Of Business Cycle 9

2.2 Theories Of Banking Crises 15

2.3 The Intersection Between Banking Crises And BusinesSSs Cycle 20

2.4 Research Questions And Hypothesis Development 24

2.5 Contribution To The Literature 26

3.0 DESIGN/METHODOLOGICAL APPROACH 28

3.1 FRAMEWORKS 28

3.1.1 Phases And Features Of The Business Cycle 28

3.1.2 Measuring The Business Cycle 30

3.1.3 Identifying Turning Points And Dating The Cycle 32

3.1.4 Classifying The Business Cycle Into Phases 33

3.1.5 Concordance Index (CI)- Synchronization Of Cycles. 34

3.2 ECONOMETRIC MODELS EMPLOYED 35

3.2.1 Model Specification And A Priori Expectations 35

3.2.1.1 Panel Vector Auto-Regressive (pVAR) Model 35

3.2.1.2 Panel Logistic Regression 40

3.2.1.3 Modelling The Relationship Between Output Gap, Credit-To-GDP Gap, And The Industrial Production Gap 41

3.2.2 Stationarity Test And Optimal Lag Selection 43

3.2.3 Model Stability Criteria And Diagnostic Test 44

3.2.4 Granger Causality And Impulse Response Function 45

3.2.5 The Least Absolute Shrinkage And Selection Operator (Lasso) 45

3.2.6 Data, Sample, And Variables Description 46

4.0 ANALYSIS 48

4.1 DESCRIPTIVE ANALYSIS 48

4.1.1 Cyclical Behavioral Pattern Of The Business Cycle Within And Outside The Sphere Of Banking Crises 49

4.1.2 The Amplitude, Duration And Slope Of The Business Cycle Outside And During Episodes Of Banking Crises. 51

4.1.3 Output, Credit, And Industrial Production Gap Loss To Banking Crises 52

4.1.3.1 Average Gap Loss In Output, Industrial Production, And Credit Before, During And After Banking Crises 52

4.1.3.2 Comparing Average Gaps In Output, Industrial Production, And Credit On The Business Cycle Phases During And Outside Banking Crises 54

4.1.4 The Concordance Index (CI)- Synchronization Of The Business, Industrial Production And Credit Cycle In Crises And Noncrises Period 55

4.2 EMPIRICAL ANALYSIS 56

4.2.1 The Relationship Between Banking Crises And The Cyclical Behaviour Of The Business Cycle; And Implications For Macroeconomic Indicators. 57

4.2.1.1 Banking Crises, Business Cycle And Banks' Credit To The Private Sector-Model 1a 57

4.2.1.2 Banking Crises, Business Cycle And Monetary Policy- Model 1b. 58

4.2.1.3 Banking Crises, Business Cycle And Aggregate Expenditure Components- Model 2a. 60

4.2.1.4 Banking Crises, Business Cycle And Sectorial Components Of Gdp- Model 2b 61

4.2.1.5 Banking Crises, Business Cycle And Banks System Stability – Model 3a 63

4.2.1.6 Banking Crises, Business Cycle And Bank System Depth- Model 3b 64

4.2.1.7 Banking Crises, Business Cycle And Bank System Efficiency 66

4.2.2 Panel Logistic Regression: The Probability Of Banking Crises Induced By The Average Cyclical Behaviour Of The Business Cycle 67

4.2.2.1 The Probability Of Systemic Banking Crises Across The Different Business Cycle PhaseSSs 71

4.2.3 The Relationship Between Banking Crises, The Output Gap, The Industrial Production Gap, And The Credit-To-Gdp Gap In The Economy. 75

4.2.3.1 Output Gap- The Extent Of Deviations Of Output From The Long-Term Economic Growth Trend Caused By Banking Crises 75

4.2.3.2 Credit Gap- The Extent Of Deviations Of Credit-To-Gdp Ratio From Its Trend Caused By Banking Crises 76

4.2.3.3 Industry Production Gap: The Extent Of Deviations Of Industry Production From Its Trend Caused By Banking Crises 77

5.0 SUMMARY OF FINDINGS 80

5.1 Summary Of Descriptives 80
5.2 Banking Crises, Cyclical Behaviour Of The Business Cycle And The Implication For Macroeconomic Indicators. 80
5.3 Probability Of Banking Crises Generated From The Cyclical Behaviour Of The Business Cycle And Each Of The Different Phases 83
5.4 The Impact Of Banking Crises On The Output Gap, Industrial Production Gap, And Credit-To-GDP Gaps. 84
5.5 Conclusion & Policy Implications 85
5.6 Limitation And Lessons For Further Research 89
REFERENCE 90
APPENDIX 95
Appendix 1: Descriptive Tables 95
Appendix 2: Stationarity, Diagnostic And Stability Tests 101
Appendix 3: Concordance Index (Ci) By Country 110
Appendix 4: Estimated Models, Granger Causality And Impulse Response Functions Basic Model 1 111
Appendix 5: Estimated Models, Granger Causality And Impulse Response Functions Basic Model 2 114
Appendix 6: Estimated Models, Granger Causality And Impulse Response Functions Model 3 121
Appendix 7: Estimated Models, Granger Causality And Impulse Response Functions Model 5 128
Appendix 8: Probability Of Banking Crises 134
Appendix 9: Robustness Checks 135

LIST OF TABLES

Table 1.2.1: Business cycle phase and periods of banking crises 7
Table 3.1: Models and Abbreviations of variables Name 37
Table 4.1: Correlation matrix of selected Variables 48
Table 4.1.1: The amplitude, duration, and slope of the business cycle 52
Table 4.1.3: Concordance Index (CI) among Business Cycle and Credit Cycle and Industrial production Cycle 56
Table 4.2.2a: Panel Logistic Regression: the probability of banking crises 70
Table 4.11: Panel Vector Autoregressive Model 5C 126
Table 4.11.1: Granger Causality for model 5C 126
Table 4.11.2: Impulse Response Functions for model 5C 127

LIST OF FIGURES

Figure 2: Diagram Depicting The Framework Of The Austrian Or Hayek Business Cycle Theory 12
Figure 3.1: Business Cycle Phases 29
Figure 4.1: Business Cycle Phases, Credit Allocation And Banking Crises 51
Figure: 4.2: Evolution Of Output Gap, Credit Gap, And Industrial Production Gap Prior, During And After Banking Crises 53
Figure 4.2.1a: Average Output, Industrial Production Gap By Business Cycle Phases: During And Without Banking Crises 54
Figure 4.2.1b: Credit Gaps By Business Cycle Phases: During And Without Banking Crises 55
Figure 4.3: Impulse Response Function: Banking Crises And Business Cycle-Model I 58
Figure 4.4: Impulse Response Functions: Banking Crises, Business Cycle And Monetary Policy- Model II 59
Figure 4.5: Response Of The Business Cycle And Imports To Banking Crises, Controlling For GDP Components 61
Figure 4.7: Impulse Response Functions: Banking Crises, Business Cycle And The Sectorial Components Of GDP 62
Figure 4.8: Response Of Business Cycle And Banks Stability Measures To Banking Crises 64
Figure 4.9: Impulse Response Functions: Banking Crises, Business Cycle, And Bank System Depth 65
Figure 4.10: Response Of Business Cycle And Selected Banks System Efficiency Variables To Banking Crises 67
Figure 4.11: Response Of Output Gap To Banking Crises And Selected Factors 76
Figure 4.12: Response Of Credit Gap To Banking Crises And Selected Factors 77
Figure 4.13: Response Of Industrial Production Gap To Banking Crises And Selected Factors 79

APPENDIX

Appendix 1: Descriptive Tables **94**
Table 3.4: Recruited Time Series Variables 94
Table 3.1.1A: The Phase State Of The Business Cycle During And Without Banking Crises 96
Table 3.1.1B: Banks' Credit To The Private Sector, % Of GDP (Leverage) Along The Business Cycle 96
Table 3.1.2A: Summary Of Variables: Total Sample 97
Table 3.1.2B: Summary Of Variables: By Phases Of The Business Cycle I 98
Table 3.1.2C: Summary Of Variables: By Phases Of The Business Cycle II 99
Table 3.5: Synchronization Of Business Cycle, Credit-To-GDP Cycle, Industrial Production And Banking Crises By Countries.
Appendix 2: Stationarity, Diagnostic And Stability Tests **100**
Table 3.2: Stationarity Test And Variable Name Abbreviation 100
Table 3.3: Optimal Number Of Lags Selected 101
Table 4.2.1: Stability Test For Model 1 101
Table 4.4.1: Stability Test For Model 2 102
Table 4.6.1: Stability Test For Model 3 103
Table 4.9A: Stability Test For Model 5 104
Appendix 3: Concordance Index (CI) By Country **106**
Table 4.1.4: Concordance Index (CI) Between Business Cycle And Credits By Country 106
Table 4.1.5: Concordance Index (CI) Between Business Cycle And Industrial Cycle By Country 106
Appendix 4: Estimated Models, Granger Causality, And Impulse Response Functions Basic Model 1 **107**
Table 4.2: Basic Model 1A, Granger Causality And Impulse Response Function (IRF) 107
Table 4.3: Panel Vector Autoregressive Model 1B 107
Table 4.3.1: Granger Causality And Irfs- Panel VAR Model 1B 108
Appendix 5: Estimated Models, Granger Causality And Impulse Response Functions Model 2 **109**
Table 4.4: Panel Vector Autoregressive Model 2A 109
Table 4.4.2: Granger Causality For Model 2A 110
Table 4.4.3: Irfs- Business Cycle, Banking Crises And Selected GDP Expenditure Components For Model 2A 110
Table 4.4.4: Irfs- Causes Of Banking Crises Among The GDP Expenditure Components 111
Figure 4.6: Response Of GDP Expenditure Components To Shocks In The Business Cycle During Banking Crises 112
Table 4.5: Panel Vector Autoregressive Model 2B 113

Table 4.5.1: Granger Causality And Impulse Response Function For Model 2B 114
Table 4.5.2: Effect Of Banking Crises On The Business Cycle And Selected Sectorial Components 114
Table 4.5.3: Effect Of The Business Cycle On Manufacturing And Service Output 114
Appendix 6: Estimated Models, Granger Causality And Impulse Response Functions Model 3 115
Table 4.6: Panel Vector Autoregressive Model 3A 115
Table 4.6.2: Granger Causality For Model 3A 115
Table 4.6.3: Irfs- Effect Of Banking Crises On The Business Cycle And Selected Banks' Stability Variables 116
Table 4.6.4: Irfs-Effect Of The Business Cycle On Banking Crises And Selected Banks Stability Variable 116
Table 4.7: Panel Vector Autoregressive Model 3B 118
Table 4.7.1: Granger Causality For Model 3B 118
Table 4.7.2: Irfs- Business Cycle, Banking Crises And Selected Banks System Depth Variables 119
Table 4.8: Panel Vector Autoregressive Model 3C 119
Table 4.8.1: Granger Causality For Model 3C 120
Table 4.8.2: Impulse Response Function For Model 3C 120
Table 4.8.3: Causes Of Banking Crises Among The Selected Banks' System Efficiency Variables 121
Appendix 7: Estimated Models, Granger Causality And Impulse Response Functions Model 5 122
Table 4.9: Panel Vector Autoregressive Model 5A 122
Table 4.9.1: Granger Causality For Model 5A 122
Table 4.9.2 Impulse Response Function For Model 5A 123
Table 4.10: Panel Vector Autoregressive Model 5B 124
Table 4.10.1: Granger Causality For Model 5B 125
Table 4.10.2: Impulse Response Function For Model 5B 125
Appendix 8: Probability Of Banking Crises 128
Table 4.2.2b: Probability Of Banking Crises By Phases; Odds Ratio And Average Marginal Effect 128
Table 4.2.2c: Probability Of Banking Crises By Phases At Minimum, Mean And Maximum 128
Appendix 9: Robustness Checks 129
Table 4.2.3a: Variable Selection- Expenditure Components And Financial Variables 130
Table 4.2.3b: Odds ratio of banking crisis across phases using adaptive lasso selected covariates- Expenditure components and financial variables 130
Table 4.2.3c: Variable Selection - Sectoral Components And Financial Variables 131

Table 4.2.3d: Odds ratio of banking crisis across phases using adaptive lasso selected covariates- Sectoral components and financial variables.
131
Table 4.2.4a: Lasso Variable Selection For The Impacts Of Banking Crises, Credits, Sectorial And Financial Variables On The Business Cycle Phases 132
Table 4.2.4b: Impacts Of Banking Crises, Credits And Lasso Selected Sectorial And Financial Variables On The Business Cycle Phases 133
Table 4.2.4c: Lasso Variable Selection For The Impacts Of Banking Crises, Credits, Aggregate Expenditure, And Financial Variables On The Business Cycle Phases 133
Table 4.2.4d: Impacts Of Banking Crises, Credits, And Lasso Selected Expenditure Aggregate And Financial Variables On The Business Cycle Phases 134

1.0 INTRODUCTION

Banking crises are rare, but literature concluded they have lasting impacts on the macroeconomic condition and stability[1]. Firstly, these impacts have been confirmed to be related and amplified by the business cycle (Calomiris, 2010; Bucher et al., 2013). Authors including Gorton (1988) have long identified banking panics as systematic events linked to the business cycle. However, "the role of banks in transmitting shocks to the macroeconomy has received little attention, even though poorly capitalized banks were affirmed with the potential to amplify the business cycles" (Stolz & Wedow, 2011; Jokipii & Milne, 2008; Ayuso et al., 2004, and Lindquist, 2004).

Secondly, the business cycle, on the other hand, affects banks' profitability, loan loss provisions and new bad debts, reflecting cyclical patterns, while the effect of recession conditions remains significant and long-lasting (Quagliariello, 2007; Albertazzi & Gambacorta, 2006). Prolonged downturns can instigate subsequent banking crises, while shocks from macroeconomic policies and overly ambitious stimulus[2] targeted at banking crises can set up an environment for future downturns (Che et al., 2014). Similarly, banking crises are seen as offshoots of the business cycle, propelled by irrational exuberance and myopic expectations (Calomiris, 2010). In like manner, Bucher et al. (2013) also acknowledged a close link between business cycles, banks' credit, and banking crises. With such a link, external and endogenous shocks that deteriorate the business cycle can also extend to the banking system, given the macroeconomic structure, reliance on investment, and the interconnectivity of banks. Therefore, systemic banking crises cannot be entirely explored outside the business cycle, either in causes or effects. Since the conditions that started the crises and the interplay of macroeconomic conditions cannot be explored in isolation of the business cycle.

Thirdly, there are very few studies regarding banking crises and the individual phases of the business cycle. Instead, the focus has been restricted to the peak, trough, and recession phases. As Berman & Pfleeger (1997) emphasised, the sectors of the economy react differently to the business cycle. If this is the case, then this varied responsiveness should explain the relationships among the segments of the real economy, the business

[1] Reinhart & Rogoff, 2008; Laeven & Valencia, 2008, 2014, 2013, 2018; 2012. Cerra et al.,(2017)
[2] This remains one of the core assertions of the Austrian business cycle theory;-…that economic boom, merely the result of excess credit expansion, remains unsustainable.

cycle phases, the banking system, and by extension, banking crises. Although the business cycle is perceived as a cyclical component of the aggregate output and the outcome of disturbing external forces and internal structure mechanisms (Hansen & Tout, 1933), it possesses instructive links relating to the financial system and the real economy in times of crises. This feature makes the business cycle an informative component of the macroeconomic structure. As a result, it can provide first-hand information ahead of most conventional indicators.

However, few papers explored the relationship between banking crises and the business cycle as most conducted this through the eye lens of financial crises, in light of the 2007/08 global financial crises(GFC). Albeit, financial crisis theories, as blanket models for banking crises, do not explain the connection between the business cycle and discontinuous phenomena such as bank crises. Despite the plethora of studies around financial crises and banking activities, the structural connectivity between the banking system and the real economy during banking crises received minimal attention. Even in the quest for more knowledge about the global financial crisis (GFC), efforts were channelled more into subprime mortgages, credits, and the stock market. However, the underlying structure created by the banking system and the business cycle interactions remains crucial in the manifestation of the GFC. Given the importance of this research area for macroprudential policy and economic stability, exploring the reactivity between banking crises and the business cycle behaviour remains important. With informed knowledge in this area, the macroeconomic conditions permitting detrimental banking crises outcomes and economic downturns can be tamed.

The paper analysed the relationship between banking crises and the business cycle behaviour of 43 economies in Europe and Central Asia and its implication for the wider macroeconomy. To explore the reactivity between these macro-financial variables and the business cycle, the business cycle of the economies were estimated using Hodrick & Prescott (1997) filter as a standard smoothing technique and the Harding & Pagan (2003) extension of the Bry and Boschan (1971) dating algorithm. The panel vector autoregressive (pVar) model and the logistic regression model were applied as well as the Harding & Pagan (2003) Concordance Index (CI) with diagnostic tests and adaptive LASSO for robustness checks. Banking crises severely contracted the business cycle with feedback mechanisms, lasting about four years. The business cycle caused banking crises

in its extreme region- the topmost peak phase, the lowest trough phase, and the recovery phase. The highlighted causes of banking crises differ across the business cycle, as each phase reacted differently. Finally, three categories of banking crises were found; those induced by liquidity pressure during economic expansions, by excessive leverage(boom and bust) and by economic downturns. The results emphasized the importance of macro-financial linkages and their vulnerabilities, the need for fiscal, monetary and macroprudential policy synergy, as well as the consideration of the business cycle phases in the design and implementation of policies.

The study is structured in the following way; section 2 explores the related theories in banking crises, the business cycle, and the intersection. Section three explains the framework, the episodes of banking crises, the dating and measurement of the business cycles, the cycle classification and the proposed econometric model. Section four estimated panel VAR models capturing several structural arrangements and segments of the economy, output gap, and the financial sector, with their attendant impulse response function. Panel logistic regression was employed to obtain a precise probability of banking crises. In addition, stability tests and robustness checks were conducted to observe the validity of the results. Finally, section five summarizes the findings, concludes, and points to the policy implications, limitations, and lessons for further Research.

1.1 DEFINING BUSINESS CYCLE AND BANKING CRISES

The business cycle has been conceptualized in diverse ways by several Authors. For instance, according to Zarnowitz (1991), the business cycle is an empirical phenomenon founded upon historical experience. Historically, good times are called prosperity, while bad times are termed depressions. Moving from depressions to prosperity is known as revivals or recoveries, while crises transition from prosperity to depression. Technically, the business cycle is defined as the real gross domestic product (GDP) fluctuations around its long-term growth trend (Madhani, 2010). Burns and Mitchell (1946) called this; "*…a type of fluctuation found in the aggregate economic activity of nations that organize their work mainly in business enterprises: a cycle consists of expansions occurring at about the same time in many economic activities, followed by similarly general recessions, contractions, and revivals which merge into the expansion phase of the next cycle; in duration, business cycles vary from more than one year to ten or twelve years; they*

are not divisible into shorter cycles of similar characteristics with amplitudes approximating their own". According to Burns (1951), this fluctuation is widely diffused over the economy – its industry, its commercial dealings, and tangles of finance. Therefore, the business cycle is the sum of the real economy's performance and reactions to events and policy, whether internal or external. As a result, the banking sector is not immune from the reactive impact of the business cycle.

On the other hand, the business cycle also remains at the receiving ends of several events generated by the banking system and other non-financial sectors, including systemic banking crises. Following Laeven and Valencia (2013, 2018) definition, a systemic banking crisis meets two conditions; firstly, there must be significant signs of financial distress in the banking system, which is evidenced by significant bank runs and losses, and bank liquidations. In addition, there must be "significant" (at least three) banking policy intervention measures[3] in response to the significant losses. The core motivations behind the sustained interest and policy efforts against systemic banking crises stem from its disruptive impacts on the real sector, destabilizing the predictability of core macroeconomic aggregates and worsening economic growth and stability. As rightly put, "*It is now well understood that the interactions between the financial system and the real economy were a weak spot of modern macroeconomics*. "(Jorda, Schularick, Taylor, 2011).

Similarly, the diffusion of signals from the business cycle unto the sectors can disrupt the banking system from playing its role in investment financing, liquidity transformation[4], and preservation of the delicate fractional reserve mechanism, which is crucial to economic expansion. How are these signals diffused, and through what channels?
As described in the literature, the conventional connexion between the real sector and the banking system is majorly through banks' credit and investment links. This connection produces the interest in issues such as; intermediation, asset-liability, currency mismatch risks, delegated monitoring, maturity and liquidity transformations, macroeconomic shocks (Mishkin, 1996; Demirgüç-Kunt & Detragiache, 1998; Diamond

[3] i) deposit freezes and/or bank holidays; ii) significant bank nationalizations; iii) bank restructuring fiscal costs, of at least 3 percent of GDP; iv) extensive liquidity support (at least 5 percent of deposits and liabilities to non-residents); v) significant guarantees put in place; and vi) significant asset purchases of at least 5 percent of GDP.
[4] Liquidity transformation is using short term aggregated deposits or debts to fuel long term investment such as loans. Banks can stimulate the economy through delegated monitoring and liquidity transformation (Diamond, 1984; Diamond &x Dybvig, 1983).

and Dybvig, 1983). Unlike the intermittent occurrence and reactivity of the abovementioned, the relationship between the business cycle and the banking system is more interwoven and continuous. Hence, there are likely business cycle phases consistent with banking crises. Can these interjections between these phases of the business cycle and the outbroke of banking crises be explained with the boom-and-bust mechanism? Can business cycle theories explain banking crises episodes? Are there banking crises-business cycle phases scenarios that confirmed the business cycle theories?

This study aims to diagnose the cause of banking crises and compare their impact on the business cycle across countries, given their macroeconomic conditions, while investigating how they affect the aggregates economy. Therefore, the questions are: what are the impacts of banking crises on the business cycle and vice versa? Why is this different across economies? Why are some countries more vulnerable than others? Can the causes of banking crises be classified according to the behavioural pattern of the business cycle? Do banking crises make the business cycle amplitude higher or low? What is the extent of the deviations of the economy from its long-term economic growth trend caused by banking crises? How do banking crises distort the business cycle's reoccurring nature (length and intensity)? What are the conditions under which banking crises terminate the boom phase of the business cycle? What is the difference between the amplitude effect of monetary and fiscal policies from that of banking crises? Does banking crises shorten or lengthen the business cycle? Are the impacts of banking crises on the business cycle temporal or long-term? The study filled the gaps in the literature by researching the reactivity between the business cycle, including its phases and systemic banking crises, an area with less attention[5]. Theories and standard econometrics methodologies were used to explore the link between systemic banking crises and the business cycle using Laeven & Valencia (2018) crisis dating.

[5] Prevalent models, including financial instability hypothesis find it difficulties in explaining … discontinuous phenomena such as bank failures (Bucher et al, 2013).

1.2 RESEARCH OBJECTIVES

The main objective is to; assess the relationship between banking crises and the behaviour of the business cycle and its implication for the wider macroeconomy and the banking system in Europe and central Asia economies. The paper is divided into four segments: (I) To explore the relationship between banking crises and the cyclical behaviour of the business cycle and the implication for macroeconomic indicators. (II) To estimate the probability of banking crises induced by the cyclical behaviour of the business cycle. (III) To ascertain the reactivity between banking crises and individual business cycle phases and their implications for the aggregate economy, taking a cue from Berman & Pfleeger (1997) submission that the sectors of the economy tend to react differently to the business cycle. (IV) To study the interactions among banking crises, the output, the industrial production and the credit gap in the economy, i.e., how the extent of their deviations from their respective trends interrelate with the tendency of banking crises as indicated by Svirydzenka (2021). In investigating these, the implication on the various components of the aggregate economy and the banking system is considered. The study is explored as a panel of countries among Europe and Central Asia countries informed by World Bank's classification and the Laeven & Valencia (2013, 2018) International Monetary Funds (IMF) working paper on systemic banking crises dating. This group of countries are among the most developed economies globally that have experienced systemic banking crises, as documented in the Laeven & Valencia (2013, 2018) from 1971 to 2018. The crises dating database is also applied by authors such as Kleimeier et al. (2013), Tonzer (2015), Babecký et al. (2014), Chaudron & De Haan (2014), Filippopoulou et al. (2020) etc.

1.3 SUMMARY STATISTICS

According to the list of economies with episodes of banking crises from 1971 to 2018 in Laeven & Valencia's (2013, 2018) IMF working paper on systemic banking crises, there are a total of 43 countries that fall under the purview of the world bank grouping of Europe and Central Asia. This classification informed the decision to explore the economies as a panel of countries. The average number of years these economies spent in episodes of banking crises was about four years, with Spain and Hungary spending the most number of years, i.e., ten years in systemic banking crises. At the same time, Albania, Armenia, Azerbaijan, Belarus, Kazakhstan, Moldova experienced systemic banking crises

for only a year. Exploring the business cycle of these economies in line with section 3.14, the classification of the economies' business cycle into phases as a pooled sample yielded 1640 phases (see table 1.2.1). From 1971 to 2018, the group has spent more years in the recovery (384 years) and expansion phases (345 years), with fewer periods in the peak (159 years) and trough phase (160 years). For more information, the sample is further split into periods of banking crises episodes and periods of calmness, i.e., without banking crises. Of the whole period, banking Gcrises were experienced at 10.1%, while 89.9% were without banking crises.

Table 1.2.1: Business cycle Phase and periods of banking crises

Business cycle Phase	Total sample	%	With Banking crises	%	Without Banking Crises	%
Expansion	345	21.0	9	5.5	336	22.8
Peak	159	9.7	20	12.1	139	9.4
Recession	289	17.6	35	21.2	254	17.2
Depression	303	18.5	45	27.3	258	17.5
Trough	160	9.8	24	14.5	136	9.2
Recovery	384	23.4	32	19.4	352	23.9
Total	**1640**	**100**	**165**	**100**	**1,475**	**100**

Source: Author, 2021

Without envisaging causality or empirical judgment, more banking crises were witnessed during the depression (27.3%), recession (21.2%), recovery (19.4%), and trough (14.5%). However, the harmful effect of each crisis differs from the other. Nevertheless, it is worthy of note that more calm periods were enjoyed in recovery (23.9%) and expansion (22.8%).

2.0 RELATED LITERATURE

Renewed interest surrounding the business cycle stems from subsequent long-term impacts of reoccurring endogenous and exogenous economic disruptions recorded from several macro-scale events such as sovereign debt crises, banking crises, consumer credit crises, mortgage crises, and other external shocks (Reinhart & Rogoff, 2008; Boyd, Kwak, & Smith, 2006; Frydl, 1999). In some cases, these events may have their foundation built on microeconomic activities, such as the 2008 global financial meltdown. The external shocks sometimes can be transmitted through the interlinkage of the financial sectors to foreign corporations or governments that are overly dependent on international trade, sovereign debts, foreign direct investment, or foreign portfolio investment from vulnerable partners (Arora & Kalsie,2018; Papell & Prodan, 2012; Morales-Zumaquero & Sosvilla-Rivero 2016). In addition, the exposure of governments' budgets to mineral resources with unstable prices, reforms implementations, and misaligned fiscal and monetary policies are some of many examples that have impacted the macroeconomic settings negatively. Authors and regulators agreed that banking crises negatively impact the wider economy, but the ignitors remain a thing of guess (see Boyd, Kwak, & Smith 2006; Reinhart & Rogoff 2008; Dungey & Gajurel 2015; De Brandt & Hartmann 2000; Laeven & Valencia 2018, 2014, 2013, 2008; Laeven 2012). In addition, the pattern of the transmissibility, degree of effects, and the havoc triggered by banking crises remain a debate, thereby distorting policy recommendations efforts. For firms or sector-specific risks, delegated monitoring and deposit insurance schemes become potent to eliminate the banks' vulnerability (Diamond, 1984; Diamond & Dybvig, 1983).

Nevertheless, systemic-wide risks that cause systemic banking crises remain cogs in the wheel of financialization and liquidity transformation and persist as unresolved macroprudential catastrophes (Boyd, Kwak, & Smith, 2006; Reinhart & Rogoff, 2008; L. Laeven, Ratnovski, & Tong, 2014). The attention paid to systemic banking crises from several other economic crises stems from its diverse impact on several economic segments, including liquidity dry-up made possible through a fractional reserve system. As suggested by Kaminsky & Reinhart (1999) and Solomon & Golo (2014), there is a strong belief that the business cycle can capture the structure of an economy, can yield sets of information needed to explain the black box between banking crises and the macroeconomics events. Similarly, Svirydzenka (2021) observed that output gap extracted from the business cycle and equity prices were the best leading indicators of

banking crises in advanced markets, while credit gap, equity and property price serve as leading indicators of banking crises in the emerging markets. While the diffused impact of banking crises onto the aggregate economy, transmitted through several channels, are felt through macroeconomic indicators, a further understanding of how the business cycle responds to these crises can act as a catalyst to mitigate and influence the direct and spillover effect of the crises.

2.1 THEORIES OF BUSINESS CYCLE

The business cycle theories remain broad with a diverse school of thought and method of analysis. However, the business cycle is generally seen as the succession of expansion and recession in the aggregate economic activity over a given period. Business cycle, formerly known as Sismondi's theory of periodic crises, is traced to the works of Jean Charles Léonard de Sismondi in the 1819 Nouveaux Principes d'économie politique.

Sismondi business cycle development deviates from the classical theory thinkers that ascribe external factors such as war to the cycle. However, the classical writers made contributions to the emergence of the theory of business cycle but were more concerned with the long-term equilibrium (Adam Smith, 1776, p. 406; Thomas Attwood, 1817, pp. 99, 101; Lord Overstone, 1857, p. 44; Alfred and Mary Marshall, 1881, pp. 154—55; Zarnowitz, 1991). Adam Smith discussed the issues of overtrading in the Wealth of Nations. Thomas Attwood ascribed the reductions in money supply during the gold-standard era to deflation the attendant drops in spending and incomes. More so, Lord Overstone wrote on the multi-stage cycle of trades. At the same time, Alfred and Mary Marshall attached low demands for goods to decline in business capital and subsequently industrial crises. The debates on the validity of Say's law— the idea that supply creates its demand, had prolonged the view on whether the factors influencing the business cycle are endogenous or external. Charles Dunoyer further expanded the theory into alternating cycles theory (Benkemoune, 2009; Arena, 2013). Charles Dunoyer reinterpreted Sismondi's theory of crises incompatibility with Say's political economy, stressing that economies were naturally subject to alternating periods of "activity" and "relapse." (Benkemoune, 2009). Some of the business cycle theories that best mirror the business cycle mechanism in this sample are Keynes' theory of the business cycle, Pure Monetary theory, and Austrian or Hayek business cycle theory. Schumpeter's innovation theory was exempted due to the absence and inability to include the measure of business

innovation in our model. Hansen–Samuelson model of the business cycle demands the use of multipliers and accelerators in explaining the business cycle, both of which was not utilized in this study.

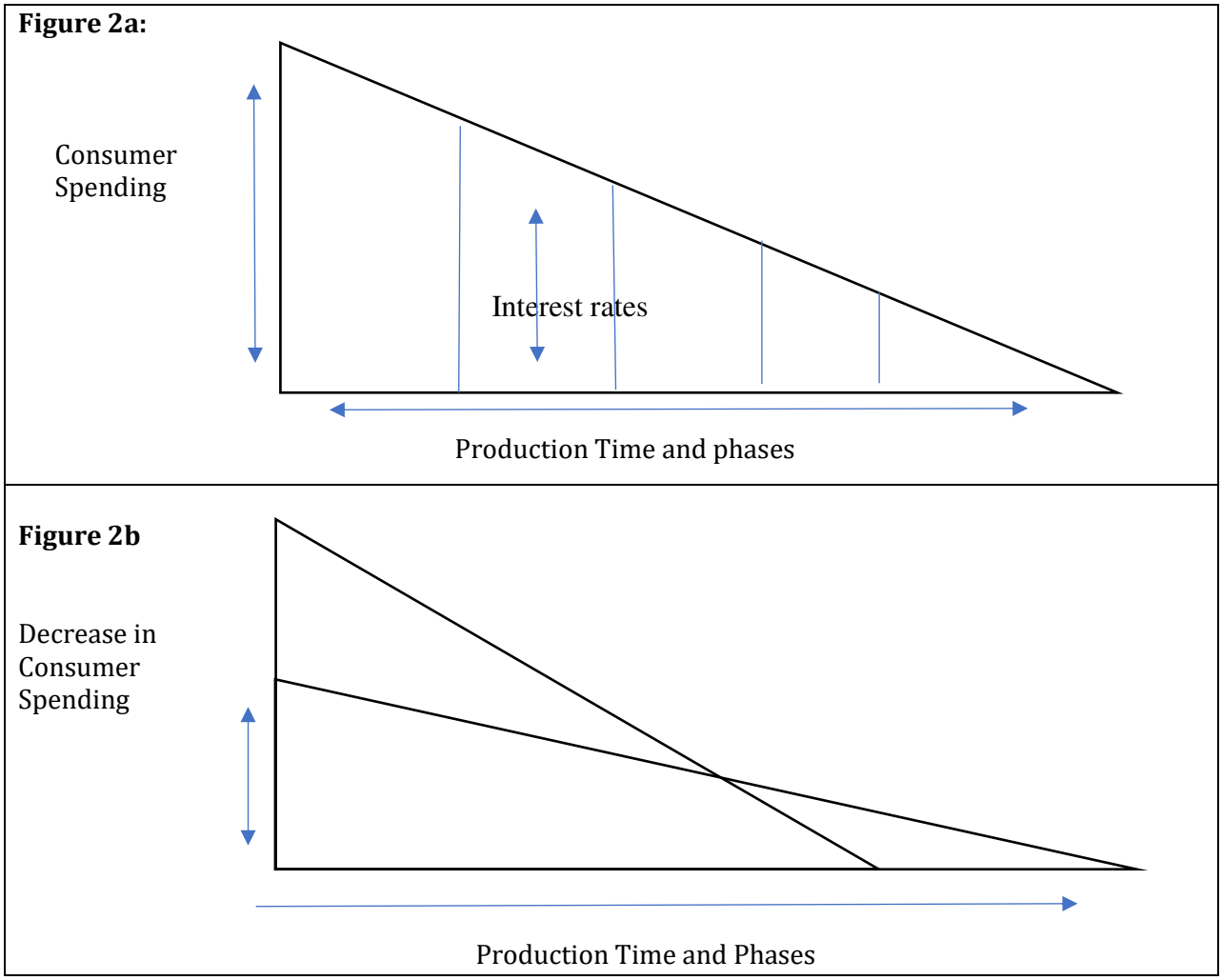
The Pure Monetary theorist, such as Ralph Hawtrey, attached the fluctuation of the business cycle to money and credit expansion and contraction (Jan Toporowski 2005). The source of the sudden contractions of credit was attached to the limits in plant capacity in the short run; when the optimal expansion of goods and services fuelled by credit is reached, credit contraction ensues and becomes recessionary. Although this sample confirmed the assertion of the monetarist that credit played a critical role in the business cycle and banking crises, this appears to be one side of the story. It was also confirmed that, like the business cycle, banking crises are not entirely monetary issues due to periods of recessions without contraction of banks' credit. More so, beyond only the expansion and recession phases focused on by the monetarist, our analysis also considered the intermediary phases of business cycles. In the same vein, credit contractions do not equate to banking crises. This paper confirmed that most banking crises occurred at the peak of the credit to GDP. Therefore, Ralph Hawtrey and the pure monetary business cycle are not robust enough to explain the relationship between the business cycle and banking crises in this sample

In his 1913 article and economic fluctuations policy thinking in the 1930s, Keynes attached two major reasons to the impulse behind the business cycle fluctuations: the future expectations of returns and banks activities, through rate of returns (Bortz, 2021). Keynes emphasized total demand's role in determining income, employment, and output against the classical Say's law. Increased demands, he argues, fuels investment and production, unemployment is reduced, and income level rises and vice versa. This demand is also influenced by changes in investment demands, which depends on the interest rate and expected rate of profit (which he tagged as the marginal efficiency of capital). The marginal efficiency of capital (which can increase due to new inventions and innovations in economic factors or fall due to inefficiency, et cetera.) is a divergence between the cost of capital (interest rates) and revenue earned from capital employment. This expected profit versus the cost of capital becomes the drive that influences investment decisions. Investors decide to invest more when expected profits exceed the current cost of capital and vice versa. Therefore, the expansion phase of the business cycle

results from investors' overestimation of positive economic conditions, which drive up the rate of returns until full employment is achieved, which he tagged the boom phase. Investors cannot diagnose the fall in capital's marginal efficiency in the boom phase, which grows faster than the interest rate. The inability to diagnose the fall in the marginal efficiency of capital and the interest rate at the boom phase kickstart the fall in the rate of returns and the increased investment cost. Investment opportunities start to dwindle, banks reduce credit, leading to contraction or recession. The depression phase set in as the demands for consumer and capital goods falls, income falls, and unemployment rises. The development of Keynes business cycle theory was centred on the saving-investment framework, the banking system capacity, the efficacy of the monetary policy and the fiscal and the investment policy.

The Austrian or Hayek business cycle theory can be explained using the "Hayekian right-angled triangle" as a heuristic mechanism to give analytical meaning to the business cycle theory as an expansion of Ludwig von Mises (1953, pp. 339-366) writings. This right-angled triangle was used to capture the macroeconomy as having value dimension on the adjacent side and time dimension on the opposite side, where the value dimension represents spending on consumption goods and the time dimension depicting the production process. It shows the economy with production structure (hypotenuse side) and the consumption on the vertical side (see figure 2a), revealing the impact of real interest rate on production structure. So, the lower the interest rate, the longer the production time. As consumers decrease consumption and save more, the interest rate falls. This low-interest rate increases investors' borrowings and encourages the production of long-term and time-intensive capital goods. It is expected that as the completed capital goods are integrated into the overall structure of the production process, it ultimately propels an increase in consumer goods (Gentle and Thornton, 2014). Therefore, Hayekian right-angled triangle showed the existence of a trade-off between investment and consumption. Its multiple-stage production processes are proportional to the production time. (as depicted in figure 2a).

Figure 2: Diagram depicting the framework of the Austrian or Hayek business cycle theory



Source: Author, 2021

Importantly, the low-interest rate needed to stimulate the expansion of capital goods can either be evoked by the "organically" decrease in consumption[6] or the "artificial" expansion of credit[7] through the central bank, government stimulus, or the fractional reserve banking system. The artificial interventions in the market make economic agents act irrationally, dislocating price signals and weakening relative price importance in communicating price signals to the producers. Hayek sees business cycles as an outcome of extreme growth in banks' credit due to organically or artificially low-interest rates set by the central bank, government stimulus, or the fractional reserve banking system

[6] This increases savings and the excess savings makes capital cheaper (through low-interest rates) and long-term capital projects become attractive for entrepreneurs.
[7] Hayek believe that artificial expansion of credit will distort price mechanism because entrepreneurs may find it difficult to distinguish between the temporal or "permanent" decline in real interest rate, as artificial credit expansion will only result in a temporal decline in real interest rate.

(Tempelman, 2010; Salerno, 2011; Evans, 2013; Luther & Cohen, 2014). The theory differentiates between artificial induced low-interest rates (excess credit or money supply) and real market-determined interest rates. The artificially induced low-interest rate, fuel excessive credit, economic boom and inflated asset prices. Unfortunately, the artificially induced low-interest rate is usually transitory and sends the wrong signal through price distortion and lengthen the production structure (figure 2a). The production structure generated by price dislocation is not consistent with the economic agent time preference (Dobrescu., 2012), hence unsustainable. This wrong signal encourages the initiation of more long-term production projects(relative to basic consumer goods) than can be completed, and then subsequent resource scarcities from the ultimate market correction turn the artificial boom into a bust. Boudreaux & Klaus (2014) highlighted that credit-fueled booms are unsustainable "… as the widespread failure of prices to coordinate producers' plans with that of consumers make economic activity stagnates". Hayek assumed all economic agents are rational and price mechanisms guide the production and consumption decisions as sources of information and the coordination of the market economy; as such, the disturbance of price equilibrium destabilise production structure (Hawtrey, 1933). That is, when prices cease to reflect realities, misinformation ensues, and resources are misallocated, distorting production. Resources are channelled from the scarce goods into further production of surplus goods[8]. Investors misinterpret a temporary low-interest rate as a long-term economic boom, distorting the market's pricing mechanism and obstructing efficient resources allocation.

When agents establish that the economic boom is transitory, crises or recession will likely occur as monetary error, and inefficient resource allocations are corrected. Hayek sees the correction as necessary and will likely be severe in output and job loss while destabilizing the macroeconomy, depending on the damage the price failure has wrecked. The adjustment will involve the termination of contracts made when prices are inaccurate, involving production plans and large numbers of workers. Hayek works on trade cycles-economic booms and busts complement Keynes's business cycle in the

[8] This coincides with Seismundian analysis of overproduction and underconsumption. For example, Sismondi attached the reason for bank panics and massive withdrawals to highly credit-laden of the bank. More so, he reasoned those banks excessive credit is fuelling the manufacturing sector overproduction which eventually led to crises. But the question that arises is why do manufacturers engage in overproduction? Sismondi blamed competition, Hayek blamed wrong price signals and misinformation.

"General Theory *of Employment, Interest, and Money"*. While Keynes focused on the aggregate demands in stabilizing the business cycle, Hayek focused on ensuring harmony and price coordination amongst the components of the aggregate demand using relative price signals; however, both disagreed on laissez-faire. In sum, the new classical explored the business cycle within the context of market clearing, while the New Keynesians attribute business fluctuations to various market failures, and the Austrian school of thought analyzed the cycle in terms of intertemporal disequilibrium. (Dobrescu et al., 2012)

Following its scientific conceptualization and operationalization through the works of Mitchell (1927), Burns and Mitchell (1946) as well as Harding and Pagan (2003), researchers have continued to glean information from the business cycle to explain macroeconomic events. The duration, amplitude, slope, output gap, synchronizations and co-movement of cycles, including observing the lead and lags of these amongst others, are common metrics. Igan et al. (2011), for instance, utilized co-movements among the business cycle, house prices, residential, investment, credit, interest rates, and real activity within advanced economies from 1981:Q1 to 2006:Q4. They found house price cycles leading credit and real activity over the long term, while Interest rates lag other cycles across all horizons. As a cross-section, the business cycle, housing cycle and interest rate cycle in the United States lead their respective counterparts in other economies over all time horizons, with the US credit cycle leading in the long-term. Another indicative measure developed by Harding & Pagan (2003) is the concordance statistics or Index (CI) and applied in Claessens et al. (2012) and Jordà et al. (2017). This assign estimates to the synchronization of the cycles of economies or series, i.e., the fraction of time cycles moved in the same phase. As described by Jordà et al. (2011), the index equals 1 when cycles from both variables are in expansion or recession at a given time, and the index is 0 if only one variable is in expansion and the other is in recession, or vice versa. Similar to the concordance index developed by Harding & Pagan (2003) is the conformity measure design by Burns and Mitchell (1946). A series conform to the reference series if such expands and contracts largely in similitude to the reference series (McDermott & Scott, 2002). Using the expansion and contraction information of the business cycle, Jorda, Schularick & Taylor(2011) separated financial-crises recessions from the normal recession of the 200 recession episodes on the business cycle phases of

14 advanced countries between 1870 and 2008. In the same vein, they separated normal expansion from credit-intensive expansions along the business cycle. These allowed the comparisons of the features and the impact of the financial crises period on the business cycle and see the effect of credit expansion on the cycle compared to normal times. The finding supports the view of Hayek's business cycle theory and supports the assertion that financial factors play a defining role in the modern business cycle. The lead and lagging relationship were utilized by Chen et al. (2012) in conjunction with a phase shift mechanism from Runstler (2004) Koopman and Azevedo (2008) to study the relationship between the cyclical components of the different economic and financial variables. Calderón & Fuentes (2010) utilized the duration, amplitude and cumulative variation features of the business cycle to characterize and compare the business cycles of 23 emerging market economies (EMEs) and 12 developed countries in 1980: Q1–2006: Q2.

2.2 THEORIES OF BANKING CRISES

As an abstraction from reality, diverse theories have attempted to explain the process of banking crises, from the early warning signals to the root causes, the economic impacts, the fiscal, monetary, direct, and indirect costs. More so, taking a clue from networks or circuits of neurons, some authors have applied artificial neural networks (made up of artificial neurons or nodes) to describe the connectivity of the banking system and the feedback mechanism describing the exchange of signals between the banks, majorly through the overnight market (Ristolainen, 2017; Celik & Karatepe, 2007; Tölö, 2020; Papadimitriou et al., 2013). The last few focused on the relationship between banking crises and the economy, of which this paper is part. However, few other papers have attempted to explain banking crises with financial crises theories or misunderstood the two as the same phenomena. Moreover, aside from the limited literature on banking crises, only a few focused on the interaction between the banking sector and macroeconomic variables with limited concentrations on the structure that generate the dynamics. Historically, theories explaining banking crises have focused on panic, self-fulfilling prophecies, financial frictions, mismatch risks, contagion, balance sheet mechanism, debts and currencies crises, macroeconomic downturns and shocks, informational asymmetries through financial intermediation et cetera. (Diamond, 1984; Allen & Santomero, 1998; Scholtens & Wensveen, 2003, Gertler et al., 2017). Generally, these theories explaining banking crises can be grouped into six categories: self-fulfilling

expectation, moral hazard, fall in asset price, asset-liability mismatch risks, local/international contagion, and macroeconomic structure/shocks.

Self-Fulfilling Expectation: Contributing to the concept of sunspot equilibrium[9], Azariadis (1981) expanded the theory of Self-fulfilling prophecies, a set of beliefs consistent with rational expectations equilibrium. Diamond and Dybvig (1983) applied this to the mechanism of bank runs, while Farmer & Woodford (1997) explore the connection between Self-fulfilling prophecies and the business cycle in a theoretical setting. Using Bayesian methods, Dai (2018) found people's animal spirits as prime drivers of U.S. business cycle fluctuations from 1955 to 2014, with less effect from financial frictions and technology shocks. He attributed a substantial part of aggregate output's contraction during the Great Recession to adverse shocks to expectations. According to Diamond and Dybvig (1983), depositors' impatience remain the core mechanism behind banking crises was. Based on the theory of financial intermediation, deposit contracts, information asymmetry, and maturity transformation, they linked business assets' illiquidity to the impatient depositors' liquidity demands. The contest between the short maturity deposit accounts and the long maturity loans impeding the process of liquidity transformation (made possible through fractional reserve banking) becomes the bedrock upon which banking crises are built. The self-fulfilling expectation is that depositors' incentive to withdraw funds depends on their expectation of other depositors. This incentive thwarted the stability assumption[10] upon which the financial intermediation was founded. In addition to this, banks' first-come, a first-serve queueing process reinforced the self-fulfilling prophecy, as depositors disregard the incentive[11] promised by the illiquid long-maturity loans for immediate withdrawal. This model revealed that no bank is safe from crises. As a result, Diamond and Dybvig (1983) suggested that a deposit insurance programme guarantees depositors and dispels self-fulfilling expectations. While the policy recommendation might prevent banking crises from originating from impatient depositors, the Diamond & Dybvig (1983) model has

[9] Developed by Cass, D., & Shell, K. (1983)
[10] Depositors' needs, which is a function of their circumstances are largely uncorrelated, therefore, the law of large number guaranteed stable deposits withdrawal on a single business day.
[11] This is explained by the expected value theory, where depositors would rather choose the option with the highest expected value. In this case, withdrawal of deposits is more certain than returns from illiquid long-maturity loans based on probability.

several other channels uncaptured. More so, impatient withdrawals by depositors can accompany other sources of bank runs, especially during falls in asset prices.

Moral hazard connotes a situation where the decision-maker and the cost bearers differ, propelling the decision-maker to explore riskier actions to the detriment of the cost bearers. With its foundation in corporate governance, the concept has always featured as a foundational stressor upon which some financial and banking crises are based (Claassen, R., 2015; Busato and Massimo Coletta, 2017; Chang, 2000; Dewatripont and Tirole, 1994). It became a foundational stressor due to the separation between ownership and control, which results from asymmetric information[12] within corporations (Busato and Massimo Coletta, 2017). The banks, as intermediation entities, are peculiar in such a way that there is a difference between the owners of funds (Depositors), owners of Assets (Shareholders), and the controller (Managers).

Moral hazard: According to Krugman (2009), a moral hazard is "any situation in which one person decides the amount of risk to take, while someone else bears the cost, should things go badly". The application of this at the micro-level is that banks' managers tend to engage in risky loans and investment activities (to reap above-market rates), especially when they are classified as "too big to fail". This theory reveals the seemly weakness of Diamond and Dybvig (1983) model with its policy recommendation of deposit insurance which discourages depositors from investing in monitoring. Deposit insurance empowers managers' risk-taking appetite with the assurance that the government will bail them out if things go wrong. Moral hazard is an enabler of free-rider problems; bank managers freeride the depositors, the shareholders, and the taxpayers in times of crisis. While the effect of moral hazard on the banking system's health may not be easily discernible, it is built up in the gamut of diverse derivatives devised to avert regulations and the scrutiny of the shareholders to generate abnormal returns. By extension, this weakens the banking system's networks through interbank market exposure. The consequences of moral hazard are seen in the collapse of Bear Stearn and the bankruptcy of Lehman Brothers (with about $800 billion worth of debts) in 2008, which started the spiral of cascades (Chakrabarty & Zhang, 2012) and eventually led to bail out[13] of the market through

[12] Akerlof, G. (1970). The Market for "Lemons": Quality Uncertainty and the Market Mechanism. *The Quarterly Journal of Economics, 84*(3), 488-500.

[13] Bear Stearn was acquired by JPMorgan through a structured loan from the Federal Reserves, while Lehman Brothers was allowed to enter into administration.

government intervention. The Asia banking crisis of 1997 was traced to many underlying factors, including moral hazards (Corsetti, Pesenti, & Roubini, 2002; Noy, 2005). Similarly, Demirgüç-Kunt & Detragiache (1998) and Busato & Massimo Coletta, (2017), among others associated moral hazard to banking crises in developed and developing countries

Fall in Asset Price: As one of the ignitors of banking crises (Schnabel and Shin, 2004; Hilbers et al., 2001), studies have confirmed the existence of feedbacks mechanism between asset prices and the business cycle (Dees, 2016; Nezafat & Slavik, 2011; Chen, Kontonikas & Montagnoli (2012); Winkler, 2020). Sustaining the value of the assets throughout the process of liquidity transformation can be a herculean task, destabilizing the process of financial intermediation. Banks convert liquid short-term aggregated deposits/debts to fuel illiquid long-term investment, with the expectation that the value/worth of the investment will surpass the aggregated deposit outlay. The spread enables banks to make returns for administrative expenses and profits for shareholders. Nevertheless, external factors can largely influence the price of these assets, which is another aspect of the banks' crisis transmission mechanism not captured by Diamond and Dybvig (1983). Self-fulfilling prophesy points to the onset of panics that makes many patient depositors suddenly impatient and increase the depositors' expenditure correlation, causing banks to engage in fire sales. The underlying mechanism is that fire sales increase the supply of the assets, saturating the market, and from the standard law of demand and supply, excess supply has strong tendencies to bring prices down. However, another viewpoint is that other external factors can ignite the falling asset price before self-fulfilling prophesy panics take over the process. Falling assets prices leading to fire sales are also common when maturity, liquidity, and exchange rate mismatch are witnessed. Asset prices have been found to affect the macroeconomy (Bansal, Kiku & Yaron, 2010), as well as one of the factors responsible for financial crises (Allen & Carletti, 2009; Allen & Gale, 2000) and banking crises (Marshall, 1998; Hossain & Rafiq 2011; Von Peter, 2009). While price falls are rampant during macroeconomic shocks, they can also result from structural arrangements. According to Hilbers et al. (2001), for instance, the conventional use of the real estate properties as collateral for loans by banks, illiquidity and imperfect information in the real estate market majorly fuel the fall in prices, while

the transfer of real estate cycle and bubble to the value of bank asset portfolio causes bank crises.

Asset-Liability Mismatch Risk: This was explored by Mishkin (1996), Demirgüç-Kunt & Detragiache (1998). The divergence of assets from liability in terms of maturity, the denominated currency, and the extent of liquidity can cause trouble for banks. This mismatch is partly why liquidity management and risk management are at the heart of the banking system. An illiquid asset cannot fund the bank balance sheet's liability side (during urgent needs for withdrawals), causing fire sales. As such, during the sudden scarcity of FOREX, banks' assets denominated in foreign currencies will not be readily available to fund the liability side of the balance sheet. In addition, banks' assets with long-term maturity will not be available liabilities with short-term maturity. Due to these potential divergences, the assumption of uncorrelated expenditure of depositors is crucial to the banking system's stability. Here, if we assume lower withdrawals during the mismatches, the divergence may not significantly impact the value of the banks' assets. However, an exchange rate mismatch can present a permanent impact, especially when such assets are locked up in an illiquid long-term maturity contract.

Local and foreign contagion: Local contagion occurs among banks within the same macro environment, while international contagions spread across borders. It is common for contagion among local banks to induce banking crises, especially when the banks tend to possess similar assets classes. Trade dependency, liberalization, cross-border financing, global banking create connectivity and the interweaving of credit relationships that breeds contagions effect (Schnabel and Shin, 2004; Hamilton, 1956). This contagion effect ignited banking crises in Asia in the 90s (Noy, 2005) and Latin America from the 1980s (Jacome, 2008). Caballero (2016) also finds evidence of banking crises emanating from international capital inflows, driven by portfolio-equity and debt flows. Further evidence from Ueda (2012) confirms that such adverse shocks from one country to others generate business cycle synchronization on the real and financial sides. Banking crises emanating from international contagion are usually difficult to tackle (Dungey & Gajurel, 2015). The ability to shield an economy from the inflow of vulnerability from other economies stems from the degree of dependency among the concerned economies, macro-structural arrangement, and counter-macroprudential policy in place.

Macroeconomic structure and shocks: Aside from having the capacity to cause systemic banking crises, an economy's underlying structure also influences the amplitude of its business cycle (Kaminsky & Reinhart 1999; Solomon & Golo, 2014). Economies with a mono-sectoral or mono-product structure tend to be vulnerable to external shocks when demands for such products become volatile at the international market, disrupting their business cycle. This is common in low-income economies, although Rebeca Jiménez-Rodríguez (2011) found evidence linking macroeconomic structure, oil price shocks, and six OECD countries' business cycles. Since financial intermediaries play a role in the transmission mechanism of monetary policy (Mishkin, 1996; Gorton & Winton, 2002) and the savings-investment process, banks activities and operations tend to mirror or tilt into the direction of the established macroeconomic structure of the economy it operates in. As banks tend to adapt to innovations faster than their regulators, this results in backward feedback to an accommodating regulatory style, banks branching structure and operations, financial liberalization leading to various levels of risks from within or outside shocks (White,1984; O'Sullivan & Kennedy, 2010; Carlson & Mitchener, 2005; Harimaya & Kondo, 2016). Exploring these theories revealed that the sources of banking crises could be within the banking industry, the broader financial sector, the real economy, or spillover from the foreign economy. This paper focuses only on the intersection of the banking industry and the real economy and their interactions within the business cycle context. The banking industry is examined using bank stability, depth, and system efficiency parameters, while the real economy is broken down into the GDP expenditure components and the sectorial output components.

2.3 THE INTERSECTION BETWEEN BANKING CRISES AND BUSINESS CYCLE

Theoretical literature that focuses on the intersection between banking crises and business cycles observed mainly the transmissibility of vulnerability between banks and firms. Due to this, credit and loans are usually focused on as the essential connecting variables (Jorda, Schularick, Taylor, 2011; Lown & Morgan, 2006; Igan, Kabundi, Nadal De Simone, Pinheiro & Tamirisa, 2011; Busch, 2012). The occurring transmissibility is usually traced into the real sector by observing the chain of reactions on core macroeconomic variables, especially loans, investment, consumption, interest rates, and employment (Gertler et al. 2017). Furthermore, the link between banks and firms is

further explored through the banks' balance sheets connectivity, stock prices and credit squeeze using the mechanism of financial friction.

Incorporating banks and banking panics within the standard new Keynesian model with capital accumulation, Gertler et al. (2017) asserts the nonexistence of crises when banks have sufficiently strong balance sheets (in a steady-state). As such, "normal size" business cycle shocks do not lead to financial crises. Leaving out the role of macroprudential policies, he affirmed that banks tend to have weak balance sheets during the recession, thereby exposing them and, by extension, the real economy to crises. In a nutshell, weak banks' balance sheets are seen as amplifying banking crises orchestrated by shocks made plausible by recessions. In the same spirit, Gertler, Kiyotaki & Prestipino (2020) developed a model of banking panics to explore the role of the credit boom in generating banking crises and the efficacy of macroprudential in preventing crises against the costs of stopping a good boom. While most banking crises precede credit boom, they found an increased tendency for credit boom and a series of bad fundamental shocks to raise bank leverage ratios and increase the system vulnerable to runs.

Using a canonical framework, Gertler & Kiyotaki (2010) examine how disruptions in financial intermediation can induce a crisis that affects real activity and how central banks might work to mitigate the crises. With the general belief that a decline in real estate values precipitated a wave of losses on mortgage-backed securities held by financial intermediaries, Gertler & Kiyotaki (2010) initialized an exogenous decline in capital quality as a disturbance. In the first scenario, leveraged banks saw a decline in assets values on net worth to the proportion of their leverage ratio. This fall in net worth contracted banks borrowings induced fire sale of assets that further depresses asset values and feed into the real economy as a fall in investment. A simulation of the 2008-2009 financial crises (5% unexpected decline in capital quality with an autoregressive factor of 0.66) generated different outcomes for financial friction and a frictionless environment. In addition to a 50% decline in bank net worth, financial friction magnified the decline in output, consumption, and employment[14] as twice the decline experienced

[14] Given the absence of standard labor market frictions that would have enhanced the response.

in a frictionless environment. Investment expenditure was the most severely affected[15], declining twice the output size in the same frictional environment. The magnifying factors were identified as bank leverage, tightening of bank borrowing constraints, the fire sale of assets and fall in the market price capital.

Similarly, the few empirical studies available adopted the method of panel regression, panel logistics, co-movements between theoretical extracted macro-wide variables, and banks data as representative of the intersection between the banking sector and the business cycle (see Glen & Mondragón-Vélez, 2011). The application of bank-level data, the evolution of credit and equity prices, property prices and the synchronization of the financial and business cycle are among the numerous techniques used in the business cycle cum banking crises literature. Jordà et al. (2017) applied the contrast of the GDP and credit cycles, the concordance index, and correlations, where they found leverage (banks' credit to the private sector, % of GDP) correlated with central business cycle moments. Canakci (2008) tested if banking crises can improve the efficiency of the banking sector using the business cycle theory postulations that crisis is the turning point where an economy recovers. The techniques used involve data envelopment analysis(DEA), financial ratio analysis covering profitability, costs and risks, and linear programming methods. The study divided 15 years of bank-level data into pre-crisis and post crises; the study shows that post crises periods have resulted in highly profitable, efficient and cost improvement for the Turkish banking sector. These might be the outcomes of macroprudential authority to the crises. In describing banks relationships, Hale (2012) used loan-level data and constructed a model to describe bank relationships, business cycles, and financial crises in a global banking network. It was discovered that recessions and banking crises negatively affected the formation of new connections and observed the effects to differ across countries and banks.

Boissay, Collard & Smets (2013) modeled banks with heterogeneous intermediation skills, giving rise to the interbank market. The study postulated that systemic banking crises are outcomes of credit intensive booms that result in deep and long-lasting recessions and large exogenous adverse shocks. Mostly, banking crises are generally

[15] Partly due to the significant increase in the spread (over 5%) between the cost of capital and the riskless rates available in the frictional environment, compared to 1% in the frictionless environment.

studied with recession and peak phase using a one-way causal impact of banking crises. Due to this, researchers have been unable to adequately show whether banking crises lead to other phases of the business cycle and explore the impact of these phases on the chances of banking crises. More so, Schüler, Hiebert & Peltonen (2015) introduced a methodology to characterize financial cycles in addition multivariate spectral approach to identifying common cycle frequencies across a set of indicators in 13 European Union countries during 1970-2013. The results suggest that credit and asset prices share cyclical similarities, and the financial cycle outperformed the credit-to-GDP gap in predicting systemic banking crises.

Regarding banking crises and the different phases of the business cycle, Berman & Pfleeger (1997) have confirmed that the sectors of the economy tend to react differently to the business cycle. Furthermore, Jordà et al. (2017) has found evidence for differing interaction between the GDP cycle and the credit cycle on the expansion and recession phases of the business cycle. Therefore, it is essential to have a wider understanding of the transmission mechanism between the different phases of the business cycle, banking system, and the chances of banking crises. How do these transmission mechanisms work across the different phases of the business cycle? Which business cycle phase creates banking crises, and where are the highest chances? Is it on the peak phase, the recession phase, or the trough phase, et cetera.? Several views have postulated the generation of banking crises from mostly the trough and boom phases because of their features, but they cannot explain banking crises occurring within other business cycle phases. For instance, Gertler, Kiyotaki & Prestipino (2020) and Boissay, Collard & Smets (2013) concluded that banking crises are outcomes of credit intensive booms.

Some of the common techniques in related empirical literature were the use of co-movements, correlations, and synchronizations, which uncover whether variables swing together and enable the identification of the lead and lag variable (see Igan et al., 2011; Chen et al., 2012; Claessens et al., 2012; Filzzdo, 1994). The main challenges in observing the relationship between business cycle (an indicator with alternating behavioral pattern) and banking crises (a discontinuous phenomenon) tend to be the difficulties in observing the co-movement between the duos. To circumvent this, researchers usually/ approximate banking crisis with credit cycle episodes and observe its co-movement with the business cycle or asset prices (see Jorda, Schularick & Taylor, 2011; Bartoletto et al.,

2019). Since these are individually and jointly continuous time series variables, unfortunately, the credit cycle does not necessarily capture the episodes of banking crises in an economy. Moreover, even if the credit cycle is sufficient in capturing episodes of banking crises, the different impacts of the business cycle phases cannot be discovered.

2.4 RESEARCH QUESTIONS AND HYPOTHESIS DEVELOPMENT

The paper was split into segments and research questions assigned per each objective in addressing study objectives. More so, the hypotheses specified were tested under each segment. The research questions are as follows;

Firstly, what explains the relationships between banking crises and the cyclical behaviour of the business cycle and the implication for macroeconomic indicators? To achieve these, we; (a) trace and categorize different causes of banking crises to the behavioural pattern of the business cycle. (b) differentiate between the behavioural pattern of the business cycle during and outside of banking crises. (c) differentiate the effect of financial factors, the sectoral and aggregate expenditure components of output on the business cycle during banking crises and non-crises. (d) determine how banking crises distort the business cycle's reoccurring nature (length and intensity).

Secondly, what are the chances of banking crises being induced by the cyclical behaviour of the business cycle? This question was explored by (a) estimating and comparing the probabilities of banking crises across the different phases of the business cycle. (b) in addition, identify and explore the phase with the highest incidence of banking crises, and isolate the factors responsible.

Thirdly, Are there reactivities between banking crises and individual business cycle phases? What explains the reactivity and the roles of banking crises on each phase, including their implications for the macroeconomy? This objective was approached by (a) estimating and comparing banking crisis impacts on the business cycle across the phases. (b) estimating the duration of troughs and peaks before, during, and following banking crises and (c) ascertaining the conditions under which banking crises terminate the boom phase of the business cycle while exploring selected macroeconomic variables' conditions.

Finally, are there interactions among the output gap, the industrial production gap, and the credit-to-GDP gap? Do they interrelate with the tendency of banking crises, as indicated by Svirydzenka (2021)? To address these, we (a) observe the synchronization

of the business cycle with the credit cycle and the industrial cycle during banking crises and non-crises. (b) examine the extent of deviations from the long-term economic growth trend caused by banking crises and (c) measure the peak or trough amplitude impact of the business cycle on banking crises.

Hypotheses I: Relationships between the business cycle and systemic banking crises

	Null Hypotheses (Ho)	**Alternative Hypotheses (H1)**	**Decision**
A	Ho1: There is no significant relationship between systemic banking crises and the business cycle among Europe and Central Asia countries with incidence(s) of banking crises from 2007 and 2018.	Ha1: There is a significant relationship between systemic banking crises and the business cycle among Europe and Central Asia countries with incidence(s) of banking crises from 2007 and 2018.	Ho1 Rejected
B	Ho2: There is no significant relationship between systemic banking crises and banks' credit to the private sector among Europe and Central Asia countries with incidence(s) of banking crises from 2007 and 2018.	Ha2: There is a significant relationship between systemic banking crises and banks' credit to the private sector among Europe and Central Asia countries with incidence(s) of banking crises from 2007 and 2018.	Ho2 Rejected

Hypothesis II: Business cycle phases and the chances of systemic banking crises

	Null Hypotheses (Ho)	**Alternative Hypotheses (Ha1)**	**Decision**
A	Ho1: Naturally, there exists an insignificant natural chance of banking crises on the recovery phases of the business cycle	Ha1: Naturally, there exists a significant chance of banking crises on the recovery phases of the business cycle	Ho1 Rejected
B	Ho2: Naturally, there exists an insignificant natural chance of banking crises on the expansion phases of the business cycle	Ha2: Naturally, there exists a significant chance of banking crises on the expansion phases of the business cycle	Ho2 Rejected Weakly
C	Ho3: Naturally, there exists an insignificant chance of banking crises on the peak phases of the business cycle	Ha3: Naturally, there exists a significant chance of banking crises on the peak phases of the business cycle	Ho3 Accepted
D	Ho4: Naturally, there exists an insignificant chance of banking crises on the recession phases of the business cycle	Ha4: Naturally, there exists a significant chance of banking crises on the recession phases of the business cycle	Ho4 Accepted
E	Ho5: Naturally, there exists an insignificant chance of banking crises on the depression phases of the business cycle	Ha5: Naturally, there exists a significant chance of banking crises on the depression phases of the business cycle	Ho5 Rejected
F	Ho6: Naturally, there exists an insignificant chance of banking crises on the trough phases of the business cycle	Ha6: Naturally, there exists a significant chance of banking crises on the troughs phase of the business cycle	Ho6 Rejected

Author, 2021

2.5 CONTRIBUTION TO THE LITERATURE

This study paper contributed to the literature in four ways; firstly, it added to the works observing the interactions between business cycles and banking crises. These papers studied the evolution of macroeconomic, financial and aggregate bank-level variables and how they have been impacted by banking crises, using single or multi-countries panel data. Techniques utilized include vector autoregressive models, time series regression, fixed or random effect panel regressions, co-movement of cycles, spectral analysis, and descriptive analysis to diagnose the cause of banking crises and document the impacts of banking crises have on macroeconomic indicators. Studies in this category are Claessens et al. (2012), Schüler et al., (2015), Bartoletto et al., (2019); Canakci, (2008); Hale, (2012); Boissay, Collard & Smets, (2013) reviewed in our literature.

Secondly, using the panel logistic regression to estimate the probability of banking crises as suggested in the literature (Berg & Pattillo, 1999a; Davis & Karim, 2008), this paper contributed to the early warning indicators of banking crises literature in the class of Hiebert & Peltonen (2015) Chen & Svirydzenka (2021), (Greenwood, Hanson, Shleifer & Sørensen, 2020), Filippopoulou et al. (2020) etc. This group estimates banking crises' probability using macro-financial data using probabilistic models such as probit, logit, bayesian or monte Carlo methods. Diverse authors also invest further in nowcasting techniques for real-time forecasting of vulnerability and risks measures.

Thirdly is the strand of works on the economic cost of banking crises (on aggregate output, in terms of rescue operations or restructuring, and welfare cost) and literature documenting relationships between banking crises and real output gaps. Examples of Authors that have written on the cost impact of banking crises are Montagnoli & Moro (2018), Kenny et al. (2017), Reinhart & Rogoff (2009), Boyd, Kwak, & Smith (2006), (Frydl, 1999), Demirgüç-Kunt & Detragiache, (1998), Tiffin (2019), Gros & Alcidi (2010) amongst others. In addition, this study evaluates the impacts of banking crises on the output gap, industrial production gaps, sectorial and aggregate expenditure.

Lastly, few studies observed how the business cycle phases influence the causal relationship between banking crises and macro-financial variables. After applying dating techniques, this study extracted the business cycle phases and studied the key features by characterising the business cycle. The closest to this is the work of Jordà et al. (2017), characterizing the business cycle into expansions and recessions by tagging the declining GDP as recession and the rising GDP as expansion. This allows the comparison of the GDP

cycle and the credit cycle within and across the two eras using the concordance index. Nevertheless, the business cycle phases go beyond expansions and recessions (or just upturns and downturns), and this limitation (see Bartoletto et al., 2019) reflects the inability to adequately date and classify the business cycle into four or six phases. This limitation usually forces most studies to conclude that the features are the same across the business cycle upturns or downturns. This study conquered this limitation by dating and categorizing the phases accordingly and found, as expected, that the causes, features, and impact of banking crises differs across the six phases of the business cycle.

3.0 DESIGN/METHODOLOGICAL APPROACH

Several theoretical, empirical, and econometric methodological approaches techniques were combined to achieve the stated objective of this study. This paper aims to diagnose the relationship between banking crises and the behaviour of the business cycle, exploring the implication for the macroeconomy and the banking system.

3.1 FRAMEWORKS

This section unites and applies several metrics and features in the business cycle literature to understand and differentiate the behaviour of the cyclical economic activities within the context of banking crises in a panel of 43 countries.

3.1.1 PHASES AND FEATURES OF THE BUSINESS CYCLE

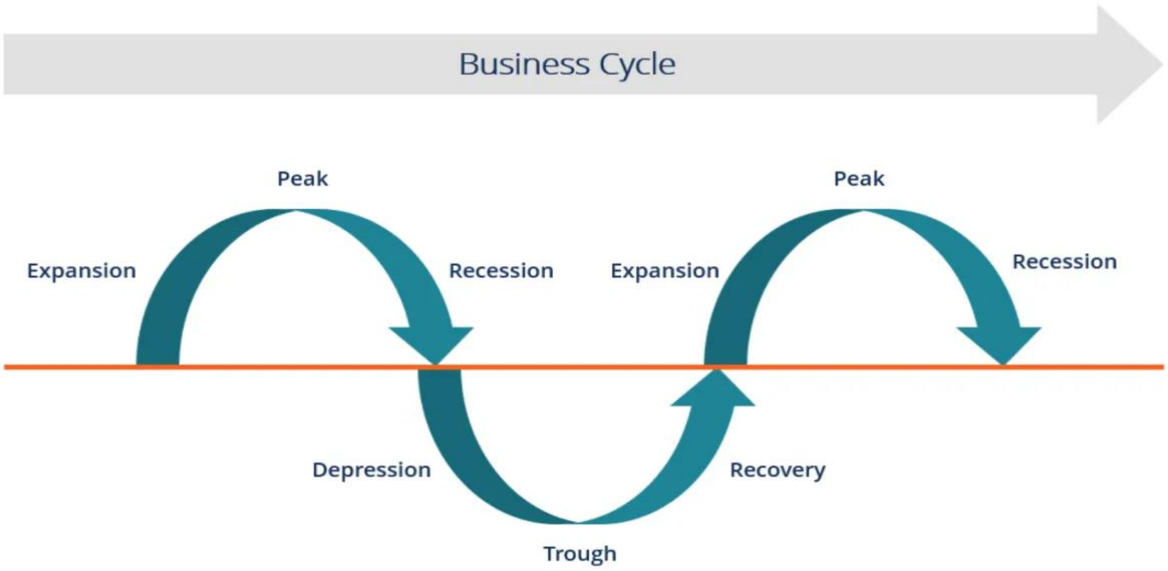
A complete business cycle comprises six phases, as depicted in figure 3.1. First, the distance between the trough and peak peaks is split into the recovery phase (the negative part after the trough) and the expansion phase (the positive part before the peak). Second, the peak phase possesses the local maximum/ highest growth rate in a single cycle. Thirdly, the distance between the peak and the trough phases; is split into the recession phase (the positive part after the peak) and the depression phase (the negative part before the trough). Finally, the trough phase has the local minimum/lowest growth rate in a single cycle. The upturn is the journey from trough to the next peak, while downturn is the journey from the peak to the next trough. Hence, the duration of a complete business cycle is the periodicity (in months, quarters or years) taken to complete a trough-to-trough cycle or to complete a peak-to-peak cycle. Although authors differ in the classification of these phases, resulting in the definition of the business cycle with either six, four or two phases. Some see the recovery phase as the earliest part of the expansion phase[16] and the depression phase as the later part of the recession phase (see Claessens, Kose & Terrones, 2012), which led to the four phases classification. In the same vein, the two phases classification combines the recovery, expansion, and the peak as a single phase (called the Expansion phase or Upturns for short), while the recession, depression, and trough are classified into another single-phase (called the Contraction phase or Downturns for short). The use of the two-phase classification is common (see

[16] The recovery is the early part of the expansion phase and is usually defined as the time it takes for output to rebound from the trough to the peak level before the recession (Claessens, Kose & Terrones, 2012).

Bartoletto et al., 2019; Jordà et al., (2017), fueled by the limitation of dating the business cycle and extracting the phases accurately.

In addition, the choice of classification among the two, four or six phases can also be influenced by the duration, periodicity of the business cycle and objectives of the studies; monthly series provides room for a more comprehensive classification than quarterly or annual series. Most importantly, the limitation that restricts most authors to two-phase classification is inherent in the available business cycle dating techniques, configured only to classify the cycle into peak and trough. The augmentation of these dating techniques with the nominal categorization of the fluctuations of the cyclical component of the GDP enables a deeper understanding of the effect of banking crises on the business cycle.

Figure 3.1: Business cycle Phases



Source: CFI, 2015

The features of a complete cycle are duration, amplitude, and slope. Duration can be split into two, the duration of a downturn or an upturn. The duration of a downturn (D^-) is the period it requires to move from a peak to the next trough. Likewise, the duration of an upturn (D^+) is the number of periods (monthly, quarterly or yearly) it takes to move from a trough to the next peak. The definition of "periods" as used by several researchers is a function of the periodicity of the recruited GDP series used in estimating the cycle. Calderón & Fuentes (2010) and Claessens, Kose & Terrones (2012) utilized quarterly series and therefore measured duration by the number of quarters, but since the series used in this study are annual, durations are measured in the number of years. Amplitude

measures the change in a variable either as an upturn or downturn. Modifying the definition of Claessens, Kose & Terrones (2012) to fit annual series, the amplitude of a downturn measures the change of the business cycle ($\Delta bizcyc_{i,t}$) from a peak to the next trough. Conversely, the amplitude of an upturn measures the change in the business cycle ($\Delta bizcyc_{i,t}$) from a trough to the next peak. Operationally, the amplitude of a downturn ($\Delta bizcyc_{i,t}{}^{-}$), measures the change of the business cycle ($bizcyc_{i,t}$) from a peak to the next trough, i.e.,

$$\Delta bizcyc_{i,t}{}^{-} = \text{bizcyc}_{\text{i,t}}{}^{\text{peak}} - \text{bizcyc}_{\text{i,t}}{}^{\text{trough}}$$

While the amplitude of an upturn ($\Delta bizcyc_{i,t}{}^{+}$), measures the change of the business cycle ($bizcyc_{i,t}$) from a trough to the next peak, i.e.,

$$\Delta bizcyc_{i,t}{}^{+} = \text{bizcyc}_{\text{i,t}}{}^{\text{trough}} - \text{bizcyc}_{\text{i,t}}{}^{\text{peak}}$$

Operationally, the definition of the peak and the trough along the business cycle is identified by the cycle dating techniques used in section 3.1.1. The slope of the business cycle measures its violence or speed of recession or expansion. The slope is the ratio of amplitude to the duration of the amplitude, $\frac{(\Delta bizcyc_{i,t})}{(\text{D})}$. The slope of the cycle is either negative or positive, depending on the direction of the amplitude. The slope depicts the violence or speed of the cyclical phase. Literature shows several other measures and estimates that can be extracted from the business cycle and several parametric and nonparametric estimations that can be used.

3.1.2 MEASURING THE BUSINESS CYCLE

According to Harding and Pagan (2003), isolating turning points is the first step to detecting and describing the business cycles before identifying periods of expansions and contractions using the marked dates. The common approaches to measuring the business cycle are the growth cycle (turning point analysis) and the classical cycle. Using the growth cycle approach, identifying the business cycle involves measuring the turning points and dating the cycle. Severe other variants also exist, such as frequency-based filters, spectral density estimation, unobserved component time series models and aggregation techniques (Svirydzenka, 2021). Identifying turning points in aggregate economic series is crucial, especially for the growth cycle. The growth cycle isolates the fluctuations of the cyclical component of the GDP or the selected macroeconomic series around its long-term trend at times with the aid of the frequency-based filters, while the

classical cycle observes the changes in levels of aggregate economic activity without the separation of long-term growth trend from its cyclical component (Belke, Domnick & Gros, 2017; Stock and Watson, 1999; Backus and Kehoe, 1992; Lucas, 1977). The classical approach to dating the business cycle was motivated by the publication of Mitchell (1927) and Burns & Mitchell (1946), which was based on the definition of recession and boom. The rule states "at least two consecutive negative- quarterly growth rates to determine the commencement of a recession": the peak being the period immediately before the first of the negative growth quarters. In consonance with the recommendation of Harding and Pagan (2003), Claessens, Kose & Terrones (2012) and Svirydzenka (2021), this study adopted the growth cycle because it enables an unbiased analysis of the cyclical properties of the targeted variables. Hence the cyclical component of each economies' GDP series is isolated from the long-term trend using the Hodrick–Prescott (HP) filter before applying the Harding and Pagan (2003) techniques. In the business cycle's literature, the HP filter, compared to other filtering techniques,[17] remained a standard smoothing technique used to extract the cyclical component of a time series from the trend movement, following the works of Hodrick, R., & Prescott, E. (1997). Given the logarithm of a time series lny_t which is made up of $\tau_t, c_t \; and \; \varepsilon_t$, trend, cyclical, and error components, respectively. With a selected positive value of the smoothing parameter λ, a trend component exists by solving equation Eqn 3.3.1

$$\min_{\tau}(\sum_{t=1}^{T}(y_t - \tau_t)^2 + \lambda \sum_{t=2}^{T-1}[(\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1})]^2) \qquad \text{Eqn 3.3.1}$$

The residual $y_t - \tau_t$The deviation from the trend is referred to as the business cycle component. The choice of the smoothing parameter λ, depends on the periodicity of the time series. According to Ravn & Harald (2002), smoothing values are typically set to λ = 1600 when series are quarterly, while parameters for annual series are derived when λ = 6.25. The technique is not without criticism (Guay & St.-Amant, 2005), but studies the application of the HP filter are Shimer, R. (2005), Covas, F., & Haan, W. (2011), Bank of England (2021) and host of others. After the extraction of the cyclical components of the series using the Hodrick–Prescott (HP) filter, the cycle dating algorithm is then applied on the cyclical component to identify and assign the periods of peaks, as well as the periods of the trough to the cyclical component (business cycle) of each economy.

[17] Butterworth Filters, Christiano-Fitzgerald (CF) filter, Band-pass filter, Kalman filter

3.1.3 IDENTIFYING TURNING POINTS AND DATING THE CYCLE

There has been extensive research on various measures of the turning points of the business cycle. These allow for identifying the local maxima and minima using certain censoring rules and cycle length constraints (Bruno Giancarlo & Edoardo Otranto, 2004). Researchers have relied on analogue rules before dating cycles using the Bry and Boshan (1971) algorithms, many of which are subjective in turning points and, by extension, peak and trough identification. Bry and Boschan (1971) developed an algorithm to identify the turning points in the log-level of monthly series to automate the NBER procedure. As a quarterly series approximation, Harding and Pagan (2003) extended the algorithm, which requires the duration of a complete cycle to be at least five quarters and each phase to be two quarters. Technically, in this algorithm, a peak in a quarterly series y_t occurs at time t if:

$$[(y_t - y_{t-2}) > 0, (y_t - y_{t-1}) > 0] \text{ and}$$
$$[(y_{t+2} - y_t) < 0, (y_{t+1} - y_t) < 0],$$

i.e., y_t must be more than each of the previous two quarters (y_{t-1}, y_{t-2}) AND more than each of the two quarters ahead (y_{t+1}, y_{t+2}) to be classified as a peak. Similarly, a cyclical trough occurs at time t if

$$[(y_t - y_{t-2}) < 0, (y_t - y_{t-1}) < 0] \text{ and}$$
$$[(y_{t+2} - y_t) > 0, (y_{t+1} - y_t) > 0],$$

i.e., y_t must be less than each of the previous two quarters (y_{t-1}, y_{t-2}) AND less than each Y of the two quarters ahead (y_{t+1}, y_{t+2}) to be classified as a trough. With the aid of the Philippe Bracke (2011) SBBQ business cycle dating algorithm in the STATA econometrics software module. Initially, a local maxima $[\![(y]\!]_{t-k}, \dots, y_{t-1} < y_t > y_{t+1}, \dots, y_{t+k})$ and minima $(y_{t+k}, \dots, y_{t-1} > y_t < y_{t+1}, \dots, y_{t+k})$ in the business cycle series (called parameter k) is identified within a time frame. More so, a minimum period is required for the duration of a phase of the cycle (peak to trough or trough to peak, called parameter p). In addition, the algorithm requires a parameter to define the minimum duration of a complete cycle, either from one peak to another peak or from one trough to another trough – this is called parameter c. With the use of the Hodrick–Prescott (HP) filter generated cyclical components (the business cycle), the Harding and Pagan (2003) suggested parameter is applied experimentally to the annual series using k = 2, p = 2, and c = 5 years. Our sample's selected periods of peak and trough coincide with the OECD based Recession Indicators (OECD Composite Leading Indicators: Reference Turning

Points and Component Series) for the OECD countries. More so, the algorithm turning point dating coincides with years of recessions and peaks for the non-OECD countries in our sample. Therefore, the algorithm is applied to each country's GDP cyclical component series and assembled into the panel form.

3.1.4 CLASSIFYING THE BUSINESS CYCLE INTO PHASES

Over the years, researchers were faced with the inability to isolate and compare the interplay of episodes of banking crises with the different phases of the business cycle. No paper has observed the mechanism of banking crises on the different phases of the business cycle and vice versa. As previously stated, the typical approach is to extract co-movement in credit, asset price and the business cycle. Unfortunately, no single time series variable can capture the definition of banking crises, neither can credit cycle or assets price, although they have roles to play during the crises process. The varied kinds of regression and other econometric techniques applied by past studies could not solve the problem because they appear to be more of a definition and classification problem. This constrain is rightly put by Bartoletto et al. (2018, p.49): "*As an alternative estimation strategy, we could have estimated a bi-VAR using GDP and the credit ratio as endogenous variables. However, we would incur the risk of not being able to classify crises according to our definition*…." Therefore, additional labelling is employed after applying the Hodrick–Prescott (HP) and the Bry and Boshan (1971) algorithms to solve this limitation. Past studies mostly use the Hodrick–Prescott (HP) filter generated cyclical components or cycles from other cycle extracting techniques as a time series in the business cycle analysis. The weakness is that the impact of the different phases of the business cycle on targeted indicators is not feasible. Researchers rely on the directional relationship between the business cycle and the targeted variables. A novel approach will be to segment the business cycle into phases to observe the impact and how each of the six phases, as depicted in figure 3.1, relate to banking crises, targeted macroeconomic and other financial indicators. The process is described below;

The business cycle of each economy is assigned phases with the Hodrick–Prescott (HP) filter generated cyclical components and the Bry and Boschan (1971) cycle dating algorithm. As depicted in figure 3.1, the depression, trough, and recovery phases are all in the lower and negative region, while the expansion, peak and recession phases are in the upper and positive region of the business cycle. A complete cycle (trough to trough)

is mapped out along the cycle, and the entire stretch and each point of that cycle are named according to the six phases nominally. For instance, from the trough to the peak, we are expected to come across "recovery" and then "expansion", but there are periods when an expanding economy slipped back into the recovery phase. In the same vein, with an adequate stimulus, a rebounded economy can move from the trough phase directly to the expansion phase. This labelling or classification facilitates the differentiation of the business cycle phases laden with banking crises from periods of non-crises. More so, it facilitates the understanding and comparison of the causes and the chances of banking crises across the behavioural pattern of the business cycle. More so, the behavioural pattern of the business cycle from the effects of banking crises can be studied from another angle. In addition to exploring the relationship between episodes of systemic banking crises and the aggregate business cycle, understanding the mechanism between the different phases of the business cycle, banking crises, and other macroeconomic indicators become feasible.

3.1.5 CONCORDANCE INDEX (CI)- SYNCHRONIZATION OF CYCLES.

The synchronization of the cycle is estimated using the concordance index developed by Harding & Pagan (2003) and applied in the works of Claessens et al. (2012). The index provides the measures of the fraction of time two series are in the same phase of their respective cycles. Two series are perfectly procyclical if the concordance index equals unity and countercyclical if the concordance index equals zero. The concordance index CI_{xy}, for variable x and y is given as;

$$CI_{xy} = \frac{1}{T}\sum_{t=1}^{T}\left[C_t^x \cdot C_t^y + (1 - C_t^x) \cdot \left(1 - C_t^y\right)\right]$$

Where;

$C_t^x = \{0, if\ x\ is\ in\ recession\ phase\ at\ time\ t; 1\ if\ x\ is\ in\ expansion\ phase\ at\ time\ t\}$

$C_t^y = \{0, if\ y\ is\ in\ recession\ phase\ at\ time\ t; 1\ if\ y\ is\ in\ expansion\ phase\ at\ time\ t\}$

C_t^x and C_t^x; are defined as binary variables. They change depending on the phase the underlying cycle is at time t.

As an addition to the literature and to further unravel the synchronization of Cycles among the business cycle, the industrial production cycle, and the credit cycle and how banking crises influence this, the concordance index CI_{xy}, is generated for a) the business

cycle and the credit cycle, b) the business cycle and the industrial production cycle, and c) the credit and the production cycle.

3.2 ECONOMETRIC MODELS EMPLOYED

In order to assess the impact of banking crises on the short-term fluctuations in economic activity, the business cycle was estimated using the Hodrick-Prescott (HP) filter. The HP filter was applied to the natural logarithm of the GDP constant (in local currency unit), and the cyclical component was then multiplied by 100 as suggested by the bank of England (2021), Baxter & King (1999), (Artis, Marcellino & Proietti, 2004). Banking crises are denoted by a dummy variable, adopting the dates of banking crises as documented by Laeven and Valencia (2013, 2018). The dummy equals one if banking crises exist and zero otherwise. All variables are annual from 1971 to 2018 and sourced from the world bank, the International Monetary Fund (IMF) and countries central banks websites.

3.2.1 MODEL SPECIFICATION AND A PRIORI EXPECTATIONS

3.2.1.1 PANEL VECTOR AUTO-REGRESSIVE (PVAR) MODEL

The panel vector auto-regressive (pVAR) model is employed (Holtz-Eakin, Newey, and Rosen 1988). The core model focuses on the dynamic relationship between banking crises, business cycles and banks' credit to the private sector. Then, the model is gradually extended to make room for theoretical structures and observe the influence of selected control factors on the interactions between the core variables. The control variables cut across the monetary policy instruments, the real sector, and the financial industry. In addition, the banking crisis-induced output gaps, industrial production gaps and credit-to-GDP gaps were estimated. Considering the k-variate homogenous panel vector autoregressive of order p, with panel specific fixed effect according to Love and Zicchino (2006). The general pVAR representation is given as follows.

$$\mathbf{Y}_{it} = \mathbf{Y}_{i,t-1}\,\mathbf{A}_1 + \mathbf{Y}_{i,t-2}\,\mathbf{A}_2 + \cdots + \mathbf{Y}_{it-p+1}\,\mathbf{A}_{p-1} + \mathbf{Y}_{i,t-p}\,\mathbf{A}_p + \boldsymbol{X}_{it}\boldsymbol{B} + \boldsymbol{u_i} + \varepsilon_{i,t}$$

i = 1, 2,..., N indexes panels; t = 1, 2, ... T_i indexes time.

Where $\mathbf{Y}_{it}$ is a $(1 \times k)$ vector of endogenous dependent variables for the ith cross-sectional unit at time t. $\boldsymbol{X}_{it}$ is a $(1 \times l)$ vector of exogenous covariates, u_i is $(1 \times k)$ vector of dependent variable-specific effect, and ε_{it} is a $(1 \times k)$ vector of idiosyncratic errors assumed to be a linear transformation of economically fundamental shocks (Christiano, 2012). $\mathbf{A}_1$, $\mathbf{A}_2$, $\mathbf{A}_{p-1}$, $\mathbf{A}_p$ and $\mathbf{A}_p$ (k x k) matrices and $(l \times k)$ Matrix $\boldsymbol{B}$ are

the parameters for estimation. Where ε_{it} is not correlated with the lags of $\mathbf{Y}_{it}$, and p is assigned a value large enough to prevent the autocorrelation of ε_{it} overtime. The disturbances ε_{it} are independently and identically distributed (i.i.d.) for all i and t with $E[\varepsilon_{i,t}] = 0$ and $Var[\varepsilon_{i,t}] = \Sigma_{\varepsilon}\Sigma_{\varepsilon}$; is a positive semi-definite matrix. Individual heterogeneity across countries was allowed by introducing the panel-specific fixed effect in the model. To prevent the possibility of correlation between the fixed effects and the regressors due to lags of the dependent variables, the forward orthogonal deviation or Helmert transformation as recommended by Arellano & Bover (1995) was applied. This ensures the preservation of the orthogonality between the transformed variables and the lagged regressors. More so, it allows the use of lagged regressors as instruments and estimation of the coefficients workable

$$\Delta^{*}\mathrm{y}_{it} = \sum_{l=1}^{P} \mathbf{A}_{l}\Delta^{*}\,\mathrm{y}_{i,t-l} + \boldsymbol{B}\Delta^{*}x_{i,t} + \Delta^{*}\varepsilon_{i,t}$$

Where Δ^{*} is forward orthogonal deviation or Helmert transformation, which exist for $t \in \{p+1, \ldots . T-1\}$. The PVAR was estimated, and Granger (1969) causality (G-Causality) was generated using Abrigo & Love (2016) Stata codes.

Table 3.1: Models and Abbreviations of variables Name

sn	Abbreviations	Full meaning	1A	1B	2A	2B	3A	3B	3C	4	5A	5B	5C
1	businesscycle	Business Cycle	✓	✓	✓	✓	✓	✓	✓	✓			
2	bctpspgdp	Banks' credit to the private sector, (% GDP)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
3	bcdummy	Banking Crises	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
4	Bmttrr	Broad Money to Total Reserves Ratio		✓	✓	✓							
5	Lr	Interest rate (proxied by lending rate)		✓	✓	✓	✓	✓		✓	✓	✓	✓
6	dlnhfce	the first difference of the natural logarithm of household final consumption expenditure (% change in consumption)			✓								
7	dlngcf	the first difference of the natural logarithm of the gross capital formation (% change in Investment)			✓					✓	✓	✓	✓
8	dlngfce	the first difference of the natural logarithm of government final consumption expenditure (% change in govt spending)			✓					✓	✓	✓	✓
9	dlnimport	the first difference of the natural logarithm of import			✓								
10	dlnexport	the first difference of the natural logarithm of export			✓					✓	✓	✓	✓
11	dlnava	the first difference of the natural logarithm of agriculture value-added				✓							
12	dlnmva	the first difference of the natural logarithm of manufacturing value-added				✓							
13	dlnsva	the first difference of the natural logarithm of service valued-added				✓							
14	bcpbd	Banks' credit as percent of bank deposits					✓						
15	blatdstf	Bank liquid assets to deposits and short-term funding					✓						
16	bscpa	Banking system capital percent of assets					✓						
14	dfsdpgdp	change in financial system deposits, % of GDP						✓					
15	bcgpepgdp	Banks' credit to government and public enterprises % of GDP						✓					
16	dllpgdp	change in liquid liabilities (% GDP)						✓					
17	dbapgdp	change in bank assets, (% GDP)						✓					
18	broap	Bank return on assets (%)							✓				
19	broep	Bank return on equity (%)							✓	✓	✓	✓	✓
20	bocpta	Bank overhead costs (% total assets)							✓				
21	bctirp	Bank cost to income ratio in percent							✓				
22	bniittip	Bank non-interest income to total income(%)							✓				
23	birpiba	Bank interest revenue(% interest-bearing assets)							✓				
24	Output Gap	The extent of deviations of output from the long-term economic growth trend									✓		
25	Credit Gap	This is the extent of the deviation of the credit-to-GDP ratio from its trend.										✓	
26	Industrial productn Gap	This is the extent of deviations of Industry Production from its trend.											✓

Source: Author, 2021

Model 1: Basic Model

Credit has been at the forefront regarding financial or banking crises (Jorda, Schularick, Taylor, 2011; Chen et al., 2012; Claessens et al., 2012). It featured massively in studies related to the 2007-2008 global financial crises (GFC). This is partly because credit, either short term or long term, represent links between the banking industry and the real economy. Historically, *the credit-to-GDP ratio is instrumental in early warning signals for financial and banking crises and is well-referenced in macroprudential studies. The gap between the credit-to-GDP ratio and its long-term trend is utilized in the Basel III metrics as a guide for setting countercyclical capital buffers (*Shota Bakhuashvili, 2017; Giese et al., 2014; Drehmann and Tsatsaronis, 2014). In the same spirit, model 1a depicted in Table 4.2 was constructed as the basic model to observe the impact of banking crises on the business cycle while controlling for banks' credit to the private sector (% GDP) defined as leverage in Jordà et al.,(2017), with two lag optimal selection. More so, model 1b (see Table 4.3) controlled for banks' credit to the private sector (% GDP) in addition to monetary policy - broad money supply (as the ratio of total reserves) and lending rate, with two lag optimal selection. This inclusion is important because monetary policy tools are restrictions for credit expansion. As a priori expectations, a surge in credit is expected to fuel an expansion in the business cycle (credit-fuelled boom) through what Hayek called the "transitory artificially induced low-interest-rate" (Boudreaux & Klaus, 2014), while banking crises is expected to induce downturns in the short-term cyclical behaviour of output.

Model 2: Controlling for the Real Sector variables

The extent of interactions and feedback between the real sector and the financial sector has implications for the response of the business cycle, primarily through investment and industrial production (Kenny et al., 2017; Diamond & Dybvig, 1983; Teimouri & Dutta, 2016) and exportation of goods and services (Iacovone et al., 2019). In the same vein, aggregate expenditures and sectoral components were included as control variables to unravel how structural characteristics influence the link between the business cycle and banking crises. The second model observed the interaction from the two standpoints: the expenditure and the sectorial components of output. Model 2A observed the relationship between banking crises on the business cycle controlling for GDP expenditure components, namely, the household final consumption expenditure, investment,

government spending, importation, exportation, and all variables employed in the basic models with two optimal lags. Model 2B (Table 4.5) explores the relationship between banking crises on the business cycle while controlling for the sectorial components of the GDP and other variables, namely agriculture outputs, manufacturing outputs and services, in addition to the variables recruited in the basic model. The sectorial components of the GDP structured the economy into stages of the production of goods and services. This also provides the mechanism to observe the various degree of pressure mounted on the banking system during banking crises via these stages of production and highlight the most severe. The model was set up with two optimal lags as suggested by the coefficient of determination. As discovered in Kenny et al., 2017, a priori expectation demands a recessionary effect of banking crises on the real sector, while decline in investmet as postulated by Diamond & Dybvig (1983) is anticipated to instigating episodes of banking crises.

Model 3: Controlling for the financial sector variables

Literature supporting the influence of financial sector variables on banking sector vulnerability is vast (Laeven, Ratnovski, & Tong, 2016; Kaminsky & Reinhart, 1999; Black et al., 2016; de Haan et al., 2020). In order to incorporate situations for this, model 3A (Table 4.6) was designed. It observed the impact of banking crises on the business cycle controlling for variables capturing bank stability, namely, banks' credit(% bank deposits), bank liquid assets to deposits and short-term funding, banking system capital (% assets), and lending rate with optimal two lags. Model 3b (in Table 4.7) observed the impact of banking crises on the business cycle controlling for variables capturing bank system depth namely, the change in financial system deposits (% of GDP), Banks' credit to government and public enterprises (% GDP), change in liquid liabilities (% GDP), and Bank assets (% GDP), with optimal 3 lags. Model 3C (in Table 4.8) observed the impact of banking crises on the business cycle controlling for variables capturing banks efficiency, namely Bank return on assets in percent, Bank returns on equity in percent, Bank overhead costs percent of total assets (bocpta), Bank cost to income ratio in percent (bctirp), Bank non-interest income to total income in percent (bniittip), Bank interest revenue as percent of interest-bearing assets (birpiba), with the optimal lag of 3.

3.2.1.2 PANEL LOGISTIC REGRESSION

Model 4: Modelling the probability of banking crises

Considering the probability of banking crises, pVAR may furnish us with the significance and directional sign but predicted values greater than one and less than zero along the X-axis are theoretically inadmissible. To acquire the probability of banking crises that fall within the range of 0 and 1, we apply logistic regression in the spirit of Roy & Kemme, 2012; Berg & Pattillo, 1999a; and Davis & Karim, 2008). Rather than observing thresholds, we rely on the assumption of a standard probability distribution of the parameters, which allows for statistical tests of significance of the indicators. According to the estimated pVar models 1 to 3, and their granger causalities, variables that were significant and granger caused banking crises across the estimated models are; business cycle, interest rate, banks' credit to the private sector, (% GDP), the percentage change in investment, the percentage change in government spending, the percentage change in export, and bank return on equity (%). The probability of banking crises is assumed to be determined by the logistic cumulative distribution function. The economies under consideration differ in macroeconomic dynamics, macroprudential regulation and institution, so the imposition of constraints or restrictions that the underlying structure is the same for each country for the estimation of ordered logistics for panel data will likely violate the constrain. As such, the introduction of panel-specific fixed effects will help overcome this restriction on the parameters and allow for individual heterogeneity across the economies (Love and Zicchino, 2006).

$$[\![\text{logit}[\Pr(Banking\ Crisis]\!]_{it} = 1)] = u_i + \boldsymbol{\alpha} bizcycle_{i,t} + \boldsymbol{\beta} lr_{i,t} + \boldsymbol{\delta}\text{bctpspgdp}_{i,t} + \boldsymbol{\zeta}\text{dlngcf}_{i,t} + \boldsymbol{\varphi}\text{dlngfce}_{i,t} + \boldsymbol{\gamma}\text{dlnexport}_{i,t} + \boldsymbol{\lambda}\text{broep}_{i,t} + \varepsilon_{i,t}$$

Where u_i is a vector of dependent variables-specific panel fixed effect, ε_{it} is (1 x k) vector of idiosyncratic errors, where i = 1,...N indexes panels; t = 1…. T_i indexes time. $\alpha, \beta, \delta, \zeta, \varphi, \gamma, \gamma$ are parameters to be estimated. The coefficient shows the natural log of the odds for an additional unit increase in the predictors, Where the Odd Ratio (OR) of banking crises is given as:

$$e^{(u_i + \boldsymbol{\alpha} bizcycle_{i,t} + \boldsymbol{\beta} lr_{i,t} + \boldsymbol{\delta}\text{bctpspgdp}_{i,t} + \boldsymbol{\zeta}\text{dlngcf}_{i,t} + \boldsymbol{\varphi}\text{dlngfce}_{i,t} + \boldsymbol{\gamma}\text{dlnexport}_{i,t} + \boldsymbol{\lambda}\text{broep}_{i,t} + \varepsilon_{i,t})}$$

Odds Ratio $(OR) > 1$ indicating high-risk factor for an increase in the igniting or predicting variable since the chance of a banking crisis is modelled as highest at one and

lowest at 0. Moreso, Odd Ratio $(OR) < 1$ indicates less risk factor for an increase in the igniting variables. In particular, the average marginal (partial) effects is of interest; it involves the calculations of effects for each observation in the targeted variable and then averaged. This allows us to observe the magnitude of change in the targeted variable that ignites banking crises [$prob(Banking\ Crisis)_{it} = 1$].

3.2.1.3 MODELLING THE RELATIONSHIP BETWEEN OUTPUT GAP, CREDIT-TO-GDP GAP, AND THE INDUSTRIAL PRODUCTION GAP

These models explored the relationship between banking crises and the deviation of output, credit and the industrial gap from their respective trends.

Model 5A: The extent of deviations from the long-term economic growth (Output Gap) trend caused by banking crises.

The objective of this pVAR model is to see the extent of the output gap created by banking crises and the variables that granger causes banking crises. More specifically, this segment shall test the Svirydzenka (2021) assertion that output gaps are excellent indicators of banking crises. The output gap is defined as an economic measure of the difference between the actual output of an economy and its potential output. An output gap suggests that an economy is running at an inefficient rate—either overworking or underworking its resources. (IMF, 2013).

$$OutputGap_{it} = \sum_{l=1}^{P} \mathbf{A}_l \ OutputGap_{it-l} + \boldsymbol{B}bc_{i,t} + \boldsymbol{C}x_{i,t} + \ \varepsilon_{i,t}$$

The $OutputGap_{it} = \frac{bizcyc_{i,t}}{\mathbf{LNY}_{it}} \times 100$, therefore, signifies the output gap, the dependent variable, where $\mathbf{LNY}_{it}$ is represents the natural logarithm of the real GDP in local currency units converted to percentages. More so, the independent variables are: banking crises; denoted by a dummy variable ($bc_{i,t}$), dates of crises as documented by Laeven and Valencia (2013, 2018), the dummy equals one if banking crises exist and zero; otherwise, lending rate($lr_{i,t}$), banks' credit to the private sector, % of GDP (bctpspgdp), the first difference of the natural logarithm of the gross capital formation (dlngcf$_{i,t}$), the first difference of the natural logarithm of government final consumption expenditure (dlngfce$_{i,t}$), the first difference of the natural logarithm of export (dlnexport$_{i,t}$), and bank return on equity in percent (broep$_{i,t}$). Where u_i is a vector of dependent variables-specific panel fixed effect, ε_{it} is (1 x k) vector of idiosyncratic errors, where i = 1,...N

indexes panels; t = 1…. T_i indexes time. A priori, banking crises should generate a negative output gap, but the extent of such gap and the understanding of feedback effects have implications for an effective micro and macroprudential policy.

Model 5B: The extent of deviations from the long-term Credit to GDP (Credit to GDP Gap) trend caused by banking crises.

The objective of this pVAR model is to see the extent of the credit gap created by banking crises and the variables that granger causes banking crises. The credit-to-GDP gap is the difference between the credit-to-GDP ratio and its long-term trend. This indicator and its property are referenced as a critical early warning indicator (EWI) for banking crises (Borio and Lowe, 2002, 2004; Giese et al., 2014; Drehmann and Tsatsaronis, 2014).

$$\text{Credit}Gap_{it} = \sum_{l=1}^{P} \mathbf{A}_l \ \text{Credit}Gap_{i,t-1} + \boldsymbol{B}bc_{i,t} + \boldsymbol{C}x_{i,t} + \ \varepsilon_{i,t}$$

The $\text{Credit}Gap_{it} = \frac{CreditCyc_{i,t}}{\mathbf{LN}\text{bctpspgdp}_{it}} \times 100$, therefore, signifies the output gap, the dependent variable, where $CreditCyc_{i,t}$ is the cyclical component of the banks' credit to the private sector, % of GDP extracted using the Hodrick-Prescott (HP) filtered. **LN**bctpspgdp$_{it}$ is defined as the natural logarithm of the banks' credit to the private sector, % of GDP. More so, the independent variables are: banking crises; denoted by a dummy variable ($bc_{i,t}$), dates of crises as documented by Laeven and Valencia (2013, 2018), the dummy equals one if banking crises exist and zero; otherwise, lending rate($lr_{i,t}$), banks' credit to the private sector, % of GDP (bctpspgdp), the first difference of the natural logarithm of the gross capital formation (dlngcf$_{i,t}$), the first difference of the natural logarithm of government final consumption expenditure (dlngfce$_{i,t}$), the first difference of the natural logarithm of export (dlnexport$_{i,t}$), and bank return on equity in percent (broep$_{i,t}$). Where u_i is a vector of dependent variables-specific panel fixed effect, ε_{it} is (1 x k) vector of idiosyncratic errors, where i = 1,...N indexes panels; t = 1…. T_i indexes time.

Model 5C: The extent of deviations from the long-term industrial production output trend caused by banking crises.

The objective of this pVAR model is to see the extent of the industrial production gap created by banking crises and the variables that granger causes banking crises.

$$\text{Production}Gap_{it} = \sum_{l=1}^{P} \mathbf{A}_l \ \text{Production}Gap_{i,t-1} + \boldsymbol{B}bc_{i,t} + \boldsymbol{C}x_{i,t} + \ \varepsilon_{i,t}$$

The $\text{Production}Gap_{it} = \frac{ProductionCyc_{i,t}}{LNIndusVconH_{it}} \times 100$, therefore, signifies the industrial production gap as the dependent variable. Where $ProductionCyc_{i,t}$ is the cyclical component of the Industrial production value-added extracted using the Hodrick-Prescott (HP) filtered.

$LNIndusVconH_{it}$ represents the natural logarithm of the Industrial production value Added. More so, the independent variables are: banking crises; denoted by a dummy variable ($bc_{i,t}$), dates of crises as documented by Laeven and Valencia (2013, 2018), the dummy equals one if banking crises exist and zero; otherwise, lending rate($lr_{i,t}$), banks' credit to the private sector, % of GDP (bctpspgdp), the first difference of the natural logarithm of the gross capital formation (dlngcf$_{i,t}$), the first difference of the natural logarithm of government final consumption expenditure (dlngfce$_{i,t}$), the first difference of the natural logarithm of export (dlnexport$_{i,t}$), and bank return on equity in percent (broep$_{i,t}$). Where u_i is a vector of dependent variables-specific panel fixed effect, ε_{it} is (1 x k) vector of idiosyncratic errors, where i = 1,...N indexes panels; t = 1.... T_i indexes time.

3.2.2 STATIONARITY TEST AND OPTIMAL LAG SELECTION

To aid the model's specification and as a requirement for the generation of pVAR models, the level of integration of the recruited variables was evaluated using panel unit root tests (table 3.2). However, variables were converted to natural logarithm before that, aside from those already in percentage. The stationarity test was conducted using the Im, Pesaran & Shin (2003) panel-data unit-root tests with a lag selection from the minimization of the Akaike information criteria (AIC), Bayesian information criteria (BIC) and the Hannan-Quinn information Criterion (HQC), HQIC criteria. Each series stationarity result is depicted in table 3.2. Using the Akaike information criteria, all variables were stationary at their fourth lag aside from the first difference of natural log of households' final consumption expenditure, the first difference of natural log of gross

capital formation, the first difference of natural log of government final consumption expenditure which was stationary at their third lag. In the same vein Inflation rate (%) was stationary at its second lag. The lag length's precision promotes the pVAR model's consistency and impulse response function (Ivanov and Kilian, 2005; Nickelsburg, 1985; Lütkepohl, 1985). More so, in the selection of the optimal lag for proposed models, the moment and model selection criteria (MMSC) is followed; namely the Akaike information criteria (AIC) (Akaike, 1969), the Bayesian information criteria (BIC) (Schwarz, 1978; Rissanen, 1978; Akaike, 1977), and the Hannan-Quinn information criteria, (HQIC)-(Hannan and Quinn, 1979), the Hansen's (1982) statistic of over-identifying restrictions, in addition to the overall coefficient of determination (CD), which captures the proportion of variation explained by the panel VAR model. Given the average period of banking crises to be about three years, nine months, the model specification targets Var models with a maximum of 4 lags. Using the optimal lag selection criteria, the number of lags to be used was optimized under a maximum of 4 lags. The MMSC was considered with the best overall CD for the achievement of adequate information and lagged large enough to prevent the autocorrelation of ε_{it} overtime. This yielded 2-year optimal lags for the basic models and the two models capturing the real sector. In addition, models controlling for the various segments of the banking system had three years of optimal lags. Model 4 applied the logistic regression techniques with no need for lag optimization. In contrast, model 5, observing the output gap, had 3-year lags recommended by the selection criteria.

3.2.3 MODEL STABILITY CRITERIA AND DIAGNOSTIC TEST

The stability of the pVAR Models was conducted using the eigenvalue stability condition and roots of the companion matrix. Stability is achieved when all the eigenvalues lie inside the unit circle, i.e., all the moduli of eigenvalues of the companion matrix are smaller than one (Lutkepohl, 2005; Hamilton 1994). The unit circle is the area boundary -1 to +1 on Y (imaginary) and X (Real) axes. After fitting each of the panel VAR models, the moduli of the companion matrix based on the estimated parameters were calculated. For example, model 1 captures the relationships between the business cycle, banks' credit to the private sector (% GDP), and banking crises dummy with two optimal lags estimated at 18 parameters. This resulted in 6 eigenvalues (Table 4.2.1) inside the unit circle. In the same vein, the maximum modulus of the eigenvalues of the companion matrix is 0.7798,

which is sufficiently less than one. Therefore, model 1A pVAR satisfies the stability condition. Similarly, the maximum moduli of the eigenvalues of the companion matrix of all models are less than unity, and each model's eigenvalues lie inside the unit circle. Therefore, the pVAR models satisfy the stability conditions and are stable.

3.2.4 GRANGER CAUSALITY AND IMPULSE RESPONSE FUNCTION

The Granger (1969) causality (G-Causality) is applied to observe causal effects among variables in the system, based on the belief that cause precedes effect and are succession in time. Results from the granger causality tests informed the impulse response function generated. Focus is placed on causality among banking crises, the business cycle, and other macro-financial variables. In addition, Granger causality tests were included for essential and significant relationships among macrofinancial, banking system variables, and the business cycle.

3.2.5 THE LEAST ABSOLUTE SHRINKAGE AND SELECTION OPERATOR (LASSO)

Having relied on the literature to select the body of factors used in this study, the pVAR and its attendant granger causality point to the most vulnerable factors. To facilitate the robustness checks, in addition to the diagnostic techniques applied, LASSO was employed as a scientific technique for banking crises ignitors selection, in comparison with factors identified by the pVar. The least absolute shrinkage and selection operator (LASSO) employs the solution of an optimization problem to select potential covariates for model estimation, thereby enhancing the prediction and interpretability of models (Chetverikov et al., 2021; Bühlmann et al., 2011; Zou, 2006). This is achieved by the optimization problem below;

$$\hat{\beta} = arg\frac{min}{\beta}\left\{\frac{1}{2n}\sum_{i}^{N}(y_i - x_i\beta')^2\right\}$$

subject to

$$\lambda \sum_{j=1}^{p} \omega_j|\beta_j|$$

Where $\lambda>0$ signifies the lasso penalty parameter; y represents the outcome variable, x contains the p potential covariates; β is the vector of coefficients on x; βj is the jth element of β; the ωj are parameter-level weights known as penalty loadings, and n represents the sample size. The tuning parameters λ and ωj specify the weight of the penalty term. As λ approaches 0, the linear lasso produces OLS estimators, but an increase

in λ shrink the magnitude of the estimated coefficients is to zero, as the cost of each nonzero $\hat{\beta}$j increases. At the optimal solution, the kink in the contribution of each coefficient to the penalty term enables some of the estimated coefficients to be precisely zero (Hastie, Tibshirani, and Wainwright (2015). The lambda (λ) penalty parameter selection follows three approaches; cross-validation, minimization of the BIC, and adaptive lasso. The cross-validation fit range of models, from one with no covariates to several models with varied numbers of covariates, which correspond to models with large λ to models with small λ.Then, the model that minimizes[18] the cross-validation function is selected. Similarly, LASSO can select the lambda (λ) that minimizes the Bayesian information criteria (BIC). The adaptive LASSO conduct a multistep version of the cross-validation and select the model that minimizes the λ_{cv} (see table 4.2.3a and table 4.2.3c in appendix). Adaptive LASSO is stricter in excluding extra covariates, especially smaller-magnitude coefficients. The application of Lasso ensures the selection of the relevant variables (within the plethora of the literature-led recruited factors) that contributes to the variation of the targeted variables. The adaptive Lasso is utilized for robustness checks (reported in the appendix) against the variables significant and granger-cause banking crises across the estimated pvar models.

3.2.6 DATA, SAMPLE, AND VARIABLES DESCRIPTION

Unlike other macro-economic measures and indicators, there are no time series nor quantitative measures to track banking crises. Researchers differed on the dates of events due to definition and conceptualization issues. As regards this, authors that have worked extensively on crisis dating are Reinhart & Rogoff (2008); Laeven & Valencia (2018); Boyd et al. (2019); Loukoianova et al. (2009), Chaudron & de Haan (2014), among others. Crises dating were tracked using historical bank sector distress, macro-prudential, policies responses, measures of systemic bank shocks. Laeven & Valencia (2018) dating remains extensive, having combined several measures ranging from significant signs of financial distress in the banking system to macroprudential, monetary and fiscal policy intervention measures. The economies identified with banking crises from 1971 to 2018 are as follows; Albania, Armenia, Austria, Azerbaijan, Bulgaria, Belarus, Belgium, Bosnia and Herzegovina, Cyprus, Croatia, Czech Republic, Denmark, Estonia, Finland, France,

[18] This is the model with the minimum lambda (λ) on the cross-validation plot

Greece, Georgia, Germany, Hungary, Iceland, Ireland, Italy, Kazakhstan, Kyrgyz Rep, Latvia, Lithuania, Luxembourg, Moldova, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Russian, Federation, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom. Data were preferred from 1971 to limit the amount of missing observation in other indicators. The sample for this study was formed using dates of events and macro-financial variables as pointed to in the literature. These countries had banking crises at different points across time with different ignitors and applied differing macro-wide prudential policies, except for a few that jointly suffered banking crises emanating from the 2007/08 global crises due to cross border channels of connectivity. Data were sourced from the world bank, the International Monetary Fund (IMF), Bankscope and the countries central banks websites. Data collected ranges from macroeconomic variables, financial sector, and banking system measures (stability, efficiency, and depth) in line with banking crises and business cycle literature recommendations. Also, the analysis was structured into descriptive and empirical analysis, with the application of the panel vector autoregressive (pVar) model. The variables were structured according to theoretical classifications and model selection techniques. Focusing on the relationship between banking crises and the business cycle, the first two variables highlighted by the literature are real GDP and credit. In line with the suggestion of Boyd, Kwak, & Smith (2006), Festić & Bekő (2008) and Diamond & Dybvig (1983), the directional attributes of the GDP can emanate from one or all the sectoral (production) or expenditure compositions. This informs the inclusion of the production and expenditure compositional distinctions. White (1984) highlighted agricultural sector induced banks failure in the 19th century and early 20th-century. The work informed the manufacturing sector series of Kosmetatos (2014), (Curott & Watts (2018) and Tiffin (2019). In addition to the structural breakdown of the financial sector series, the monetary aggregate variables were suggested by Kaminsky & Reinhart (1999) as a proxy for financial liberalization [broad money (% GDP) and the ratio of broad money to total reserves], which was highlighted as the structural weakening factors that instigated banking crises in 20 countries. The CPI inflation follows the recommendation of Tiffin (2019). All recruited series are in real terms, in annual periodicity and local currency unit. The sources and description of all variables are shown in table 3.4 in the appendix.

4.0 ANALYSIS

This section covers the descriptive and empirical analysis of the study. It presents the correlation matrix of recruited variables, and charts depict the relationships between the targeted macroeconomic variables. Models induced by the literature were used to capture the relationships between the business cycle behaviour and banking crises while documenting implications for selected macro and banking sector variables using available theoretical structures. The outputs of the analysis are presented within.

4.1 DESCRIPTIVE ANALYSIS

Table 4.1: Correlation matrix of selected Variables

		Business Cycle	Banks Crises	Banks' credit to the private sector (% GDP)	Broad Money to Total Reserves Ratio	Interest rate
1	Business cycle	1				
2	Banks crises	-0.11	1			
3	Banks' credit to the private sector(% GDP)	0.03	0.17	1		
4	Broad Money to Total Reserves Ratio	0.10	0.11	0.54	1	
5	Interest rates	-0.07	0.16	-0.25	-0.08	1
6	Household Consumption (% Change)	0.32	-0.33	-0.13	-0.05	-0.31
7	Investment (% Change)	0.16	-0.08	-0.13	-0.07	0.54
8	Govt. Spending (% Change)	0.21	-0.12	0.03	0.02	-0.33
9	Imports(% Change)	0.22	-0.30	-0.10	-0.09	-0.07
10	Exports(% Change)	0.11	-0.20	-0.08	-0.08	0.00
11	Agriculture (% Change)	0.12	-0.03	-0.06	-0.05	-0.10
12	Manufaturing (% Change)	0.05	-0.16	-0.03	-0.18	-0.47
13	Services (% Change)	0.36	-0.21	-0.13	-0.14	-0.10
14	Banks' credit (% bank deposits)	0.05	0.12	0.64	0.54	-0.08
15	Bank liquid assets to deposits and short-term funding	-0.10	0.12	0.02	-0.24	0.22
16	Banking system capital(% Assets)	-0.01	-0.04	-0.38	-0.34	0.31
17	Change in financial system deposits (%GDP)	0.09	-0.14	0.38	0.15	-0.23
18	Banks' credit to govt. & public enterprises (% GDP)	-0.06	0.09	0.07	0.18	-0.20
19	Change in liquid liabilities (% GDP)	0.10	-0.15	0.28	0.11	-0.18
20	Change in bank assets (% GDP)	0.01	-0.24	0.28	0.30	-0.08
21	Banks Return on Asset(%)	0.05	-0.20	-0.24	-0.17	0.27
22	Banks Return on Equity (%)	0.13	-0.19	-0.09	-0.06	0.48
23	Bank overhead costs (% of total assets)	-0.07	0.04	-0.18	-0.12	0.13
24	Bank cost to income ratio(%)	0.00	0.01	0.06	0.06	-0.16
25	Bank non-interest income to total income(%)	0.00	0.22	0.27	0.11	0.13
26	Bank interest revenue (% interest-bearing assets)	0.05	-0.07	-0.51	-0.29	0.42
27	Output Gap	1.00	-0.10	0.03	0.10	-0.07
28	Industrial Production Gap	0.78	-0.13	0.00	0.06	0.04
29	Credit-to-GDP Gap	0.05	0.00	0.24	0.06	-0.10

Source: Author, 2021

The correlation matrix of the series recruited is represented in Table 4.1. Aside from the relationship between the business cycle and banking crises, other negatively related variables and those positively correlated with banking crises were reported. These highlight variables with the possibility of instigating a downward side of the cyclical behaviour and pinpointing the likely propellers of banking crises among the macroeconomic and financial variables. This is done without ascribing causality among the targeted variables. The correlation matrix met the a priori expectations and revealed a negatively correlated relationship [-0.11] between the business cycle and banking crises. In addition, the list of variables that had negative correlations with the business cycle are; interest rates, bank liquid assets to deposits and short-term funding, banking system capital (% assets), banks' credit to government and public enterprises (% of GDP), and bank overhead costs (% total assets). Bank cost to income ratio and the bank non-interest income to total income shows an extremely weak relationship at -0.002 and -0.0002, respectively. Conversely, the correlation matrix revealed a positive correlation between bank crises and; banks' credit to the private sector [0.17], broad money to total reserves ratio [0.11], interest rates [0.16], bank credit, % of deposits [0.12], bank liquid assets to deposits and short-term funding [0.12], banks' credit to government and public enterprises [0.09], bank overhead costs percent of total assets [0.04], bank cost to income ratio(%)[0.01] and bank non-interest income to total income (%) [0.22]. *These suggest that banking crises are products of extreme or liquidity scarcity, amplified by the business cycle.*

4.1.1 CYCLICAL BEHAVIORAL PATTERN OF THE BUSINESS CYCLE WITHIN AND OUTSIDE THE SPHERE OF BANKING CRISES

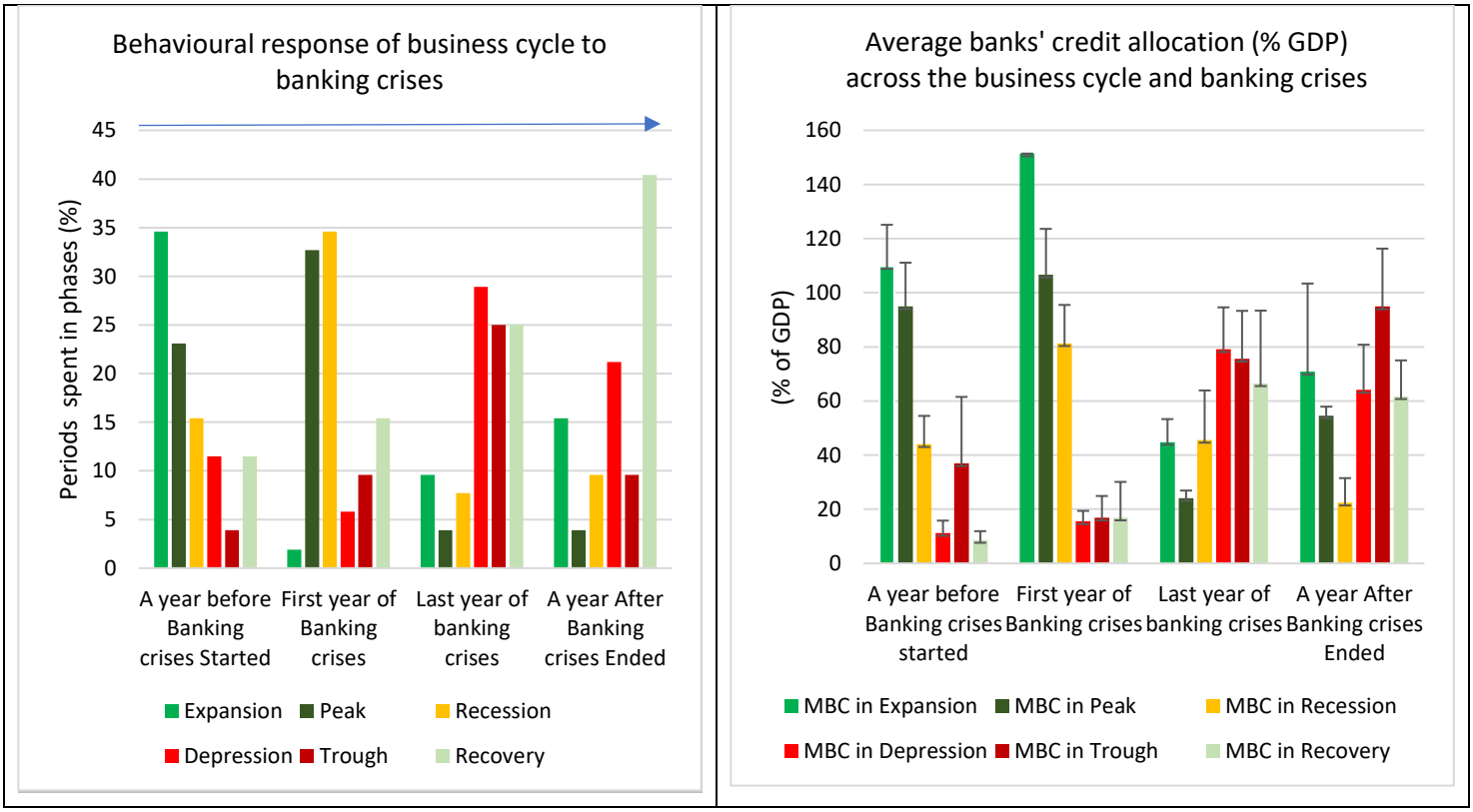
As a panel, the 43 economies studied have experienced several phases along their business cycle from 1971 to 2018. To put in perspective, cumulatively, the period was segmented into 1640 business cycle phases of the economy (table 3.1.1A). The business cycle behaviour showed that about 23.4% of the period had been spent in the recovery phase. The expansion phase also occupied about 21% of the period. Similarly, recession and depression occupied about 17.6% and 18.5% of the studied duration, respectively. At the same time, the economies spent about 9.7% and 9.8% in the peak phase and trough phase, respectively. The business cycle structure was compared during crises and non-crises to know the phase most vulnerable to crises. The difference was evident as the

economies spent the most period in depression (27.3%) and recession (21.2%) during episodes of banking crises, compared to periods without banking crises where substantial time was spent in recovery (23.9%) and expansion (22.8%). Banking crises trapped the economies in the trough for about 14.6% (cumulatively that is about 24 years) of the crises period, but only 9.2% of the period in trough without banking crises episodes. How do the business cycles of economies respond to banking crises? The business cycle phases were observed along the trajectory (i.e., numbers of years before and after) of the episodes of banking crises. On average, banking crises lasted for about four years in this sample, with a one-year minimum and five years maximum of a single episode, although some economies experienced up to three episodes within the studied time frame. After the business cycle phase classification into the trajectory of the episodes of banking crises, descriptive evidence shows that a year before banking crises commenced, about 34.6% of the business cycle was in the "expansion phase, while 23.1% were in the "peak phase". In the first year of the crises, the "peak phase" increased to 32.7%, while the recession phase rose to 34.6% from the 15.4% a year before. This result suggests that banking crises in this sample are boom and bust outcomes and strain cast upon a banking system by an economy in the process of achieving or sustaining expansion and maximal growth. This assertion was confirmed as shown in figure 4.1, panel B[19]. For instance, the average credit to the private sector (% GDP) was almost at its highest point a year before the banking crisis started. In the first year of the banking crisis, the average credit to the private sector (%GDP) reached its summit at 151.4%. The average credit collapsed to 79.1% in the last year of the banking crisis but took off to 94.9% a year after the crisis has ended. Combining this information with the interaction between the business cycle and banking crises, the year after the crises shows that more countries moved from the business cycle expansion and peak phases to the "peak" and "recession phase**".** This signal that, as regards the business cycle, in the year before crises, banking crises proceeds mainly from two phases: expansion or Peak. The following year shows that banking crises cut short economic expansions, although they can result in peak or recession, depending on the strength of the banking system. After three years of banking crises, 78.9% of the phases deteriorated into the depression and trough, while 40.4% in

[19] Each of the economies was in different business cycle phases at the different periods of banking crises. figure 4.1, panel B observed the mean of the banks' credit to the private sector (% GDP) at the various phases

the recovery phase. Even the peak phases sustained in the first year of the crisis fell to an infinitesimal 3.9% by the end of the crisis. *Descriptively, three types of banking crises were seen; firstly, the category induced by the banking system's inability to support economic expansion and secondly, the category caused by excessive leverage and lastly, the category caused by economic downturns*. The business cycle seems to be induced by bank credit to the private sector.

Figure 4.1: Business cycle phases, credit allocation and banking crises



"MBC in Expansion" is the mean of banks' credit to the private sector (%GDP) during the expansion periods; "MBC in Peak" is the mean of banks' credit to the private sector (%GDP) during the Peak periods; "MBC in Recession" is the mean of banks' credit to the private sector (%GDP) during the Recession periods; "MBC in Depression" is the mean of banks' credit to the private sector (%GDP) during the Depression periods; "MBC in Trough" is the mean of banks' credit to the private sector (%GDP) during the Trough periods; "MBC in Recovery" is the mean of banks' credit to the private sector (%GDP) during the Recovery periods

Source: Author 2021

4.1.2 THE AMPLITUDE, DURATION AND SLOPE OF THE BUSINESS CYCLE OUTSIDE AND DURING EPISODES OF BANKING CRISES.

The business cycle's amplitude, duration, and slope during and outside banking crises were observed. First, the standard error revealed that the business cycle is more volatile during banking crises. The amplitude, upturn and downturn, and the slope were steeper during banking crises than what entails outside of banking crises. The only exemption is

the duration of downturns, and this was one year higher (4.4 Years) than the duration of an upturn (3.4 years).

Table 4.1.1: The amplitude, duration, and slope of the business cycle

	Total Sample (Pooled)		**During Banking Crises**		**Without Banking Crises**	
	Average (Std Err.)	N	Average (Std Err.)	n	Average (Std Err.)	n
Amplitude of upturn	5.94 (0.39)	159	6.99 (1.18)	20	5.79 (0.41)	139
Durations of Upturns	4.8 (0.18)	130	4.9(0.65)	19	4.8 (0.18)	111
Slope of upturn	1.58 (0.13)	130	1.71(0.31)	19	1.56 (0.15)	111
Amplitude of Downturns	-6.19 (0.41)	160	-8.65 (1.62)	24	-5.76(0.39)	136
Durations of Downturns	4.3 (0.196)	145	3.4(0.38)	19	4.4(0.22)	126
Slope of Downturns	-1.91 (0.19)	145	-3.43(0.999)	19	-1.68 (0.15)	126

Source: Author 2021. The sample size varies due to the difference in the duration of the phases

4.1.3 OUTPUT, CREDIT, AND INDUSTRIAL PRODUCTION GAP LOSS TO BANKING CRISES

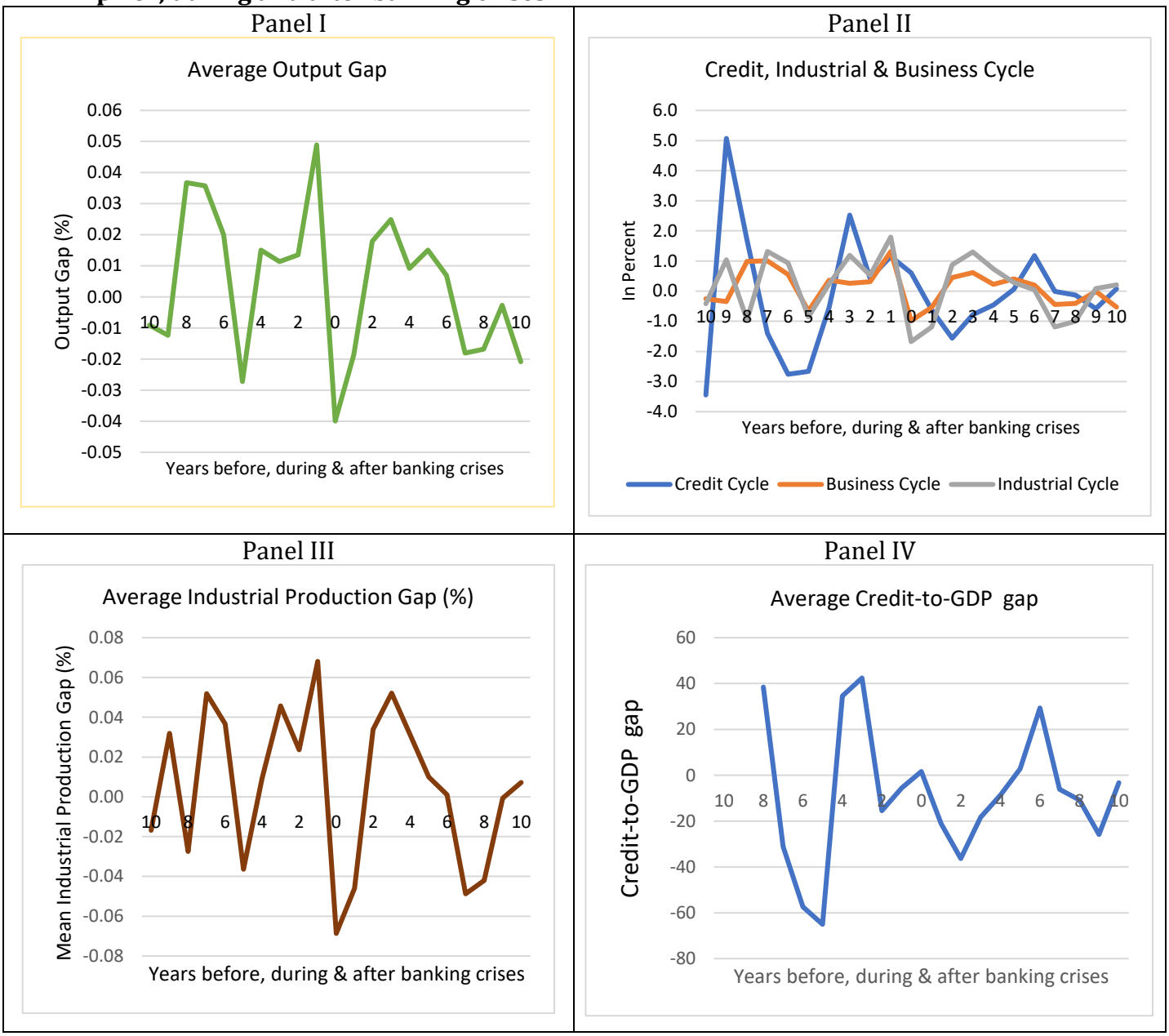
The deleterious effects of banking crises are on credit, aggregate output, and industrial production output's deviation from its trend shows changes in the long-run level. More so, exploring the impacts on the short-term cycle offer the opportunity to estimate the gap loss, thereby providing valuable information for policy readiness as a form of insurance in the event of banking crises.

4.1.3.1 AVERAGE GAP LOSS IN OUTPUT, INDUSTRIAL PRODUCTION, AND CREDIT BEFORE, DURING AND AFTER BANKING CRISES

This section shows the gap in output, credit, and industrial production. Table- 3.1.3 shows ten years before and after banking crises, while the period of banking crises is labelled as year 0. In this sample, the average output gap during and without banking crises shows that banking crises had a recessionary gap in the panel of countries. Overall, the sample reveal an output gap of -0.00024% (std dev 0.11), credit gap of -4.92% (std dev 4.12) and industrial production gap of -0.0056% (0.0060). Outside of the period of banking crises, output gap averaged about 0.0042% (std dev 0.099) credit gap averaged -5.95(std dev 4.39) and industrial production gap 0.0041% (0.0063). During banking crises period, output gap of -0.0399% (std dev 0.186), credit gap of 2.06% (11.94), industrial production gap of -0.072% (0.019). The assessment of the cycle and the gaps signals before, during and after banking crises, as shown in Table 4.1.2, revealed that banking crises tend to generate output gap loss, industrial product gap loss and credit-to-gaps loss. As seen in panel II of the same table, the cycles signal shows that the credit-

to-GDP cycle consistently leads the business cycle and the industrial production cycle in the build-up phase to banking crises, but the trend changed from the start of the crises. The commencement of banking crises saw both the credit and business cycles being led by the industrial production cycle. This feature of the credit-to-GDP confirmed it as an early warning indicator of banking crises and suggested that the quick recovery of industrial production is paramount to ending the negative impact of banking crises on the macroeconomy.

Figure: 4.2: Evolution of Output Gap, Credit Gap, and Industrial Production Gap prior, during and after banking crises

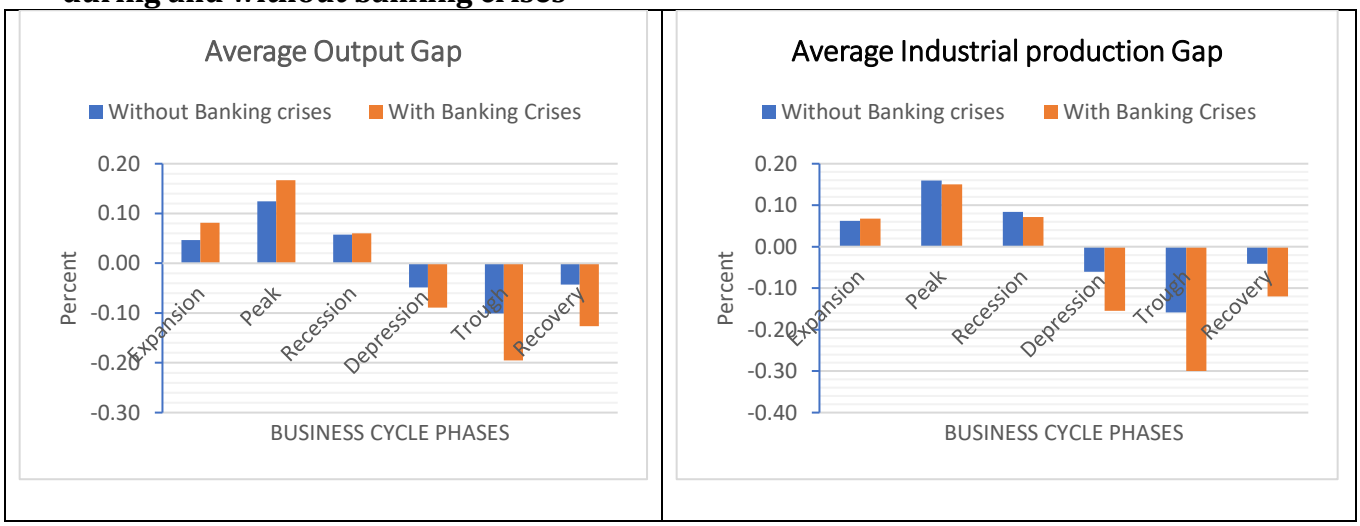


Source: Author 2021. On the horizontal axis are numbers of years into and after banking crises. Year 0 signifies periods of banking crises.

4.1.3.2 COMPARING AVERAGE GAPS IN OUTPUT, INDUSTRIAL PRODUCTION, AND CREDIT ON THE BUSINESS CYCLE PHASES DURING AND OUTSIDE BANKING CRISES

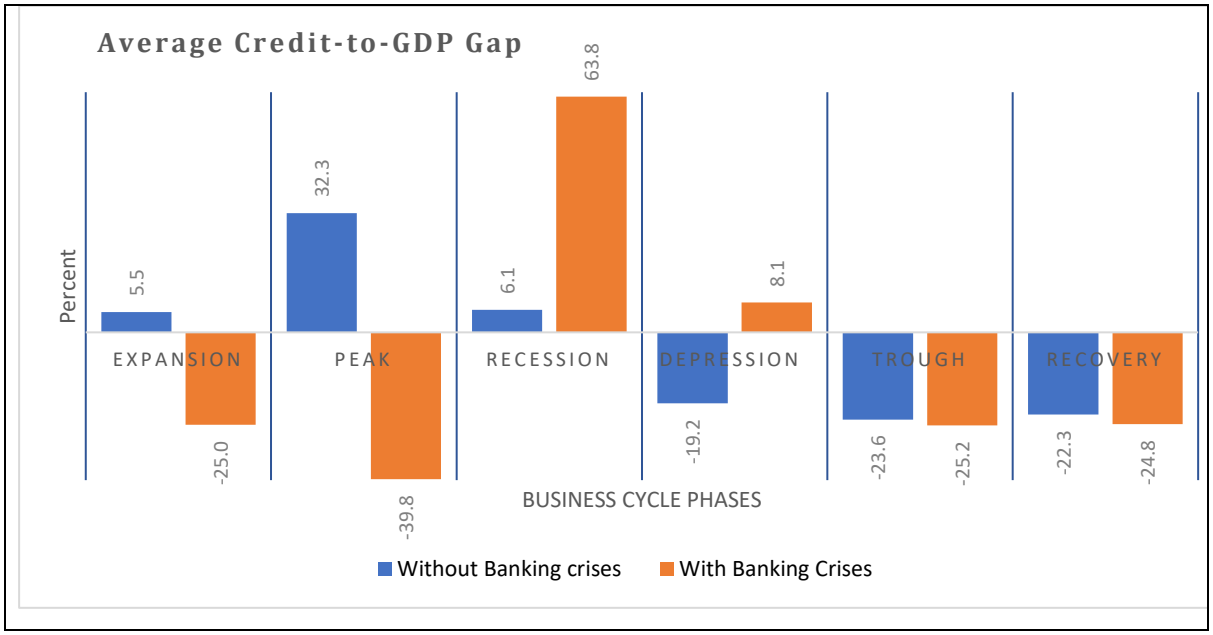
The graphical representation of the extent of the gap created by banking crises along the cyclical behaviour is shown in figure 4.2.1a. It compared the average output gap, industrial production gap, and the credit to GDP gap during the episodes of banking crises with the non-crises period across the business cycle phases. This shows that the industrial and output gaps are positive during the expansion, peak, and recession phases but harmful during the depression, trough, and recovery phases. Periods of banking crises saw more negative gaps than the period of non-crises, especially during the trough. Therefore, banking crises amplify the negative gaps during these periods. Figure 4.2.1b shows that excessive credit demands created banking crises during the recession by plotting the average credit-to-GDP gap within the different phases. Since causality is not implied, banking crises either disrupt the business cycle by obstructing the liquidity needed to sustain the expansion and peak phases, or the sudden liquidity disruption on these phases led to crises.

Figure 4.2.1a: Average output, industrial production gap by business cycle phases: during and without banking crises



Source: Author 2022

Figure 4.2.1b: Credit gaps by business cycle phases: during and without banking crises



Source: Author 2022

4.1.4 THE CONCORDANCE INDEX (CI)- SYNCHRONIZATION OF THE BUSINESS, INDUSTRIAL PRODUCTION AND CREDIT CYCLE IN CRISES AND NONCRISES PERIOD

The analysis of the estimated concordance index of the panel (Table 4.1.3) and the individual countries (Table 4.1.4 and 4.1.5 in Appendix 3) remains informative. The business and credit cycles were in the same phase of their respective cycles, 7.7% less during banking crises than the period of non-crisis. The two series are less procyclical during banking crises than when there are no banking crises. Conversely, the business and industrial production cycles were in the same phase of their respective cycles by14.5% more. They were more procyclical during the systemic banking crises than non-banking crises. This suggests that *the business cycle and the industrial cycle will likely hurt or aid each other more during banking crises than in periods of calmness.* The Industrial production and credit cycles were 9.4% less procyclical during banking crises than during non-banking crises. This shows that the industrial production cycle was more disconnected from the credit cycle during banking crises than the calm period. As a panel of countries, the positive synchronization between real output and credit is weakened during systemic banking crises compared to the period of calmness. The degree of synchronization between the business cycle and banks' credit to the private sector (table 4.1.4) varies across economies; a perfect procyclicality is seen only in Armenia,

Azerbaijan, Belarus and Germany, Kazakhstan, Moldova, Netherlands, Norway during the period of banking crises. More countries experienced perfect procyclicality between the business and industrial cycles during banking crises, with only Bulgaria witnessing countercyclicality (see table 4.1.5).

Table 4.1.3: Concordance Index (CI) among Business Cycle and Credit Cycle and Industrial production Cycle

Concordance Index (CI)	Total Sample	During Banking Crises	Without Banking Crises
Business Cycle and Credit Cycle	0.577	0.537	0.582
Business Cycle and Industrial production Cycle	0.787	0.887	0.775
Industrial production Cycle and Credit Cycle	0.558	0.512	0.565

Source: Author 2021

4.2 EMPIRICAL ANALYSIS

This segment is divided into four parts; section 4.2.1 studies the relationship between banking crises and the cyclical behaviour of the business cycle and what the implication of these interactions hold for macroeconomic indicators. These were explored with seven models, moving from basic to complex ones. Macroeconomic indicators recruited range from banks' credit to the private sector, monetary policy targets, the real economic activities, Sectorial components of GDP, banks stability, depth measures, and bank system efficiency indicators. In the same vein, the second part, section 4.2.2, estimated the probability of banking crises induced by the average cyclical behaviour of the business cycle. This section calculates and compares the probability of systemic banking crises across the different business cycle phases while exposing the most vulnerable phases. Finally, the degree of the output gap, the industrial production gap, and the credit gap created by banking crises was observed. In addition, the synchronization of the business cycle with the credit cycle and the industrial cycle during banking crises and non-crisis was highlighted.

4.2.1 THE RELATIONSHIP BETWEEN BANKING CRISES AND THE CYCLICAL BEHAVIOUR OF THE BUSINESS CYCLE; AND IMPLICATIONS FOR MACROECONOMIC INDICATORS.

This section uses the panel vector autoregressive model to explore how banking crises and the business cycle interact while highlighting such interactions' impact on the selected macroeconomic indicators.

4.2.1.1 BANKING CRISES, BUSINESS CYCLE AND BANKS' CREDIT TO THE PRIVATE SECTOR-MODEL 1A.

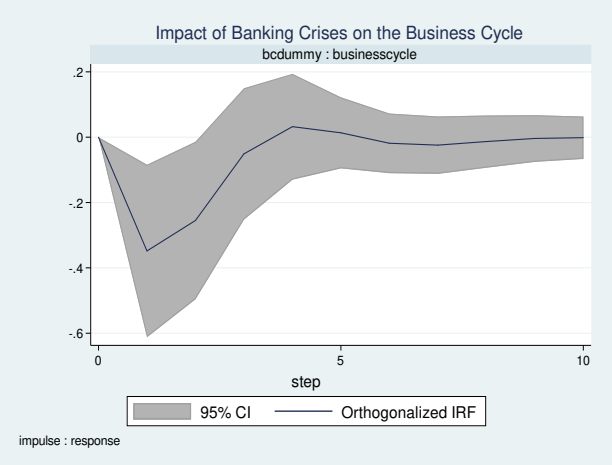
The estimation of the first basic model found the first lag of banking crises with a significant recessionary effect (-125.7% pts) on the business cycle (Table 4.2). More so, the banks' credit had a mixed effect on the business cycle; while the second lag of the banks' credit had a negative effect (-1.5% pts) on the business cycle, the first lag of the banks' credit to the private sector had a positive effect (1.6% pts) on the business cycle. Conversely, business cycle upturns tend to significantly instigate banking crises by 2.64%. In addition, banking crises tend to reinforce, as the past period of banking crises significantly propelled by 76.5%. The eigenvalues were less than unity; therefore, the model satisfied the stability criteria.

In summary, banking crises have a recessionary causal effect on the business cycle when banks' credit to the private sector is included as a controlled variable. Based on the estimated model, the impulse response function (IRF) and confidence intervals are computed using 200 Monte Carlo draws. This, according to table 4.2 on the impulse response of banking crises on the business cycle and figure 4.3, shows that positive shocks in banking crises lead to recessionary effects on the business cycle in the first two years of the crisis (-34.8% pts and -25.5% pts respectively). This negative effect of banking crises on the business cycle eased to -5.1% pts and 3.2% pts in the third and fourth year and died out. On the other hand, the business cycle increased the chances of banking crises. The IRF revealed that positive shocks in the business cycle led to an increase in banking crises in the first three years by 5.7%, 5.8% and 3.1%, respectively, before dying out. This suggests that banking crises are more likely during periods of business cycle upturn (this assertion will be explored by the phase-by-phase analysis of the business cycle), and when the crises happen, the severe impact is seen on the cycle for about two years. The chances of banking crises are slim, but the impacts remain severe. Under this model, there appears to be no significant causal relationship between

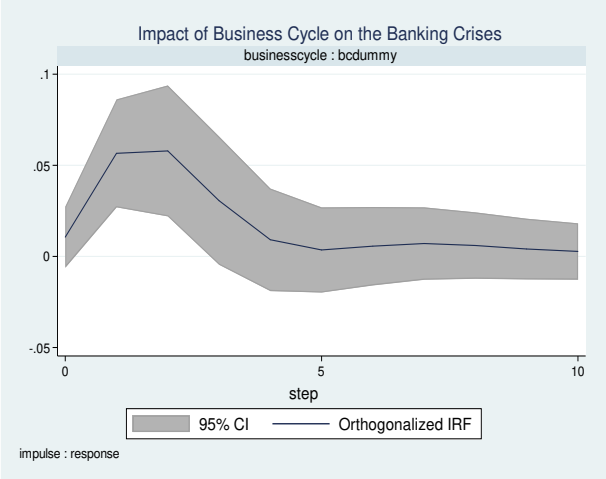
banking crises and banks' credit to the private sector. In addition, there is no significant causal relationship between the business cycle and banks' credit to the private sector, but the alternative hypothesis of a causal relationship between systemic banking crises and the business cycle remains strongly significant.

Figure 4.3: Impulse response function: Banking crises and business cycle-Model I

Response of business cycle to banking crises



Response of banking crises to shocks in the business cycle



Source: Author 2021

4.2.1.2 BANKING CRISES, BUSINESS CYCLE AND MONETARY POLICY- MODEL 1B.

This model (1b, shown in table 4.3) presents the impact of banking crises on the business cycle while controlling for banks' credit to the private sector (% GDP) and monetary policy targets[20] - with two lag optimal selection. While the significant impact of the second lag of leverage[21] on the business cycle is negative -3.27% pts, the impact of its first lag was positive, 5.93% pts. Conversely, the first lag period of the business cycle significantly propelled banking crises by 1.91%. An increase in the first lag of interest rate and leverage significantly reduced banking crises by 0.28% and 0.47%, respectively. The model remains stable, as shown by the eigenvalues' stability condition (table 4.3c).

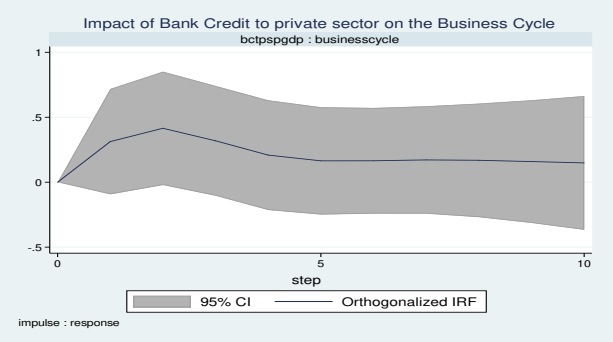
In summary, after controlling for interest rate and broad money supply into the basic model 1A, IRF of leverage had an expansionary effect on the business cycle. The positive shocks in leverage lead to an increase in the business cycle in the first, second, third and fourth year and slightly throughout the remaining forecast horizon. The recessionary effect of banking crises on the business cycle, as seen in basic model 1A, disappeared. In

[20] Broad money supply (as the ratio of total reserves) and the interest rate.
[21] Banks' credit to the private sector (% GDP).

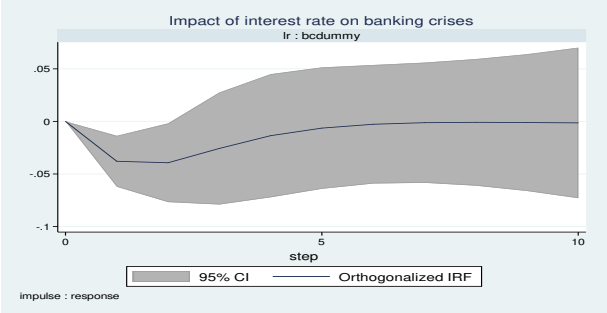
addition, positive shocks in lending rate stabilize the banking system by reducing banking crises and is more impactful in the first four years. Positive shocks in banks' credit to the private sector shoot up the broad money to reserve ratio for about three years before returning to calmness. The model revealed the implication of excess money supply and lax interest rates on banking crises, confirming the view of Jorda et al. (2011) and Hayek business cycle theory. Positive shocks in lending rate reduced the broad money supply to total reserve ratio; the effect was highest in the second and third years and gradually throughout the time horizon. This model concludes that there is no significant relationship between systemic banking crises and the business cycle when the interest rate and broad money supply were controlled. Also, banking crises had no significant relationship with the banks' credit to the private sector. The transmission of vulnerability from the banking sector to the business cycle is a monetary phenomenon that can be tamed with interest rates with the right timing.

Figure 4.4: Impulse response functions: banking crises, business cycle and monetary policy- Model II

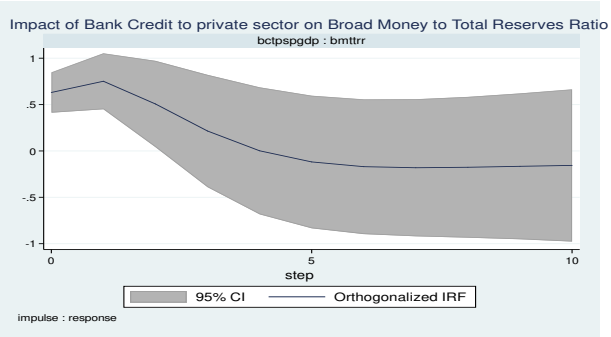
Response of business cycle to shocks in banks' credit to the private sector



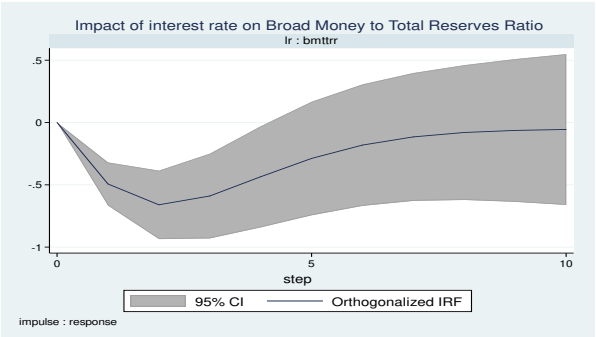
Response of banking crises to shocks in interest rates



Response of broad money to total reserves ratio to shocks in banks' credit to the private sector



Response of broad money to total reserves ratio to shocks in interest rates



Source: Author 2021

4.2.1.3 BANKING CRISES, BUSINESS CYCLE AND AGGREGATE EXPENDITURE COMPONENTS- MODEL 2A.

Model 2A control for the real sector aggregate expenditure variables. The effect of the first lag of banking crises on the business cycle was a significant recessionary at -137.3% pts, and the second lag was insignificant. On the other hand, the first lag of the business cycle increases banking crises by 2.9%, and the second lag was insignificant. The second lag of government expenditure increased banking crises by 48.7%, while its first lag reduced banking crises by 83.1%. The second lag of investment expenditure increases banking crises by 28.1%, while the first lag reduces it by 23.3%. The model remains stable according to the eigenvalue stability condition. The granger causality test better summarises this picture. The granger causality test shows that three variables granger causes banking crises: business cycle, investment, and government spending.

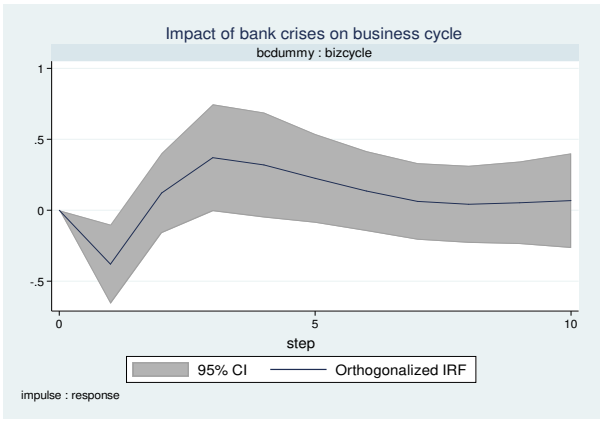
On the other hand, all but government spending and lending rate impacted the business cycle shows that government spending is not important for the business cycle in this sample when the real sector aggregate expenditure variables are controlled for. In addition, banking crises significantly harmed importations immediately at -1.4% and at -2.1% in the first year (Figure 4.5). At the same time, banking crises impacted the business cycle by an instant stop and by -38.0% in the first year. Although the business cycle returned to the positive region throughout the horizon, importation was destabilized. It became positive in the second and third years, by 1.1% and 0.57% respectively and negative after that.

As expected, positive shocks in the business cycle (Figure 4.6)result in immediate positive impacts on consumption, investment, government spending, imports, and exports. Nevertheless, the expansionary impact was only transitionary as they all contracted for three to five years after the immediate expansion. This is because the interest rate and the broad money supply granger cause each other. Positive interest rate shocks had an immediate contraction effect on investment (-4.3%) and government spending (-1.3%). However, investment returned to the positive region in the first year (8.4%), government spending weakened and stayed negative throughout the forecast horizon. This monetary effect was transferred to the business cycle through the broad money supply, credit to the private sector and importation, all of which had contraction impacts on the business cycle in the year banking crises affected the business cycle negatively.

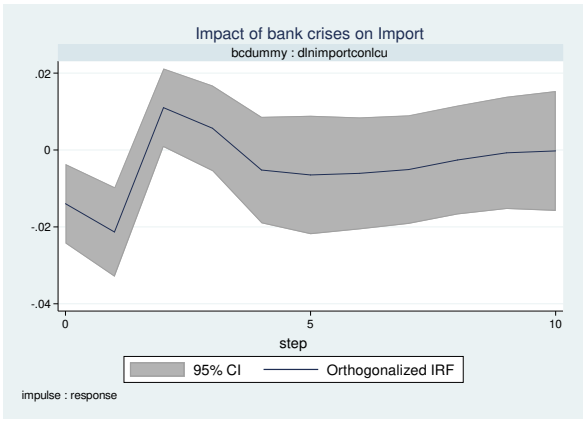
From the standpoint of the real sector, this model shows that banking crises significantly result from collapse in investment, government spending, and contraction of the business cycle from banks' credit and exports contractions. Banking crises were seen during declined imports and on the business cycle. This confirmed the assertion of Hayek business cycle theory and Keynes business cycle theory, as both agreed that a fall in investment usually leads to an avalanche of loan defaults.

Figure 4.5: Response of the business cycle and imports to banking crises, controlling for GDP Components

Response of business cycle to banking crises



Response of imports to banking crises



Source: Author 2022

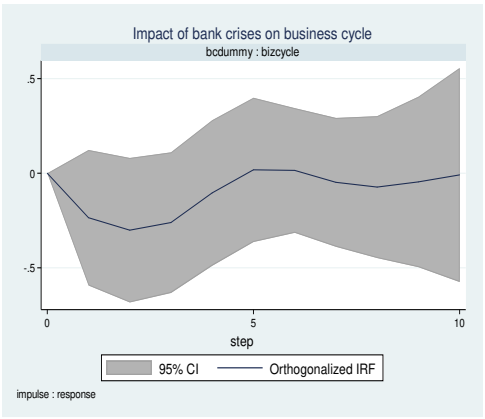
4.2.1.4 BANKING CRISES, BUSINESS CYCLE AND SECTORIAL COMPONENTS OF GDP- MODEL 2B

Model 2B shows that the first lag of banking crises had a significant recessionary impact of -192% pts on the business cycle, while the second lag remained insignificant. All variables but the broad money supply and manufacturing output influence the business cycle. On the other hand, only the manufacturing sector first lag and the business cycle second lag influence banking crises by 129% and 2.5%, respectively, but the chances remain moderately weak. The model remains stable according to the eigenvalue stability condition. According to the granger causality, all the variables, but broad money to total reserve ratio granger causes the business cycle. Banking crises had granger causal impacts on the business cycle, the manufacturing output, and the service sector output, but none of these variables propagated banking crises. The banks' credit to the private sector reflected a cyclical impact of the business cycle. The model also shows that the effect of broad money on the business cycle is transmitted through the interest rate, the manufacturing output and the services sector output.

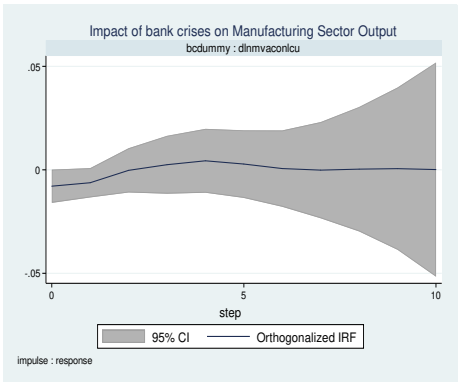
As seen in figure 4.7 below and table 4.5.2 in appendix 5, positive shocks on banking crises generated a recessionary effect on the business cycle from the first year to the fourth year, with the first three years being most severe at -23.5% pts, -30% pts and -26.1% pts respectively confirming the view of Reinhart & Rogoff, (2008). The same shocks had an immediate recessionary impact on the manufacturing and services sector output but faded out after the third and fourth years, respectively. On the other hand, positive business cycle shocks immediately increased the manufacturing and services sector by 1.4% and 1.7%, respectively. Still, these were only transitionary as the two sectorial outputs growth returned negative from the first two years with an average of about 2.2% and 1.1%, respectively, before fading away. This model affirmed that the impact of banking crises on the business cycle is partly transmitted through the service sector and shows that the business cycle and the service sector are possessed feedback mechanisms.

Figure 4.7: Impulse Response Functions: Banking crises, business cycle and the sectorial components of GDP

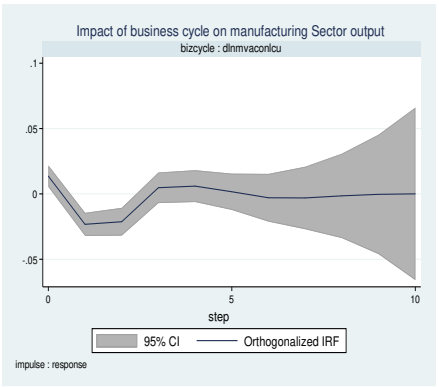
Response of business cycle to banking crises



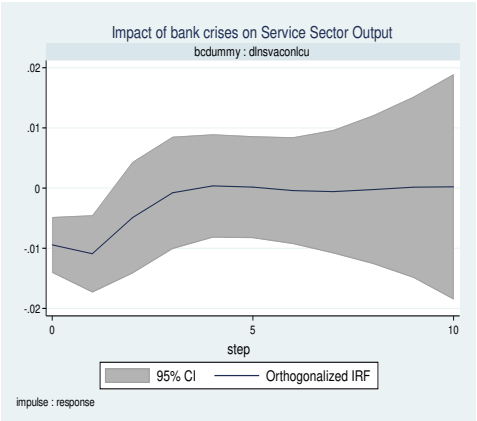
Response of manufacturing sector output to banking crises



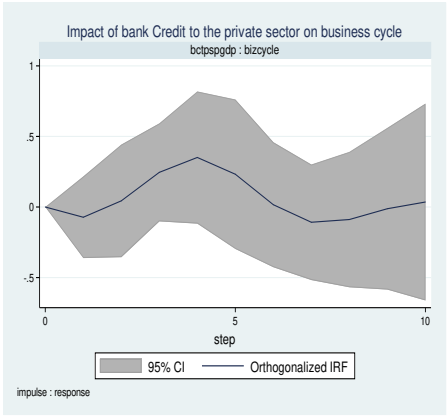
Response of manufacturing sector output to shocks in the business cycle



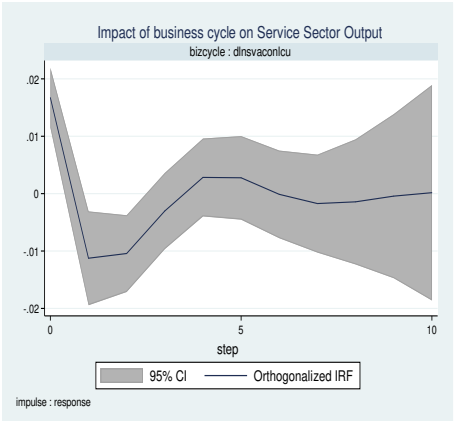
Response of service sector output to banking crises



Response of business cycle to shocks in banks' credit



Response of the service sector output to shocks in the business cycle



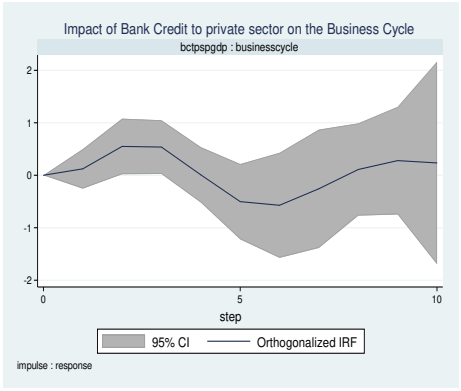
4.2.1.5 BANKING CRISES, BUSINESS CYCLE AND BANKS SYSTEM STABILITY – MODEL 3A

After controlling for selected banks' stability variables, Model 3A shows that banking crises did not significantly impact the business cycle but impacted all the selected bank stability. More so, the business cycle did not instigate any banking crises. Instead, causal relationships between the business cycle and the stability variables were seen. It can be inferred that the bank stability variables prevented the direct transmissibility of stress between banking crises and the business cycle. These stability variables stood as buffers that prevent banking crises from impacting the business cycle and vice versa. Still, these buffers in themselves had a significant effect on the business cycle. Positive shocks in banking crises led to an immediate fall in lending rate (consistently for five years) and banking system capital (% assets) contracted for two years. The bank liquid assets to deposits and short-term funding significantly contracted instantly, from year 2 to year 5.

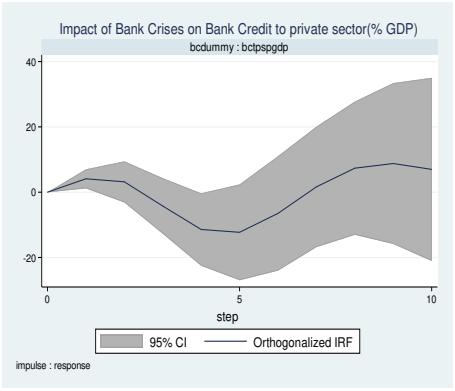
In comparison, credit to deposit had an instant expansion for four years, after which contraction set in during the fifth and sixth and positive after that. Banks' credit to the private sector jumped, witnessed a sudden stop and then increased by 4.1% and 3.18% in the first and second years, respectively. Positive shocks in the banks' credit to the private sector directly oscillated the business cycle throughout the forecast horizon. Leverage and the business cycle exhibit feedback. This supports the view of Hawtrey (2013) that business cycles are monetary phenomena. Prognosis of what caused banking crises shows that none of the stability variables nor the business cycle propelled banking crises (Figure 4.8), which signifies the effectiveness of the stability variables as macroprudential tools when deployed appropriately.

Figure 4.8: Response of business cycle and banks stability measures to banking crises

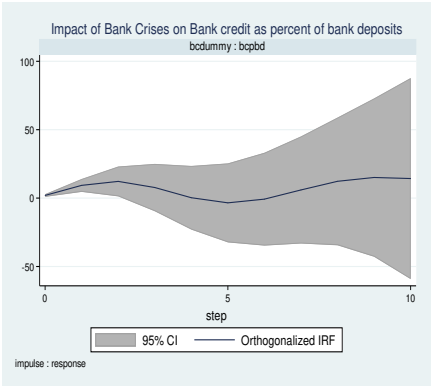
Response of the business cycle to shocks in banks' credit to the private sector



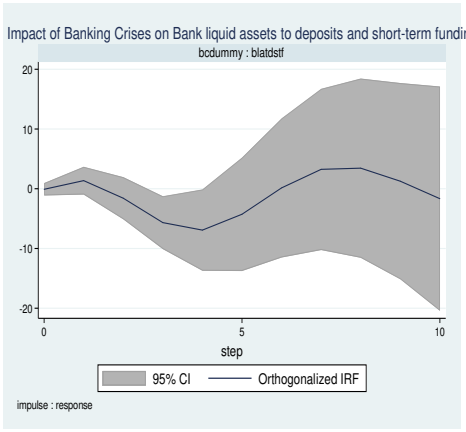
Response of banks' credit to the private sector to banks crises



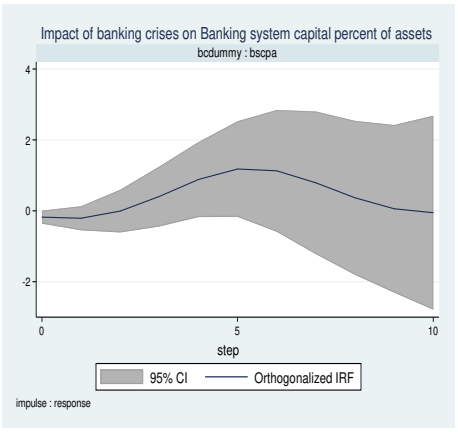
Response of banks' credit(% bank deposit) to banks crises



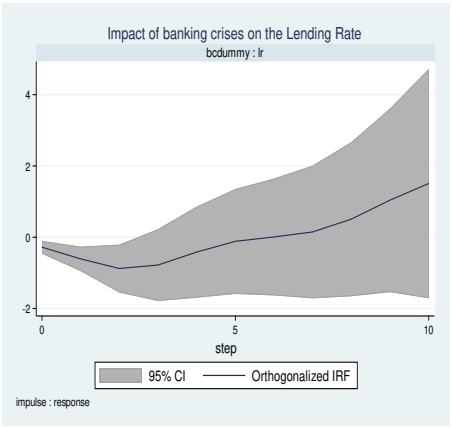
Response of Bank liquid assets to deposits and short-term funding to banks crises



Response of banking system capital percent of assets to banks crises



Response of interest rate to banking crises



Source: Author 2021

4.2.1.6 BANKING CRISES, BUSINESS CYCLE AND BANK SYSTEM DEPTH- MODEL 3B

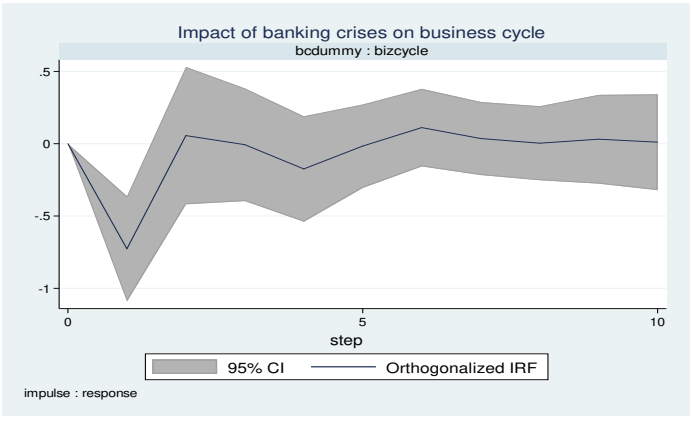
In this model (3B), The impact of banking crises on the business cycle was significant from its third-period lag to the first-period lag. It revealed an oscillating impact; the third lag of banking crises had a severe negative effect (-183.6% pts), the second lag had a positive impact (251.7% pts), while the first lag had a more severe negative impact (-340.5% pts). All the lags of leverage had no significant impact on the business cycle. The three lags of the financial system deposits (% GDP) had no significant impact on the business cycle; only its third lag impacted banking crises by 3.7%. Conversely, the business cycle's first lag propelled banking crises (35.9%), the second and third lags reduced banking crises by -22.8% and -21.4%, respectively. Model 3B satisfied the eigenvalue stability condition and, therefore, is stable.

To achieve a more robust bank depth, the effect of banking crises, the banks' credit to the government and the lending rate on the business cycle remained crucial. Positive shocks

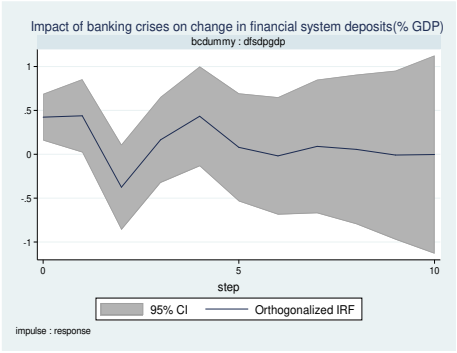
(Figure 4.9) in banking crises was instant stops on the business cycle, and the business cycle went on to have an immediate contraction on bank assets (% GDP). In the first year, banking crises caused contracted the business cycle (-72.7% pts), which was also destabilised after that. Calm only returned from the sixth year. The same shocks led to the contraction in the financial system deposit (% GDP) and liquid liabilities (% GDP) in the second year by -37.6% and -41.4%, respectively. Further diagnosis shows that this negative impact on the business cycle from banking crises is transmitted through the interest rate and the bank credit to government & public enterprises. Also, the negative effect of banking crises extends to financial system deposits and liquid liabilities. On the causes of banking crises under this model, positive shocks on leverage had an immediate reduction in banking crises till the fifth year. This shows that banking crises in this model resulted from liquidity contraction. Finally, the impact of banking crises reached the business cycle in a year; financial system deposits and liquid liabilities only feel the impact from the second year.

Figure 4.9: Impulse Response Functions: Banking crises, business cycle, and bank system depth

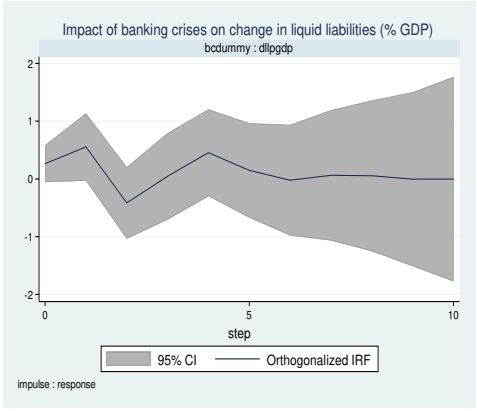
Response of business cycle to banking crises



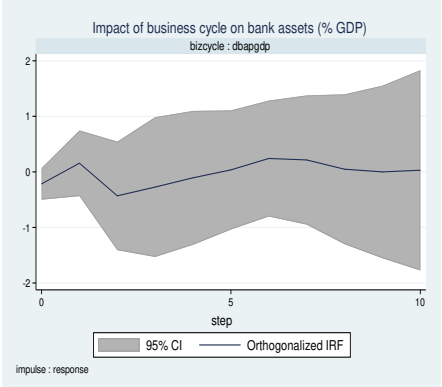
Response of change in deposit (% GDP) to banking crises



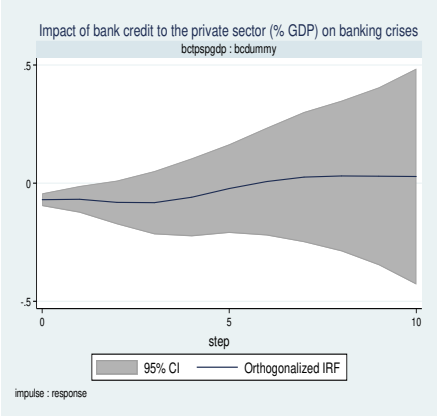
Response of change in liquid liabilities (% GDP) to banking crises



Response of change in banks assets (% GDP) shocks in the business cycle



Response of banking crises to banks' credit to the private sector



Source: Author 2021

4.2.1.7 BANKING CRISES, BUSINESS CYCLE AND BANK SYSTEM EFFICIENCY

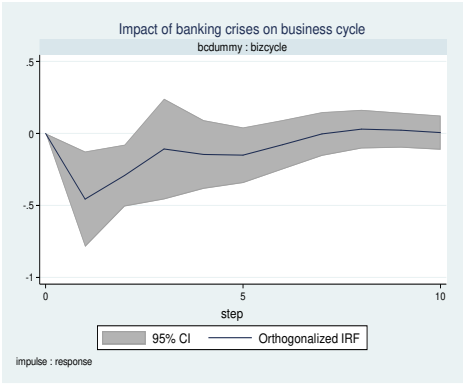
Despite controlling for banks efficiency, the effect of banking crises on the business cycle remains oscillating but recessionary in the first and second lag. The third lag of banking crises negatively affected the business cycle by -110.4 % pts, the second lag had 133% pts, and the first lag had -172% pts. Leverage had no significant impact on the business cycle (only significant at 10%). Banks returns, both on equity and asset, had an upturn impact on the business cycle at 3.2% pts and 7.8% pts, respectively. Conversely, the third and first lag of the business cycle, the second lag of bank return on equity and the second lag of the bank non-interest income to total income increase the chances of banking crises. All eigenvalues are less than one; therefore, the model remains stable regarding the eigenvalue stability condition.

From the granger causality and impulse response function (table 4.8.1 and Figure 4.10), positive shocks on bank crises contracted the business cycle and the banks' return on equity (%), lasting for seven years. While the immediate effect (year 0) was a stop for the business cycle, it was -1.52% for banks return on equity (%), acting as an early warning signal[22]. Positive shocks on the business cycle propagated instant banking crises and increased leverage. Leverage turned negative after the second year, while the instant rise in banks' return on equity returned to the negative region from the first year. The bank overhead costs (% total assets) became more unstable but experienced an immediate positive impact and returned negative in year one and from year four onward. The model revealed that business cycle and bank return on equity (%) instigated banking crises when controlled for bank efficiency. The business cycle and banking crises maintain a feedback mechanism. Likewise, the banks' credit to the private sector and the business cycle maintains a feedback mechanism. The impact of banking crises was first felt on the bank return on equity (%) a year before the business cycle was impacted negatively (Figure 4.10). This shows the efficacy of the stock market activities as partly responsible for the transmission of vulnerabilities from the banking system to the business cycle.

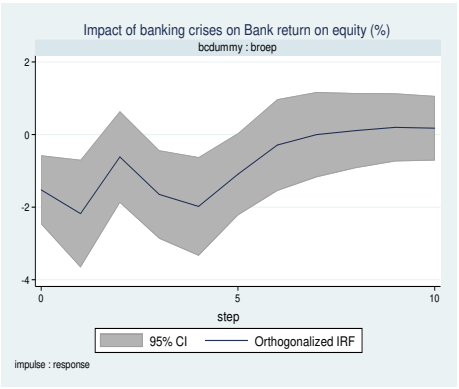
[22] Banking crises manifested instantly on the banks' return on equity almost a year before it manifested on the business cycle.

Figure 4.10: Response of business cycle and selected banks system efficiency variables to banking crises

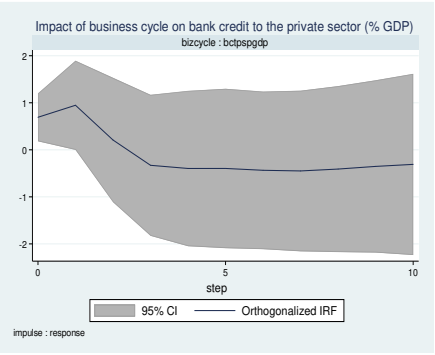
The impulse response of banking crises on the business cycle



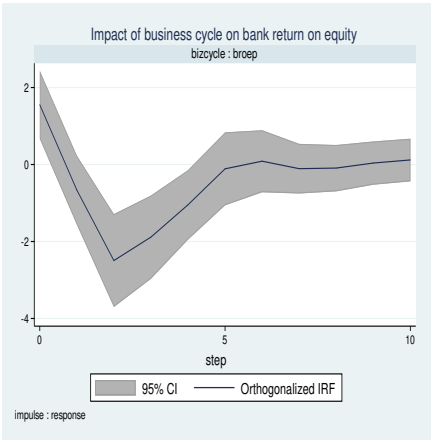
The impulse response of banking crises on bank return on equity (%)



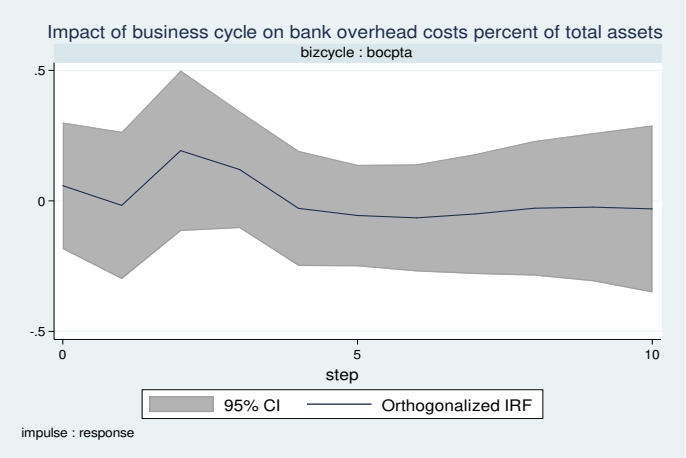
The impulse response of business cycle on banks' credit to the private sector(%GDP)



The impulse response of business cycle on bank returns on Equity



Impact of the business cycle on bank overhead costs (% total assets)



Source: Author 2021

4.2.2 PANEL LOGISTIC REGRESSION: THE PROBABILITY OF BANKING CRISES INDUCED BY THE AVERAGE CYCLICAL BEHAVIOUR OF THE BUSINESS CYCLE.

As previously stipulated, logistic regression was applied to increase precision, estimate the probabilities of banking crises and provide a clearer interpretation of the impact of the macro and financial variables (selected by granger causality) on the vulnerability of the banking system. The logistic regression model in table 4.2.2a revealed the odd ratio[23] of banking crises emanating from the selected factors and the average marginal effect (AME), which reveal the effect of a percentage change in each factor on the incidence of banking crises (which ranges from zero to one). Furthermore, to solve the problem of outliers, especially in periods of extreme macroeconomic shocks, the probability of

[23] The *odd* ratio of banking crises is the probability of it occurring over the probability of it not happening.

banking crises were observed at the minimum, mean and maximum value change (either in percentage change or level, depending on their state of stationarity as ascertained by the Im, Pesaran & Shin (2003) panel-data unit-root tests). This provides us with the region of vulnerability in the magnitude of change in the selected series. In addition, the random effect version of the odds ratio was included for comparison purposes. The minimum, mean and maximum changes in these variables used are shown in table 3.1.2a, table 3.1.2b, and table 3.1.2c. As a diagnostic test, the LR chi2(7), which is the probability of obtaining the chi-square statistic (74.03) given that the null hypothesis is zero (i.e., Ho: all the factors, taken together, does not ignite banking crises), is statistically significant at 1% level of significance. This signifies that the model is statistically significant, and the factors combined influence banking crises.

Overall, in consonance with a priori expectation, the average marginal effects revealed a significant positive relationship between the business cycle, interest rate, and bank crises, each with the incidence of banking crises, while investment, exportations, government spending and banks return on equity had a negative relationship, each with the crises dummy. The odds of banking crises from a percentage change in the business cycle and government spending remain insignificant. However, when examined by the mean and maximum changes (18.31 points) in the business cycle, this revealed that an extreme upward spike in the business cycle has about 69.6% chances of igniting banking crises, however weakly.

Specifically, the interest rate and the banks' private sector credit have the most increased odds of causing banking crises at 13.5% and 1.7% more for a 1% increase in each, all things equal. A percentage point rise in banks' private sector credit (% GDP) increase the odds of igniting banking crises by a factor of 1.7% more, i.e., hypothetically speaking, a credit-to-GDP of about 58.8% is likely to instigate banking crises, holding other variables constant. This falls within the range of the IMF recommended debt threshold of about 56 percent of GDP and that debt is beneficial for the economies if under 30 percent of GDP (Drakes, Thomas, Craigwell & Greenidge, 2012; Pescatori, Sandri & Simon, 2014[24]). Note that the average credit-to-GDP of the sample was about 63.9%, ranging from Kyrgyz

[24] when debt to gdp increases above the sample mean (56 percent), countries tend to experience a relatively higher volatility

Republic having 11.3% and Cyprus possessing about 197.7% of banks' private sector credit (as %GDP). Similarly, a 7.4% spike in lending rates tends to ignite banking crises with all other factors constant. For these factors, while their average marginal effects were smaller (1.9 and 0.25% for a percentage increase in each, respectively), they were still significant in their potency to starting banking crises. This was affirmed with the duos' probability of banking crises increasing with the mean and maximum positive change. The probabilities of banking crises are significantly 91.8% and 74.2%, given that the interest rate and the banks' credit (% GDP) are set at their sample averages, 19.1% and 63.2%, respectively, holding other factors constant.

Conversely, each additional percentage increase in investment, exports, government spending and banks return on equity is associated with about 3.8%, 6.8% and 3.1% decrease[25] in the odds of having banking crises, respectively, i.e., they become protective factors. However, the decline in these variables increases the chances of banking crises, as shown by the negative relation on the average marginal effect. More so, the significant possibility of banking crises induced by the minimum and mean percentage change in these factors (see table 4.2.2a) shows that their maximum increase possible is needed to stabilize the banking sector. For example, a percent fall in investment increase the probability of banking crises by 0.59%. The highest fall in investment in the sample (i.e., -91.62% collapse in investment) generated about 97.3% probability of banking crises. In the same manner, with a priori expectation that improved exports should reduce firms' chances of loans defaults and, by extension, strengthen the banking industry, a percentage increase in exports shrink the incidence of banking crises by 1.06%. Observing both extreme % change in exports in the sample, -120.4% fall in exports causes 99.9% chances of banking crises, which fades as exports grow. In the same vein, a percent reduction in government spending increases the incidence of banking crises by 0.48%, as seen in the average marginal effect results. An extreme collapse of -45.95 in government spending generated an 81.2% probability of banking crises, which also fades as government spending grows. In like manner, a percent fall in banks' returns on equity (BROEP) significantly increases the incidence of banking crises by 1.14%, with an extreme collapse of about -112.2% generating 99.9% chances of banking crises, and fades with increasing banks' returns on equity. In sum, the result revealed that an increase in

[25] Change in Odds %: (OR-1) * 100.

the interest rate and banks' credit (%GDP) tend to generate banking crises, all things equal.

The study examined the chances of banking crises at the minimum, mean, and maximum value change factors. It was discovered that the business cycle indeed could ignite banking crises, albeit weakly, at its mean (by 50% chance) and significantly weak at its maximum value (by 69.6% chance). This suggested that as an aggregate, the business cycle itself is not potent enough to provoke banking crises without the aid of a stimulant. Across all the economies, interest rates and banks' credit increase the chances of banking crises along their upper spectrum, with higher probabilities as we approach their maximum value (from min to max), as seen in table 4.2.2a. Conversely, investment, exportation, government spending and banks return on equity generates the probability of banking crises of 97.3%, 99.9%, 81.3% and 99.9%, respectively, at their extreme decline in percentage change terms and weakly at their mean value.

Table 4.2.2a: Panel Logistic Regression: the probability of banking crises

.	**Odds Ratio with fixed effect**	***Odds Ratio With random Effect***	**Average Marginal Effects , FE**	**@Minimum prob(bc =1 | other predictors constant), FE**	**@Mean prob(bc =1 | other predictors constant), FE**	**@Maximum prob(bc =1 | other predictors constant), FE**
Business cycle	1.047 (0.103)	*1.023* *(0.0956)*	0.0068 (0.015)	0.2628 (0.4317)	0.5*** (2.74e-11)	0.696* (0.379)
Interest rate(%)	1.135*** (0.0367)	*1.111 **** *(0.0226)*	0.0189*** (0.0039)	0.5158*** (0.00404)	0.9179*** (0.0467)	1.0*** (0.00021)
Banks' private sector credit (% GDP)	1.017** (0.0077)	*1.023**** *(0.0058)*	0.0025*** (0.00082)	0.5008*** (0.00036)	0.7423*** (0.0919)	0.994*** (0.0132)
Investment (% Change)	0.962 ** (0.0146)	*0.964**** *(0.0118)*	-0.0059** (0.0024)	0.9733*** (0.036)	0.4715*** (0.01099)	0.000131 (0.000452)
Exports (% Change)	0.932** (0.027)	*0.943*** *(0.025)*	-0.0106** (0.0045)	0.9998*** (0.000729)	0.4124*** (0.0354)	0.0237 (0.0355)
Govt. Spending (% Change)	0.969 (0.047)	*0.962* *(0.036)*	-0.0048 (0.0072)	0.8128** (0.337)	0.4825*** (0.02643)	0.2292 (0.3235)
Banks Return on Equity(%)	0.927*** (0.0165)	*0.926**** *(0.0159)*	-0.0114*** (0.0027)	0.9998*** (0.000387)	0.2716*** (0.0456)	0.00013 (.000271)
_Con	-	0.0097*** (0.0073)	-	-	-	-
LR chi2(7) Log likelihood	74.03*** -54.974	41.28***				

Standard errors are reported in parentheses. AME: Average marginal effects. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively. Interest rate (proxied by lending rate), FE: fixed effect, prob(bc =1 | other predictors constant) signifies the probability of banking crises resulting from a factor, holding others constant.

While this is informative, the story would be incomplete, assuming that every segment of the business cycle generates the same behaviour. For example, do the interest rate and the banks' credit create banking crises in every segment of the business cycle? Are the defending factors potent on all the phases of the business cycle? Given these factors, what

part of the business cycle is more vulnerable to banking crises? To distil the difference in the reactions of the factors on the incidence of banking crises across the different phases of the business cycle, the probability of banking crises resulting from each of the factors is estimated by phases; namely, recovery, expansions, peak, recession, depression, and trough phases.

4.2.2.1 THE PROBABILITY OF SYSTEMIC BANKING CRISES ACROSS THE DIFFERENT BUSINESS CYCLE PHASES

As a further exploration, precise probabilities of systemic banking crises arising from the business cycle and other ignitors highlighted in the causality tables were estimated. For detailed findings, these probabilities and the transmission mechanisms were compared across the different phases of the business cycle. This comparison furnishes us with the phase mostly embedded with financial fragility in this sample. Firstly, the fixed effect is technically unsuitable when each phase is observed individually across countries (since the grouping is changed from the panel of countries to phases of the business cycle), as such, the generalized estimating equation (GEE) population-averaged model with the robust variance-covariance matrix of the estimators is applied for the individual phases' exploration. This allows the estimation of the average response over each phase sub-population ("population-averaged" effects). Then, the odd ratio and the average marginal effect for each of the phases given each factor were extracted and presented in table 4.2.2b, while the effect from the mean and extreme value of factors is presented in table 4.2.2c, holding other factors constant. Focus is placed on factors significant at up to 1% and 5% and 10% on extreme cases.

First, we found banking crises (i.e., holding all the factors constant) to be naturally[26] significant on the recovery, depression, and trough phases and weakly significant on the expansion phase (see the intercept on the odds ratio in Table 4.2.2b). This shows that banking crises are not only associated with downturns (Bartoletto et al. 2018); the recovery and expansion phase of the upturns also generated banking crises. We also explore the chances of banking crises from the factors within each phase. In terms of direction, the business cycle, interest rate and banks' credit to the private sector maintain their positive relationship with the incidence of banking crises. As shown in table 4.2.2a,

[26] Holding all the factors constant

on average, we would have concluded that the business cycle as a whole had no significant impact on the chances of banking crises.

Nevertheless, we found significant impacts during the extreme swing of the business cycle. These effects are recorded during the recovery, extreme peak, cascading down into the recession phase, and extreme part of the trough phases. Also, the odds ratio (0.2814) revealed that a rising business cycle is a panacea for the banking system during the trough phase, albeit weakly significant at the 10% level. The probabilities of banking crises were highest and significant on the lowest ebbs of the recovery phase (100.0%), at the maximum point of the peak phase (97.9%), at the mean (85.6%) and maximum (99.8%) segment of the recession phase as well as the lowest ebbs of the trough phase(100.0%). *This suggests that the business cycle naturally tends to induce banking crises in extreme regions - the topmost part of the peak phase, the lowest region of the trough phase and the strain attached to recovery***.**

An additional increase in interest rate significantly increases the odds of banking crises in the depression phase by 12.7%. This was confirmed by1.15% increase in the average marginal effect on the depression phase. When other factors are held constant, an interest rate of 1% is associated with a 76.2% probability of banking crises in the recession phase. This revealed that the banking industry was very sensitive to interest rates during the recession. More so, the extreme value of the interest rate, such as 213.0% on the upper part of the depression phase and 250.3% on the upper part of the trough phases, created banking crises. This confirmed that the downward-sloping of the business cycle (i.e., the recession and depression phases) and the trough phase generate banking crises with increased interest rates since failing economies cannot yield surplus returns. This result clarifies Buch et al. (2011) assertion that falling interest rates induce investment to shift into risky activities, creating financial instability. Our result shows that this depends on the phase of the business cycle.

The probability of banking crises by phases from banks' credit revealed that credit did not impact every segment of the business cycle. An additional increase in banks' credit is significantly associated with an increase in the average marginal effect on the recovery phase, depression phase and trough phase by 0.17%, 0.26% and 0.13%, increasing the odds ratio of banking crises by 4.3%, 2.8% and 3.5% over the non-

occurrence respectively. Holding other factors constant, excess leverage[27] of about 308.9% and 252.8% on the recovery and depression phases significantly caused banking crises (by probabilities of 99.5% and 87.0%, respectively). More so, maximum leverage of about 249.8% within the peak phases is associated with a 90.7% probability of banking crises extending into the recession phase. This confirms the assertion of Austrian or Hayek business cycle theory that banking crises emanate from boom and bust outcomes, although there are also other mechanisms at play.

Overall, investment, government spending and banks return on equity maintained their negative relationship with the incidence of banking crises. More specifically, a per cent decline in investment had an average marginal effect of 2.1% and 0.85% increment in banking crises within the peak and the trough phases, as seen in table 4.2.2b. The two phases also had 96.0% and 99.0% probability of banking crises associated with 21.3% and 62.5% decline in investment, which are the maximum fall in investment recorded during the phases. In the recessionary phases, aside from the 91.6% investment decline associated with 94.7% probability of banking crises, inadequate increment in investment by about 0.10%, yet generated 79.1% in the probability of banking crises. This shows that the maximum investment feasible is needed to stabilize the banking industry during the peak and the trough phases in consonance with other mechanisms. The maximum growth in investment across all the phases never instigates banking crises. The minimum investment threshold to stabilize the banking system varies across the phases.

A percentage decline in exports significantly increases the average marginal effect on the incidence of banking crises by 0.63% and 0.72% on the recessionary and trough phases. However, during the sudden massive collapse in export, the probabilities of banking crises are highest on the expansion and the recession phases.

The odd ratio of the incidence of banking crises from government spending shows that increased govt spending is significantly defensive within the recovery and expansion phases. Increased government spending during recovery or expansion prevents banking crises, allowing the economy to reach the next growth phase without liquidity contraction. At the extreme segment of the business cycle, a 24.1% decline in government spending was associated with a 99.2% probability of banking crises during the peak

[27] Banks' credit to the private sector (%GDP)

phase. During the recessionary, a 27.8% fall in government spending was associated with a 95.4% probability of banking crises. In fact, 2.1% increased government spending was inadequate to eliminate banking crises, which has a probability of about 7.7% in the same phase.

While the result in table 4.2.2a shows that percentage fall in banks' returns on equity significantly increases the incidence of banking crises by 1.14%, findings from the business cycle phases breakdown confirmed that this result is not the same across all phases of the business cycle. A percentage decline in banks return on equity only significantly increases the incidence of banking crises during the recession and depression phases and weakly on the recovery phase by 1.2%, 1.1% and 0.25%, respectively. During extreme periods, cut in the returns on equity by 38.3%, 101.5% and 112.2% in times recession, depression, and trough phase respectively, created about 99.9%, 99.7% and 99.9% probability of banking crises. In agreement with table 1.2.1, the Average Marginal Effect as shown in table 4.2.2b confirms that the depression phase remains the most vulnerable to banking crises, with the highest number of banking crises among the phases, then the recession phase being next vulnerable. While the phase with the highest numbers of factors that caused banking crises remained the depression and trough phase and the recession phase during extreme periods. Naturally, the recovery, depression and trough phases are strongly susceptible to banking crises, while the expansion phase is weakly susceptible. In addition, the chances of banking crises from each factor differ, depending on the phase of the business cycle.

4.2.3 THE RELATIONSHIP BETWEEN BANKING CRISES, THE OUTPUT GAP, THE INDUSTRIAL PRODUCTION GAP, AND THE CREDIT-TO-GDP GAP IN THE ECONOMY.

4.2.3.1 OUTPUT GAP- THE EXTENT OF DEVIATIONS OF OUTPUT FROM THE LONG-TERM ECONOMIC GROWTH TREND CAUSED BY BANKING CRISES.

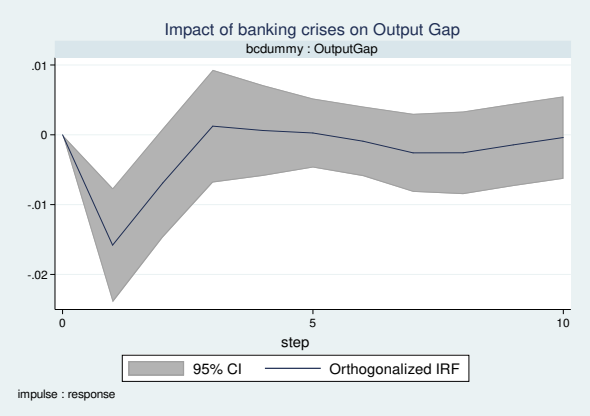
Output gap signifies the difference between the economy's actual output and the maximum potential output as the percentage of GDP. This model was introduced to observe the extent of the gap generated by banking crises and factors largely significant in igniting banking crises across the models[28]. According to the model, banking crises created a significant negative output gap (-0.067%) in the first year, destabilized investment (-0.126%) and reinforced future banking crises (0.61%). More so, the model shows that a negative gap is deleterious for all variables in the first year, aside from credit availability, which was negatively impacted after two years of banking crises and with a severe impact on government spending. The model satisfied the eigenvalue stability condition and is therefore stable. The granger causality shows that banking crises, credit, export, and investment had a causal impact on the output gap, with feedback mechanisms from export and investments.

Likewise, based on the estimated model, the impulse response function (IRF) confidence intervals were computed using 200 Monte Carlo draws for variables with significant causality. As shown in figure 4.11, the impulse response function revealed that banking crises led to a severe negative output gap (-0.016%) in the first year, after an instant stop from a one standard deviation positive shocks in banking crises. This reveals the speed at which banking crises impact output, suggesting early warning signals. A positive credit shock propels a short positive output gap, lasting about three years, while exports caused a positive but unstable output gap before dying out in the 6th year. As expected, investment did not instantly impact the output gap positively; this took a waiting period of about two years, during which the output gap was depressed. From the third year, the response of output gaps to the investment shocks became positive until the 6th year. Bank credit, investment and exports appear ameliorating to the output gap.

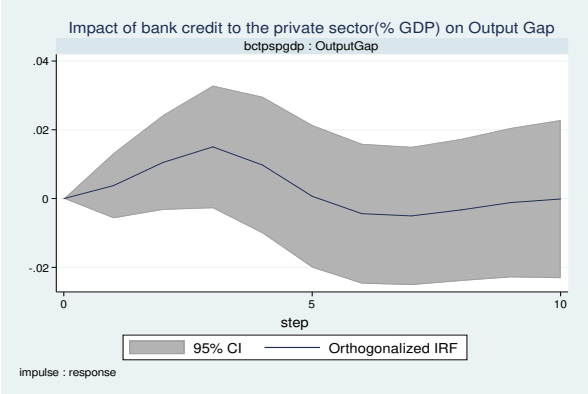
[28] Interest rate, banks' credit to the private sector (% GDP), Investment, exports, government spending and bank return on equity.

Figure 4.11: Response of output gap to banking crises and selected factors

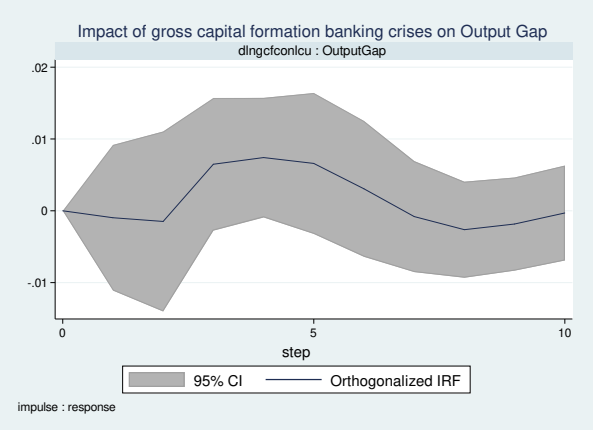
The impulse response of banks' credit to the private sector (% GDP) on Output Gap



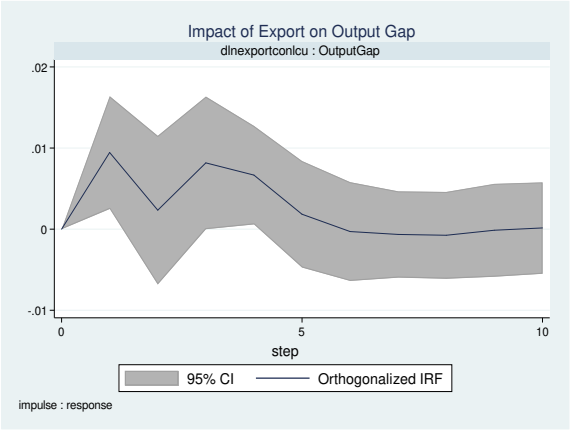
The impulse response of banks' credit to the private sector (% GDP) on Output Gap



The impulse response of Investment on Output Gap



The impulse response of export on Output Gap



The $OutputGap_{it} = \frac{bizcyc_{i,t}}{\mathbf{LNY}_{it}} \times 100$, signifies the output gap, Banking Crises(bcdummy), the first difference of the natural logarithm of the gross capital formation- (dlngcf), the first difference of the natural logarithm of export (dlnexport), Banks' credit to the private sector, % of GDP (bctpspgdp).

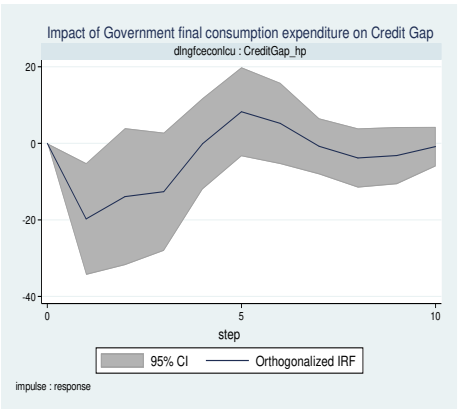
4.2.3.2 CREDIT GAP- THE EXTENT OF DEVIATIONS OF CREDIT-TO-GDP RATIO FROM ITS TREND CAUSED BY BANKING CRISES

The gap between the credit-to-GDP ratio and its long-term trend is a standard metric in the macroprudential and regulatory industry, featuring in the third version of the global, voluntary regulatory framework on bank capital adequacy, stress testing, and market liquidity risk designed by the Basel Committee on Bank Supervision (Drehmann and Tsatsaronis, 2014). As revealed by this model (Table 4.9B), banking crises created a negative credit gap (-57.96) in the third year of the crisis, while 1% change in investment generated about 210.5% in credit gap in the first year but turned significantly negative (-81.1%) in the third year. In addition, a 1% change in government spending generated a negative and severe credit gap throughout banking crises among the examined variables.

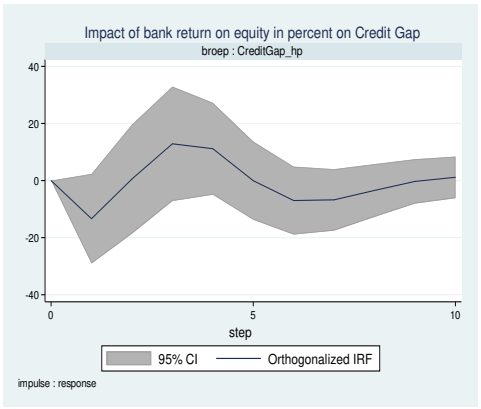
All eigenvalues were less than unity; therefore, the model satisfied the eigenvalue stability condition and is stable (table 4.9, panel B). The granger causality result shows variables that had a causal effect on the credit gap as investment, government spending, and banks return on equity, which generated feedback mechanism. With this information, the impulse response functions were generated and concluded that; at the signal of banking crises, it is recommended that the banks return on equity and the government borrowings from the industry be suspended. Bank returns on equity and government spending generate a negative credit gap in the first year of the crises (-13.4% and -19.8%, respectively), contracting liquidity in the industry. Banking crises did not significantly impact credit availability until after the third year; the negative impact on the credit gap comes from the returns on equity and government spending. This is the case of the crowding-out of investors and the extraction of banks' earnings needed for recovery. In such a situation of diminishing credit, investment suffers, and the feedback of investment on credit, which manifested from the third year to the 6th year of the crisis, became severe, prolonging the negative credit gaps. The model also shows that fall in interest rates and increase in banks' returns on equity as the causal culprits and factors that prolong banking crises.

Figure 4.12: Response of credit gap to banking crises and selected factors

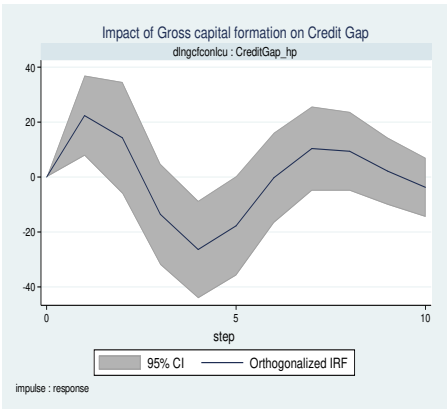
The impulse response of government spending on Credit Gap



The impulse response of bank return on equity (%) on Credit gap



The impulse response of gross capital formation on Credit Gap



Source: Author 2021

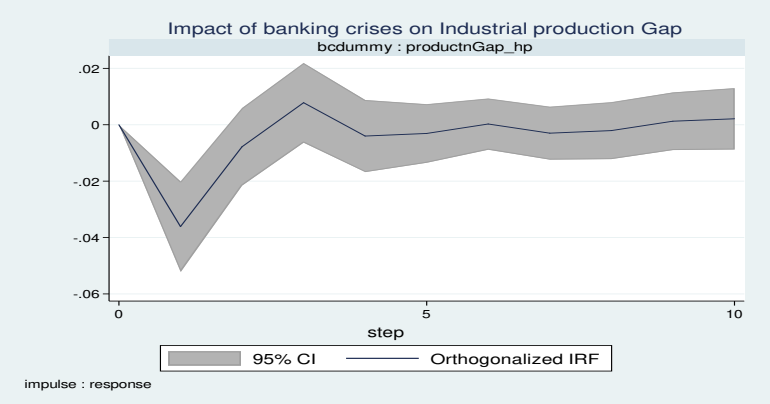
4.2.3.3 INDUSTRY PRODUCTION GAP: THE EXTENT OF DEVIATIONS OF INDUSTRY PRODUCTION FROM ITS TREND CAUSED BY BANKING CRISES

The study observed the effect of banking crises on the gap between industrial production *and its long-term trend (*Table 4.9C). *The result showed a negative production gap (*-0.134 %) *emanating from banking crises in the first year. Factors significant in instigating banking crises such as interest rate (*-0.002 %) *and export (*-0.395%) *also result in a negative production gap in the third and first-year respectively, but investment created a positive production gap (*0.19 %) *in the third of banking crises. The model also revealed that a positive* industrial production *gap increases the chances of banking crises, further pointing to overproduction. All eigenvalues were less than unity; therefore, t*he model satisfies the stability requirements of the eigenvalue stability condition (panel 3, Table 4.9). The granger causality shows that banks crises, bank credit, interest rate, investment, and exports have a causal impact on the industrial production gap, especially during crises. Thus, the impact of positive shocks in these macro and financial indicators were assessed. For example, a positive shock in banking crises indicator from tranquillity to crises generated a negative production gap of -0.036%. In the same vein, positive shocks in **interest rate** met the a priori expectation by depressing the industrial production gap for about five years, although it created volatility during the same period. Similarly, positive shocks in exports created a negative industrial production gap in the second year, after a slightly positive gap in the first year.

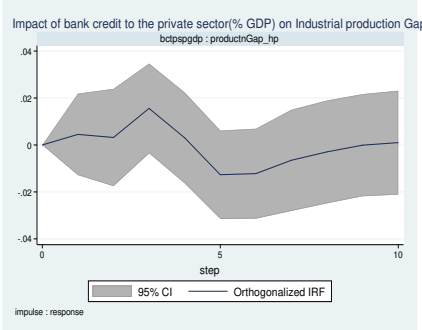
Conversely, positive shocks in **banks' private sector credit** deliver a transitory positive industrial production gap after two years of waiting periods. The shortfall of credit negatively impacted the production gap starting from the fourth but severely from the fifth and sixth years, coinciding with the loss incurred from backlogs of failed investment on credit availability in model 5B. The same shocks in **investment** met the a priori expectation by yielding a momentary positive industrial production gap after two year waiting periods. After that, the shortfall in banks' private sector credit from the backlogs of failed investments set in, starting from the fifth year.

Figure 4.13: Response of Industrial Production Gap to banking crises and selected factors

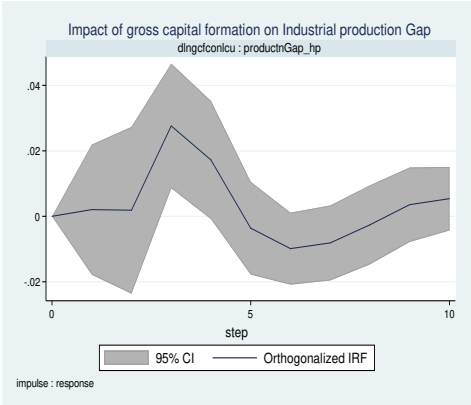
The impulse response of Industrial Production Gap to banking crises



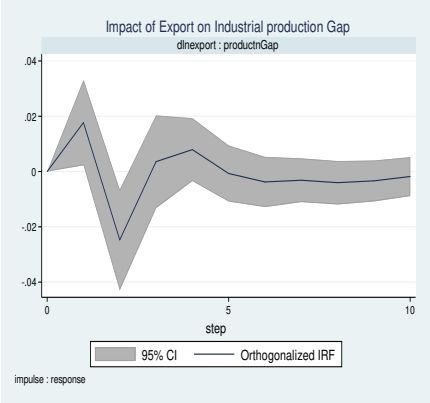
The impulse response of Industrial Production Gap to credit



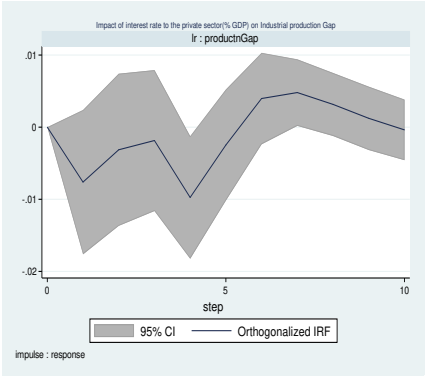
The impulse response of Industrial Production Gap to shocks in gross capital formation



The impulse response of Industrial Production Gap to shocks in export



The impulse response of Industrial Production Gap to shocks in interest rate



5.0 SUMMARY OF FINDINGS

In line with the study's objectives, the relationship between banking crises and the behaviour of the business cycle was explored. Furthermore, its implication for the macroeconomy and the banking system in Europe and central Asia economies from 1971 to 2018 was highlighted. The results are presented below.

5.1 SUMMARY OF DESCRIPTIVES

Descriptively, the correlation matrix points to banking crises as outcomes of extreme ends of excessive liquidity or scarcity of liquidity, which was amplified by the business cycle. Segmenting the cyclical behavioural pattern into periods with banking crises and without, the boom-and-bust scenario was observed in addition to banking crises that result from a strain banking system. During banking crises, the business cycle became more volatile, while its amplitude and the slopes became steeper. Nations were dragged from peak to trough, and none moved from trough to peak., suggesting that sustained economic growth is uncertain during systemic banking disruptions. The trajectory of the output, Industrial production, and credit gap was observed before, during and after banking crises. The finding shows that banking crises generate gaps loss and credit-to-GDP herald banking crises. As credit-to-GDP cycle leads the real economic activities in the build-up phase to banking crises, but from the start of the crises. The credit and business cycles were led by the industrial production cycle. Liquidity contracted during banking crises on the expansion and peak phases compared to non-crisis periods. In contrast, the recession saw excessive credit during banking crises against non-crises periods. Averagely, the positive synchronization of private sector credit with the real output cycle and the industrial production cycle was weakened during systemic banking crises compared to the period of calmness. In contrast, the industrial production cycle and the real output cycle synchronization is strengthened more during banking crises.

5.2 BANKING CRISES, CYCLICAL BEHAVIOUR OF THE BUSINESS CYCLE AND THE IMPLICATION FOR MACROECONOMIC INDICATORS.

Empirically, the research questions were provided answers from the outcome of the analysis. The basic model shows that banking crises reinforce and contract the business cycle for about two years. However, this effect eased by the fourth year, while the business cycle increased the chances of banking crises in the first three years before dying out. Due to the insignificant and absence of causality from leverage, the model was expanded, controlling for broad money supply (to the total reserve ratio) and interest

rate. Then, leverage had an expansionary effect on the business cycle throughout the forecast horizon. At the same time, the contraction effects of banking crises on the business cycle, as seen in the basic model, disappeared, and the business cycle also had no significant impact on banking crises either. In line with the view of Jorda, Schularick, Taylor (2011) and Hayek business cycle theory, leverage increases the broad money supply (to reserve ratio) for about three years. Still, the lending rate as a monetary tool had a reduction impact on the broad money supply (to total reserve ratio) and stabilized the banking system for about four years. This proves that interest rates can be a correcting tool if rightly applied when the banking crisis emanates from the monetary phenomenon.

To further explore the relationship between banking crises and segments of the real sector, the GDP expenditure and the sectorial components and other fiscal and monetary factors were controlled. Within the model, positive shocks in interest rates led to a fall in government spending and investment. This impacted the business cycle through the contraction effect on broad money supply, leverage and imports. These, in addition to the business cycle contraction, caused banking crises. Then banking crises contracted the business cycle and the importations of goods and services strongly for a year. Confirming the position of Keynes that rising interest rates hurt investment, this model makes a case for the indirect impact of rising interest rates on the banking system's health. More so, on a side note, the model confirmed that stimulating the business cycle only had about three to five years expansionary impacts on consumption, investment, government spending, imports, and exports. In contrast, all the factors but government spending and lending rate, granger causes the business cycle.

The harmful effect of banking crises was further confirmed from the sectoral view of real economic activities. Banking crises had a significant recessionary causal impact on the business cycle for about four years; the first three years were most severe. Moreover, the negative effect of the banking crisis was also felt on the manufacturing output, which fades after two years and the service sector output, which lasted for three years. Still, none of these variables propagated banking crises. Instead, this impact of banking crises on the business cycle was partly transmitted through the service sector, agricultural sector, interest rate and leverage, while the business cycle and the service sector possess feedback mechanisms. In addition, a rising business cycle had an immediate and

transitory (about two years) expansionary impact on the manufacturing and services sector. This means that as the business cycle worsens from the impact of banking crises, its vulnerability is transmitted to the service and the manufacturing sector, as confirmed by the granger causality test.

Furthermore, to observe the interplay between banking crises and the business cycle while controlling for banks' system stability, depth, and efficiency. When banks' system stability measures were included, banking crises subside. The banking system stability variables prevented the direct transmissibility of stress between banking crises and the business cycle. Banking crises did not cause the business cycle; rather, banking crises destabilized and had casual impacts on banks stability measures. There were five years-long declines in lending rate, two years contraction in banking system capital (% assets), and the bank liquid assets to deposits and short-term funding significantly contracted instantly, and then from year two to year five. Four years expansion in credit to deposit was seen, contraction in fifth and sixth years and positive after that. Sudden stop in banks' credit to the private sector and two years increase. Conversely, none of the factors or control variables causes banking crises, showing that banks stability measures are sufficient in containing banking crises, but the series of negative impacts on the stability measures remain significant.

After controlling banks system depth, bank crises created a contraction impact on the business cycle in the first year. This impact caused a contraction in the financial system deposit and liquid liabilities in the second year. More so, it takes about a year for the ravaging effect of banking crises to negatively impact the banking system resources. The model also revealed that the effect of banking crises on the change in banks assets (% GDP) is usually transmitted through the business cycle. The efficiency of the banking system did not deter an immediate negative impact of the banking crisis on the bank return on equity (%) for a year before it engulfed the business cycle negatively while maintaining negative effects on banks' return on equity for about seven years. This highlights the importance of the banks' return to equity as an early warning signal and emphasizes the role of the stock market in the transmission of vulnerabilities from the banking system to the business cycle. The recessionary effect of banking crises on the business cycle extends to the banks' private sector credit. There was a sharp fall and severe dip in the second year in bank returns on equity, lasting about four years. Banks'

overhead costs (% total assets) remained high for about three years. Business cycle and bank return on equity (%) were unearthed as the instigator of banking crises when the efficiency of the banking system was controlled. The business cycle maintains a feedback mechanism with banking crises, as well as with credit**.**

5.3 PROBABILITY OF BANKING CRISES GENERATED FROM THE CYCLICAL BEHAVIOUR OF THE BUSINESS CYCLE AND EACH OF THE DIFFERENT PHASES

The business cycle phase-by-phase analysis revealed the natural existence of banking crises on the recovery, depression, trough phases and weakly on the expansion phase. Regarding impacts from factors, the probability of banking crises shows that percentage increase in the interest rate and the banks' credit to the private sector (% GDP) significantly increase banking crises by 1.9% and 0.3%, respectively. On the other hand, the percentage decline in investment, exportations, government spending, and banks return on equity significantly increased banking crises by 0.6%, 1.1%, 0.5%, and 1.14%, respectively. While a percentage change in the business cycle had no significant impact on the incidence of banking crises, we found 50% chances of banking at the mean value of the business cycle.

Are these factors' impacts on banking crises the same across the business cycle? What phase is most vulnerable? The probabilities of banking crises from these factors were further examined using phase by phase analysis of the business cycle. The finding shield more light that *the business cycle induced banking crises in its extreme regions – i.e., the topmost part of the peak phase, the lowest ebbs of the trough phase, in addition to the recovery phase.* The role of interest rate in banking crises is seen in the economy's inability to pay back a higher rate of returns during the recession, depression, and trough phase of the business cycle. More sensitive of these is the recessionary periods. In addition, the significant effect of banks' private sector credit in stimulating banking crises is seen within the recovery, depression, and trough phase.

In contrast, excessive credit ignited crises of banks from the peak phase into the recession phase in line with Hayek's business cycle theory. Increasing investments, government spending, and banks return on equity are buffers to prevent banking crises, but their impacts differ across the business cycle phases. The significant impact of the decline in investments on banking crises is generated during the business cycle's peak and trough

phase. The finding also revealed the significant effect of dwindling exports on banking crises within the recessionary and trough phases and in the expansion phase during extreme export falls. As these phases are already straining on the banking system, the decline in exports further contract the liquidity and economic growth the banks need to survive, causing banking crises. In the same vein, the decline in government spending causes banking crises within the recovery and expansion phase, while banking crises seen on the peak phase are during extreme cases of slashed government spending. In like manner, the significant decline in banks return on equity (BROEP) caused banking crises, as confirmed by Baron et al. (2018), but not across all the business cycle phases. The vulnerable phases to banking crises from these factors remain the depression, recession, and trough phase, in addition to the recovery phase, which is weakly significant. This result remains in consonance with the a priori expectation; cut or decline in banks returns on equity during challenging times further aggravate the outflow of liquidity from the banks, as investors punish the industry by shifting resources into other sectors they believed would "wade the storm".

5.4 THE IMPACT OF BANKING CRISES ON THE OUTPUT GAP, INDUSTRIAL PRODUCTION GAP, AND CREDIT-TO-GDP GAPS.

Overall, banking crises created negative output gaps, industrial production gaps and credit-to-GDP gaps. Banking crises created a significant negative output gap of about -0.067% in the first year, which negatively affected investment and reinforced future banking crises, as confirmed by Svirydzenka (2021). This negative output gap was harmful to all macrofinancial variables in the first year, aside from credit availability, which was negatively impacted after two years and severely impacted government spending. The output gap was further amplified by banking crises, credit, exports, and investment with feedback mechanisms from export and investments. In addition, it took about three years for banking crises to create a negative credit gap of about -57.9%; this impact was transmitted via the sensitive impact of banking crises on investment. This investment negatively affects the credit-to-GDP gap by about -81.1% in the same third year. According to the granger causality result, the credit gap was further amplified by investment, government spending, and banks return on equity, which generated a feedback mechanism.

More so, it was discovered that banks' return on equity and government spending tends to create a negative credit gap in the first year of the crises, by -13.0% and -19.8%, respectively, contracting liquidity in the banking industry. This contraction of liquidity, as highlighted by Gambacorta and Mistrulli (2004) and Peek & Rosengren (1995), are usually moved by poorly capitalized banks which are usually forced to cut their loan supply during a recession. This suggests the need for the suspension of banks return on equity and government borrowings from the banking industry at the sight of banking crises to prevent the crowding-out of investors and the extraction of banks' earnings needed for recovery. The model shows that lasting diminishing credit impact investment and prolong a severe negative credit gap. *Banking crises created a negative industrial production gap of about -0.13% in the same vein*. In addition to banking crises, factors that create industrial production gaps were bank credit, interest rate, investment, and exports, especially during crises. *The negative industrial production gap leads to* investment and credits contraction from the fifth year. *The model also confirmed that positive* industrial production *gaps tend to increase the chances of banking crises, pointing to overproduction as identified by* Seismundian (Arena, 2013).

5.5 CONCLUSION & POLICY IMPLICATIONS

This paper finds that banking crises were instigated at different points by the extreme region of the business cycle; topmost peak and deepest trough. More so, banking crises was also caused by the following factors; rising interest rates, increased leverage (banks' credit to the private sector, % GDP), the decline in investment, contraction in government spending, collapse in exports, declined banks' return on equity and positive industrial production gaps. Among these, increased interest rate, the decline in exportation and extreme cut in banks returns on equity has the highest chances of causing banking crises. On the other hand, the impact of banking crises on the business cycle are more severe on the trough (-318.5%), depression(about -114.35 to -174.2%) and recovery (-59.7% to -110.1%) phases.

This study identified three categories of banking crises, those induced by economic expansion intense liquidity demand pressure, as an adequate but optimal amount of liquidity is needed for economic growth (Berger, 2017). The second category of banking crises are caused by excessive leverage(boom and bust), supporting the view of the Austrian (Hayek) Business Cycle Theory (Tempelman, 2010; Boudreaux & Klaus, 2014).

More so, these crises coincide with the submission of Gertler, Kiyotaki & Prestipino (2020) and Boissay, Collard & Smets (2013), who concluded that banking crises are outcomes of credit intensive booms. The last categories of banking crises are those caused by economic downturns. A wide range of loan defaults during economic downturns and the attendant banks' liquidity contraction can explain this category of banking crises. This is evidenced by the bank profits, loans, and even capital buffers procyclicality (Albertazzi & Gambacorta, 2006; Montagnoli et al., 2021).

In addition, checking through the interplay between banking crises and business cycles via different economic structures and the implications on macroeconomic indicators, banking crises had contraction effects on the business cycle with feedback mechanisms. The other findings are; the impact of banking crises permeates the business cycle rapidly via liquidity dryness. It hurts investments, government spending, manufacturing, and the service sector. The positive relationship between bank liquidity creation and real economic output was also affirmed by Berger(2017), although the optimality of the liquidity remains crucial. Banking crises and the business cycle have feedbacks mechanisms; their impact on each lasted about four years, with the third-year worsening. Banks' stability and broad money measures contained the negative effect and feedback mechanism between banking crises and the business cycle. Banks stability measures stood as buffers between banking crises and their negative impact on the business cycle, but not without significant disruptions of the banking system for 2 to 5 years. Banks system depth and efficiency did not prevent the banking crisis nor ameliorate its negative impact on the business cycle. As banks' credit to the private sector (% GDP) expands the money supply, the chance of banking crises is increased but stabilized via the impact of interest on the broad money supply. Also, the contraction of government spending and investment created banking crises. This hurts the business cycle and the importations of goods and services strongly for about a year. Other impacts of banking crises documented are; contraction in deposits, banks' assets (% GDP), banks equity, and liquid liabilities, and the increase in bank overhead costs (% total assets).

The phase-by-phase analysis revealed that banking crises are naturally inbuilt events in the business cycle's depression, recovery, trough phases and weakly on the expansion phases too (in that order), while the effect of the selected factors on banking crises is not the same across the phases. This confirmed Bartoletto et al. (2019) findings that banking

crises are not only associated with economic downturns. The recovery and expansions phases also generate banking crises naturally due to their liquidity pressure on the banking system. The business cycle created banking crises in extreme regions: the topmost part of the peak phase, the lowest region of the trough phase, and the recovery phase. On the recovery phase of the business cycle, declined government spending, excessive leverage (banks' credit to the private sector, % GDP) caused banking crises, and the decline in banks return on equity ignited crises weakly. On the expansion phases, extreme dwindling exports and government spending declined caused banking crises. In the peak phase, excess banks' credit, investment decline, and excessive slashed government spending caused banking crises. In the recession phase, increased interest rate, increased banks' credit to the private sector, the decline in exports and cut in banks return on equity caused banking crises. In the depression phase, increased interest rate, increased leverage (banks' credit to the. private sector,% GDP), and decline in banks return on equity caused banking crises. On the trough phase, increased interest rate, increased banks' credit to the private sector, the decline in investments, dwindling exports, the decline in banks return on equity caused banking crises. Given the igniting factors, the depression, trough, and recession phases remain the most vulnerable business cycle phases to banking crises.

The industrial output production and credit-to-GDP gap analysis shows that banking crises disrupt economic activities by creating negative output and industrial production gaps while also contracting banks' liquidity by creating a negative credit-to-GDP gap. When banking crises create negative output gaps, this shrinks investment, further reinforcing future banking crises and creating severe negative output gaps. More so, observing the credit gap and the different phases, banking crises were seen to have disrupted the business cycle by obstructing the liquidity needed to sustain the expansion and peak phases of the business cycle. In addition, it took about three years for banking crises to create a negative credit gap of about -57.9%; this impact was transmitted via the sensitive impact of banking crises on investment, which had a negative effect of about -81.1% on the credit-to-GDP gap in the same third year. The results also show that investment, government spending, and banks' return on equity further amplified the credit gap, which generated feedback mechanisms. This feedback was 13.0% and 19.8% negative credit gap caused by banks' return on equity and government spending

respectively in the first year of the crises, contracting liquidity in the banking industry. Therefore, the need to suspend dividend payments on banks equity and government borrowings from the banking industry during crises is confirmed to facilitate quick recovery. Banking crises created a negative industrial production gap of about -0.13%, further amplified by bank credit, interest rate, investment, and exports. This negative industrial production gap leads to backlogs of failed investment and banks' private sector credit contraction from the fifth year. More so, the model added the positive industrial production gap to the list of factors igniting banking crises, as emphasized by Seismundian analysis (see Arena, 2013).

Nations slipped from peak to trough during banking crises, but none moved from trough to peak. This crisis-induced retrogression is due to the economies critical reliant on the banking system for liquidity to fuel growth. In contrast, the banking system depends on the economy's health for profitability (Albertazzi & Gambacorta, 2006) to stabilize its fragile fractional reserves mechanism. Banking crises are bound to occur when these relationships are obstructed. Therefore, the macroeconomy needs sufficient liquidity during the recovery and expansion phase to sustain the momentum required to reach the peak phase of the business cycle. In addition to other sources of liquidity, growth in investment, exports expansions, gradual fiscal expansion, and banks return on equity provides some amount of liquidity, especially from real economic activities. As long as this liquidity is consistently provided, the economy is empowered to meet its obligations and limit loan default rates to the banks, thereby stabilising the banking system.

Policywise, this study emphasized the need for policy synergy among monetary, macroprudential and fiscal policy. Taking a cue from the list of significant banking crisis-induced factors we saw in this study, prevention and containment should involve a wide range of policy interventions as above-mentioned. In addition, the business cycle phases should be considered in the design and implementation of macroprudential policy. Motivated by the Austrian, Monetarist and Keynes business cycles theories, past studies and regulatory policies have focused solely on the peak, recession and trough phases. However, as evidenced from this sample of countries, banking crises also occur during recovery and expansion phases. All banking crises were not the same (in causes and impacts) across the business cycle phases, although they had detrimental effects.

5.6 LIMITATION AND LESSONS FOR FURTHER RESEARCH

This study encounters some limitations. Firstly, the absence of a single time series to capture banking crises as a macroeconomic event. Even when banking crises are finally captured with dummy variables, relating discontinuous and rare events with the business cycle are uncommon. Finally, banking crises stems from macroeconomic issues, financial sector, banking industry distortions, or internal mismanagements, especially when highly connected networks of banks are involved. Hence the most reliable dataset are ones consisting of all these. As such, extracting information from several banks, especially for about 48 years, can be difficult. More so, banks internal data such as interbank lending, discount window borrowings, individual cross borders claims and exposure are not readily available in the public space as part of the confidentiality clause[29] to prevent the revelation of individual activities of banks. The confidentiality clause states, "*The individual reports are regarded as confidential and will not be voluntarily disclosed to the public. However, aggregated data that do not reveal the activities of individual banks will be published*" (Federal Financial Institutions Examination Council, 2006). More so, the bank of international settlement (BIS) suppressed some observations for confidentiality reasons. These confidentialities may be due to macroprudential purposes, especially to prevent self-fulfilling prophesies, unhealthy competition, et cetera. The debate for open financial data continues as researchers rely on limited data sharing sources such as quarterly financial statements, regulatory authorities, the IMF and the World Bank, and commercial data repositories. Moreover, several events such as the entry of new banks, mergers and acquisitions and changes in the industry structure can also cause structure breaks of the dataset. Finally, with these findings, future research should consider macroprudential policy's design and application, within and across the business cycle phases.

[29] Instructions for the Preparation of the Country Exposure Report (FFIEC 009)

REFERENCE

A. F. Burns, Introduction. In: Wesley C. Mitchell, what happens during business cycles: A progress report. New York, National Bureau of Economic Research, 1951

Albertazzi, U., & Gambacorta, L. (2006). Bank Profitability and the Business Cycle. *SSRN Electronic Journal*.

Allen, F., & Gale, D. (2000). Bubbles and Crises. *The Economic Journal, 110*(460), 236-255. Retrieved May 14, 2021

Allen, F., & Santomero, A. (1998). The theory of financial intermediation. *Journal of Banking & Finance*.

Allen, F., Babus, A., & Carletti, E. (2009). Financial Crises: Theory and Evidence. *Annual Review of Financial Economics, 1*, 97-116.

Amalia Morales-Zumaquero & Simón Sosvilla-Rivero (2016) A contribution to the empirics of convergence in real GDP growth: the role of financial crises and exchange-rate regimes, Applied Economics, 48:23, 2156-2169

Arena, R. (2013). Sismondi et l'analyse des crises économiques. *Œconomia. History, Methodology, Philosophy*, (3-2), 179-197.

Artis, M., Marcellino, M., & Proietti, T. (2004). Dating Business Cycles: A Methodological Contribution with an Application to the Euro Area. *Oxford Bulletin Of Economics And Statistics*, *66*(4), 537-565.

Arora, A., & Kalsie, A. (2018). Impact of US Financial Crises on GDP of BRICS Economies: An Analysis Using Panel Data Approach. Global Business Review, 19(2), 439–454.

Attwood, T. (1817). A Letter to Nicholas Vansittart on the creation of money and its action upon national prosperity. Birmingham: R. Wrightson.

Azariadis, C. (1981). Self-fulfilling prophecies. Journal of Economic Theory, 25(3), 380–396.

Allen, F., & Santomero, A. (1998). The theory of ®nancial intermediation. *Journal of Banking & Finance*.

Arellano, M., & Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*.

Babecký, J., Havránek, T., Matějů, J., Rusnák, M., Šmídková, K., & Vašíček, B. (2014).

Banking, debt, and currency crises in developed countries: Stylized facts and early warning indicators. *Journal of Financial Stability*, *15*, 1-17.

Baron, M., Verner, E., & Xiong, W. (2018). Identifying banking crises. *Princeton university manuscript*.

Bartoletto, S., Chiarini, B., Marzano, E., & Piselli, P. (2019). Banking crises and business cycle: evidence for Italy(1861-2016). *Journal Of Financial Economic Policy*, *11*(1), 34-61.

Berman, J., & Pfleeger, J. (1997). Which industries are sensitive to business cycles. *Monthly Lab. Rev.*, *120*, 19.

Berger, A. N., & Sedunov, J. (2017). Bank liquidity creation and real economic output. *Journal of Banking & Finance*, *81*, 1-19.

Black, L., Correa, R., Huang, X., & Zhou, H. (2016). The systemic risk of European banks during the financial and sovereign debt crises. *Journal of Banking and Finance*.

Boissay, F., Collard, F., & Smets, F. (2016). Booms and banking crises. *Journal of Political Economy*, *124*(2), 489-538

Boyd, J. H., Kwak, S., & Smith, B. (2006). The Real Output Losses Associated with Modern Banking Crises. *Journal of Money, Credit, and Banking*.

Bucher, M., Dietrich, D., & Hauck, A. (2013). Business cycles, bank credit and crises. *Economics Letters*, *120*(2), 229-231.

Caballero, J. A. (2016). Do surges in international capital inflows influence the likelihood of banking crises?. *The Economic Journal*, *126*(591), 281-316.

Calomiris, C. (2010). Banking crises yesterday and today. *Financial History Review*, *17*(1), 3-12.

Carlson, M. A., & Mitchener, K. J. (2005). Branch Banking, Bank Competition, and Financial Stability. In *SSRN*.

Cerra, M. V., & Saxena, M. S. C. (2017). *Booms, crises, and recoveries: A new paradigm of the business cycle and its policy implications*. International Monetary Fund.

Chaudron, R., & de Haan, J. (2014). Dating banking crises using incidence and size of bank failures: Four crises reconsidered. *Journal of Financial Stability*.

Chen, X., Kontonikas, A., & Montagnoli, A. (2012). Asset prices, credit and the business cycle. *Economics Letters*, *117*(3), 857–861.

Claessens, S., Kose, M. A., & Terrones, M. E. (2012a). How do business and financial cycles interact? *Journal of International Economics*, *87*(1), 178–190.

Claessens, S., Kose, M. A., & Terrones, M. E. (2012b). How do business and financial cycles interact? *Journal of International Economics*, *87*(1), 178–190.

Corsetti, G., Pesenti, P., & Roubini, N. (2002). What caused the Asian currency and financial crisis? *Japan and the World Economy*.

Curott, N. A., & Watts, T. A. (2018). A Monetary Explanation for the Recession of 1797. *Eastern Economic Journal*.

De Brandt, O., & Hartmann, P. (2000). Systemic risk: A survey. *ECB Working Paper Series*, *3*(3), 1–19.

De Grauwe, P. (2010). The banking crisis: Causes, consequences and remedies. In *The Global Crash: Towards a New Global Financial Regime?*

De Haan, J., Fang, Y., & Jing, Z. (2020). Does the risk on banks' balance sheets predict banking crises? New evidence for developing countries. *International Review of Economics & Finance*, *68*, 254–268.

Demirguc-Kunt, A., & Detragiache, E. (2007). The Determinants of Banking Crises in Developing and Developed Countries. *Staff Papers - International Monetary Fund*.

Demirgüç-Kunt, A., & Detragiache, E. (1998). The Determinants of Banking Crises in Developing and Developed Countries. *IMF Staff Papers*.

Diamond, D. W. (1984). Financial Intermediation and Delegated Monitoring. *The Review of Economic Studies*.

Diamond, D. W., & Dybvig, P. H. (1983). Bank Runs, Deposit Insurance, and Liquidity. *Journal of Political Economy*.

Dobrescu, M., Badea, L., & Paicu, C. (2012). Business cycle theories and their relevance to the current global crisis. *Procedia-Social and Behavioral Sciences*, *62*, 239-243.

Dungey, M., & Gajurel, D. (2015). Contagion and banking crisis - International evidence for 2007-2009. *Journal of Banking and Finance*.

Festić, M., & Bekő, J. (2008). The banking sector and macroeconomic indicators: some evidence for Hungary and Poland. *Bančni Sektor in Makroekonomski Indikatorji: Nekaj Evidence Za Madžarsko in Poljsko.*

Federal Financial Institutions Examination Council. (2006). *Instructions for the*

Preparation of the Country Exposure Report (FFIEC 009) (p. 2). Virginia, United States: Federal Financial Institutions Examination Council. Retrieved from https://www.ffiec.gov/pdf/ffiec_forms/ffiec009_201103_i.pdf

Filippopoulou, C., Galariotis, E., & Spyrou, S. (2020). An early warning system for predicting systemic banking crises in the Eurozone: a logit regression approach. *Journal of Economic Behavior & Organization*, *172*, 344-363

Frydl, E. J. (1999). The Length and Cost of Banking Crises. *IMF Working Papers*.

Gambacorta, L., & Mistrulli, P. (2004). Does bank capital affect lending behaviour?. *Journal Of Financial Intermediation*, *13*(4), 436-457.

Glen, J., & Mondragón-Vélez, C. (2011). Business cycle effects on commercial bank loan portfolio performance in developing economies. *Review of Development Finance*, *1*(2), 150–165.

Gorton, G. (1988). Banking panics and business cycles. *Oxford economic papers*, *40*(4), 751-781.

Gorton, G., & Winton, A. (2002). Financial Intermediation. *Journal of Financial Intermediation*.

Hale, G. (2012). Bank relationships, business cycles, and financial crises. *Journal Of International Economics*, *88*(2), 312-325.

Hansen, A. H., & Tout, H. (1933). Annual survey of business cycle theory: investment and saving in business cycle theory. *Econometrica: Journal of the Econometric Society*, 119-147.

Harding, D., & Pagan, A. (2003). A comparison of two business cycle dating methods. *Journal of Economic Dynamics and Control*, *27*(9), 1681–1690.

Harimaya, K., & Kondo, K. (2016). Effects of branch expansion on bank efficiency: evidence from Japanese regional banks. *Managerial Finance*.

Hilbers, P. L. C., Zacho, L., & Lei, Q. (2001). Real Estate Market Developments and Financial Sector Soundness. *IMF Working Papers*.

Holtz-Eakin, D., Newey, W., & Rosen, H. S. (1988). Estimating Vector Autoregressions with Panel Data. *Econometrica*, *56*(6), 1371–1395. https://doi.org/10.2307/1913103

Iacovone, L., Ferro, E., Pereira-López, M., & Zavacka, V. (2019). Banking crises and exports: Lessons from the past. *Journal of Development Economics*, *138*, 192–204.

Igan, D., Kabundi, A., Nadal De Simone, F., Pinheiro, M., & Tamirisa, N. (2011). Housing, credit, and real activity cycles: Characteristics and comovement. *Journal of Housing Economics*, *20*(3), 210–231.

Jokipii, T., & Milne, A. (2008). The cyclical behaviour of European bank capital buffers. *Journal of banking & finance*, *32*(8), 1440-1451.

Jorda, O., Schularick, M., & Taylor, A. (2011). When Credit Bites Back: Leverage, Business Cycles and Crises. *SSRN Electronic Journal*.

Jordà, Ò., Schularick, M., & Taylor, A. (2017). Macrofinancial History and the New Business Cycle Facts. *NBER Macroeconomics Annual*, *31*(1), 213-263.

Kaminsky, Graciela L., & Reinhart, C., & M. (1999). The Twin Crises: The Causes of Banking and Balance-of-Payments Problems. *American Economic Review*.

Kenny, S., Lennard, J., & Turner, J. (2017). *The Macroeconomic Effects of Banking Crises : Evidence from the United Kingdom, 1750-1938*. *October*.

Kindleberger, C. P., Aliber, R. Z., & Solow, R. M. (2005). Manias, panics, and crashes: A history of financial crises.

Kleimeier, S., Sander, H., & Heuchemer, S. (2013). Financial crises and cross-border

banking: New evidence. *Journal of International Money and Finance*, *32*, 884-915.
Klomp, J. (2010). Causes of banking crises revisited. *North American Journal of Economics and Finance*.
Kosmetatos, P. (2014). The winding-up of the Ayr Bank, 1772-1827. *Financial History Review*.
Laeven, L., Ratnovski, L., & Tong, H. (2014). Bank Size and Systemic Risk: Some International Evidence. *International Monetary Fund, Mimeo.*
Laeven, Luc. (2012). Banking Crises: A Review. *Ssrn*, *December 2011*.
Laeven, Luc, Ratnovski, L., & Tong, H. (2016). Bank size, capital, and systemic risk: Some international evidence. *Journal of Banking and Finance*.
Laeven, Luc, & Valencia, F. (2010). Resolution of banking crises: the good, the bad, and the ugly. Research Department. *Working Papers*.
Laeven, Luc, & Valencia, F. (2013). Systemic banking crises database. *IMF Economic Review*.
Loukoianova, E., De Nicoló, G., & Boyd, J. H. (2009). Banking Crises and Crisis Dating: Theory and Evidence. *IMF Working Papers*, *09*(141), 1.
Luther, W. J., & Cohen, M. (2014). An Empirical Analysis of the Austrian Business Cycle Theory. *SSRN Electronic Journal*.
Madhani, P. M. (2010). Rebalancing Fixed and Variable Pay in a Sales Organization: A Business Cycle Perspective. Compensation & Benefits Review, 42(3), 179–189.
Mishkin, F. (1996). The channels of monetary transmission: lessons for monetary policy. *NBER Working Paper Series*.
Montagnoli, A., Mouratidis, K., & Whyte, K. (2021). Assessing the cyclical behaviour of bank capital buffers in a finance-augmented macro-economy. *Journal of International Money and Finance*, *110*, 102256.
Noy, I. (2005). Banking crises in East Asia: The price tag of liberalization? *Asia Pacific Issues*.
O'Sullivan, K. P. V., & Kennedy, T. (2010). What caused the Irish banking crisis? *Journal of Financial Regulation and Compliance*.
Papadimitriou, T., Gogas, P., & Tabak, B. M. (2013). Complex networks and banking systems supervision. *Physica A: Statistical Mechanics and Its Applications*, *392*(19), 4429–4434.
Peek, J., & Rosengren, E. (1995). Bank regulation and the credit crunch. *Journal Of Banking & Finance*, *19*(3-4), 679-692.
Philippe Bracke, (2011). SBBQ: Stata module to implement the Harding and Pagan (2002) business cycle dating algorithm. Statistical Software Components S457288, Boston College Department of Economics, revised 17 Jan 2012.
Quagliariello, M. (2007). Banks' riskiness over the business cycle: a panel analysis on Italian intermediaries. *Applied Financial Economics*, *17*(2), 119-138.
Reinhart, C. M., & Rogoff, K. S. (2008). *This time is different: A panoramic view of eight centuries of financial crises* (No. w13882). National Bureau of Economic Research.
Roy, S., & Kemme, D. M. (2012). Causes of banking crises: Deregulation, credit booms and asset bubbles, then and now. *International Review of Economics and Finance*.
Scholtens, B., & Wensveen, D. Van. (2003). The Theory of Financial Intermediation: An Essay on What It Does (Not) Explain. *SUERF Studies*.
Stolz, S., & Wedow, M. (2011). Banks' Regulatory Capital Buffer and the Business Cycle: Evidence for Germany. *SSRN Electronic Journal*, *August*.
Teimouri, S., & Dutta, N. (2016). Investment and bank credit recovery after banking crises. *Journal of Financial Stability*, *26*(June 2020), 306–327.

Tempelman, J. (2010). Austrian Business Cycle theory And the global financial crisis: Confessions of a mainstream economist. *Quarterly Journal of Austrian Economics*, *13*(1), 3–15.

Tonzer, L. (2015). Cross-border interbank networks, banking risk and contagion. *Journal of Financial Stability*, *18*, 19-32.

White, E. N. (1984). A Reinterpretation of the Banking Crisis of 1930. *The Journal of Economic History*.

Winkler, F. (2020). The role of learning for asset prices and business cycles. *Journal of Monetary Economics*, *114*, 42–58.

Zarnowitz, V. (1992). What is a business cycle?. In *The business cycle: Theories and evidence* (pp. 3-83). Springer, Dordrecht.

Zou, H. (2006). The Adaptive Lasso and Its Oracle Properties. *Journal Of The American Statistical Association*, *101*(476), 1418-1429.

APPENDIX
APPENDIX 1: DESCRIPTIVE TABLES

Table 3.4: Recruited Time Series Variables

	Variables	Definition	Data Source	Periodicity
1	Real GDP	The GDP constant local currency unit (LCU) is the sum of gross value added of all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products at constant local currency.	The World Bank (WB)	Annual
2	Business Cycle	The business cycle was extracted using the Hodrick-Prescott (HP) filter. First, the HP filter was applied to the natural logarithm of GDP constant (in local currency unit), and the cyclical component was then multiplied by 100 as suggested by the bank of England (2021), Baxter & King (1999), (Artis, Marcellino & Proietti, 2004).	The World Bank (WB)	Annual
3	Agriculture value-added	Agriculture, forestry, and fishing value-added, constant local currency unit for each country from the year 1971 to 2018	The World Bank	Annual
4	Manufacturing value-added	manufacturing value-added, constant local currency unit for each country from the year 1971 to 2018	The World Bank	Annual
5	Services value-added	This is the services value-added, in constant local currency unit for each country from 1/970 to 2018.	The World Bank	Annual
6	industrial production value-added	The industrial production (including construction), value added (constant LCU) unit for each country from the year 1971 to 2018	The World Bank	Annual
7	The industrial production cycle	The industrial production cycle is extracted from the Industry (including construction) value added (constant LCU) unit for each country from 1971 to 2018 using the HP filter.	The World Bank	Annual
8	The broad money supply (% of GDP)	Broad money is the sum of currency outside banks; demand deposit of the public; the time, saving and foreign currency deposit of the residents apart from government, bank and travellers' cheques and other securities.	The World Bank	Annual
9	Broad money to total reserves ratio	The proportion of broad money to foreign reserves for each country from 1971 to 2018.	The World Bank	Annual
10	Foreign Direct Investment (% of GDP).	Foreign direct investment is the net inflows of investment to acquire a lasting management interest (10 per cent or more of voting stock) in an enterprise operating in an economy other than that of the investor, as a per cent of the GDP.	The World Bank	Annual
11	Consumer price index (CPI)	Changes in the cost to the average consumer of acquiring a basket of goods and services in a year	The World Bank	Annual
12	Households' Final consumption expenditure	Households' Final consumption expenditure for each country from the year 1971 to 2018	The World Bank	Annual
13	Gross capital formation	Gross capital formation for each country from the year 1971 to 2018	The World Bank	Annual
14	General government final consumption expenditure	general government final consumption expenditure for each country from the year 1971 to 2018	The World Bank	Annual
15	Exports	Value of exportation of goods and services for each country from the year 1971 to 2018	The World Bank	Annual
16	Imports	Value of importation of goods and services for each country from 1971 to 2018.	The World Bank	Annual
17	Non-performing loans (% of all bank loans)	Bank nonperforming loans as a percentage of total gross loans are the value of nonperforming loans divided by the total value of the loan portfolio (including nonperforming loans before the deduction of specific loan-loss provisions).	The World Bank	Annual
18	Bank credit (% bank deposits)	Domestic money banks provide this financial resource to the private sector as a share of total deposits.	IMF	Annual

19	The ratio of bank liquid assets to deposits and short-term funding	The ratio of the value of liquid assets (easily converted to cash) to short-term funding plus total deposits	Bankscope	Annual
20	Banking system capital (% of assets)	This is the ratio of bank capital & reserves to total assets.	IMF	Annual
22	Bank return on assets (%)	This is the commercial banks' pre-tax income to yearly averaged total assets.	Bankscope	Annual
23	Bank return on equity (%)	This the commercial bank's pre-tax income to yearly averaged equity	Bankscope	Annual
24	Bank overhead costs (% of total assets)	This is the bank's operating expenses as a share of the value of all assets held.	Bankscope	Annual
25	Bank cost to income ratio (%)	This is the bank's operating expenses as a share of the sum of net-interest revenue and other operating income.	Bankscope	Annual
26	Bank non-interest income to total income (%)	Bank's income that has been generated by noninterest related activities as a percentage of total income (net-interest income plus noninterest income).	Bankscope	Annual
27	Bank interest revenue (% of interest-bearing assets)	The accounting value of the banks' net interest revenue as a share of its average interest-bearing (total earning) assets.	Bankscope	Annual
28	Bank lending-deposit interest rate spread	Difference between the lending rate and the deposit rate. The lending rate is the rate charged by banks on loans to the private sector, and the deposit interest rate is the rate offered by commercial banks on three-month deposits	IMF	Annual
29	Financial system deposits (% of GDP)	Demand, time and saving deposits in deposit money banks and other financial institutions as a share of GDP	IMF	Annual
30	Banks' credit to the private sector(% of GDP)	Domestic credit to the private sector by banks refers to financial resources provided to the private sector by other depository corporations (deposit-taking corporations except for the central banks).	The World Bank	Annual
31	Banks' credit-to-GDP Cycle	This was extracted from the Banks' credit to the private sector(% of GDP) using the HP filter		
32	Bank credit to government and public enterprises (% of GDP)	Bank credit is the amount of credit available to the government sector. It is made up of the total amount of combined funds that are provided to the government by the bank sector	IMF	Annual
33	Liquid liabilities (% of GDP)	This is the ratio of liquid liabilities to the GDP. Liquid liabilities are also described as broad money or M3	IMF	Annual
34	Bank assets (% of GDP)	This is the total assets held by deposit money banks as a share of GDP	IMF	Annual

Source: Author 2021

Table 3.1.1A: The phase state of the business cycle during and without banking crises

Business Cycle Phases	Total Sample (Pooled)		During Banking Crises		Without Banking Crises		A year before banking crises started		First-year of Banking crises		Last year of banking crises		A year After Banking crises Ended	
	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%	Freq	%
Expansion	345	21.0	9	5.5	336	22.8	18	34.6	1	1.9	5	9.6	8	15.4
Peak	159	9.7	20	12.1	139	9.4	12	23.1	17	32.7	2	3.9	2	3.9
Recession	289	17.6	35	21.2	254	17.2	8	15.4	18	34.6	4	7.7	5	9.6
Depression	303	18.5	45	27.3	258	17.5	6	11.5	3	5.8	15	28.9	11	21.2
Trough	160	9.8	24	14.6	136	9.2	2	3.9	5	9.6	13	25.0	5	9.6
Recovery	384	23.4	32	19.4	352	23.9	6	11.5	8	15.4	13	25.0	21	40.4
Total	**1,640**	**100**	**165**	**100**	**1,475**	**100**	**52**	**100**	**52**	**100**	**52**	**100**	**52**	**100**

Source: Author 2021

Table 3.1.1B: Banks' credit to the private sector, % of GDP (Leverage) along the business cycle

	Total Sample (Pooled)	During Banking Crises	Without Banking Crises	A year before banking crises started	First-year of Banking crises	Last year of banking crises	A year After Banking crises Ended
	Mean (std)	Mean (std)	Mean (std)	Mean (std)	Mean (std)	Mean (std)	Mean (std)
ALL	63.2 (1/.5)	82.7 (5.3)	60.4(1.5)	75.1(9.5)	74.98(9.8)	66.2(8.6)	62.4(8.1)
Expansion	64.0(48.6)	56.5(14.9)	64.3(3.3)	109.8(15.3)	151.42(0.0)	44.8(8.5)	70.8(32.6)
Peak	67.8(49.4)	99.1(16.0)	61.4(4.5)	95.0(16.1)	106.7(16.9)	24.1(2.8)	54.6(3.3)
Recession	57.96(45.4)	93.8(11.4)	51.2(3.0)	44(10.5)	81.3(14.2)	45.6(18.3)	22.4(9.1)
Depression	59.9(44.8)	84.8(9.0)	54.1(3.2)	11.2(4.6)	15.51(3.9)	79.1(15.5)	64.1(16.7)
Trough	63.6(48.5)	86.7(15.6)	58.8(4.4)	37(24.5)	16.9(8.0)	75.6(17.7)	94.9(21.4)
Recovery	66.7(48.5)	58.9(13.4)	67.6(3.4)	8.6(3.3)	16.9(13.2)	66.5(26.9)	61.7(13.3)

Source: Author 2021

Table 3.1.2A: Summary of variables: Total Sample

Variables	Total Sample					With Banking crises					Without Banking crises				
	Obs	Std. dev.	Min	Mean	Max	Obs	Std. dev.	Min	Mean	Max	Obs	Std. dev.	Min	Mean	Max
Business cycle	1640	2.8	-22.74	-1.1E-09	18.3	165	4.50	-22.74	-0.98	18.3	1475	2.6	-18.94	0.11	16.8
Banks Credit (% GDP)	1079	48.3	0.19	63.17	309.0	136	62.23	1.17	82.71	255.2	943	45.3	0.19	60.36	309.0
Broad Money to Total Reserves Ratio (BM:TR)	792	137.9	0.59	12.2	3691.1	77	12.31	0.67	7.11	71.8	715	145.1	0.59	12.75	3691.1
Interest rate (%)	541	26.96	0.5	19.11	291.1	60	52.59	0.50	33.21	291.1	481	21.2	0.50	17.35	250.3
Households' Consumption. (% Δ)	1477	5.6	-40.6	2.73	30.6	145	6.96	-40.55	-0.47	15.4	1332	5.3	-32.85	3.08	30.6
Investment (% Δ)	1490	15.4	-91.6	2.91	227.7	145	27.61	-83.29	-3.68	227.7	1345	13.3	-91.63	3.62	74.4
Govt. Spending (% Δ)	1502	5.44	-45.95	2.19	38.0	145	5.68	-36.97	-0.04	16.4	1357	5.4	-45.95	2.43	37.9
Imports (% Δ)	1502	11.3	-120.4	4.64	39.1	145	12.84	-49.47	-1.11	25.4	1357	10.9	-120.40	5.26	39.1
Exports (% Δ)	1502	9.6	-120.4	5.03	52.8	145	10.25	-37.95	1.35	30.2	1357	9.5	-120.40	5.42	52.8
dlnavaH	1263	9.7	-61.1	0.97	47.0	139	11.84	-44.9	-0.13	47.0	1,124	9.4	-61.1	1.11	42.6
dlnmvaH	1201	9.5	-136.4	2.36	66.07	137	15.41	-136.4	-2.96	49.6	1,064	8.3	-87.6	3.04	66.1
dlnsvaH	1258	5.5	-35.7	2.95	47.0	139	5.25	-15.91	0.32	35.7	1,119	5.4	-35.7	3.27	47.0
Banks credit (% bank deposits)	1430	117.8	6.46	115.86	2861.1	148	233.12	14.36	142.00	2861.0	1282	95.72	6.46	112.84	2861.1
Bank liquid assets to deposits and short-term funding	943	18.4	1.41	38.42	240.6	124	18.35	6.59	39.94	98.4	819	18.39	1.41	38.19	240.6
Banking system capital(% Assets)	749	4.5	2	9.27	30.6	100	3.70	4.10	7.94	23.0	649	4.59	2.00	9.48	30.6
Change in financial system deposits (%GDP)	1422	6.1	-91.6	1.12	50.0	148	10.76	-91.56	-0.63	50.0	1274	5.22	-57.49	1.32	48.9
Banks credit to govt. & public enterprises (% GDP)	1317	12.6	0.02	14.21	74.8	155	8.67	0.03	13.11	41.7	1162	12.98	0.02	14.36	74.8
Change in liquid liabilities (% GDP)	1457	17.7	-182.1	1.38	561.8	147	18.52	-182.11	-0.78	77.6	1310	17.60	-121.90	1.63	561.8
Change in bank assets (% GDP)	1467	8.1	-84.2	1.13	69.5	151	9.74	-48.32	-0.06	23.5	1316	7.90	-84.24	1.27	69.5
Banks Return on Asset(%)	938	4.3	-56.8	1.3	66.3	113	6.63	-56.77	-0.89	12.9	825	3.74	-24.12	1.60	66.3
Banks Return on Equity (%)	937	17.1	-112.2	12.95	117.5	113	27.46	-101.49	2.83	97.3	824	14.62	-112.19	14.34	117.5
Bank overhead costs (% of total assets)	944	3.92	0.04	3.3	81.9	108	4.71	0.11	3.02	44.7	836	3.81	0.04	3.34	81.9
Bank cost to income ratio(%)	920	13.4	19.9	59.43	150.0	108	16.85	19.90	60.13	139.5	812	12.92	19.90	59.34	150.0
Bank non-interest income to total income(%)	942	14.2	1.4	40.44	96.2	113	17.29	2.80	40.59	91.2	829	13.76	1.35	40.42	96.2
Bank interest revenue(% interest-bearing assets)	938	9.3	0.13	5.17	97.3	113	10.58	0.13	5.37	53.9	825	9.14	0.18	5.15	97.3
Output Gap	1640	0.11	-0.98	-0.00024	0.8	165	0.19	-0.98	-0.04	0.8	1475	0.10	-0.68	0.00	0.7
Industrial Production Gap	1284	0.18	-1.95	-0.00057	1.5	141	0.21	-0.83	-0.07	0.5	1143	0.18	-1.95	0.01	1.4
Credit Gap	1079	124.6	-1143.9	-4.66	1333.6	136	128.78	-702.68	1.64	334.4	943	124.08	-1143.93	-5.57	1333.6

Author, 2022

Table 3.1.2B: Summary of Variables: By Phases of the Business Cycle I

	Recovery Phase					Expansion Phase					Peak Phase				
Variable	Obs	Std. dev.	Min	Mean	Max	Obs	Mean	Std. dev.	Min	Max	Obs	Mean	Std. dev.	Min	Max
Business cycle	384	1.96	-19.3	-1.3	-0.00057	345	1.24	1.71	0.01	16.14	159	3.37	2.88	-0.17	18.31
Banking Crises Dummy	384	0.28	0	0.08	1.00	345	0.03	0.16	0	1	159	0.13	0.33	0	1
Banks Credit (% GDP)	251	52.12	1.38	66.7	308.98	225	64.0	48.6	2.97	248.2	107	67.8	49.4	2.64	249.8
Broad Money to Total Reserves Ratio	186	7.86	0.86	5.53	61.1	175	5.22	7.40	0.80	53.46	75	6.68	11.38	0.78	79.02
Interest rate (%)	125	24.74	0.50	19.4	159.8	120	13.7	13.23	0.50	96.10	50	23.61	41.80	1.00	291.1
Households' Consumption (% Change)	347	4.4	-22.3	3.2	18.7	308	4.9	4.4	-9.4	30.6	145	4.26	5.01	-10.32	24.26
Investment (% Change)	353	12.4	-57.5	5.1	74.4	311	8.7	9.3	-29.4	40.5	146	7.92	11.16	-21.26	57.33
Govt. Spending (% Change)	354	4.7	-16.6	2.2	26.2	315	3.1	5.3	-22.3	37.9	147	3.06	5.14	-24.12	19.11
Imports(% Change)	355	8.2	-34.8	6.6	37.5	316	8.3	7.7	-37.7	34.8	147	6.51	11.80	-64.12	32.16
Exports(% Change)	355	6.8	-20.1	6.4	39.9	316	7.7	8.4	-66.0	52.8	147	5.58	10.55	-63.60	37.47
Agricultural Value Added (% Change)	290	9.5	-35.1	1.2	28.8	274	2.1	9.1	-43.8	42.6	120	4.0	10.4	-44.9	47.0
Manufacturing Value Added (% Change)	276	5.9	-25.1	3.5	20.1	263	5.4	6.1	-15.9	40.5	112	3.3	17.3	-136.4	66.1
Service Value Added (% Change)	288	5.1	-26.7	2.9	31.8	273	5.0	4.1	-4.1	20.8	120	5.3	5.6	-7.1	35.7
Banks' credit (% bank deposits)	340	56.15	14.36	115.2	370.3	273	121.2	172.70	9.66	2861.0	143	135.6	234.71	6.54	2861.1
Bank liquid assets to deposits and short-term funding	233	17.18	1.41	38.2	78.3	184	37.6	15.84	5.26	87.36	97	37.42	16.99	1.69	98.4
Banking system capital (% Assets)	174	4.43	2.70	8.88	23.0	145	9.30	4.63	2.80	23.30	75	8.72	4.29	2.00	22.0
Change in financial system deposits, % of GDP	341	5.38	-28.23	1.33	37.8	278	1.51	4.87	-22.16	41.54	138	0.41	6.27	-31.49	28.8
Banks' credit to government and public enterprises % of GDP	319	12.86	0.03	14.8	74.2	242	13.4	12.47	0.11	73.83	131	12.92	11.53	0.02	57.7
Change in liquid liabilities (% GDP)	352	8.29	-76.36	0.23	37.8	289	1.29	6.73	-78.47	42.17	144	0.98	7.21	-34.37	37.8
Change in bank assets, (% GDP)	356	8.70	-84.24	0.25	55.9	291	1.18	8.86	-81.33	69.52	144	2.24	8.64	-48.32	50.6
Banks Return on Asset (%)	223	5.73	-21.81	1.89	66.3	197	1.92	2.73	-3.75	22.34	93	0.65	6.81	-56.77	15.6
Banks Return on Equity (%)	222	17.33	-28.92	15.7	117.5	197	16.4	11.00	-37.19	48.22	93	14.20	17.69	-44.97	97.3
Bank overhead costs (% total assets)	227	2.95	0.24	3.07	27.1	197	3.07	2.12	0.04	14.32	94	3.06	2.64	0.05	13.3
Bank cost to income ratio(%)	218	11.84	19.90	59.8	88.9	192	58.2	10.79	19.90	95.77	92	57.42	14.62	19.90	111.6
Bank non-interest income to total income(%)	225	13.98	1.57	41.1	96.2	197	40.2	12.33	2.50	77.25	94	41.42	14.83	2.43	78.9
Bank interest revenue(% interest-bearing assets)	223	11.32	0.33	5.54	97.3	197	5.2	8.88	0.38	62.53	93	4.98	9.05	0.25	63.5
Output Gap	384	0.08	-0.86	-0.05	-0.00002	345	0.05	0.07	0.00018	0.66	159	0.13	0.12	-0.01	0.76
Industrial Production Gap	299	0.14	-0.91	-0.05	1.00	276	0.06	0.13	-0.90	0.72	123	0.16	0.17	-0.22	0.85
Credit-to-GDP Gap	251	135.58	-1048.6	-22.5	1333.6	225	4.4	107.17	-466.7	739.7	107	20.2	119.1	-559.33	433.4

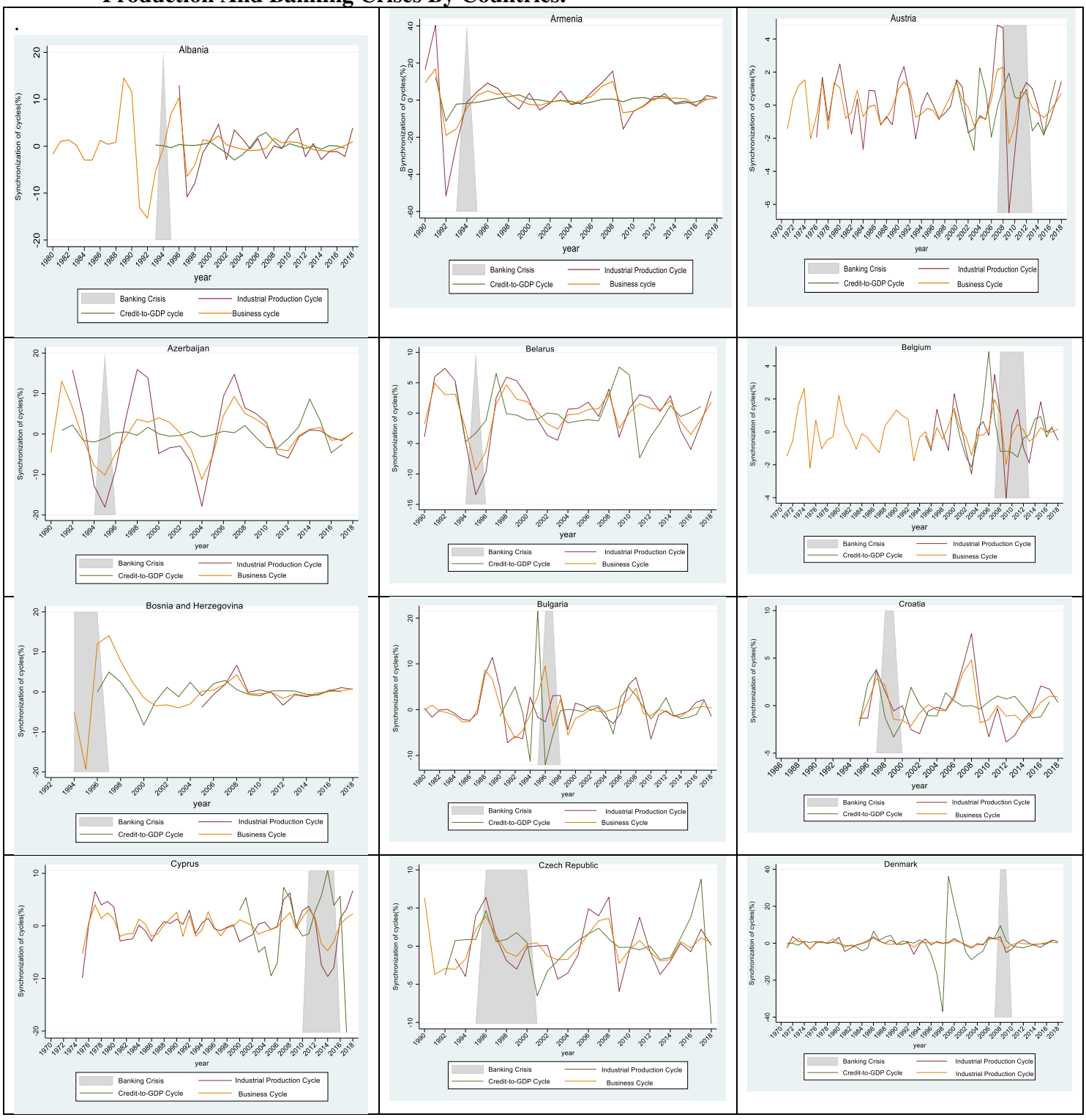
Author, 2021

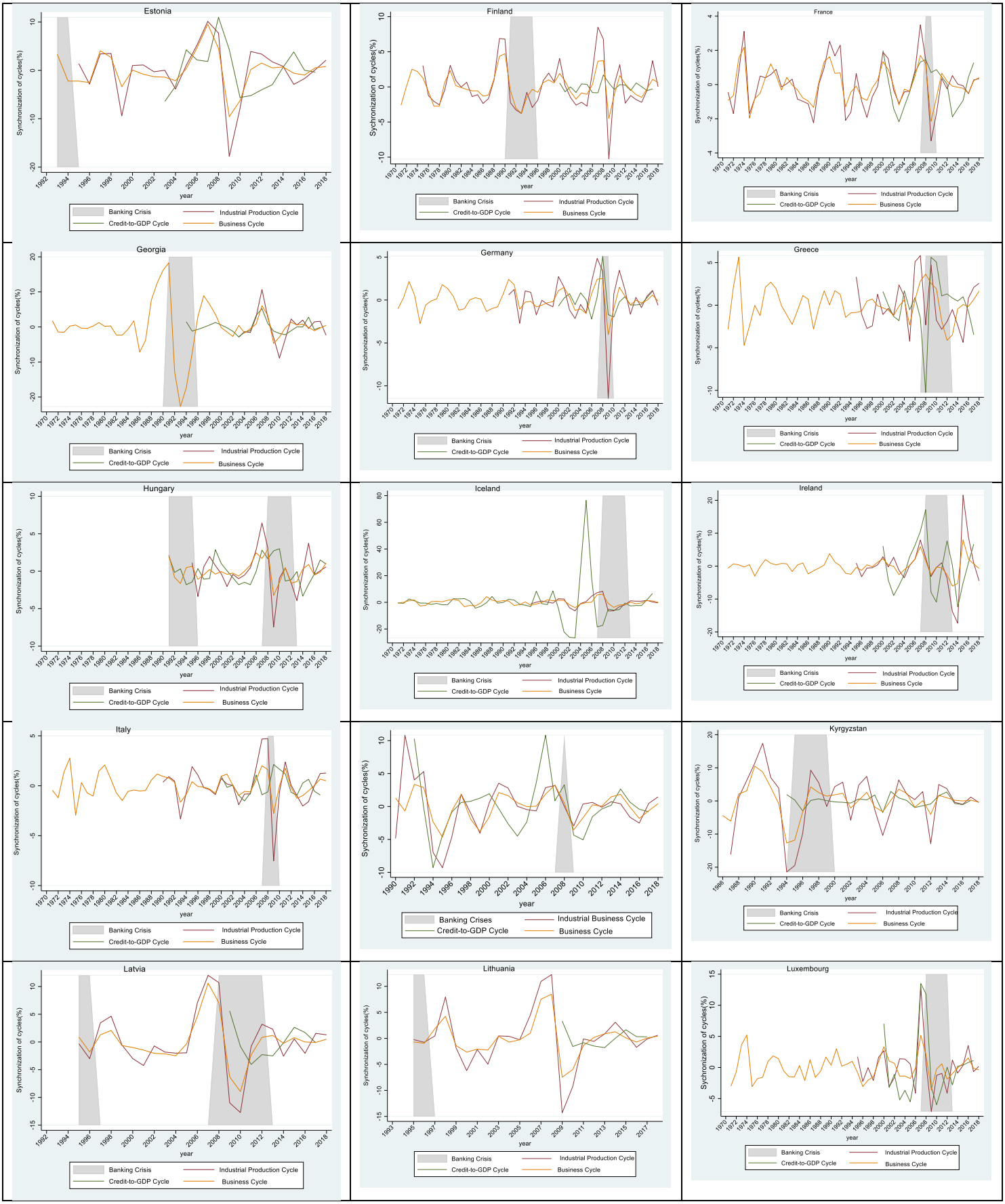
Table 3.1.2C: Summary of Variables: By Phases of the Business Cycle II

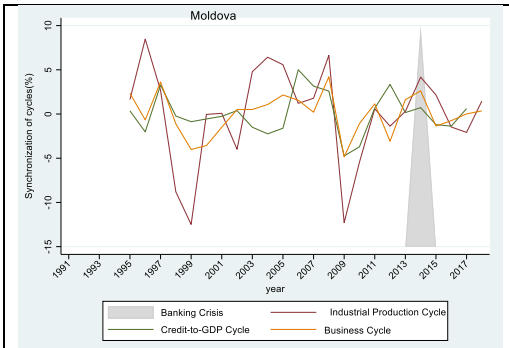
	Recession Phase					Depression Phase					Trough Phase				
Variable	Obs	Std. dev.	Min	Mean	Max	Obs	Std. dev.	Min	Mean	Max	Obs	Std. dev.	Min	Mean	Max
Business cycle	289	2.09	-7.16	1.51	16.8	303	1.71	-13.13	-1.43	0.00	160	3.07	-22.7	-2.97	0.41
Banking Crises Dummy	289	0.33	0	0.12	1	303	0.36	0	0.15	1	160	0.36	0	0.15	1.00
Banks Credit (% GDP)	189	45.41	1.41	57.96	255.2	195	44.78	0.19	59.92	252.78	112	48.52	1.2	63.55	244.9
Broad Money to Total Reserves Ratio	139	12.89	0.59	6.07	128.33	137	323.87	0.74	37.76	3691.14	80	87.53	0.86	15.04	785.7
Interest rate (%)	98	23.01	1.00	21.83	184.25	96	26.75	1.00	18.58	213.02	52	40.83	0.64	22.44	250.3
Households' Consumption (% Change)	251	5.45	-30.23	2.27	25.13	279	7.08	-40.55	0.53	19.85	147	5.63	-25.6	0.60	17.44
Investment (% Change)	256	14.56	-91.63	0.10	61.31	276	21.38	-83.29	-2.82	227.73	148	16.67	-62.5	-3.97	42.3
Govt. Spending (% Change)	256	5.22	-27.8	2.1	36.97	281	5.90	-36.97	1.59	30.23	149	6.60	-45.95	0.70	16.3
Imports(% Change)	256	13.18	-120.4	2.13	39.09	279	13.49	-109.86	1.19	36.55	149	11.64	-40.2	1.01	33.1
Exports(% Change)	256	11.94	-120.4	3.81	28.03	279	10.12	-62.86	2.88	36.29	149	9.43	-37.95	1.81	25.1
Agricultural Value Added (% Change)	210	8.7	-37.5	1.1	29.7	241	10.3	-61.1	-0.7	28.8	128	10.3	-32.9	-1.9	23.6
Manufacturing Value Added (% Change)	200	7.2	-30.1	1.3	21.3	229	9.4	-36.8	0.5	32.9	121	12.6	-87.5	-2.6	13.4
Service Value Added (% Change)	210	5.7	-35.7	2.3	18.2	240	4.6	-16.6	1.0	14.7	127	7.4	-32.3	1.1	47.0
Banks' credit (% bank deposits)	250	87.52	6.46	115.3	1167.74	278	40.95	8.64	103.56	304.31	146	49.56	15.9	112.48	359.2
Bank liquid assets to deposits and short-term funding	155	17.45	1.41	37.36	85.29	177	23.95	1.41	42.17	240.61	97	16.17	1.41	36.42	88.1
Banking system capital (% Assets)	122	4.09	3.00	9.41	20.00	149	4.56	3.10	9.52	30.50	84	5.09	3.1	9.91	30.6
Change in financial system deposits, % of GDP	242	6.99	-57.49	0.98	49.96	277	7.30	-91.56	0.69	39.16	146	5.05	-26.1	1.62	27.2
Banks' credit to government and public enterprises % of GDP	232	14	0.03	14.21	74.05	251	10.67	0.26	14.37	62.76	142	13.48	0.29	15.02	74.8
Change in liquid liabilities (% GDP)	251	37.05	-121.90	3.64	561.76	271	15.21	-182.11	0.98	134.13	150	5.43	-28.8	1.63	17.1
Change in bank assets, (% GDP)	251	9.03	-66.68	1.47	55.89	275	5.77	-25.41	1.18	31.02	150	6.51	-25.3	1.42	39.3
Banks Return on Asset (%)	154	2.43	-15.54	1.15	15.64	177	2.58	-17.66	0.74	11.62	94	4.20	-24.1	0.53	20.9
Banks Return on Equity (%)	154	12.08	-38.34	12.05	53.65	177	20.17	-101.49	8.32	97.09	94	23.30	-112.2	8.14	64.97
Bank overhead costs (% total assets)	155	3.33	0.07	3.63	23.71	176	7.07	0.05	3.93	81.90	95	2.14	0.21	2.84	12.3
Bank cost to income ratio(%)	151	11.93	24.74	59.18	112.63	176	17.09	19.90	61.65	150.00	91	14.79	21.4	59.38	139.5
Bank non-interest income to total income(%)	154	14.79	2.80	38.35	85.07	178	15.22	1.35	41.96	95.26	94	14.75	1.87	38.97	78.6
Bank interest revenue(% interest-bearing assets)	154	8.77	0.13	5.51	69.43	177	6.91	0.18	4.44	71.77	94	10.22	0.28	5.33	68.1
Output Gap	289	0.08	-0.29	0.06	0.59	303	0.07	-0.54	-0.05	-0.00010	160	0.12	-0.98	-0.11	0.01
Industrial Production Gap	218	0.16	-0.18	0.08	1.45	243	0.13	-0.63	-0.08	0.19	125	0.24	-1.95	-0.18	0.06
Credit-to-GDP Gap	189	98.9	-481.9	15.2	450.5	195	148.6	-1143.9	-14.0	1142.3	112.0	122.1	-702.7	-23.9	337.7

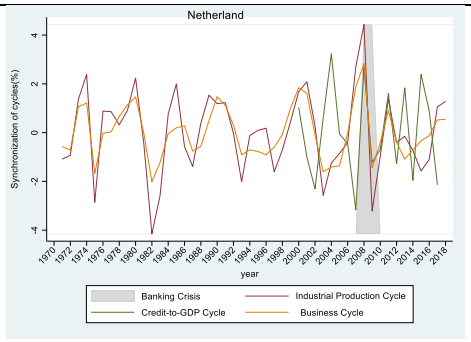
Author, 2021

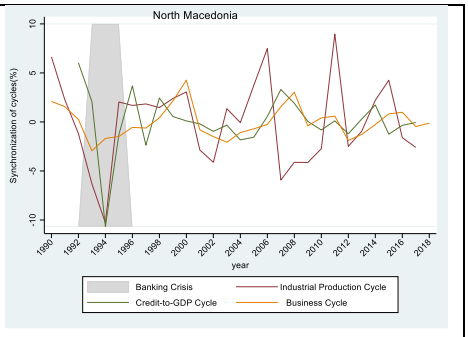
Table 3.5: Synchronization Of Business Cycle, Credit-To-GDP Cycle, Industrial Production And Banking Crises By Countries.

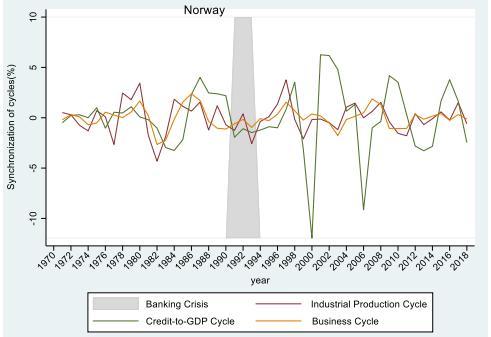


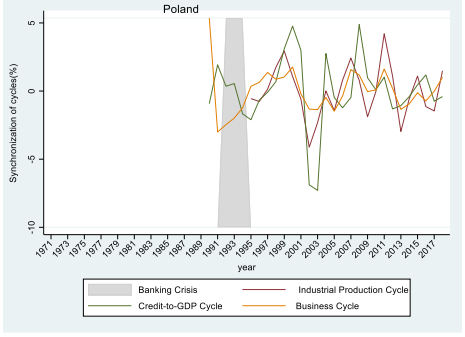

Estonia
Finland
France
Georgia
Germany
Greece
Hungary
Iceland
Ireland
Italy
Kyrgyzstan
Latvia
Lithuania
Luxembourg
Synchronization of cycles(%)
year
Banking Crisis
Banking Crises
Industrial Production Cycle
Industrial Business Cycle
Credit-to-GDP Cycle
Business Cycle

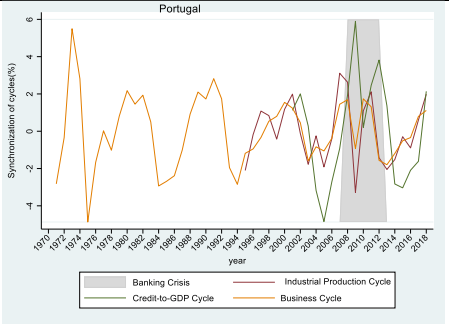

Moldova
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

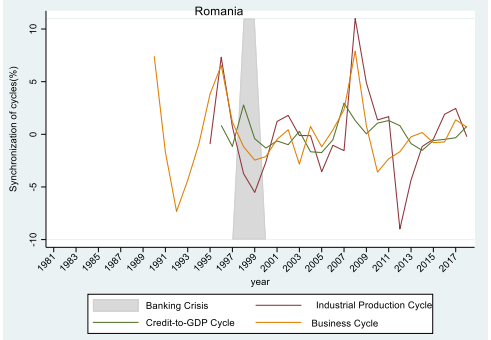

Netherland
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

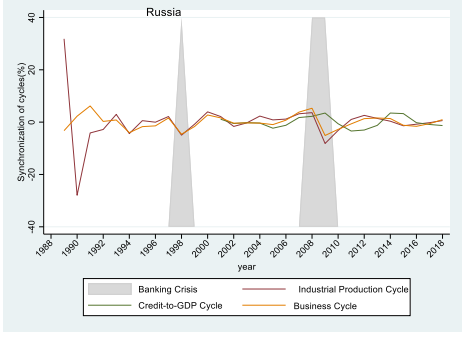

North Macedonia
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

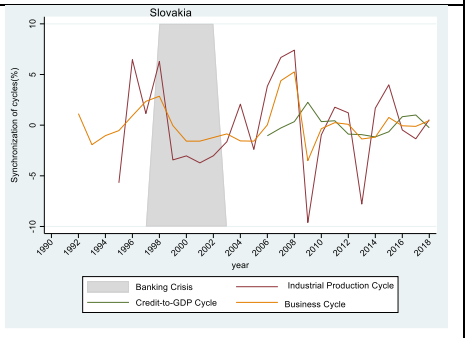

Norway
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

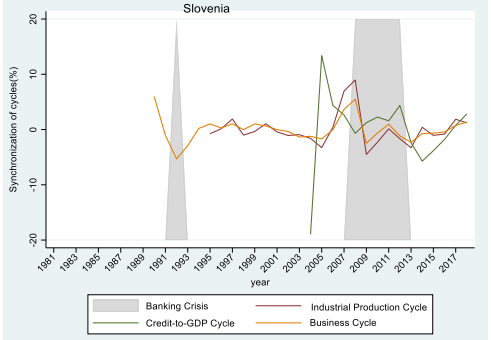

Poland
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

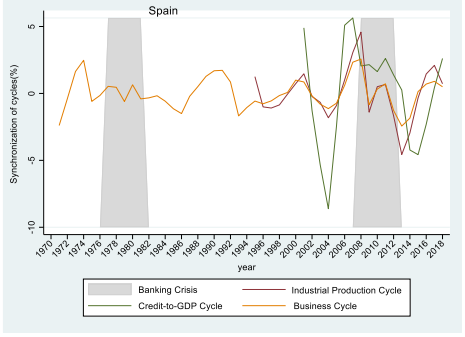

Portugal
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

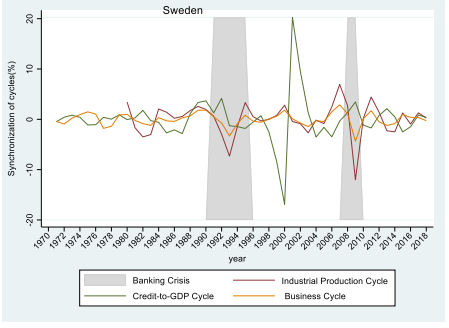

Romania
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

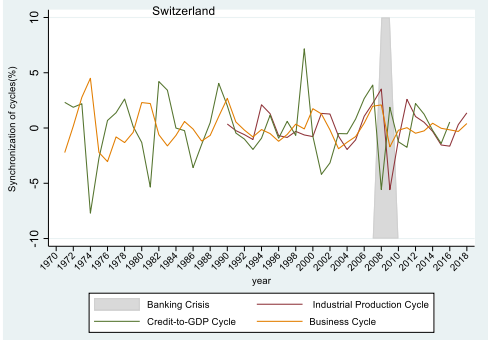

Russia
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

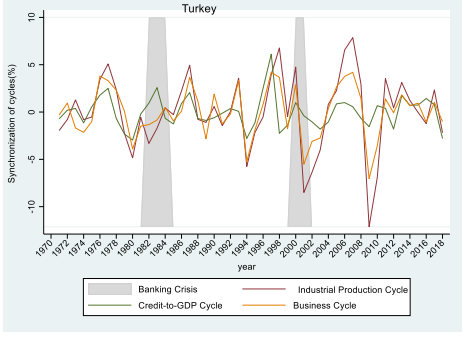

Slovakia
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

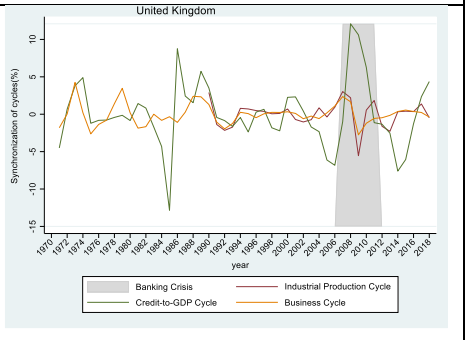

Slovenia
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle

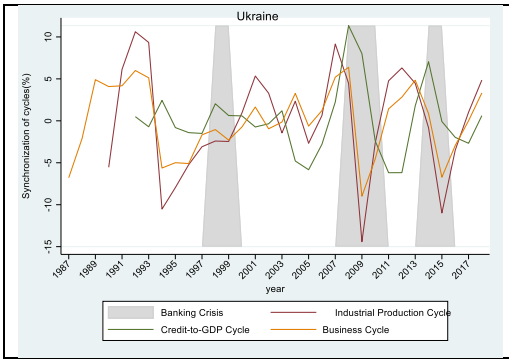

Spain
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle


Sweden
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle


Switzerland
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle


Turkey
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle


United Kingdom
Synchronization of cycles(%)
year
Banking Crisis
Industrial Production Cycle
Credit-to-GDP Cycle
Business Cycle



Source: Author, 2021

APPENDIX 2: STATIONARITY, DIAGNOSTIC AND STABILITY TESTS

Table 3.2: Stationarity Test and Variable Name Abbreviation

Variables at Level	Variables Name Abbreviation	Lags (AIC 4)	Lags (BIC 4)	Lags (HQIC 4)
Business Cycle estimated using the Hodrick-Prescott (HP) filtered	businesscycle	-26.0***	-28.4***	-27.07***
Bank credit to the private sector (% of GDP)	bctpspgdp	-2.15**	-2.14**	-2.31**
Natural log of Households Final consumption expenditure. lags(3) HQIC(2)	lnhfce	1.96	1.95	1.66
First Difference of Natural log of Households Final consumption expenditure. lags (3) HQIC(1)	dlnhfce	-24.21***	-26.74***	-26.84***
Natural log of Gross capital formation	lngcf	1.74	1.79	1.93
First Difference of Natural log of Gross capital formation. lags(3)	dlngcf	-25.71***	-26.16***	-25.83***
Natural log of Government final consumption expenditure	lngfce	-3.95***	-5.20***	-4.31***
First Difference of natural log of Government final consumption expenditure	dlngfce	-18.32***	-22.75***	-19.06***
Natural log of Agriculture, value added (constant LCU)	lnava	-2.89**	-2.599**	-2.79**
First Difference of natural log of Agriculture, value added (constant LCU)	dlnava	-27.36***	-32.31***	-26.97***
Natural log of Manufacturing, value added (constant LCU)	lnmva	0.1882	-0.2617	-0.3027
First difference of Natural log of Manufacturing, value added (constant LCU)	dlnmva	-24.44***	-25.31***	-24.44***
Natural log of Service, value added (constant LCU)	lnsva	1.112	2.0436	1.1477
First difference of Natural log of Service, value added (constant LCU)	dlnsva	-24.261***	-25.514***	-24.261***
Broad Money to Total Reserves Ratio	bmttrr	-24.51***	-41.57***	-24.61***
Inflation rate (%) (lag 2)	infl	-35.94***	-36.11***	-36.05***
Interest rate (%)	lr	-14.02***	-14.39***	-14.20***
Financial system deposits percent of GDP	fsdpgdp	4.89	5.097	5.383
First Difference of financial system deposits percent of GDP	dfsdpgdp	-18.72***	-20.75***	-18.66***
Bank credit to government and public enterprises percent of GDP	bcgpepgdp	-9.21***	-8.88***	-9.21***
Liquid liabilities percent of GDP	llpgdp	5.44	4.01	5.17
First difference of Liquid liabilities percent of GDP	dllpgdp	-21.51***	-21.29***	-23.41***
Bank assets percent of GDP	bapgdp	0.83	0.44	0.69
First difference of Bank assets percent of GDP	dbapgdp	-12.06***	-13.86***	-13.47***
Bank return on assets in percent	broap	-13.78***	-14.42***	-14.02
Bank return on equity in percent	broep	-11.28***	-11.62***	-11.12 ***

Bank overhead costs percent of total assets	bocpta	-7.57***	-7.44***	-5.95***
Bank cost to income ratio in percent		-8.52***	-8.43***	-8.52***
Bank non-interest income to total income in percent	bniittip	-6.69***	-7.77***	-6.55***
Bank interest revenue percent of interest-bearing assets	birpiba	-10.94***	-11.62***	-11.03***
Output Gap	$OutputGap$	-26.03***	-28.47***	-27.18***
Credit Gap	CreditGap	-19.99***	-22.41***	-19.38***
Industrial production Gap	ProductionGap	-22.83***	-25.81***	-23.22***

Source: Author 2021. Legend: * p<0.05; ** p<0.01; *** p<0.001

Table 3.3: Optimal number of lags selected

Models	Lag	CD	J	J-value	MBIC	MAIC	MQIC
1A	1	0.9786135	74.83	6.79e-09	-47.76	38.82	5.76
	2	0.9878096	22.02	0.0088	-39.27	4.02	-12.51
1B	1	0.9989943	76.97	0.0085	-220.43	-23.03	-101.34
	2	0.9996072	23.14	0.5693	-125.56	-26.86	-66.01
2A	1	0.9843585	230.48	0.0687	-932.35	-169.53	-473.64
	2	0.9999598	106.71	0.3047	-474.70	-93.29	-245.35
2B	1	0.9991025	173.26	0.258	-754.49	-150.74	-392.17
	2	0.9998763	91.78	0.1939	-372.10	-70.22	-190.94
3A	1	0.9999978	116.61	0.0968	-408.34	-79.395	-212.35
	2	0.9999997	62.93	0.0872	-199.54	-35.07	-101.54
3B	1	0.9995812	229.83	0.0322	-875.28	-154.17	-442.25
	2	0.9999359	141.68	0.1927	-595.05	-114.32	-306.37
	3	0.9999926	59.31	0.6427	-309.06	-68.69	-164.71
3C	1	0.9997932	340.49	0.000036	-1210.29	-145.51	-560.29
	2	0.9999121	192.92	0.0489	-840.93	-131.08	-407.60
	3	0.9999695	73.29	0.7167	-443.64	-88.70854	-226.97
5A	1	0.9733221	197.92	0.3696	-879.80	-186.08	-464.52
	2	0.9998529	135.42	0.3097	-583.06	-120.58	-306.21
	3	0.9999915	71.57	0.2411	-287.67	-56.43	-149.24
5B	1	0.716709	151.64	0.3797	-673.49	-142.37	-355.55
	2	0.995730	114.62	0.1204	-435.47	-81.38	-223.50
	3	0.999639	47.23	0.5451	-227.81	-50.77	-121.83
5C	1	0.993929	201.86	0.2986	-875.86	-182.14	-460.58
	2	0.999704	143.91	0.1594	-574.57	-112.09	-297.72
	3	0.999986	76.37	0.1384	-282.88	-51.64	-144.45

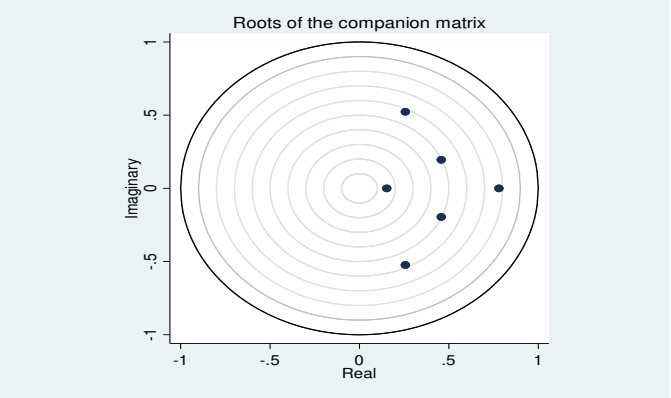
Source: Author 2021

Table 4.2.1: Stability Test for Model 1

Eigenvalue stability condition for Model 1A

Eigenvalue		
Real	Imaginary	Modulus
.7798269	0	.7798269
.2564906	-.5232317	.5827168
.2564906	.5232317	.5827168
.4571149	-.1950959	.4970075
.4571149	.1950959	.4970075
.1524067	0	.1524067

All the eigenvalues lie inside the unit circle. pVAR satisfies stability conditions.



Eigenvalue stability condition for model 1B

Eigenvalue		
Real	Imaginary	Modulus
.9300511	0	.9300511
.6407721	0	.6407721
.5814616	0	.5814616
.4724854	.2928218	.555866
.4 724854	-.292822	.555866
.2331293	.4711865	.5257052
.2331293	-.4711865	.5257052
.1880976	-.1078503	.2168234
.1880976	.1078503	.2168234
.1107523	0	.1107523

All the eigenvalues lie inside the unit circle. pVAR satisfies stability conditions.

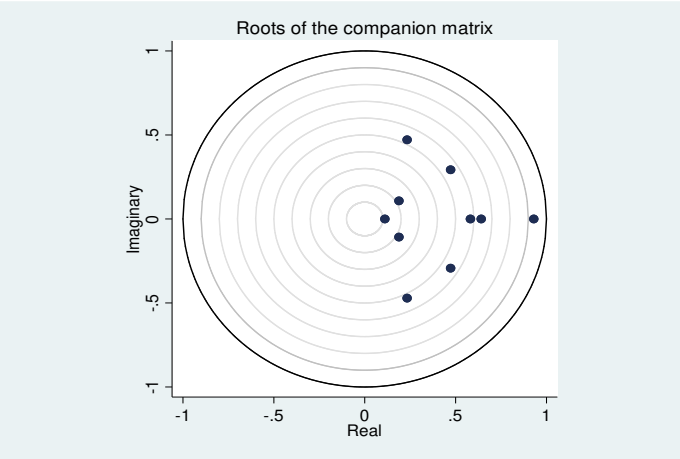
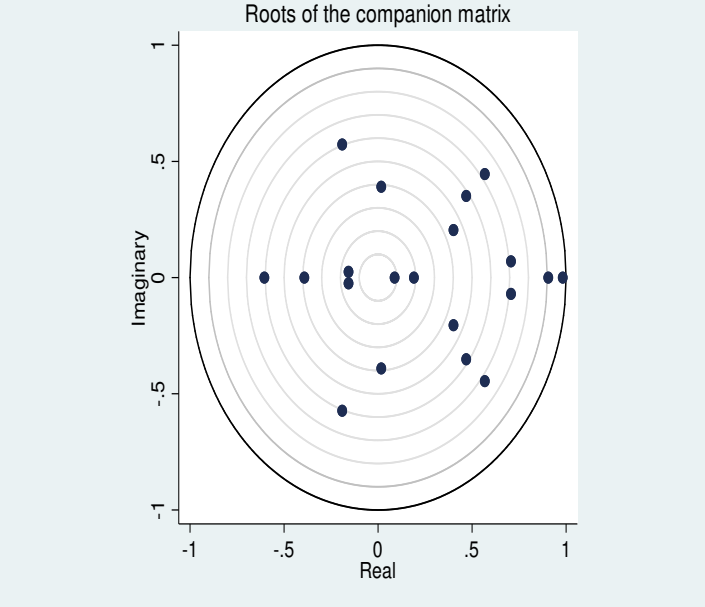


Table 4.4.1: Stability Test for model 2

Eigenvalue stability condition for model 2A

Eigenvalue		
Real	Imaginary	Modulus
.9821357	0	.9821357
.9050853	0	.9050853
.567633	.4454751	.7215644
.567633	-.4454751	.7215644
.7068442	.0699922	.7103011
.7068442	-.0699922	.7103011
-.6047317	0	.6047317
-.1907128	.5728422	.6037546
-.1907128	-.5728422	.6037546
.4687509	.351281	.5857694
.4687509	-.351281	.5857694
.4009039	.2046736	.450128
.4009039	-.2046736	.450128
-.3922412	0	.3922412
.0169024	-.3908921	.3912573
.0169024	.3908921	.3912573
.1904991	0	.1904991
-.1570443	.024796	.1589898
-.1570443	-.024796	.1589898
.0879674	0	.0879674

All the eigenvalues lie inside the unit circle. pVAR satisfies stability conditions.



Eigenvalue stability condition for model 2B

Eigenvalue		
Real	Imaginary	Modulus
.8896087	0	.8896087
.8478456	0	.8478456
.7000369	0	.7000369
.3763706	-.5616112	.6760636
.3763706	.5616112	.6760636
.5406911	.3386658	.637998
.5406911	-.3386658	.637998
.0944869	.6115701	.6188261
.0944869	-.6115701	.6188261
-.3515224	-.174837	.3926016
-.3515224	.174837	.3926016
.1066143	-.2042333	.2303863
.1066143	.2042333	.2303863
-.050377	.1871282	.1937907
-.050377	-.1871282	.1937907
.185243	0	.185243

All the eigenvalues lie inside the unit circle. pVAR satisfies stability conditions.

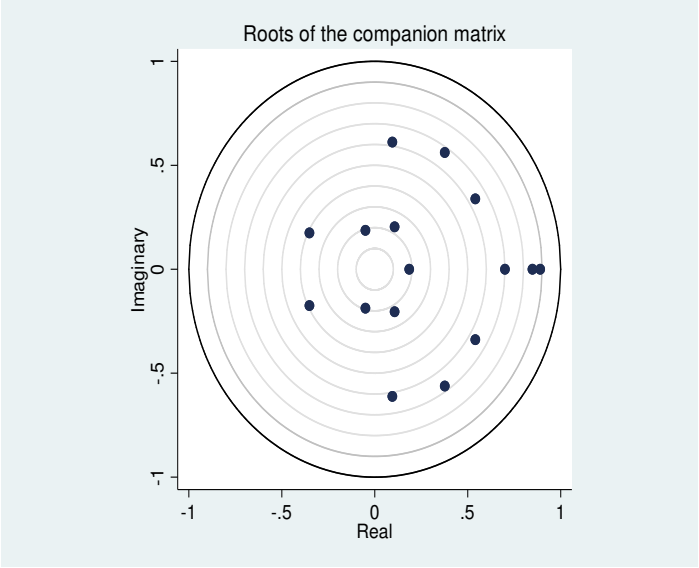
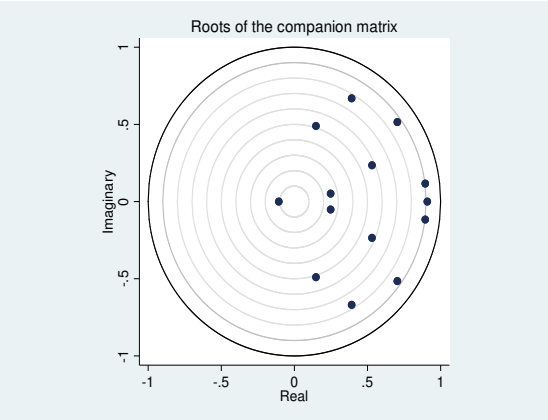


Table 4.6.1: Stability Test for model 3

Eigenvalue stability condition for model 3A

Eigenvalue		
Real	Imaginary	Modulus
.9086374	0	.9086374
.8943726	-.1165531	.9019351
.8943726	.1165531	.9019351
.7037239	-.5150739	.8720828
.7037239	.5150739	.8720828
.3912851	.6689879	.7750154
.3912851	-.6689879	.7750154
.5305947	.2351574	.5803703
.5305947	-.2351574	.5803703
.1473039	-.4897912	.5114624
.1473039	.4897912	.5114624
.2477119	-.0514877	.2530063
.2477119	.0514877	.2530063
-.1067514	0	.1067514

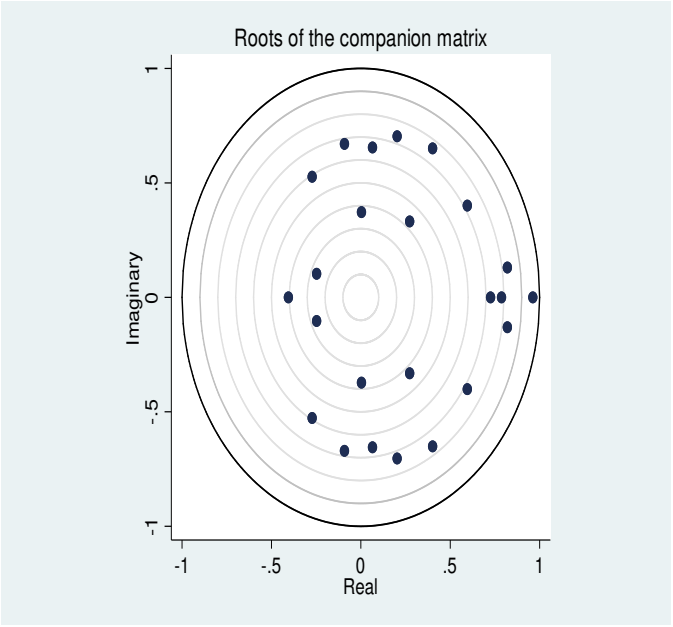
All the eigenvalues lie inside the unit circle. pVAR satisfies stability conditions.



Eigenvalue stability condition for model 3B

Eigenvalue	
Real	Imaginary	Modulus
.9618917	0	.9618917
.8194521	-.1305007	.8297784
.8194521	.1305007	.8297784
.7867621	0	.7867621
.4012952	.6507765	.7645573
.4012952	-.6507765	.7645573
.2028708	.7036515	.7323128
.2028708	-.7036515	.7323128
.7254675	0	.7254675
.5952803	-.4008116	.7176409
.5952803	.4008116	.7176409
-.0915929	.670374	.6766022
-.0915929	-.670374	.6766022
.0651814	.6547945	.6580307
.0651814	-.6547945	.6580307
-.2724252	-.5269462	.5932012
-.2724252	.5269462	.5932012
.2729614	-.3316008	.4294963
.2729614	.3316008	.4294963
-.4051334	0	.4051334
.0034037	.3723043	.3723199
.0034037	-.3723043	.3723199
-.2473569	-.1030786	.267975
-.2473569	.1030786	.267975

All the eigenvalues lie inside the unit circle. pVAR satisfies stability condition



Eigenvalue stability condition model 3C

Eigenvalue	
Real	Imaginary	Modulus
.9273881	-.0754471	.930452
.9273881	.0754471	.930452
.8524999	0	.8524999
-.361579	-.6555345	.748642
-.361579	.6555345	.748642
.7314656	-.1310364	.74311
.7314656	.1310364	.74311
.3162036	-.6070192	.6844392
.3162036	.6070192	.6844392
.5685756	-.3618142	.6739346
.5685756	.3618142	.6739346
.5813817	0	.5813817
.069202	-.5496168	.5539563
.069202	.5496168	.5539563
-.0909613	-.5410512	.5486441
-.0909613	.5410512	.5486441
-.2486373	.4411277	.5063735
-.2486373	-.4411277	.5063735
.4498155	0	.4498155
-.3481363	.0375205	.3501524
-.3481363	-.0375205	.3501524
.1977658	-.2173002	.2938208
.1977658	.2173002	.2938208
-.0963089	-.2718221	.2883793
-.0963089	.2718221	.2883793
-.0896685	-.2049859	.2237402
-.0896685	.2049859	.2237402

All the eigenvalues lie inside the unit Circle. pVAR satisfies stability conditions.

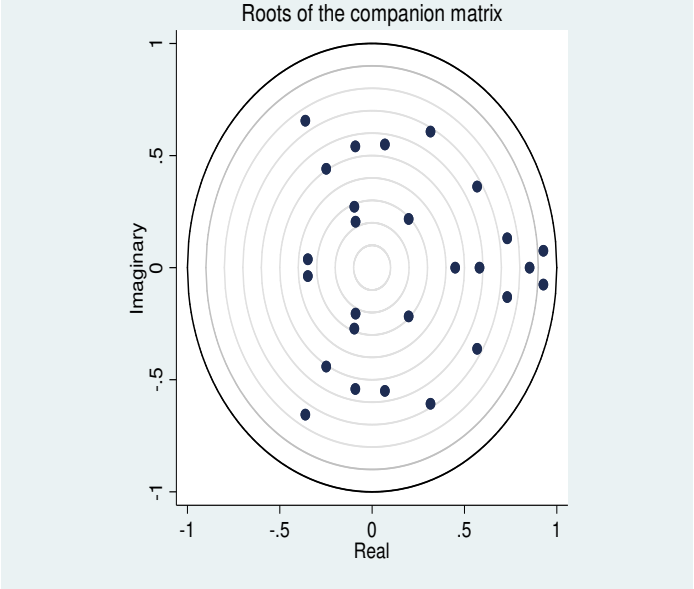
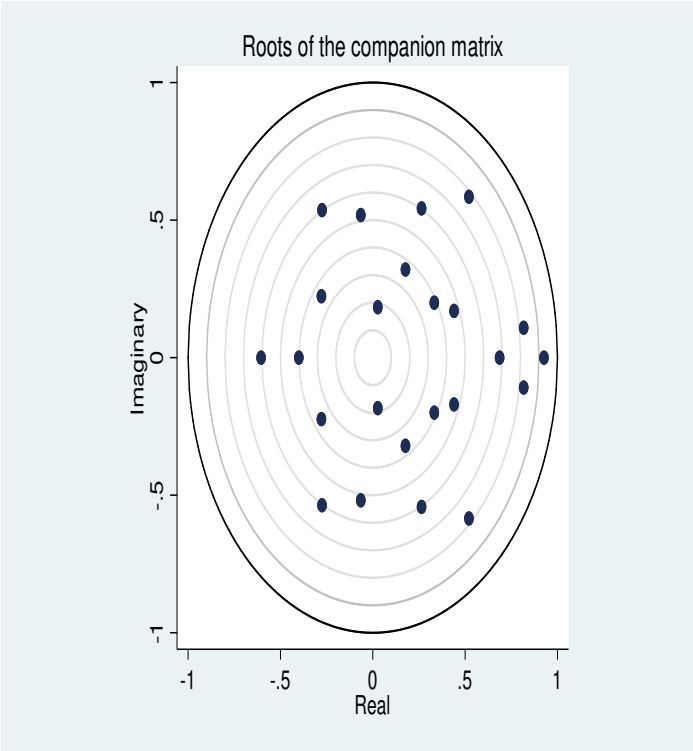


Table 4.9A: Stability Test for model 5

Eigenvalue stability condition for model 5A

Eigenvalue	
Real	Imaginary	Modulus
.9269001	0	.9269001
.8168978	.108579	.8240822
.8168978	-.108579	.8240822
.520509	.5846497	.7827802
.520509	-.5846497	.7827802
.6865203	0	.6865203
-.6049661	0	.6049661
.2640044	.5425438	.6033673
.2640044	-.5425438	.6033673
-.274937	-.5363811	.6027396
-.274937	.5363811	.6027396
-.0651186	-.5183397	.5224141
-.0651186	.5183397	.5224141
.439841	.1700047	.4715524
.439841	-.1700047	.4715524
-.4004012	0	.4004012
.3329821	.1997305	.3882903
.3329821	-.1997305	.3882903
.1767622	.3204202	.3659425
.1767622	-.3204202	.3659425
-.2783164	.2232783	.3568098
-.2783164	-.2232783	.3568098
.0270756	-.1834598	.1854469
.0270756	.1834598	.1854469

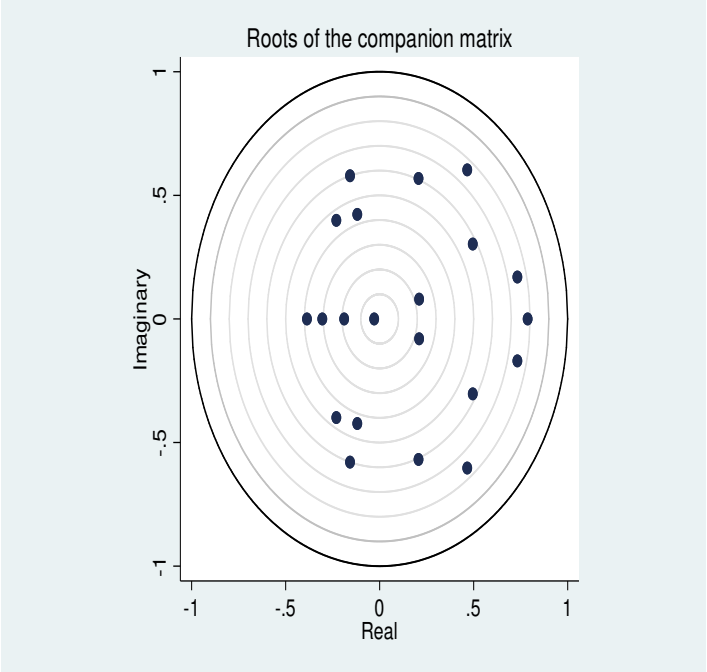
All the eigenvalues lie inside the unit circle. pVAR satisfies stability conditions.



Eigenvalue stability condition for 5B

Eigenvalue	
Real	Imaginary	Modulus
.787097	0	.787097
.465711	-.6030344	.7619299
.465711	.6030344	.7619299
.7323172	-.169601	.7517
.7323172	.169601	.7517
.2065659	-.5682621	.6046415
.2065659	.5682621	.6046415
-.1575627	.5792061	.6002547
-.1575627	-.5792061	.6002547
.4950879	-.3030674	.5804841
.4950879	.3030674	.5804841
-.2305322	.3988564	.4606859
-.2305322	-.3988564	.4606859
-.1190261	-.4230176	.4394441
-.1190261	.4230176	.4394441
-.386549	0	.386549
-.3050918	0	.3050918
.2099465	-.0802179	.2247497
.2099465	.0802179	.2247497
-.1888005	0	.1888005
-.0291387	0	.0291387

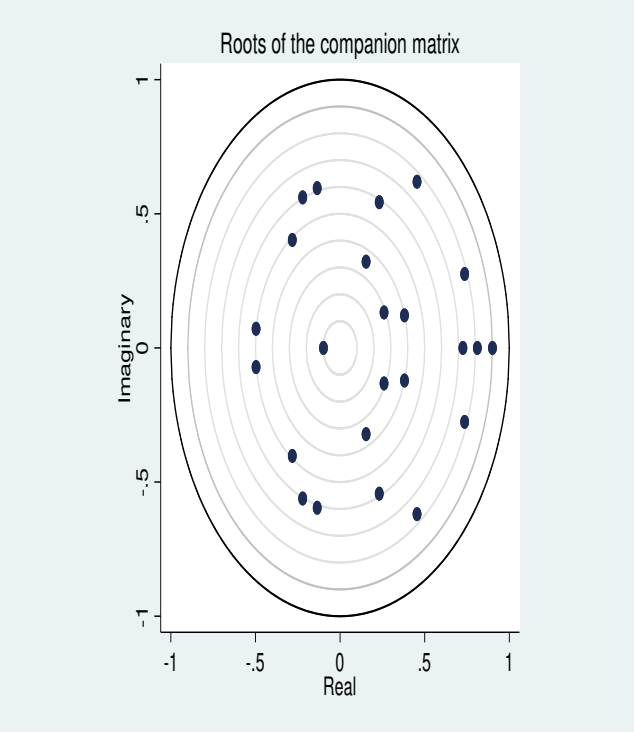
All the eigenvalues lie inside the unit circle. pVAR satisfies stability conditions.



Eigenvalue stability condition for model 5C

Eigenvalue		
Real	Imaginary	Modulus
.900444	0	.900444
.8111348	0	.8111348
.7359988	-.2756618	.7859285
.7359988	.2756618	.7859285
.4545423	-.6194624	.7683374
.4545423	.6194624	.7683374
.7257285	0	.7257285
-.1351143	.5956546	.6107866
-.1351143	-.5956546	.6107866
-.2209813	.5611187	.6030646
-.2209813	-.5611187	.6030646
.2314243	.5432035	.5904466
.2314243	-.5432035	.5904466
-.4964397	-.0713293	.5015378
-.4964397	.0713293	.5015378
-.2823573	-.4025182	.4916773
-.2823573	.4025182	.4916773
.3804342	.1214203	.3993408
.3804342	-.1214203	.3993408
.1536274	.321525	.3563422
.1536274	-.321525	.3563422
.2598665	.1323611	.2916334
.2598665	-.1323611	.2916334
-.0983025	0	.0983025

All the eigenvalues lie inside the unit circle. pVAR satisfies stability conditions.



APPENDIX 3: CONCORDANCE INDEX (CI) BY COUNTRY

Table 4.1.4: Concordance Index (CI) between Business Cycle and Credits by Country

Country	Total Sample	During banking crises	Without banking crises	Country	Total Sample	During banking crises	Without banking crises
Albania	0.4	0.0	0.4	Kazakhstan	0.6	1.0	0.6
Armenia	0.6	1.0	0.6	Kyrgyz Rep	0.7	0.8	0.7
Austria	0.6	0.6	0.5	Latvia	0.6	0.5	0.6
Azerbaijan	0.7	1.0	0.7	Lithuania	0.6		0.6
Belarus	0.5	1.0	0.5	Luxembourg	0.7	0.6	0.7
Belgium	0.6	0.4	0.7	Moldova	0.8	1.0	0.8
Bosnia and Herzegovina	0.6	0.0	0.7	Netherlands	0.6	1.0	0.5
Bulgaria	0.6	0.5	0.6	North Macedonia	0.7	0.7	0.7
Croatia	0.6	0.5	0.6	Norway	0.5	1.0	0.5
Cyprus	0.6	0.2	0.7	Poland	0.5	0.3	0.5
Czech Republic	0.6	0.6	0.6	Portugal	0.7	0.6	0.7
Denmark	0.6	0.5	0.6	Romania	0.5	0.5	0.5
Estonia	0.5	NA	0.5	Russian Federation	0.7	0.5	0.7
Finland	0.4	NA	0.4	Slovak Republic	0.3	NA	0.3
France	0.8	0.5	0.9	Slovenia	0.6	0.2	0.8
Georgia	0.7	0.5	0.7	Spain	0.7	0.6	0.8
Germany	0.7	1.0	0.6	Sweden	0.4	0.6	0.4
Greece	0.6	0.4	0.6	Switzerland	0.4	0.0	0.4
Hungary	0.4	0.4	0.4	Turkey	0.7	0.4	0.7
Iceland	0.6	0.8	0.5	Ukraine	0.6	0.6	0.6
Ireland	0.8	0.8	0.8	United Kingdom	0.5	0.4	0.6
Italy	0.5	0.0	0.6				

Table 4.1.5: Concordance Index (CI) between Business Cycle and Industrial Cycle by Country

Country	Total Sample	During banking crises	Without banking crises	Country	Total Sample	During banking crises	Without banking crises
Albania	0.6		0.6	Kazakhstan	0.8	1.0	0.8
Armenia	0.8	1.0	0.8	Kyrgyz republic	0.8	0.8	0.9
Austria	0.9	1.0	0.8	Latvia	0.9	0.9	0.9
Azerbaijan	0.8	1.0	0.8	Lithuania	0.9	1.0	0.9
Belarus	0.9	1.0	0.9	Luxembourg	0.6	0.8	0.6
Belgium	0.6	0.6	0.6	Moldova	0.8	1.0	0.8
Bosnia and Herzegovina	0.8		0.8	Netherlands	0.8	1.0	0.8
Bulgaria	0.6	0.0	0.6	North Macedonia	0.6	0.7	0.6
Croatia	0.8	1.0	0.8	Norway	0.7	0.7	0.7
Cyprus	0.8	1.0	0.8	Poland	0.8		0.8
Czech Republic	0.9	0.8	1.0	Portugal	0.9	1.0	0.8
Denmark	0.8	1.0	0.8	Romania	0.6	1.0	0.5
Estonia	0.9		0.9	Russian Fed	0.7	1.0	0.7
Finland	0.9	1.0	0.9	Slovak Republic	0.9	1.0	0.9
France	0.9	1.0	0.8	Slovenia	0.8	1.0	0.8
Georgia	0.8		0.8	Spain	0.9	1.0	0.8
Germany	0.8	1.0	0.8	Sweden	0.8	1.0	0.8
Greece	0.6	0.6	0.6	Switzerland	0.7	1.0	0.6
Hungary	0.8	1.0	0.7	Turkey	0.8	1.0	0.8
Iceland	0.7	1.0	0.6	Ukraine	0.8	0.9	0.8
Ireland	0.8	0.8	0.8	United Kingdom	0.8	0.6	0.8
Italy	0.9	1.0	0.9				

APPENDIX 4: ESTIMATED MODELS, GRANGER CAUSALITY AND IMPULSE RESPONSE FUNCTIONS BASIC MODEL 1

Model 1A; Banking Crises, Business Cycle, And Banks' Credit.

Table 4.2: Basic Model 1A, Granger Causality and Impulse Response Function (IRF)

Panel Vector Autoregressive Model 1A

	Business cycle	bctpspgdp	bcdummy
businesscyle			
L1.	0.5007***	0.040	0.0264***
L2.	-0.3109***	-0.228	-0.0037
bctpspgdp			
L1.	0.016	1.0931***	-0.0051
L2.	-0.015	-0.295*	0.0011
bcdummy			
L1.	-1.257**	2.684	0.766***
L2.	0.629	-3.986	-0.0855

Legend: * p<0.05; ** p<0.01; *** p<0.001. Business Cycle (businesscycle), Bank credit to the private sector, % of GDP (bctpspgdp), Banking Crises (bcdummy).

panel VAR-Granger causality Wald test
Ho: Excluded variable does not Granger-cause Equation variable
Ha: Excluded variable Granger-causes Equation variable

Equation \ Excluded	chi2	df	Prob > chi2
businesscycle			
bctpspgdp	1.738	2	0.419
bcdummy	6.891	2	0.032
ALL	12.523	4	0.014
bctpspgdp			
businesscycle	2.285	2	0.319
bcdummy	3.407	2	0.182
ALL	5.439	4	0.245
bcdummy			
businesscycle	11.359	2	0.003
bctpspgdp	1.074	2	0.584
ALL	13.073	4	0.011

The impulse response of banking crises on the business cycle

Orthogonalized IRF	
Impulse Variable: Banking Crises Forecast horizon	Impulse Variable: Business Cycle
0	0
1	-0.3481375
2	-0.2548451
3	-0.0511135
4	0.032203
5	0.0133583
6	-0.0185654
7	-0.0242041
8	-0.0133297
9	-0.0038951
10	-0.0014349

The impulse response of business cycle on the probability of banking crises

Impulse Variable: Business Cycle Forecast horizon	Response Variable: Banking Crises
0	0.0106023
1	0.0565745
2	0.0578895
3	0.0305958
4	0.0091542
5	0.0035318
6	0.0056222
7	0.0070781
8	0.0059938
9	0.0040636
10	0.0027342

Model 1B: Business Cycle, Banking crises, Bank credits and Monetary Policy

Table 4.3: Panel Vector Autoregressive Model 1B

Independent Variable	businesscycle	bctpspgdp	bcdummy	bmttrr	lr
Business cycle					
L1.	0.459***	0.071	.01906*	0.057	0.32
L2.	-0.268***	-0.151	-0.0032	-0.034	-0.17
bctpspgdp					
L1.	0.0593**	1.356***	-0.0047*	-0.005	-0.305*
L2.	-0.0327*	-0.414***	0.0022	-0.017	0.04
bcdummy					
L1.	-0.81	5.78	0.757***	1.688*	-3.04
L2.	0.57	-5.10	-0.099	-1.067	5.44
bmttrr					
L1.	-0.15	-0.72	-0.005	0.8397***	2.04
L2.	-0.01	0.07	0.005	-0.0448	-0.44
Interest Rate					
L1.	0.02	0.00	-0.0028**	-0.0358***	0.639***
L2.	-0.01	-0.01	0.0004	.00839*	-0.13

Source: Author 2021.Legend: * p<0.05; ** p<0.01; *** p<0.001. Business Cycle (businesscycle), Bank credit to the private sector, % of GDP (bctpspgdp), Banking Crises (bcdummy), broad money to total reserve ratio (bmttrr), interest rate(lr).

Table 4.3.1: Granger causality and IRFs- Panel VAR Model 1B

panel VAR-Granger causality Wald test
Ho: Excluded variable does not Granger-cause Equation variable
Ha: Excluded variable Granger-causes Equation variable

	Business cycle	bctpspgdp	bcdummy	bmttrr	LR
Business cycle	-	0.368	5.599"	3.549	0.424
bctpspgdp	7.01*	-	5.083"	8.464*	5.56
bcdummy	0.618	0.884	-	4.886	0.331
bmttrr	2.034	0.607	1.779	-	1.327
lr	1.919	0.044	8.407*	27.298***	-
ALL	10.592	3.633	18.166*	45.213***	11.798

Legend: * p<0.05; ** p<0.01; *** p<0.001, " p<0.1

The impulse response function of Credit to the Private Sector on the Business Cycle

Orthogonalized IRF	
Impulse Variable: Bctpspgdp Forecast horizon	**Response Variable:** Business Cycle
0	0
1	0.3126401
2	0.4150263
3	0.3189282
4	0.2086133
5	0.1645865
6	0.1650812
7	0.1714822
8	0.1686508
9	0.1591682
10	0.1484442

The impulse response function of interest on the probability of banking crises

Orthogonalized IRF	
Impulse Variable: Interest rate Forecast horizon	**Response Variable:** Banking Crises
0	0
1	-0.0379095
2	-0.0393026
3	-0.0256995
4	-0.0135728
5	-0.0063544
6	-0.00272
7	-0.001198
8	-0.0008667
9	-0.001078
10	-0.0013774

The impulse response function of Bank Credit to the Private Sector on the Broad Money to Total Reserve Ratio

Orthogonalized IRF	
Impulse Variable: Bank Credit to the private sector (%GDP) Forecast horizon	**Response Variable:** Broad Money to Total Reserve Ratio
0	0 .6304876
1	0.7514341
2	0.5065596
3	0.2151304
4	0.0017492
5	-0.1183956
6	-0.1694625
7	-0.1812073
8	-0.1758536
9	-0.1657119
10	-0.1556842

The impulse response function of Interest rate on Broad Money to Total Reserve Ratio

Orthogonalized IRF	
Impulse Variable: Interest rate Forecast horizon	**Impulse Variable:** Broad Money to Total Reserve Ratio
0	0
1	-0.4930358
2	-0.6603487
3	-0.589667
4	-0.4353808
5	-0.2882501
6	-0.1810681
7	-0.1152139
8	-0.0800769
9	-0.0634275
10	-0.0558511

APPENDIX 5: ESTIMATED MODELS, GRANGER CAUSALITY AND IMPULSE RESPONSE FUNCTIONS MODEL 2

MODEL 2A: Business cycle, Banking crises and GDP expenditure components

Table 4.4: Panel Vector Autoregressive Model 2A

Independent Variables	Lag	business cycle	bctpspgdp	bcdummy	bmttrr	Interest rate	dlnhfce	dlngcf	dlngfce	dlnimport	dlnexport
Business Cycle	1.	0.214***	0.059	0.029***	0.026	0.106	-.0134***	-0.0254**	-0.00546***	-0.023***	-0.0165***
	2.	-0.209***	-0.354	-0.0048	-0.078	-0.357	-0.0044*	-0.0019	0.0018	0.0032	0.0026
bctpspgdp	1.	-0.025*	1.467***	0.0005	0.021	0.226*	0.0001	0.0017	-0.00059*	0.00088	-0.0011*
	2.	0.0259***	-0.512***	0.0013	-0.021	-0.11	-0.0002	-0.0018	0.0002	-0.00158***	0.000442
bcdummy	1.	-1.373*	2.20	0.775***	0.388	3.33	-0.0005	-0.114*	0.0141	-0.0815**	-0.028
	2.	0.3434	-2.399*	-0.137**	-0.447	-3.29	0.0040	0.0855*	-0.0080	0.0768***	0.021
bmttrr	1.	-0.0178	-0.932	-0.0235	0.831***	0.56	-0.0021	0.0216	-0.0008	0.0031	-0.0023
	2.	0.064***	0.1785*	0.0005	-0.0700***	-0.916***	.00128*	-0.01196**	0.0015**	-0.00012	.00165**
lr	1.	-0.017*	-0.016	-0.0006	-0.0164*	0.90***	-0.0003	0.0074***	-.000997***	-0.00014	-0.00027
	2.	0.0099	-0.024	0.00105*	0.0025	0.0249	-0.0001	-0.0039***	.00034**	-0.00016	0.000001
dlnhfce	1.	14.17***	-2.70	-0.1724	1.38	53.36**	0.325***	-0.3876	0.247***	0.3088**	0.6122***
	2.	19.38***	-7.67	-0.5303	-1.29	-3.40	0.411***	-0.2632	0.266***	-0.104	0.0448
dlngcf	1.	2.81***	4.919*	-0.233**	0.835*	-18.06	0.0749***	0.1183	0.148***	0.106***	0.067*
	2.	0.685	2.193	0.281***	1.811***	29.25***	.1655***	-0.0407	-0.0063	-0.0875**	-0.1411***
dlngfce	1.	-2.4714	-31.66***	-0.831**	-7.09***	-48.497*	-0.228**	1.018***	-0.0353	0.178	0.033
	2.	1.5040	20.93*	0.487*	1.439	29.345*	0.011	0.0815	-0.0219	-0.126	-0.1314*
dlnimport	1.	-7.103***	-16.08**	0.0148	-3.47***	-16.89	-0.163**	0.449**	-0.214***	-0.059	-0.314***
	2.	-10.0***	0.103	-0.388*	-2.89*	-58.41***	-.345***	0.444**	-0.066*	0.2615***	0.2024**
dlnexport	1.	2.71	17.77**	0.390	2.898*	44.056**	0.210***	-0.25	0.209***	0.2112*	0.259***
	2.	6.322***	4.23	0.3299*	3.628***	45.69***	0.247***	-0.377*	0.071*	-0.165*	-0.119*

Legend: * p<0.05; ** p<0.01; *** p<0.001. Banks' credit to the private sector, % of GDP (bctpspgdp), Banking Crises (bcdummy), the first difference of the natural logarithm of household final consumption expenditure (dlnhfce), the first difference of the natural logarithm of the gross capital formation (dlngcf), the first difference of the natural logarithm of government final consumption expenditure (dlngfce), Broad Money to Total Reserves Ratio (bmttrr), Interest rate (lr), the first difference of the natural logarithm of import (dlnimport), the first difference of the natural logarithm of export (dlnexport).

Table 4.4.2: Granger Causality for Model 2A

panel VAR-Granger causality Wald test
Ho: Excluded variable does not Granger-cause Equation variable
Ha: Excluded variable Granger-causes Equation variable

	Businesscycle	**bctpspgdp**	**bcdummy**	**bmttrr**	**lr**	**dlnhfce**	**dlngcf**	**dlngfce**	**dlnimport**	**dlnexport**
Business cycle	-	1.7	13.6**	2.8	0.61	108.6***	14.5**	13.7**	41.3***	73.1***
bctpspgdp	11.7**	-	6.4*	3.6	4.7	1.4	2.95	5.5	19.9***	8.1**
bcdummy	7.4*	5.7	-	1.5	3.0	0.2	5.73	2.4	14.7**	3.8
bmttrr	23.3***	5.3	4.1	-	35.2***	4.8	10.9**	9.05*	0.6	11.8**
lr	5.4	3.1	4.2	7.4*	-	3.0	37.7***	20.7***	1.7	1.8
dlnhfce	68.4***	0.7	3.4	1.5	7.5*	-	3.07	29.0***	8.2*	36.1***
dlngcf	29.9***	9.4**	21.2***	20.5***	31.7***	67.6***	-	77.9***	20.2***	46.8***
dlngfce	3.7	21.7***	15.0**	20.8***		9.3*	14.7**	-	7.2*	6.2*
dlnimport	35.5***	7.7*	4.9	14.4**	22.6***	32.5***	11.5**	24.6***		41.1***
dlnexport	15.2***	9.4**	7.8*	21.3***	28.0***	41.6***	8.8*	26.2***	10.3**	-
ALL	152.5***	74.1***	96.5***	48.6***	125.6***	208.0***	90.4***	140.1***	216.4***	274.6***

Legend: * p<0.05; ** p<0.01; *** p<0.001. Bank credit to the private sector, % of GDP (bctpspgdp), Banking Crises (bcdummy), the first difference of the natural logarithm of household final consumption expenditure (dlnhfce), the first difference of the natural logarithm of the gross capital formation (dlngcf), the first difference of the natural logarithm of government final consumption expenditure (dlngfce), Broad Money to Total Reserves Ratio (bmttrr), Interest rate (lr), the first difference of the natural logarithm of import (dlnimport), the first difference of the natural logarithm of export (dlnexport).

Table 4.4.3: IRFs- Business cycle, banking crises and selected GDP expenditure components for model 2A

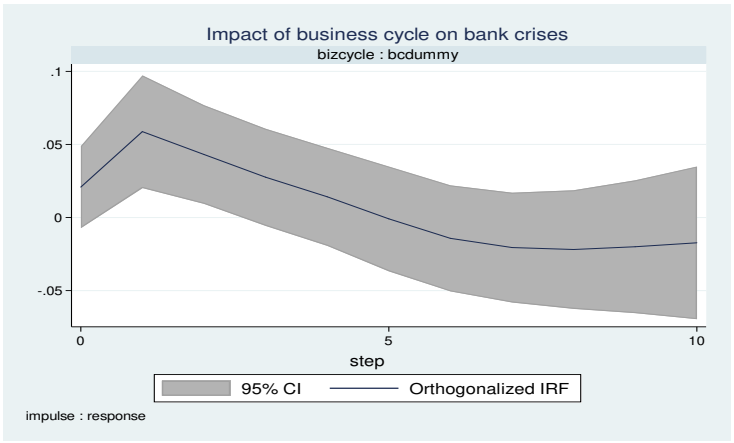
Effect of banking crises on the business cycle and Import

Orthogonalized IRF		
Impulse Variable: Bank Crises Forecast horizon	**Response Variable:** Business Cycle	**Response Variable:** Import
0	0	-0.0139617
1	-0.3800196	-0.0213236
2	0.121301	0.0110113
3	0.3706323	0.0056537
4	0.3194269	-0.0052118
5	0.2249096	-0.0064883
6	0.1356579	-0.0060696
7	0.0624144	-0.0050856
8	0.0421523	-0.0025936
9	0.052822	-0.0007354
10	0.0681386	-0.0002418

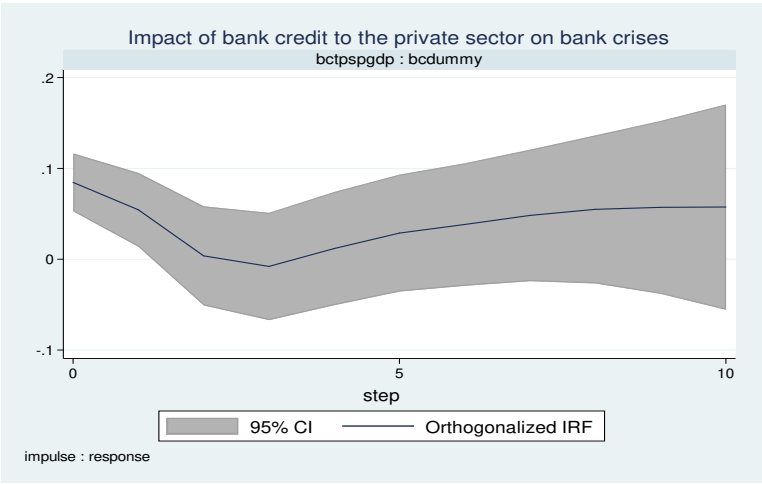
Effect of the business cycle on GDP components during banking crises

Orthogonalized IRF					
Impulse Variable: Business Cycle Forecast horizon	**Response Variable:** dlnhfce	**Response Variable:** **dlngcf**	**Response Variable:** **dlngfce**	**Response Variable:** **dlnimport**	**Response Variable:** **dlnexport**
0	0.022385	0.0082843	0.0068599	0.0131268	0.0159459
1	-0.022139	-0.0254159	-0.0066723	0.0385066	-0.0210493
2	-0.015019	-0.0250354	-0.0002053	0.0279557	-0.0153588
3	-0.012652	-0.0086976	-0.0066117	0.0048552	-0.0025721
4	-0.000399	0.0036889	-0.0028146	0.0054517	0.0020648
5	0.002039	0.0108896	-0.0006875	0.0118686	0.0070479
6	0.005443	0.0111408	0.0028316	0.0117734	0.0062823
7	0.003613	0.0078169	0.0030841	0.0087446	0.004704
8	0.002081	0.0032127	0.0031819	0.0048825	0.0024696
9	-0.0000561	-0.0006969	0.0022397	0.0026332	0..0013445
10	-0.0008618	-0.0028015	0.0015475	0.0018496	0.000812

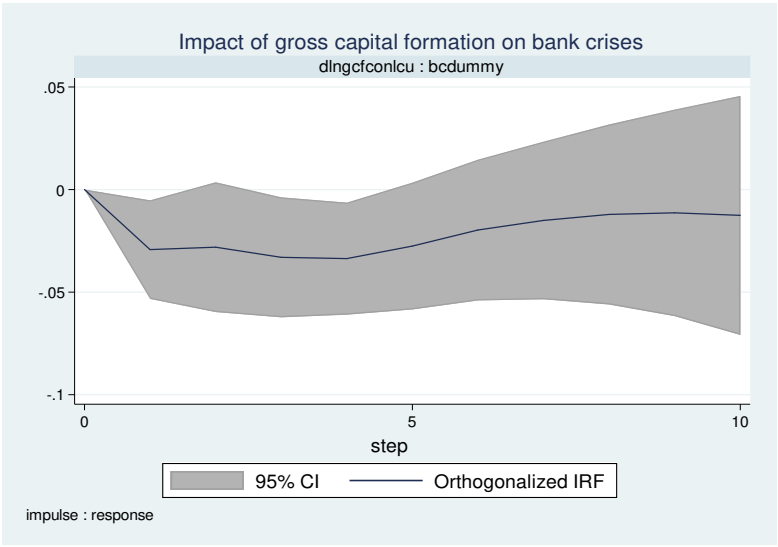
Table 4.4.4: IRFs- Causes of banking crises among the GDP expenditure components



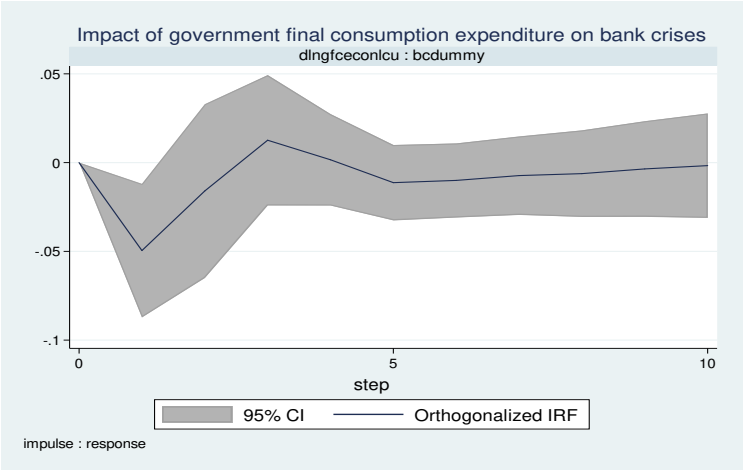
Orthogonalized IRF	
Impulse Variable: Business Cycle Forecast horizon	Response Variable: banking crises
0	0.0208246
1	0.0587865
2	0.0431342
3	0.0275695
4	0.0142068
5	-0.0008885
6	-0.0142427
7	-0.0205462
8	-0.0218848
9	-0.0199791
10	-0.0173098



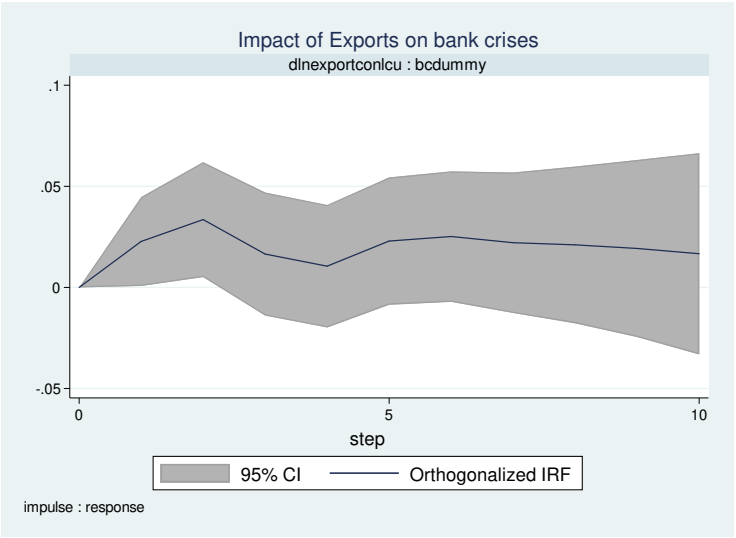
Orthogonalized IRF	
Impulse Variable: bctpspgdp Forecast horizon	Response Variable: banking crises
0	0.0846058
1	0.0544152
2	0.0037209
3	-0.0079428
4	0.0117482
5	0.0288225
6	0.0382636
7	0.0482403
8	0.054914
9	0.0571335
10	0.0574747



Orthogonalized IRF	
Impulse Variable: dlngcf Forecast horizon	Response Variable: banking crises
0	0
1	-0.0292683
2	-0.0280898
3	-0.0330297
4	-0.03367
5	-0.0275453
6	-0.0197252
7	-0.0150595
8	-0.0121348
9	-0.0113328
10	-0.0125779



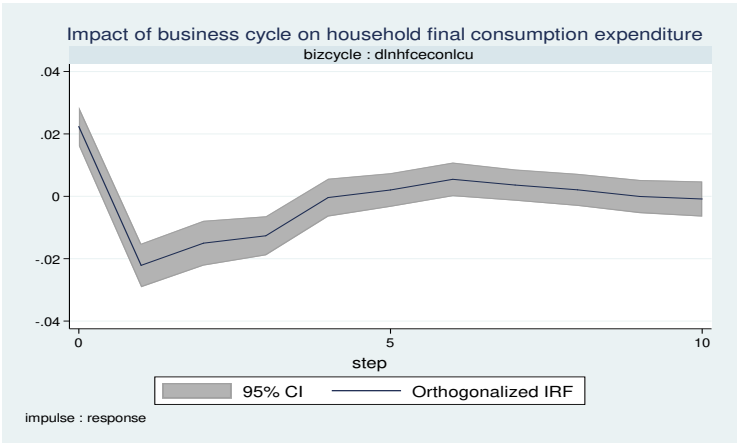
Orthogonalized IRF	
Impulse Variable: dlngfce Forecast horizon	Response Variable: banking crises
0	0
1	-0.049556
2	-0.0159871
3	0.0126041
4	0.0015817
5	-0.0112918
6	-0.0100507
7	-0.0073103
8	-0.0062127
9	-0.0035681
10	-0.0017108



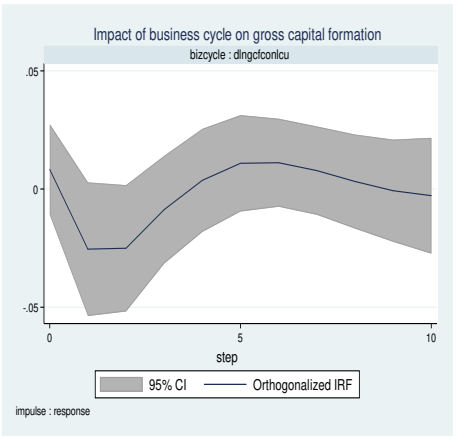
Orthogonalized IRF	
Impulse Variable: Exports Forecast horizon	Response Variable: banking crises
0	0
1	0.0227191
2	0.0335583
3	0.0165013
4	0.0104968
5	0.0229243
6	0.0251656
7	0.0221047
8	0.0210627
9	0.0192608
10	0.0166666

Figure 4.6: Response of GDP expenditure components to shocks in the business cycle during banking crises

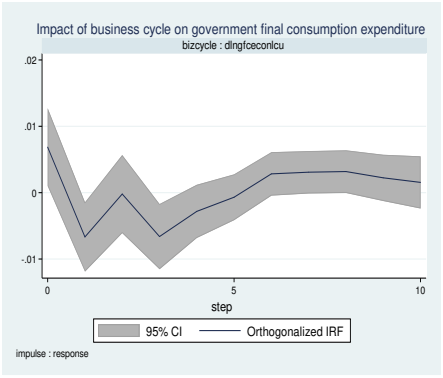
Response of households' consumption to shocks in the business cycle



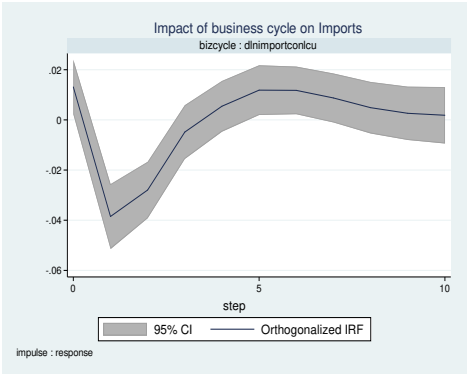
Response of gross capital formation to shocks in the business cycle



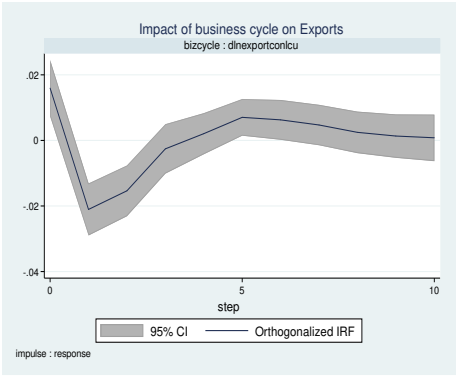
Response of government expenditure to shocks in the business cycle



Response of imports to shocks in the business cycle



Response of exports to shocks in the business cycle



Model 2B: Business Cycle, Banking Crises and GDP Sectorial Components

Table 4.5: Panel Vector Autoregressive Model 2B

In]dependent Variables	bizcycle	bctpspgdp	bcdummy	bmttrr	lr	dlnava	dlnmva	dlnsva
bizcycle								
L1.	0.295**	-0.103	-0.0153	-0.227	-0.270	0.0085	-0.0104***	-0.0078***
L2.	-0.452***	0.426	0.025*	0.032	0.119	-0.0021	-0.00324	-0.00093
bctpspgdp								
L1.	-0.0107	1.27***	-0.0023	-0.0203	-0.0332	-0.000679	0.000077	0.000602
L2.	0.0288*	-0.468**	0.00084	0.0140	0.0699	-0.000016	-0.000487	-0.000384
bcdummy								
L1.	-1.92*	-1.66	0.769***	0.182	2.58	-0.042	-0.0063	-0.0344**
L2.	0.489	-6.05	-0.158	-1.21	1.33	0.0577	0.0302*	0.0093
bmttrr								
L1.	0.129	0.725	0.0169	1.12***	0.312	-0.00658	-0.00715	0.00182
L2.	-0.046	0.0171	0.0063	-0.0567	-0.502***	0.00274	-0.00213*	-0.0022**
lr								
L1.	0.0518*	-0.085	-0.0063	-0.0357	0.781***	-0.00152	0.0019***	0.00128**
L2.	-0.028***	-0.057	0.0024	0.0115	0.0264	-0.000108	-0.001***	-.00070***
dlnava								
L1.	-5.81***	4.98	0.0342	-1.54	-5.41	-.43367939***	-0.0198	0.0636
L2.	0.348	12.75	-0.0667	0.5731	-5.97	-0.182	0.0898*	-0.0101
dlnmva								
L1.	2.71	45.27*	1.29*	12.51*	-4.27	-0.496**	-0.0273	0.0344
L2.	1.02	-8.77	-0.395	-3.42	1.11	0.182	-0.022	0.087*
dlnsva								
L1.	-1.40	-47.78	-0.267	-6.25	49.21**	1.01***	0.198	0.287**
L2.	14.82**	-54.75	0.98	13.79	57.28**	-0.665	-0.0037	-0.122

Table 4.5.1: Granger Causality and Impulse Response Function for Model 2B

panel VAR-Granger causality Wald test
Ho: Excluded variable does not Granger-cause Equation variable
Ha: Excluded variable Granger-causes Equation variable

Independent Variables	bizcycle	bctpspgdp	bcdummy	bmttrr	lr	dlnava	dlnmva	dlnsva
bizcycle	-	0.791	4.361	2.552	0.52	1.852	34.6***	24.99***
bctpspgdp	9.23*	-	0.912	0.922	2.7	1.132	4.96	3.283
bcdummy	8.35*	5.467	-	2.393	3.53	2.129	8.92*	8.472*
bmttrr	1.83	0.586	2.766	-	22.4***	1.652	13.73**	9.502**
Interest rates	13.16**	3.18	3.789	1.235	-	1.606	34.5***	35.33***
dlnava	16.14***	0.56	0.098	0.789	0.81	-	5.3	3.79
dlnmva	1.82	4.915	5.896	6.071*	0.32	7.522*	-	4.727
dlnsva	10.72**	4.595	2.592	7.351*	10.6**	18.52***	3.963	-
ALL	74.79***	17.362	23.464	17.661	61.4***	48.69***	157.84***	156.9***

Legend: * p<0.05; ** p<0.01; *** p<0.001

Table 4.5.2: Effect of banking crises on the business cycle and selected Sectorial components

Orthogonalized IRF				Orthogonalized IRF	
Impulse Variable: Bank Crises Forecast horizon	**Response Variable:** Business Cycle	**Response Variable:** Manufacturing Outputs	**Response Variable:** Service Output	**Impulse Variable**: Bank Credit to the private sector Forecast horizon	**Response Variable:** Business Cycle
0	0	-0.007895	-0.0094414	0	0
1	-0.2351118	-0.0062355	-0.0109109	1	-0.072395
2	-0.300908	-0.0002578	-0.0049165	2	0.0438566
3	-0.2607398	0.0024866	-0.0007806	3	0.2454918
4	-0.1038797	0.0043743	0.000364	4	0.350999
5	0.018006	0.0027908	0.0001614	5	0.2325356
6	0.0150108	0.0006124	-0.0004174	6	0.0163639
7	-0.0480229	-0.0001441	-0.0005901	7	-0.1076989
8	-0.0731735	0.000332	-0.0002469	8	-0.0888004
9	-0.0457098	0.0005753	0.0001476	9	-0.0120502
10	-0.0087254	0.0001357	0.000213	10	0.0354305

Table 4.5.3: Effect of the business cycle on manufacturing and service Output

Orthogonalized IRF		
Impulse Variable: Business Cycle Forecast horizon	Response Variable: Manufacturing Sector Output	Response Variable: Service Sector Outputs
0	0.0135985	0.0167194
1	-0.0232604	-0.0112484
2	-0.021268	-0.0104296
3	0.0047489	-0.0030205
4	0.0059842	0.0028331
5	0.0016712	0.0027649
6	-0.0029407	-0.0001187
7	-0.0030738	-0.0017265
8	-0.0014773	-0.0014276
9	-0.0003195	-0.0004356
10	0.0000544	0.0001656

APPENDIX 6: ESTIMATED MODELS, GRANGER CAUSALITY AND IMPULSE RESPONSE FUNCTIONS MODEL 3

Model 3A: Business Cycle, Banking Crises and Banks' Stability

Table 4.6: Panel Vector Autoregressive Model 3A

	businesscycle	bctpspgdp	bcdummy	bcpbd	blatdstf	bscpa	lr
businesscycle							
L1.	0.4507***	-0.3091	0.0091	-0.122	-0.8052**	0.0823*	0.2388***
L2.	-0.4081***	-0.961*	-0.0048	-1.1299**	0.092	-0.0271	-0.1246**
bctpspgdp							
L1.	-0.013	0.9389***	-0.0036	0.0868	-0.179	-0.0122	-0.0051
L2.	0.04454*	-0.385*	0.0043	-0.3969**	-0.026	-0.0018	-0.0008
bcdummy							
L1.	-0.484	16.08*	1.191***	29.129***	4.198	-0.0868	-1.550**
L2.	0.442	-27.874***	-0.6083***	-31.324***	-17.081***	1.322**	0.0544
bcpbd							
L1.	0.0689***	0.2381*	0.00072	1.3644***	0.0202	-0.00486	0.00945
L2.	-0.0628***	-0.2231*	-0.0025	-0.4188***	-0.0160	0.01156	0.01400
blatdstf							
L1.	-0.0255	-0.00569	0.0010	-0.300*	0.8014***	-0.01514	0.0166
L2.	0.0365*	-0.4046***	-0.0018	-0.0247	-0.1675**	0.00279	0.00367
bscpa							
L1.	0.2926*	-1.4899*	-0.0351	0.312	-0.6288	0.9268***	-0.0999
L2.	0.032	0.156	0.015	0.108	-0.417	-0.091	0.123
Lending Rate							
L1.	0.3315*	1.8139*	0.0079	1.270	-0.9684*	0.0536	0.9591***
L2.	-0.0909	-1.1140*	-0.0097	-0.822	0.4230	-0.0469	-0.2024**

Legend: * p<0.05; ** p<0.01; *** p<0.001
Business Cycle (businesscycle), Bank credit to the private sector, % of GDP (bctpspgdp), Banking Crises(bcdummy), Bank credit as percent of bank deposits (bcpbd), Bank liquid assets to deposits and short-term funding (blatdstf), Banking system capital percent of assets (bscpa), lending rate (lr).

Table 4.6.2: Granger Causality for model 3A

panel VAR-Granger causality Wald test
Ho: Excluded variable does not Granger-cause Equation variable
Ha: Excluded variable Granger-causes Equation variable

		Response Variables						
		businesscycle	bctpspgdp	bcdummy	bcpbd	blatdstf	bscpa	Lr
Impulse Variables	businesscycle	-	7.826*	1.202	7.432*	8.92*	5.68	59.69***
	bctpspgdp	7.935*	-	1.898	9.756**	4.12	1.445	0.256
	bcdummy	0.369	15.53***	-	14.285**	20.99***	13.04**	9.51**
	bcpbd	16.70***	6.056*	1.469	-	0.059	1.245	6.695*
	blatdstf	5.285	23.01***	0.919	14.539**	-	3.124	10.72**
	bscpa	7.893*	6.55*	3.968	0.284	3.742	-	3.309
	lr	7.901*	5.716"	0.97	2.955	4.003	0.604	-
	ALL	74.825***	104.40***	20.57"	86.119***	43.48***	42.16**	270.76***

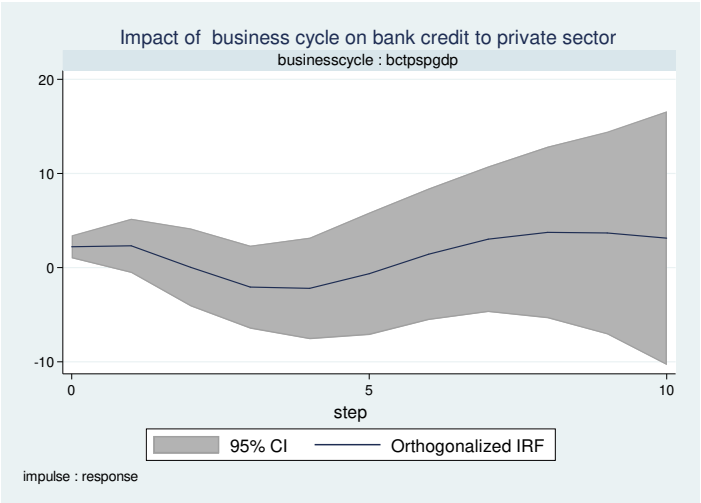
Legend: * p<0.05; ** p<0.01; *** p<0.001,.

Table 4.6.3: IRFs- Effect of banking crises on the business cycle and selected banks' stability variables

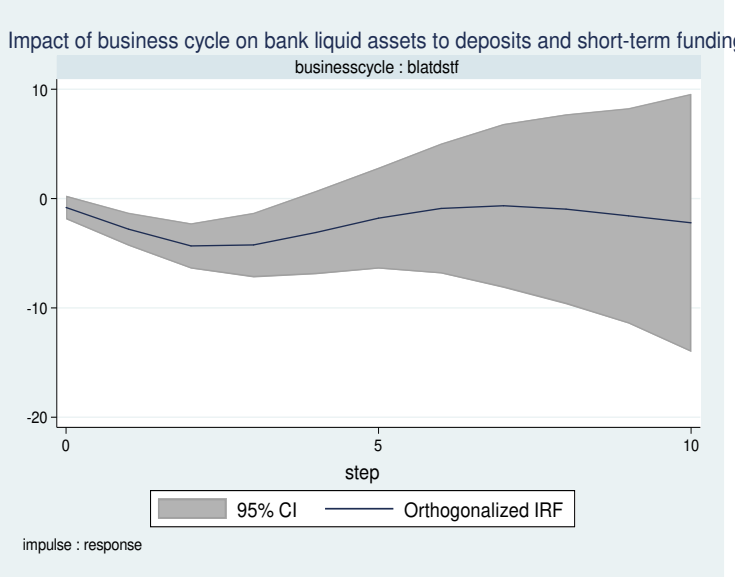
Orthogonalized IRF					
Impulse Variable: Banking Crises Forecast horizon	Response Variable: Bank Credit to the private sector (% of GDP)	Response Variable: Bank credit as percent of bank deposits	Response Variable: Bank liquid assets to deposits and short-term funding	Response Variable: Banking system capital percent of assets	Response Variable: Lending Rate
0	0	1.984319	-0.089889	-0.1784791	-0.2789511
1	4.103902	9.33738	1.361196	-0.2095459	-0.6057914
2	3.180943	12.21428	-1.586382	-0.0078362	-0.876967
3	-4.226302	7.752341	-5.667881	0.404347	-0.7802901
4	-11.41641	0.3033607	-6.916766	0.8834794	-0.4159183
5	-12.28123	-3.458779	-4.266398	1.178435	-0.1149128
6	-6.48407	-0.759094	0.1411763	1.128391	0.0086837
7	1.633951	5.992514	3.24573	0.7896154	0.1497402
8	7.356933	12.27198	3.447233	0.3674282	0.5086719
9	8.780797	15.08087	1.264512	0.0584125	1.040819
10	6.989908	14.295	-1.661065	-0.053488	1.508093

Orthogonalized IRF	
Impulse Variable: Bctpspgdp Forecast horizon	Response Variable: Business Cycle
0	0
1	0 .1228712
2	0 .5502738
3	0 .5373515
4	0.0084921
5	-0.5022029
6	-0.5716951
7	-0.2564937
8	0.1104707
9	0.2798119
10	0.2354148

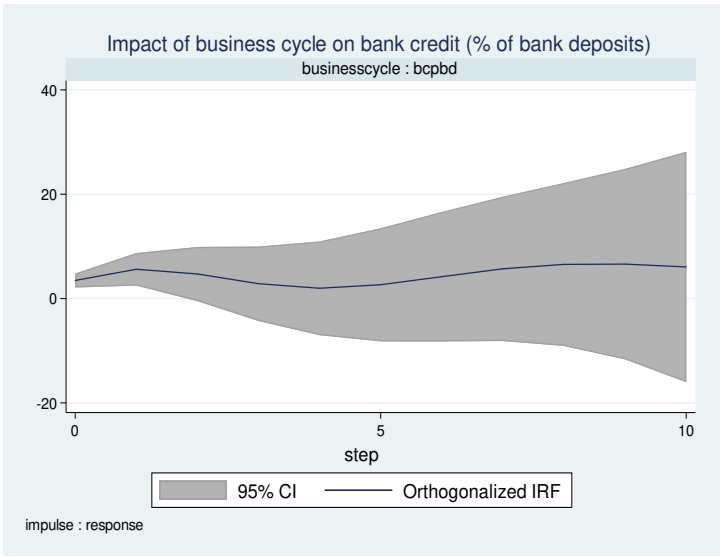
Table 4.6.4: IRFs-Effect of the business cycle on banking crises and selected banks stability variables



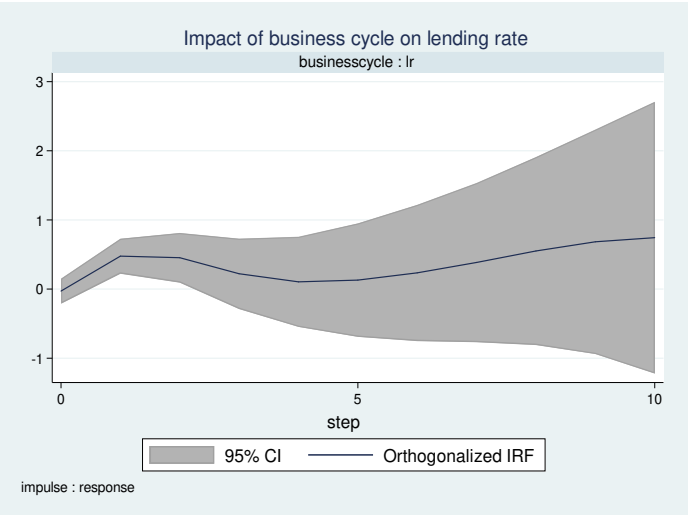
Orthogonalized IRF	
Impulse Variable: Business Cycle Forecast horizon	**Response Variable:** Bank Credit to the private sector (% of GDP)
0	2.218501
1	2.318245
2	0.0311029
3	-2.066172
4	-2.200831
5	-0.6426752
6	1.425628
7	3.02197
8	3.746664
9	3.678885
10	3.13175



Orthogonalized IRF	
Impulse Variable: Business Cycle	**Response Variable:** bank liquid assets to deposits and short-term funding
Forecast horizon	
0	-0.8154258
1	-2.799135
2	-4.333693
3	-4.244053
4	-3.102507
5	-1.793718
6	-.9063201
7	-.6578965
8	-.9678028
9	-1.581193
10	-2.21709



Orthogonalized IRF	
Impulse Variable: Business Cycle	**Response Variable:** bank liquid assets to deposits and short-term funding
Forecast horizon	
0	3.464086
1	5.611818
2	4.715832
3	2.849206
4	1.977358
5	2.643449
6	4.195927
7	5.698422
8	6.546618
9	6.604294
10	6.056324



Orthogonalized IRF	
Impulse Variable: Business Cycle	**Response Variable:** Lending Rate
Forecast horizon	
0	-0.0287181
1	0.4763215
2	0.4536955
3	0.221663
4	0.1051623
5	0.1302801
6	0.2343664
7	0.3848158
8	0.5509597
9	0.6840612
10	0.7439721

Model 3B: Business Cycle, Banking Crises and Banks System Depth

Table 4.7: Panel Vector Autoregressive Model 3B

	Lag	Business Cycle	bctpspgdp	bcdummy	dfsdpgdp	bcgpepgdp	dllpgdp	dbapgdp	lr
Business Cycle	L1.	0.3596***	0.231	0.0122	0.1608*	0.0712	0.154	0.395***	-0.247
	L2.	-0.228***	-0.363	0.00069	-0.1313*	0.00996	-0.238**	-0.21666*	0.697
	L3.	-0.214***	0.314	0.00884	0.0242	0.0141	0.073	0.0433	-0.337
bctpspgdp	L1.	-0.026	1.725***	-0.0054	0.176***	0.0598*	0.228***	0.535***	-0.662
	L2.	0.039	-1.107***	0.0067	-0.061	-0.0787	-0.114	-0.333***	1.559**
	L3.	0.0095	0.291*	0.0034	-0.033	0.0838***	-0.0102	-0.191***	-0.761*
bcdummy	L1.	-3.405***	-2.23	0.566***	0.155	-0.177	0.302	-1.772*	-17.47
	L2.	2.517**	1.10	-0.259**	-1.923*	0.637	-3.069*	0.843	2.48
	L3.	-1.836**	3.67	0.0007	1.528**	0.713	2.051***	-0.395	-9.63
dfsdpgdp	**L1.**	**0.114**	**0.307**	**0.011**	**0.693*** **	**-0.159**	**0.059**	**-0.071**	**1.33**
	L2.	**0.109**	**-0.230**	**-0.0065**	**-0.3102***	**-0.141**	**0.218**	**0.083**	**-1.06**
	L3.	**0.050**	**-0.637**	**0.0369***	**0.198***	**-0.017**	**-0.113**	**0.106**	**1.95**
bcgpepgdp	L1.	-0.186	0.486	-0.0440	-0.106	0.611***	-0.066	0.547**	-1.72
	L2.	-0.177**	0.527	0.00432	-0.292***	0.217***	-0.348***	-0.469***	-1.98
	L3.	0.183*	-0.399	0.00501	0.119	-0.198**	0.152	-0.113	1.70
dllpgdp	L1.	-0.0068	0.137	-0.0149	-0.075	0.0112	0.681***	-0.085	-1.59
	L2.	-0.0379	0.263	0.00844	0.115	0.0702	-0.389**	0.036	0.67
	L3.	-0.0622	0.275	-0.02068	-0.058	-0.0323	0.274*	-0.089	-1.32
dbapgdp	L1.	-0.0547	0.300	-0.00761	-0.207**	0.0101	-0.227*	0.321**	-1.699*
	L2.	0.0115	0.105	-0.00593	0.1444**	0.0368	0.164*	-0.224***	-0.102
	L3.	-0.0377	0.192	-0.00595	-0.0818*	-0.0150	-0.107*	0.1123*	-0.187
lr	L1.	0.0063	0.137**	-0.00185	0.0154	-0.0048	0.0387	0.02266*	0.6109***
	L2.	0.0063	-0.0726	-0.00094	-0.0168	-0.0129	-0.0231	0.00178	-0.4109**
	L3.	-0.021*	0.0517	0.00032	0.0264*	0.00089	0.0419**	0.00540	0.137

Legend: * p<0.05; ** p<0.01; *** p<0.001. Business Cycle (businesscycle), Bank credit to the private sector, % of GDP (bctpspgdp), Banking Crises(bcdummy), change in financial system deposits, % of GDP (dfsdpgdp), Bank credit to government and public enterprises % of GDP (bcgpepgdp), change in liquid liabilities, % of GDP (dllpgdp), change in bank assets, % of GDP (dbapgdp), lending rate(lr).

Table 4.7.1: Granger Causality for model 3B

	bizcycle	bctpspgdp	bcdummy	dfsdpgdp	bcgpepgdp	dllpgdp	dbapgdp	lr
bizcycle	-	4.02	5.61	6.19	3.4	7.2	26.9***	1.36
bctpspgdp	3.24	-	10.0*	22.2***	29.4***	18.6***	707.4***	7.8*
bcdummy	26.3***	4.38	-	9.87*	6.93	15.2**	5.35	4.35
dfsdpgdp	1.41	4.09	5.21	-	7.4	2.25	3.161	1.65
bcgpepgdp	9.99*	4.94	4.04	21.6***	-	17.6**	96.5***	4.06
dllpgdp	0.55	2.96	2.54	1.785	2.3	-	0.872	1.59
dbapgdp	1.31	6.44	7.07	11.9**	2.97	8.2*	-	9.3*
Interest rate	16.1**	7.82*	5.42	9.9*	6.6	11.2*	6.338	-
ALL	149.5***	41.9**	69.6***	265.3***	120.8***	178.6***	10707.3***	23.77

Legend: * p<0.05; ** p<0.01; *** p<0.001. Business Cycle (businesscycle), Bank credit to the private sector, % of GDP (bctpspgdp), Banking Crises(bcdummy), change in financial system deposits, % of GDP (dfsdpgdp), Bank credit to government and public enterprises % of GDP (bcgpepgdp), change in liquid liabilities, % of GDP (dllpgdp), change in bank assets, % of GDP (dbapgdp), lending rate(lr).

Table 4.7.2: IRFs- Business Cycle, Banking crises and selected Banks System Depth variables

Orthogonalized IRF			
Impulse Variable: Banking Crises Forecast horizon	**Response Variable:** Business Cycle	**Response Variable:** Change in financial system deposits (% GDP)	**Response Variable:** Change in liquid liabilities (% GDP)
0	0	0.4231198	0.2647423
1	-0.726833	0.438607	0.5543833
2	0.056253	-0.375577	-0.4143739
3	-0.006424	0.164597	0.0458533
4	-0.174527	0.4331494	0.4549236
5	-0.016291	0.0789137	0.1484539
6	0.111439	-0.018269	-0.0213358
7	0.036004	0.0902444	0.0629506
8	0.003613	0.0557406	0.0550106
9	0.031117	-0.008773	-0.0030769
10	0.010621	-0.002655	-0.0026364

Orthogonalized IRF	
Impulse Variable: business cycle **Forecast horizon**	**Response Variable:** bank assets (% GDP)
0	-0.2151488
1	0.1565481
2	-0.4314832
3	-0.2731668
4	-0.1065134
5	0.0364109
6	0.2410333
7	0.2155183
8	0.0483507
9	-0.0002636
10	0.0298547

Orthogonalized IRF	
Impulse Variable: bank credit to the private sector (% GDP). **Forecast horizon**	**Response Variable:** Banking Crises
0	-0.069897
1	-0.0682137
2	-0.0814467
3	-0.0826149
4	-0.0595611
5	-0.0228749
6	0.00677
7	0.0255981
8	0.0304894
9	0.029357
10	0.0282821

Model 3C: Business Cycle, Banking Crises and Banks Efficiency

Table 4.8: Panel Vector Autoregressive Model 3C

		business cycle	bctpspgdp	bcdummy	broap	broep	bocpta	bctirp	bniittip	birpiba
businesscycle	L1.	0.395***	-0.171	0.028***	-0.122	-0.546*	-0.074	0.053	-0.221	-0.001
	L2.	-0.34***	-0.4083*	-0.014	-0.093	-0.857**	0.110*	0.100	0.055	-0.008
	L3.	-0.054	0.242	0.0197**	-0.008	-0.297	0.032	0.250	-0.131	0.033
bctpspgdp	L1.	-0.017	1.472***	-0.0001	0.0318	0.0460	0.0080	-0.0566	0.0165	-0.014
	L2.	0.036”	-0.628***	0.0012	-0.0583	-0.0726	0.0036	0.053	-0.0541	0.0006
	L3.	0.006	0.14	0.0014	0.0170	0.0171	0.0112	-0.0454	0.1351	0.0037
bcdummy	L1.	-1.72*	2.69	0.74***	-1.64	-7.077*	1.533	1.31	1.378	-0.437
	L2.	1.33	-4.30	-0.2595*	0.71	3.905	-1.114	-1.623	-2.277	0.178
	L3.	-1.104***	1.53	0.1231*	-0.33	-9.468**	0.351	0.996	2.641	-0.418
broap	L1.	0.0775*	0.049	0.0003	0.116	-0.627*	-0.010	-0.047	0.050	-0.051
	L2.	0.071	-0.098	-0.0108	0.041	-0.362	0.060	-0.023	0.497***	-0.028
	L3.	0.029	0.098	-0.0048	0.49**	0.458	-0.070	-0.375	0.095	0.043
broep	L1.	0.032*	0.1019*	0.0018	0.0139	0.373***	0.0399**	-0.06	0.09*	0.0010
	L2.	-0.0017	0.0805	0.0035*	0.0179	0.11	0.005	-0.0515	0.0004	-0.0009
	L3.	0.0092	0.0397	0.00164	-0.058***	-0.0323	0.0035	0.0465	-0.0037	-0.0063
bocpta	L1.	-0.02	-0.0923	-0.0022	-0.0297	-0.0001	0.315*	0.223	0.086	-0.006
	L2.	0.03	-0.0520	0.0005	0.0009	-0.021	-0.108	0.006	-0.082	0.007
	L3.	-0.01	0.0115	-0.0045	-0.0382	-0.184	0.126***	0.501*	0.144*	-0.034
Bctirp	L1.	0.0013	0.1192*	0.0036	0.0106	0.0433	0.08**	0.339***	0.216**	-0.021

	L2.	0.0076	0.077	-0.0006	0.078**	0.2017**	-0.0045	0.0038	0.0846	-0.0013
	L3.	0.0183	0.066	0.0028	-0.076**	-0.083	-0.0009	0.085	-0.102*	0.002
bniittip	L1.	-0.004	0.051	0.00003	-0.022	0.083	0.1175***	0.165	0.7149***	-0.0002
	L2.	-0.008	0.004	0.0048*	0.003	-0.0038	-0.009	-0.011	-0.007	0.012
	L3.	0.006	-0.121	-0.003	0.065**	0.19*	-0.0119	-0.26***	0.1136*	-0.0012
birpiba	L1.	0.081	-0.445	0.005	-0.011	-0.012	0.177	0.968*	-0.28	0.566***
	L2.	0.039	0.419	-0.0003	0.172	0.503	0.198	0.381	-0.02	0.120*
	L3.	-0.074	-0.265	-0.011	-0.037	0.156	-0.177*	-0.557*	0.29	0.009

Legend: * p<0.05; ** p<0.01; *** p<0.001. Business Cycle (businesscycle), Bank credit to the private sector, % of GDP (bctpspgdp), Banking Crises(bcdummy), Bank return on assets in percent (broap), Bank return on equity in percent(broep), Bank overhead costs percent of total assets (bocpta), Bank cost to income ratio in percent (bctirp), Bank non-interest income to total income in percent (bniittip), Bank interest revenue percent of interest-bearing assets (birpiba).

Table 4.8.1: Granger Causality for model 3C

	bizcycle	**bctpspgdp**	**bcdummy**	**broap**	**broep**	**bocpta**	**bctirp**	**bniittip**	**birpiba**
bizcycle	-	8.3*	21.9***	5.7	19.3***	11.8**	5.5	1.6	1.8
bctpspgdp	15.6**	-	4.6	4.4	1.3	6.4	0.7	11.4*	6.2
bcdummy	15.7**	3.2	-	2.275	17.5**	3.9	0.8	3.3	4.1
broap	7.1	1.5	4.7	-	8.3*	5.1	3.6	16.1**	5.6
Broep	7.96	10.4*	8.2*	12.3**	-	9.4*	4.3	4.2	1.3
Bocpta	2.2	2.4	0.74	1.4	2.1	-	7.5	6.3	1.3
Bctirp	3.6	8.7*	4.95	10.3*	8.5*	10.1*	-	13.6**	3.2
Bniittip	0.36	4.4	5.7	12.7**	8.6*	14.9**	33.3***	-	1.8
birpiba	1.0	4.9	1.4	2.3	1.99	8.9*	16.2**	1.7	-
ALL	74.2***	43.8**	79.1***	65.4***	97.4***	43.9**	118.3***	113.6***	36.4

Legend: * p<0.05; ** p<0.01; *** p<0.001

Business Cycle (businesscycle), Bank credit to the private sector, % of GDP (bctpspgdp), Banking Crises(bcdummy), Bank return on assets in percent (broap), Bank return on equity in percent(broep), Bank overhead costs percent of total assets (bocpta), Bank cost to income ratio in percent (bctirp), Bank non-interest income to total income in percent (bniittip), Bank interest revenue percent of interest-bearing assets (birpiba).

Table 4.8.2: Impulse Response Function for model 3C

The impulse response of banking crises on the business cycle & Bank return on equity (%)

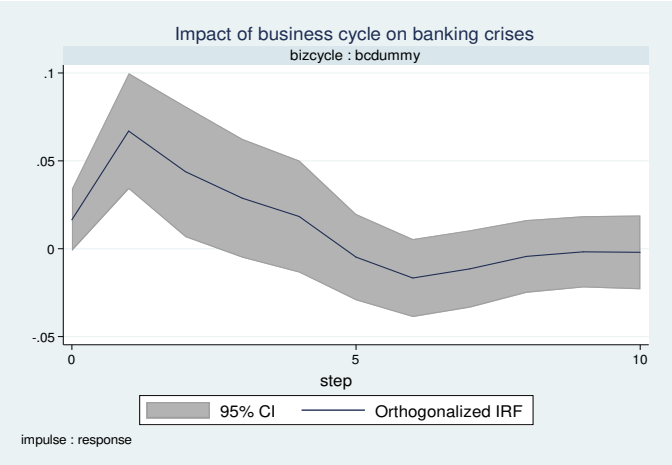
Orthogonalized IRF		
Impulse Variable: Banking Crises Forecast horizon	**Response Variable:** Business Cycle	**Response Variable:** Banks' return on equity (%)
0	0	-1.52383
1	-0.4562122	-2.178721
2	-0.2920771	-.6166154
3	-0.1080857	-1.649485
4	-0.1459316	-1.980414
5	-0.150799	-1.093338
6	-0.0784971	-.2898116
7	-0.0033757	-.0007819
8	0.0298816	0.1095124
9	0.0225752	0.1981026
10	0.005849	0.1754253

The impulse response of banks' credit, bank return on equity & bank overhead costs (% total assets) to shocks in the business cycle

Orthogonalized IRF			
Impulse Variable: Business cycle Forecast horizon	**Response Variable:** Bank credit to the private sector (% GDP)	**Response Variable:** Bank return on equity	**Response Variable:** Bank overhead costs (% total assets)
0	0.6912504	1.55296	0.0583198
1	0.9469293	-0.6632212	-0.0174017
2	0.2081202	-2.495319	0.19226
3	-0.3296292	-1.885299	0.1200753
4	-0.3966554	-1.046612	-0.0287355
5	-0.3959747	-.1112845	-0.0560404
6	-0.4359004	0.0870129	-0.0650747
7	-0.44958	-0.1071671	-0.0501893
8	-0.409269	-0.0924693	-0.0280897
9	-0.3527528	0.0385311	-0.0240491
10	-0.3102002	0.1192295	-0.0307431

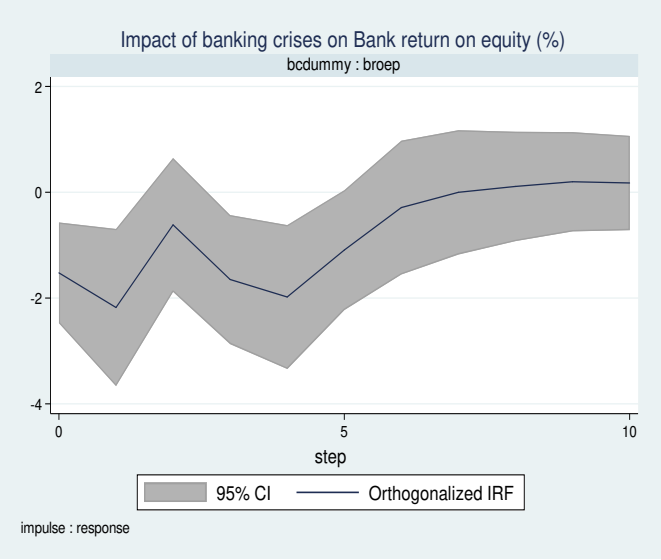
Table 4.8.3: Causes of banking crises among the selected banks' system efficiency variables

The impulse response of business cycle on banking crises



Orthogonalized IRF	
Impulse Variable: Forecast horizon	**Response Variable:** Banking Crises
0	0.0164655
1	0.0669535
2	0.0438117
3	0.0287517
4	0.0183213
5	-0.004775
6	-0.0166713
7	-0.0114665
8	-0.0043443
9	-0.0017696
10	-0.0020342

The impulse response of banking crises on bank return on equity (%)



Orthogonalized IRF	
Impulse Variable: Bank return on equity (%) Forecast horizon	**Response Variable:** Banking Crises
0	0
1	0.0128931
2	0.0586047
3	0.0676505
4	0.0486687
5	0.0356355
6	0.0328557
7	0.0277872
8	0.0246547
9	0.0262161
10	0.0264484

APPENDIX 7: ESTIMATED MODELS, GRANGER CAUSALITY AND IMPULSE RESPONSE FUNCTIONS MODEL 5

Model 5A: Output Gap, Banking Crises and selected variables

Table 4.9: Panel Vector Autoregressive Model 5A

Variable		OutputGap	bcdummy	Lr	bctpspgdp	dlngcf	dlnexport	dlngfce	broep
OutputGap	L1.	0.34***	0.792**	4.24**	4.9	-0.55**	-0.53***	-0.018	-26.1***
	L2.	-0.17*	-0.538*	-4.86**	-14.7*	-0.181	0.120	-0.25***	15.8*
	L3.	-0.27***	0.693***	4.2**	9.7	0.086	-0.121	0.066	-13.7
bcdummy	L1.	-0.067***	0.61***	-0.266	-0.753	-0.126**	-0.007	-0.0066	1.2
	L2.	0.033	-0.069	-0.472	-0.730	0.15**	-0.023	0.0051	-3.9
	L3.	0.003	0.08	0.463	-1.04	-0.091**	0.026	-0.0038	1.2
LR	L1.	-0.0003	-0.016**	0.886***	-0.032	0.0014	-0.0065*	0.0013	-0.057
	L2.	0.0004	0.0059	-0.126	0.078	-0.0010	0.009***	-0.0014	-0.006
	L3.	-0.0008	0.0013	0.0007	-0.011	-0.0003	-0.0032***	-0.0004	0.038
Bctpspgdp	L1.	0.0004	0.00399*	0.0598**	1.5***	-0.0034*	-0.00056	0.00010	-0.113
	L2.	0.0008	-0.005*	-0.036	-0.750***	0.0027	0.00089	-0.00054	0.063
	L3.	-0.0002	0.0041**	0.024	0.277*	-0.0029*	0.00006	0.00033	-0.021
dlngcf	L1.	0.007	-0.293*	0.77	3.7	0.289***	-0.0060	-0.008	-0.573
	L2.	-0.0362	0.17	1.9*	4.6	0.082	0.034	0.0763***	-4.7
	L3.	0.077**	-0.18**	-0.085	2.3	-0.039	0.073**	0.047**	-0.454
dlnexport	L1.	0.130*	-0.15	-0.60	1.8	0.072	0.27***	0.025	21.0***
	L2.	-0.068	0.07	1.3	-0.50	0.093	-0.002	0.066	7.5
	L3.	0.143**	-0.21	-1.54	1.4	0.222**	0.056	0.045	4.1
dlngfce	L1.	-0.040	0.37	0.24	-4.43	-0.16	-0.21*	0.028	-6.3
	L2.	0.105	0.32	2.44	2.96	-0.13	0.122	-0.034	9.6
	L3.	0.115	0.16	0.49	-4.10	0.04	0.093	0.012	17.0*
broep	L1.	0.0002	0.0015	0.04*	0.05	-0.002*	0.00086	-0.000094	0.575***
	L2.	0.0004	0.0039*	0.025	0.11	-0.0011	-0.00019	.00092**	0.09
	L3.	0.0004	0.0054**	0.013	0.02	0.0002	0.00075	-0.00029	0.049

Legend: * p<0.05; ** p<0.01; *** p<0.001. The $OutputGap_{it} = \frac{bizcyc_{i,t}}{\mathbf{LNY}_{it}} \times 100$, signifies the output gap, Banking Crises(bcdummy), the first difference of the natural logarithm of the gross capital formation- Investment (dlngcf), Interest rate, proxied by lending rate (lr), Bank credit to the private sector, % of GDP (bctpspgdp), the first difference of the natural logarithm of export (dlnexport), the first difference of the natural logarithm of government final consumption expenditure (dlngfce), Bank return on equity in percent (broep).

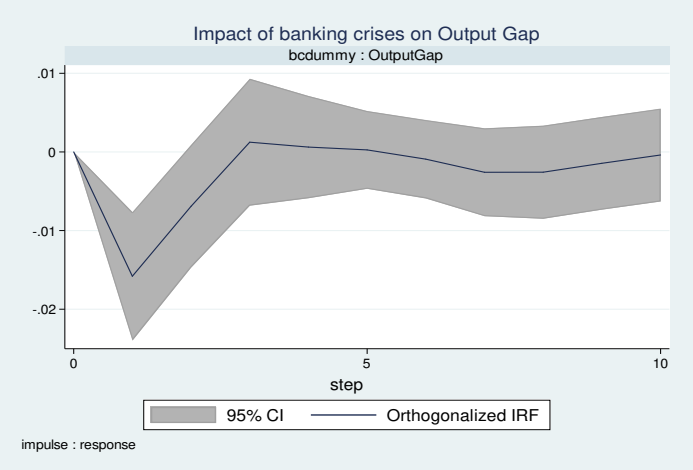
Table 4.9.1: Granger Causality for model 5A

	OutputGap	bcdummy	lr	bctpspgdp	dlngcf	dlnexport	dlngfce	broep
OutputGap		17.1**	13.3**	6.1	22.0***	77.3***	33.7***	17.4**
Bcdummy	14.0**		1.9	1.6	13.1**	4.3	0.6	3.2
Lr	4.1	14.7**		0.6	0.4	82.2***	10.8*	0.96
bctpspgdp	20.2***	7.2	13.5**		14.6**	4.4	7.3	2.2
Dlngcf	9.0*	13.4**	7.96*	3.7		9.1*	18.8***	1.6
dlnexport	18.5***	4.2	3.6	0.5	9.6*		7.5	14.9**
dlngfce	5.2	4.3	2.1	2.5	2.7	13.6**		6.1
broep	3.1	22.0***	12.95**	3.7	5.8	4.9	8.2*	
ALL	86.3***	108.5***	109.8***	29.3	158.4***	256.3***	126.3***	55.3***

Legend: * p<0.05; ** p<0.01; *** p<0.001. The $OutputGap_{it} = \frac{bizcyc_{i,t}}{\mathbf{LNY}_{it}} \times 100$, signifies the output gap, Banking Crises(bcdummy), the first difference of the natural logarithm of the gross capital formation- Investment (dlngcf), Interest rate, proxied by lending rate (lr), Bank credit to the private sector, % of GDP (bctpspgdp), (dlngcf), the first difference of the natural logarithm of export (dlnexport), the first difference of the natural logarithm of government final consumption expenditure (dlngfce), Bank return on equity in percent (broep).

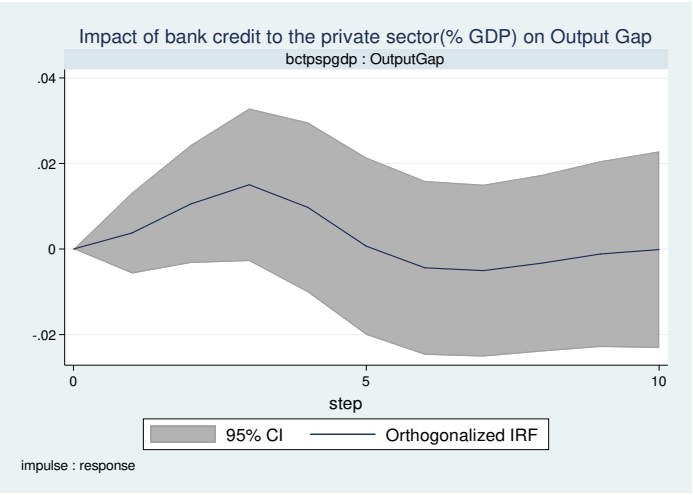
Table 4.9.2 Impulse response function for model 5A

The impulse response of banking crises on Output Gap



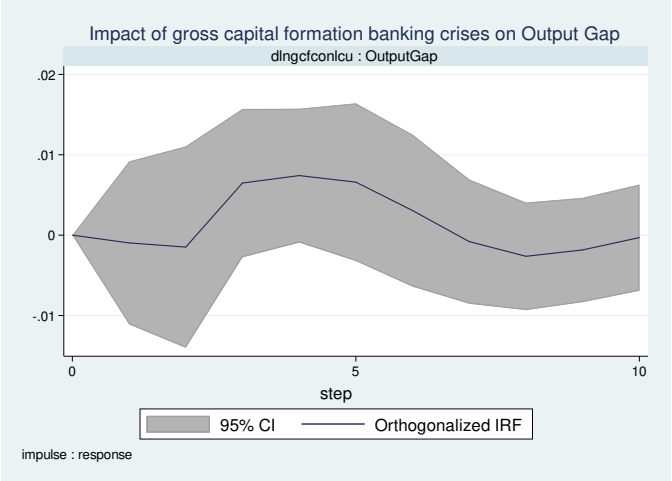
Orthogonalized IRF	
Impulse Variable: Banking Crises **Forecast horizon**	**Response Variable:** Output Gap
0	0
1	-0.0158081
2	-0.0069097
3	0.0012374
4	0.0006187
5	0.0002583
6	-0.0009184
7	-0.0025854
8	-0.0025773
9	-0.001447
10	-0.0003874

The impulse response of bank credit to the private sector (% GDP) on Output Gap



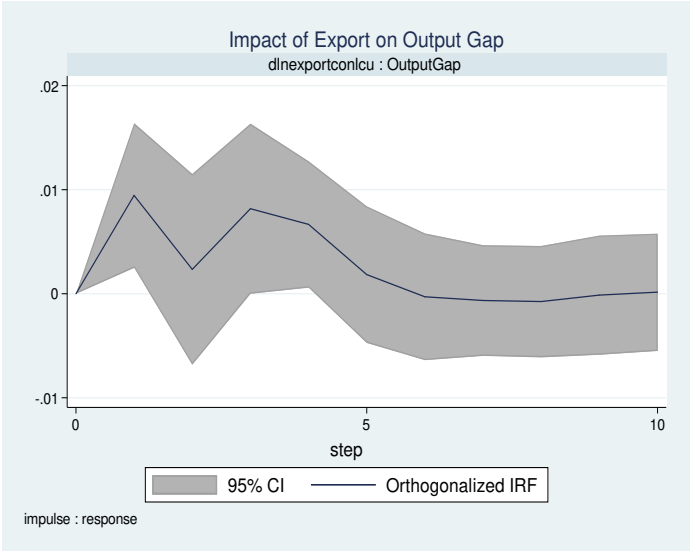
Orthogonalized IRF	
Impulse Variable: Bctpspgdp **Forecast horizon**	**Response Variable:** Output Gap
0	0
1	0.0037694
2	0.0105244
3	0.0150349
4	0.009757
5	0.0006772
6	-0.0043798
7	-0.0050396
8	-0.0032963
9	-0.0011537
10	-0.0001203

The impulse response of gross capital formation on Output Gap



Orthogonalized IRF	
Impulse Variable: dlngcf Forecast horizon	**Response Variable:** Output Gap
0	0
1	-0.0009615
2	-0.0014831
3	0.0064849
4	0.0074121
5	0.0065995
6	0.0030645
7	-0.0008025
8	-0.0026313
9	-0.001842
10	-0.0003033

The impulse response of export on Output Gap



Orthogonalized IRF	
Impulse Variable: Export **Forecast horizon**	Response Variable: Output Gap
0	0
1	0.0094469
2	0.0023405
3	0.0081698
4	0.0066658
5	0.0018418
6	-0.0002955
7	-0.00065
8	-0.000752
9	-0.0001325
10	0.0001458

Model 5B: Business Cycle, Banking Crises, And Credit Gap

Table 4.10: Panel Vector Autoregressive Model 5B

Variable		CreditGap	bcdummy	lr	dlngcf	dlnexportc~u	dlngfce	broep
CreditGap	L1.	0.407**	0.000027	0.0014	-0.00005	-0.000022	-0.00000083	-0.0101
	L2.	-0.39***	-.00017*	0.0008	0.00004	0.000024	-0.000020	-0.0032
	L3.	-0.167	0.000063	0.0009	-0.00015*	0.000020	0.000023	-0.0054
bcdummy	L1.	14.4	0.665***	0.36	-0.213***	-0.03	-0.0179	-5.70*
	L2.	19.1	-0.155*	-0.56	0.235***	-0.01	0.022	1.8
	L3.	-57.96*	0.1817**	1.068*	-0.1668***	0.02	-0.007	-0.58
Lr	L1.	0.6	-0.009	0.852***	-0.006	-0.0072	0.00066	-0.11
	L2.	-2.9	0.003	-0.1405*	0.005	0.0111***	-0.0014	0.12
	L3.	-0.1	-0.0027*	-0.013	0.002	-.0027***	0.00005	0.03
dlngcf	L1.	210.5***	-0.06	1.02	0.352***	-0.1396**	.091711**	0.3
	L2.	-10.4	-0.02	-0.05	-0.04	0.029	0.028	4.7
	L3.	-81.1*	-0.07	-0.67	-0.05	0.1040**	0.034	1.7
Dlnexport	L1.	-136.4	0.03	0.59	-0.149	0.206*	0.0266	15.63**
	L2.	-113.4	-0.25	-0.04	-0.04	-0.04	0.01	5.7
	L3.	15.8	-0.15	-0.37	0.11	0.04	0.01	4.2
dlngfce	L1.	-351.6*	0.16	-2.1	-0.12	-0.005	0.0649	-12.3
	L2.	-89.8	0.16	1.3	-0.14	0.13	-0.0808	2.24-6
	L3.	-238.9**	0.01	-0.1	0.21	0.08	0.1125*	6.54
broep	L1.	-1.7	-0.0013	0.042**	0.0004	0.0006	0.000052	0.535***
	L2.	1.65*	.00398*	0.036**	-0.0005	-0.0012	0.0006	0.0512
	L3.	0.95	0.0057**	0.023*	-0.0005	0.0003	-0.000397	0.049

Legend: * p<0.05; ** p<0.01; *** p<0.001. The $\text{Credit}Gap_{it} = \frac{creditsCycle_{i,t}}{\text{Credit}_{it}} \times 100$, signifies the Credits gap, Banking Crises(bcdummy), the first difference of the natural logarithm of the gross capital formation- Investment (dlngcf), Interest rate, proxied by lending rate (lr), Bank credit to the private sector, % of GDP (bctpspgdp), the first difference of the natural logarithm of export (dlnexport), the first difference of the natural logarithm of government final consumption expenditure (dlngfce), Bank return on equity in percent (broep).

Table 4.10.1: Granger Causality for Model 5B

	CreditGap_hp	bcdummy	lr	dlngcf	dlnexport	dlngfce	broep
CreditGap		7.0	7.0	6.9	0.7	3.8	8.2*
bcdummy	7.73		6.4	28.0***	3.4	3.6	5.3
lr	3.6	14.6**		14.2**	32.5***	4.7	1.6
dlngcf	17.1**	1.9	3.6		17.7**	15.2**	2.3
dlnexport	4.7	5.3	0.3	3.4		0.4	10.4*
dlngfce	10.3*	1.4	1.9	6.4	2.7		2.4
broep	8.0*	20.7***	26.6***	0.7	4.3	3.9	
ALL	47.8***	53.5***	89.7***	98.9***	81.6***	48.1***	50.3***

Legend: * p<0.05; ** p<0.01; *** p<0.001. The $\text{Credit}Gap_{it} = \frac{creditsCycle_{i,t}}{\textbf{Credit}_{it}} \times 100$, signifies the Credits gap, Banking Crises(bcdummy), the first difference of the natural logarithm of the gross capital formation- Investment (dlngcf), Interest rate, proxied by lending rate (lr), Bank credit to the private sector, % of GDP (bctpspgdp), (dlngcf), the first difference of the natural logarithm of export (dlnexport), the first difference of the natural logarithm of government final consumption expenditure (dlngfce), Bank return on equity in percent (broep).

Table 4.10.2: Impulse response function for model 5B

IRF of bank return on equity (%) on Credit gap

Orthogonalized IRF	
Impulse Variable: bank return on equity (%) Forecast horizon	Response Variable: Credit Gap
0	0
1	-13.3555
2	0.5475
3	12.8833
4	11.1663
5	-0.0428
6	-7.0012
7	-6.7555
8	-3.4587
9	-0.29299
10	1.1401

IRF of government spending on Credit Gap

Orthogonalized IRF	
Impulse Variable: Government final consumption Forecast horizon	Response Variable: Credit Gap
0	0
1	-19.754
2	-13.921
3	-12.63813
4	-0.099969
5	8.248201
6	5.213698
7	-0.7704853
8	-3.824463
9	-3.193077
10	-.8472282

IRF of Investment on Credit Gap

Orthogonalized IRF	
Impulse Variable: gross capital formation Forecast horizon	Response Variable: Credit Gap
0	0
1	22.36763
2	14.28854
3	-13.54245
4	-26.37805
5	-17.74551
6	-.2250149
7	10.37194
8	9.385821
9	2.158753
10	-3.739918

Model 5C: Industrial Production Gap, Banking Crises, and Selected Variables

Table 4.11: Panel Vector Autoregressive Model 5C

		Production Gap	bcdummy	bctpspgdp	lr	dlngcf	dlnexport	dlngfce	broep
production Gap	L1.	0.24**	0.24*	-2.5	0.70	-0.316***	-0.15***	-0.087***	-11.0***
	L2.	-0.143*	0.04	2.7	-1.4	0.03	-0.034	0.03	-0.87
	L3.	-0.24***	0.07	1.2	1.2*	0.05	-0.069	-0.04	-9.9***
Bcdummy	L1.	-0.134***	0.63***	-1.6	-0.095	-0.156***	-0.034	-0.009	-0.10
	L2.	0.089*	-0.11	-0.01	-0.65	0.165**	-0.002	0.01	-2.52
	L3.	-0.005	0.10	-2.2	0.87	-0.089**	0.021	0.003	0.42
Bctpspgdp	L1.	0.0006	0.0052*	1.4***	0.059**	-0.0028*	-0.001	0.00003	-0.12
	L2.	0.0008	-0.008**	-0.76***	-0.036	0.0024	0.002	-0.0004	0.09
	L3.	-0.0002	0.006***	0.304**	0.022	-0.0023*	-0.001	0.0004	-0.08
LR	L1.	-0.003	-0.0134*	-0.071	0.91***	-0.003	-0.0088**	0.0007	-0.13
	L2.	0.002	0.006	-0.009	-0.147*	0.002	0.01***	-0.0012	-0.03
	L3.	-0.002**	0.0006	0.022	-0.006	0.0002	-0.003***	-0.0002	0.06
dlngcf	L1.	0.041	-0.097	7.7**	0.63	0.41***	-0.114**	0.098***	-6.6
	L2.	0.028	-0.066	-1.6	0.96	0.03	0.022	0.008	-4.2
	L3.	0.19***	-0.15*	-0.45	-0.41	-0.03	0.087**	0.07***	0.05
dlnexport	L1.	0.24*	-0.096	2.1	-0.34	-0.023	0.15*	0.105**	14.8**
	L2.	-0.395***	-0.270	-5.0	0.35	0.036	-0.029	0.025	11.98*
	L3.	0.23*	-0.282*	-3.1	-1.5	0.046	0.05	-0.01	6.99
dlngfce	L1.	-0.32	0.82**	0.69	1.1	-0.11	-0.28*	0.155*	-15.6*
	L2.	0.11	0.488*	0.08	2.7	-0.26*	0.069	-0.0497	7.9
	L3.	0.05	0.54**	0.31	1.7	0.11	-0.025	0.226***	9.4
Broep	L1.	-0. 000005	0.0017	0.012	0.04*	-0.001	0.0008	0.000003	0.58***
	L2.	-0.00002	.004*	0.138	0.03*	-0.0009	-0.000002	0.0003	0.081
	L3.	0.0008	0.005**	0.01	0.021	0.0003	0.0005	-0.0001	0.016

Legend: * p<0.05; ** p<0.01; *** p<0.001. The Production$Gap_{it} = \frac{ProductionCyc_{i,t}}{LNIndusVconH_{it}} \times 100$, signifies the Industrial production Gap, Banking Crises(bcdummy), the first difference of the natural logarithm of the gross capital formation- Investment (dlngcf), Interest rate, proxied by lending rate (lr), Bank credit to the private sector, % of GDP (bctpspgdp), (dlngcf), the first difference of the natural logarithm of export (dlnexport), the first difference of the natural logarithm of government final consumption expenditure (dlngfce), Bank return on equity in percent (broep).

Table 4.11.1: Granger Causality for model 5C

	Product Gap	bcdummy	bctpspgdp	LR	dlngcf	dlnexport	dlngfce	broep
Production Gap		7.9*	3.7	6.2	20.9***	27.3***	19.7***	25.8***
bcdummy	15.9**		4.3	3.0	14.3**	6.1	1.4	1.6
bctpspgdp	13.7**	16.9**		11.7**	10.3*	3.0	7.3	3.2
lr	7.9*	7.8	0.8		1.2	83.6***	6.9	3.6
dlngcf	13.6**	6.4	11.8**	3.1		20.8***	21.9***	4.6
dlnexport	23.3***	6.8	3.4	2.1	0.6		7.2	13.3**
dlngfce	4.2	16.9**	0.02	3.8	6.4	9.2*		6.5
broep	0.9	21.5***	4.5	17.5**	2.1	3.7	1.3	
ALL	168.3***	112.0***	35.3*	81.1***	158.6***	246.9***	86.2***	69.5***

Legend: * p<0.05; ** p<0.01; *** p<0.001. The Productn$Gap_{it} = \frac{IndusProdnCycle_{i,t}}{\text{IndustrialProductn}_{it}} \times 100$, signifies the Industrial production Gap, Banking Crises(bcdummy), the first difference of the natural logarithm of the gross capital formation- Investment (dlngcf), Interest rate, proxied by lending rate (lr), Bank credit to the private sector, % of GDP (bctpspgdp), (dlngcf), the first difference of the natural logarithm of export (dlnexport), the first difference of the natural logarithm of government final consumption expenditure (dlngfce), Bank return on equity in percent (broep).

Table 4.11.2: Impulse Response Functions for model 5C

IRF of Industrial Production Gap to banking crises

Orthogonalized IRF	
Impulse Variable: Banking Crises Forecast horizon	Response Variable: Industrial Production Gap
0	0
1	-0.03612
2	-0.007804
3	0.007824
4	-0.004003
5	-0.003074
6	0.0002658
7	-.0029768
8	-0.002072
9	0.001254
10	0.002121

IRF of Industrial Production Gap to shocks in Exports

Orthogonalized IRF	
Impulse Variable: **Exports** Forecast horizon	Response Variable: **Industrial Production Gap**
0	0
1	0.0177114
2	-.0247275
3	0.0035706
4	0.0079243
5	-0.0007048
6	-0.0037742
7	-0.0031462
8	-0.0040301
9	-0.0033888
10	-0.0018019

IRF of Industrial Production Gap to shocks in interest rate

Orthogonalized IRF	
Impulse Variable: **Interest rate** Forecast horizon	Response Variable: **Industrial Production Gap**
0	0
1	-0.007611
2	-0.003132
3	-0.001853
4	-0.009742
5	-0.002475
6	0.0039757
7	0.0048035
8	0.0031588
9	0.0012329
10	-0.0003688

IRF of Industrial Production Gap to shocks in Gross capital formation

Orthogonalized IRF	
Impulse Variable: **gross capital formation** Forecast horizon	Response Variable: **Industrial Production Gap**
0	0
1	0.0020586
2	0.0018731
3	0.0276142
4	0.0172136
5	-0.0035997
6	-0.0098604
7	-0.0081104
8	-0.0025806
9	0.0035691
10	0.0053879

IRF of Industrial Production Gap to shocks in credits

Orthogonalized IRF	
Impulse Variable: Bank credit to the private sector (% GDP) Forecast horizon	Response Variable: **Industrial Production Gap**
0	0
1	0.00451
2	0.003192
3	0.015582
4	0.003048
5	-0.012661
6	-0.012208
7	-.0065156
8	-.0029443
9	-.0000773
10	0.000992

APPENDIX 8: PROBABILITY OF BANKING CRISES

Table 4.2.2b: Probability of banking crises by phases; Odds Ratio and Average marginal effect

factors	Recovery Phases		Expansions Phases		Peak Phases		Recession Phases		Depression Phases		Trough Phases	
	Odds Ratio	Average Marginal Effect	Odds Ratio	Average Marginal Effect	Odds Ratio	Average Marginal Effect	Odds Ratio	Average Marginal Effect	Odds Ratio	Average Marginal Effect	Odds Ratio	Average Marginal Effect
Business cycle	0.268 (0.29)	-0.0529 (0 .053)	1.156 (0.336)	0.00372 (0.0071)	1.291 (0.3011)	0.0286 (0.0232)	1.345 (0.912)	0.0172 (0.042)	0.770 (0.209)	-0.025 (0.0266)	0.2814* (0.185)	-0.0484 (0.0303)
Interest rate (%)	1.067 (0.0903)	0.0026 (0.00294)	-	-	1.0036 (0.0526)	0.0004 (0.0059)	0.8427* (0.076)	-0.00995 (0.0065)	1.127*** (0.037)	0.0115*** (0.0022)	1.167 (0.2177)	0.0059 (0.0071)
Banks Credit (% GDP)	1.043*** (0.0081)	0.0017*** (0.00029)	1.002 (0.0106)	0.000043 (0.00027)	1.013 (0.0119)	0.00139 (0.0012)	1.00 (0.0134)	0.00012 (0.00076)	1.028*** (0.0077)	0.0026*** (0.00049)	1.035*** (0.0137)	0.00133*** (0.0005)
Investment (% Change)	0.9595 (0.034)	-0.00167 (0 .00165)	0.921* (0.0388)	-0.00212 (0.0014)	0.828** (0.0691)	-0.0211*** (0.00741)	0.983 (0.0418)	-0.00099 (0.0023)	0.973* (0.0152)	-0.0026* (0.0015)	0.8014*** (0.0623)	-0.00845** (0.0041)
Exports (% Change)	0.865* (0.071)	-0.0058* (0.0033)	0.895 (0.0664)	-0.0029 (0.0022)	0.9604 (0.066)	-0.00453 (0.0082)	0.897*** (0.0315)	-0.0063*** (0.0022)	1.00 (0.0239)	0.000297 (0.0023)	0.829*** (0.042)	-0.0072** (0.00301)
Govt. Spending (% Change)	0.637** (0.131)	-0.018* (0.011)	0.900** (0.041)	-0.0027 (0.0017)	0.7905 (0.124)	-0.026* (0.0134)	0.9405 (0.0713)	-0.00357 (0.0052)	0.977 (0.022)	-0.00224 (0.0021763)	1.061 (0.0972)	0.00226 (0.00346)
Banks Return on Equity (%)	0.939*** (0.018)	-0.0025* (0.001)	0.973 (0.0243)	-0.00072 (0 .00085)	0.9767 (0.0251)	-0.00264 (0.0027)	0.816*** (0.0376)	-0.0118*** (0.0036)	0.898** (0.0438)	-0.01037** (0.0044)	0.8606 (0.0849)	-0.0057 (0.0044)
Constant	0.00043*** (0.00048)	-	0.1175* (0.151)	-	0.439 (0.8362)	-	3.795 (7.157)	-	0.0067*** (0.0081)	-	0.0001*** (0.0002)	-
Wald chi2	849.4***		27.45		14.20**		21.40***		21.2***		39.2**	
N	88	88	162	162	35	35	70	70	76	76	36	36

Author, 2022; *,**,*** indicates significance at the 10%, 5% and 1%. Factors and phases with strong probabilities of banking crises; Factors and phases with weak probabilities of banking crises

Table 4.2.2c: Probability of banking crises by phases at Minimum, Mean and Maximum- Extreme cases

Factors	Recovery Phases			Expansions Phases			Peak Phases			Recession Phases			Depression Phases			Trough Phases		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Business cycle	1.0*** (4.74e-07)	0.0023 (0.0046)	0.00044 (0.00048)	0.105 (0.121)	0.123 (0.115)	0.548 (0.965)	0.296 (0.401)	0.509 (0.425)	0.979*** (0.0776)	0.313 (1.079)	0.8557*** (0.2761)	0.998*** (0.0211)	0.1709 (0.498)	0.0096 (0.0113)	0.0067 (0.0079)	1.0*** (7.14e-08)	0.0044 (0.0101)	0.0000601 (0.00015)
Interest rate (%)	0.00045 (0.00049)	0.0015 (0.0024)	0.933 (0.815)				0.306 (0.3995)	0.323 (0.382)	0.555 (3.584)	0.762** (0.328)	0.083 (0.0759)	7.67e-14 (1.16e-12)	0.0075 (0.0088)	0.0585 (0.049)	1.0*** (5.61e-08)	0.00011 (0.00027)	0.0032 (0.0162)	1.0*** (9.49e-07)
Banks Credit (% GDP)	0.00046 (0.00051)	0.00725 (0.00626)	0.995*** (0.00899)	0.1056 (0.1193)	0.1156 (0.0878)	0.151 (0.229)	0.312 (0.403)	0.504* (0.297)	0.907*** (0.112)	0.792** (0.308)	0.811*** (0.2018)	0.865*** (0.247)	0.0067 (0.008)	0.0333 (0.027)	0.8702*** (0.1167)	0.000105 (0.00025)	0.00092 (0.00173)	0.331 (0.5024)
Investment (% Change)	0.0047 (0.0127)	0.00035 (0.00037)	0.00002 (0.000046)	0.5698* (0.3314)	0.0542 (0.076)	0.0041 (0.0105)	0.960*** (0.109)	0.0898 (0.154)	8.83e-06 (0.00004)	0.947*** (0.201)	0.791** (0.3117)	0.5726 (0.848)	0.0596 (0.0864)	0.0072 (0.0085)	0.000015 (0.00006)	0.9904*** (0.0412)	0.00024 (0.00056)	8.69e-09 (4.24e-08)
Exports(% Change)	0.00789 (0.0151)	.0001726 (0.00022)	1.34e-06 (4.73e-06)	0.994*** (0.0246)	0.0479 (0.074)	0.00034 (0.0016)	0.852 (0.714)	0.2595 (0.332)	0.088 (0.1797)	0.999*** (2.91e-06)	0.715* (0.377)	0.154 (0.238)	0.00549 (0.01097)	0.0067 (0.0079)	0.00745 (0.01044)	0.109 (0.299)	0.000072 (0.00017)	9.16e-07 (2.51e-06)
Govt. Spending (% Change)	0.434 (0.877)	0.0001627 (0.000196)	3.15e-09 (1.74e-08)	0.55* (0.304)	0.0778 (0.0974)	0.0022 (.00556)	0.992*** (0.0274)	0.1761 (0.309)	0.0049 (0.0199)	0.954*** (0.138)	0.0769** (0.328)	0.282 (0.597)	0.0157 (0.0207)	0.00642 (0.0077)	0.0033 (0.0048)	6.63e-06 (0.00003)	0.00012 (0.00025)	0.00027 (.00075)
Banks Return on Equity (%)	0.00265 (0.0032	0.000163 (0.00019)	2.79e-07 (7.34e-07)	0.248 (0.365)	0.0692 (0.072)	0.0298 (0.0347)	0.5588 (0.613)	0.239 (0.334)	0.0425 (0.1096)	0.9998*** (0.0003)	0.2479 (0.3597)	0.00007 (0.0002)	0.997*** (0.01305)	0.0027 (0.0034)	1.86e-07 (9.08e-07)	0.9995*** (0.0058)	0.00003 (0.00007)	5.87e-09 (3.52e-08)
N	88	88	88	162	162	162	35	35	35	70	70	70	76	76	76	36	36	36

Author, 2022; *,**,*** indicates significance at the 10%, 5% and 1%; Factors and phases with strong probabilities of banking crises; Factors and phases with weak probabilities of banking crises

APPENDIX 9: ROBUSTNESS CHECKS

Robustness checks with the least absolute shrinkage and selection operator (LASSO)

Variables recruited in the logistic regression to predict the probability of banking crises (Table 4.2.8) were the suggested variables across the panel vector autoregressive models. This is to provide an accurate probability and odds ratio of having banking crises within the sample. In addition, alternative robustness checks were conducted by employing and incorporating the Least Absolute Shrinkage and Selection Operator (LASSO) for variable selection while controlling for the credit to the private sector and the business cycle.

Using LASSO adaptive lambda, the odds ratio of banking crises across the business cycle phases.

The real sector variables were segmented into expenditure and sectorial components of the aggregate output as separate models. The LASSO selected variables in table 4.2.3a and 4.2.3c, while the findings are shown in table 4.2.3b and 4.2.3d. Factors highlighted by the adaptive LASSO within the expenditure components and financial variables were percentage change in exports, banks' return on equity, and the bank non-interest income to total income, all starred and listed in Table 4.2.3a. Having been repeated under the Granger causality and the adaptive lasso selection process, the percent change in exportation and banks returns on equity remain important in the factors causing banking crises, further strengthening the panel var and logistics regression results. A percentage decline in exports weakly increased the odds of banking crises on the recovery and expansion phase, respectively, while a fall in banks returns on equity increased the odds ratio of banking crises on the expansion and recession phase. The significant impact of banks credits (%GDP) supports the result in table 4.2.2b that increased leverage on the depression, and trough phases increased the odds of banking crises. More so, both models, table 4.2.2b and table 4.2.3b, agreed that a fall in banks returns on equity (%) increase the odds of banking crises in the recession phase. An increase in the banks' non-interest income to total income (%) is an additional factor highlighted by the LASSO model that strengthens the banking system during recessions.

Table 4.2.3a: Variable Selection- Expenditure components and financial variables

```
Lasso logit model                           No. of obs         =        149
                                            No. of covariates  =         24
Cluster: id                                 No. of clusters    =         17
Selection: Adaptive                         No. of lasso steps =          2

Final adaptive step results
------------------------------------------------------------------------------
          |                                  No. of      Out-of-
          |                                 nonzero       sample      CV mean
       ID |      Description      lambda      coef.   dev. ratio     deviance
----------+-------------------------------------------------------------8------
       14 |     first lambda    .6015592          0      -0.0971       .71837
       45 |    lambda before     .033632          3       0.1079      .5841539
    * 46 | selected lambda    .0306443          3       0.1082      .5839152
       47 |     lambda after    .0279219          3       0.1081      .5839859
       95 |      last lambda     .000321          4       0.0683      .6100519
------------------------------------------------------------------------------
* lambda selected by cross-validation in final adaptive step.
```

Lasso coefficient

	active
Exports(% Change)	x
Banks Return on Equity (%)	x
Bank non-interest income to total income	x
_cons	x

Legend:
b - base level
e - empty cell
o - omitted
x - estimated

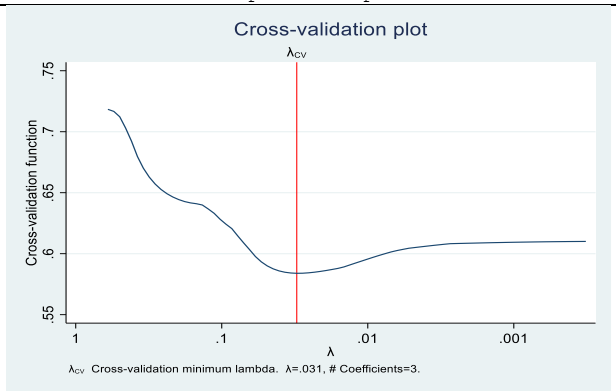


Table 4.2.3b: Odds ratio of banking crisis across phases using adaptive lasso selected covariates- Expenditure components and financial variables

Odds Ratios	Average across all Phases	Average across Recovery Phases	Average across Expansion Phases	Average across Peak Phases	Average across Recession Phases	Average across Depression Phases	Average across Trough Phases
Business cycle	1.073 (0.111)	0.496*** (0.119)	0.945 (0.254)	1.412** (0.211)	1.444 (0.590)	0.593 ** (0.129)	0.695 (0.195)
Banks' Credit (% GDP)	1.021** (0.0087)	1.012* (0.0071)	1.001 (0.0085)	1.016*** (0.006)	1.026*** (0.0075)	1.024*** (0.0071)	1.019*** (0.007)
Exports(% Change)	0.940** (0.024)	0.926* (0.0396)	0.8997* (0.049)	0.961 (0.039)	0.968 (0.037)	0.9897 (0.0156)	0.910 (0.052)
Banks Return on Equity (%)	0.954*** (0.012)	0.989 (0.0178)	0.955** (0.0197)	0.981 (0.028)	0.823*** (0.029)	0.984 (0.0219)	0.977 (0.016)
Bank non-interest income to total income	0.998 (0.022)	0.992 (0.015)	0.962 (0.041)	1.025 (0.025)	0.965** (0.0165)	1.007 (0.0172)	0.959* (0.0209)
Cons	0.0291 (0.064)	0.019*** (0.025)	0.411 (0.972)	0.0126*** (0.021)	0.349 (0.319)	0.0161*** (0.019)	0.0635** (0.082)
Wald chi2(5)	35.14***	16.99***	14.67**	16.67***	37.56***	18.44***	10.09*

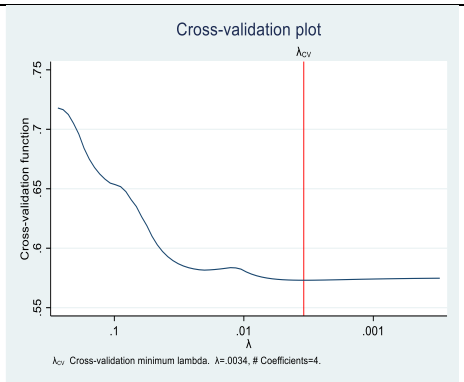
GEE population-averaged model with vce(robust). With the assumption of the random effect model. Standard errors are reported in parentheses. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively. Cons estimates baseline odds (conditional on zero random effects).

Factors highlighted by the adaptive LASSO within the sectorial outputs and financial variables were manufacturing output, service output, banks returns on equity and bank non-interest income to total income. This re-emphasised the importance of bank non-interest income to total income. The new factors selected by the adaptive LASSO were manufacturing and service output. An increase in manufacturing and service output were both defensive on the business cycle; they reduced the chances of banking crises. Observing these impacts phase by phase shows that the significant defensive impact of the increase in service output for banking crises was on the recovery phase, while the defensive impact of manufacturing was weak on the peak phase. On the other hand, the cyclical behaviour of the business cycle stirs up systemic banking crises on the recovery phase (induced by a fall in the service sector output), peak phase (induced by a rise in banks credit) and depression phase (also induced by a rise in banks credit). A further 1% rise on the peak phase increases the odds of banking crises by about 41.2% to 47.4%. The model confirmed the vulnerability of banking crises on the peak phase of the business cycle while adding service output as one of the factors whose increase strengthens the banking system on the recovery phase.

Table 4.2.3c: Variable Selection - Sectoral components and financial variables

```
Lasso logit model                          No. of obs         =        156
                                           No. of covariates  =         23
Cluster: id                                No. of clusters    =         17
Selection: Adaptive                        No. of lasso steps =          2
Final adaptive step results
------------------------------------------------------------------------------
         |                                 No. of      Out-of-
         |                                nonzero       sample      CV mean
      ID |     Description      lambda      coef.   dev. ratio     deviance
---------+--------------------------------------------------------------------
      15 |    first lambda    .2729298         0      -0.0964     .7179148
      61 |   lambda before    .0037798         4       0.1248     .5730882
    * 62 | selected lambda     .003444         4       0.1248     .5730656
      63 |    lambda after     .003138         4       0.1248     .5730794
      88 |     last lambda    .0003066         4       0.1222     .5747733
------------------------------------------------------------------------------
* lambda selected by cross-validation in final adaptive step.
```

```
                Lasso coefficient
------------------------------------------
                                 |  active
-------------------------------- +---------
Manufacturing(%change)           |  x
Service(%change)                 |  x
Banks Return on Equity(%)        |  x
Bank non-interest income to total
 income                          |  x
 _cons                           |  x
-------------------------
Legend:
  b - base level
  e - empty cell
  o - omitted
  x - estimated
```



s

Table 4.2.3d: Odds ratio of banking crisis across phases using adaptive lasso selected covariates- Sectoral components and financial variables.

Odds Ratios	Average across all Phases	Average across Recovery Phases	Average across Expansion Phases	Average across Peak Phases	Average across Recession Phases	Average across Depression Phases	Average across Trough Phases
Business cycle	1.146* (0.082)	0.661* (0.153)	0.884 (0.292)	1.474*** (0.201)	1.243 (0.487)	0.665* (0.148)	0.714 (0.188)
Banks Credit	1.011*** (0.0027)	1.011 (0.0075)	1.000 (0.009)	1.016** (0.00728)	1.025*** (0.0067)	1.021*** (0.0077)	1.0196*** (0.007)
Manufacturing (%change)	0.932*** (0.0122)	1.0004 (0.0602)	0.876 (0.0391)	0.946 * (0.0303)	0.948 (0.0464)	0.976 (0.243)	0.937 (0.0386)
Service(%change)	0.875 *** (0.0252)	0.845 ** (0.0588)	0.887 (0.125)	0.891 * (0.0524)	0.935 (0.073)	0.954 (0.048)	0.941 (0.0597)
Banks Return on Equity (%)	0.965*** (0.0105)	0.983 (0.014)	0.978 (0.0267)	0.954 (0.031)	0.849*** (0.0294)	0.9827 (0.0215)	0.984 (0.0149)
Bank non-interest income to total income	0.9899 (0.0102)	0.984 (0.0172)	0.962 (0.0462)	1.0214 (0.0209)	0.976 (0.0147)	1.006 (0.0166)	0.962** (0.0187)
Cons	0.148*** (0.085)	0.0438** (0.0658)	0.415 (1.1277)	0.0234*** (0.0299)	0.231* (0.199)	0.0256*** (0.0309)	0.053** (0.068)
Wald chi2(5)	65.57***	13.41**	25.19***	14.52**	41.00***	26.69***	11.64*

GEE population-averaged model with vce(robust). With the assumption of the random effect model. Standard errors are reported in parentheses. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively. Cons estimates baseline odds (conditional on zero random effects).

The impact of banking crises and adaptive LASSO selected factors on the business cycle phases.

The robustness checks in table 4.2.4a confirmed banks return on equity (%) as an important factor influencing the business cycle. Increased banks return on equity steered up the business cycle on the expansion and peak phase but slowed the business cycle on the recovery phase. In addition, factors such as a change in bank assets (% GDP), agriculture, manufacturing, and service output were highlighted. The model (table 4.2.4b) showed that the recessionary impacts of banking crises on the business cycle are severe and through the recovery (-59.7%) and depression (-114.3%) phases. In addition, although LASSO recruited agriculture and bank assets, both factors only had weak effects on the business cycle.

Table 4.2.4a: LASSO variable selection for the impacts of banking crises, credits, sectorial and financial variables on the business cycle phases

```
Lasso linear model                          No. of obs         =        156
                                            No. of covariates  =         23
Cluster: id                                 No. of clusters    =         17
Selection: Adaptive                         No. of lasso steps =          2

Final adaptive step results
------------------------------------------------------------------------------
             |                                No. of      Out-of-      CV mean
             |                               nonzero       sample   prediction
          ID |      Description      lambda     coef.    R-squared        error
-------------+----------------------------------------------------------------
          21 |     first lambda    4.061128         2      -0.0420     5.998683
          44 |    lambda before    .4779184         7       0.2449      4.3472
      * 45 |  selected lambda    .4354614         7       0.2463     4.338913
          46 |     lambda after    .3967762         7       0.2458     4.341882
         108 |      last lambda    .0012402        10      -0.0224     5.885962
------------------------------------------------------------------------------
* lambda selected by cross-validation in final adaptive step.
```

Lasso selected variables

	active
Banking crises	x
Banks' credit	x
Agriculture(%change)	x
Manufacturing (%change)	x
Services(%change)	x
change in bank assets(%GDP)	x
Banks Return on Equity (%)	x
_cons	x

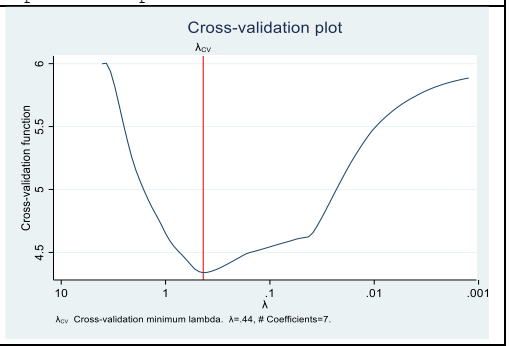


Table 4.2.4b: Impacts of banking crises, credits and lasso selected sectorial and financial variables on the business cycle phases

Coefficients	Average across all Phases	Average across Recovery Phases	Average across Expansion Phases	Average across Peak Phases	Average across Recession Phases	Average across Depression Phases	Average across Trough Phases
Banking crises	-0.231 (0.264)	-0.597** (0.273)	-0.090 (0.357)	1.566*** (0.511)	0.499 (0.309)	-1.143*** (0.278)	-0.522 (0.63)
Banks' Credit	0.0016*** (0.0006)	0.002 (0.0013)	0.001 (0.002)	-0.009* (0.005)	-0.0058*** (0.0016)	0.011 *** (0.003)	0.009 (0.0059)
Agriculture (%change)	0.00416 (0.00841)	-0.00538 (0.00627)	0.0136 (0.0182)	0.0493* 0.0275	-0.00248 (0.0107)	0.00706 (0.00541)	-0.00105 (0.0118)
Manufacturing (%change)	0.01602 (0.01442)	-0.0158 (0.0216)	-0.01254 (0.018)	0.0129 (0.0148)	-0.02019 (0.0202)	0.0329 *** (0.0122)	0.0848*** (0.0312)
Services (%change)	0.1066*** (2.121)	0.01330 (0.029)	0.0924*** (0.02)	0.1413** (0.0584)	0.02237 (0.0355)	0.0625 ** (0.026)	0.0181 (0.064)
Change in bank assets(%GDP)	-0.00036 (0.007)	0.0139 (0.00876)	-0.003 (0.010)	-0.023 (0.021)	0.014* (0.007)	-0.0298 * (0.017)	-0.017 (0.041)
Banks Return on Equity (%)	-0.0037 (0.0046)	-0.012*** (0.004)	0.016** (0.007)	0.033*** (0.013)	0.007 (0.010)	-0.00085 (0.005)	0.011 (0.011)
_Cons	-0.346** (0.141)	-0.817*** (0.179)	0.334* (0.171)	2.26*** (0.677)	1.324*** (0.223)	-1.86*** (0.282)	-3.026*** (0.485)
Wald chi2(5)	54.51***	58.39***	42.38***	68.6***	28.71***	51.37***	43.1***

GEE population-averaged model with vce(robust). With the assumption of the random effect model. Standard errors are reported in parentheses. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively. _cons estimates baseline coefficients (conditional on zero random effects).

The robustness checks in table 4.2.4c also emphasized the importance of banks return on equity (%) as an important factor in influencing the business cycle. Increased banks return on equity increased the business cycle on the peak phase(3.5%) but led to downturns in the recovery

(1.5%) and trough (4.9%) phase of the business cycle. Similarly, the model (table 4.2.4d) showed banking crises recessionary impact on the business cycle through the recovery (-110.1%) and depression (-114.3%) phases.

Table 4.2.4c: Lasso variable selection for the impacts of banking crises, credits, aggregate expenditure, and financial variables on the business cycle phases

```
 Lasso linear model                          No. of obs         =        149
                                             No. of covariates  =         24
Cluster: id                                  No. of clusters    =         17
Selection: Adaptive                          No. of lasso steps =          2

Final adaptive step results
------------------------------------------------------------------------------
             |                                No. of      Out-of-      CV mean
             |                               nonzero       sample   prediction
          ID |     Description      lambda     coef.    R-squared        error
-------------+----------------------------------------------------------------
          24 |    first lambda    2.054306         2      -0.0470     5.663358
          55 |   lambda before    .1148523         8       0.1558      4.56642
      * 56 | selected lambda    .1046492         8       0.1559     4.565873
          57 |    lambda after    .0953524         8       0.1550     4.570473
          97 |     last lambda    .0023077         9      -0.1162     6.037882
------------------------------------------------------------------------------
* lambda selected by cross-validation in final adaptive step.
```

Lasso selected variables

	active
Banking Crises	x
Banks' Credit	x
Investment(%change)	x
Import (%change)	x
Broad Money to Total Reserves Ratio	x
change in bank assets(%GDP)	x
Banks Return on Assets(%)	x
Banks Return on Equity(%)	x
_cons	x

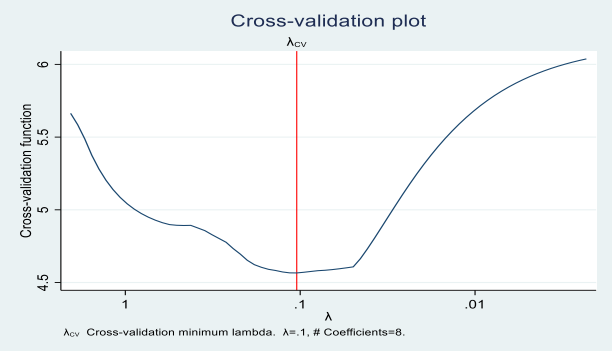


Table 4.2.4d: Impacts of banking crises, credits, and lasso selected expenditure aggregate and financial variables on the business cycle phases

Coefficients	Average across all Phases	Average across Recovery Phases	Average across Expansion Phases	Average across Peak Phases	Average across Recession Phases	Average across Depression Phases	Average across Trough Phases
Banking crises	-0.546** (0.220)	-1.101*** (0.137)	-	1.244* (0.658)	0.675 * (0.407)	-1.742*** (0.583)	-3.185*** (1.002)
Banks' Credit	0.001 (0.001)	0.003*** (0.001)	0.0004 (0.003)	-0.024*** (0.005)	-0.007 ** (0.003)	0.006** (0.003)	0.022** (0.009)
Investment (%change)	0.012 (0.008)	0.001 (0.013)	0.004 (0.012)	-0.055** (0.024)	0.004 (0.012)	0.006 (0.007)	-0.023 (0.025)
Import (%change)	0.032*** (0.010)	-0.020 (0.012)	-0.011 (0.019)	0.012 (0.025)	-0.019 * (0.010)	0.022 (0.015)	0.030 (0.034)
Broad Money to Total Reserves Ratio	-0.002 (0.002)	0.012*** (0.003)	-0.018** (0.009)	-0.024** (0.012)	0.010 (0.008)	0.236 (0.155)	0.006 (0.015)
Change in bank assets(%GDP	0.002 (0.015)	0.014 (0.012)	-0.006 (0.019)	0.031 (0.020)	-0.003 (0.008)	-0.040 (0.031)	-0.103** (0.050)
Banks Return on Assets(%)	-0.009 (0.022)	0.013 (0.014)	0.062 (0.274)	-0.234** (0.111)	0.023 (0.054)	-0.118** (0.047)	0.069* (0.036)
Banks Return on Equity(%)	0.003 (0.004)	-0.015** (0.007)	0.031 (0.037)	0.035*** (0.013)	0.020 (0.017)	0.0005 (0.012)	-0.049** (0.020)
_Cons	-0.253** (0.103)	-0.780*** (0.218)	0.635** (0.295)	4.944*** (0.698)	1.229 *** (0.333)	-2.103*** (0.503)	-2.895*** (0.397)
Wald chi2	27.56***	813.87***	27.47***	89.66***	12.97	40.69***	29.76***

GEE population-averaged model with vce(robust). With the assumption of the random effect model. Standard errors are reported in parentheses. *,**,*** indicates significance at the 10%, 5% and 1% level, respectively. _cons estimates baseline coefficient (conditional on zero random effects).