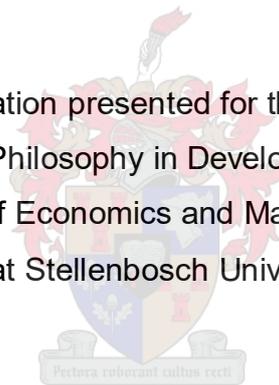


LENDING BOOMS AND BANK FRAGILITY: THE SOUTH AFRICA EXPERIENCE

MICHAEL MAPHOSA

Dissertation presented for the degree of
Doctor of Philosophy in Development Finance
in the Faculty of Economics and Management Sciences
at Stellenbosch University



**Supervisors: Professor Eon Smit
&
Professor Sylvanus Ikhide**

March 2020

DECLARATION

By submitting this thesis/dissertation electronically, I declare that the entirety of the work contained therein is my own, original work, that I am the sole author thereof (save to the extent explicitly otherwise stated), that reproduction and publication thereof by Stellenbosch University will not infringe any third-party rights and that I have not previously in its entirety or in part submitted it for obtaining any qualification.

M Maphosa

March 2020

DEDICATION

I dedicate this study to Andile (the love of my life), my daughters Mikayla Nokwazi Maphosa and Philasande Kylie Maphosa, and my son Lonwabo Michael Maphosa. I also dedicate this study to my late mother; life could never be the same without you.

ACKNOWLEDGEMENTS

Firstly, I would like to thank God Almighty: it is His grace that has brought me this far. Father, thank you for lighting my way. Your unmerited favour and your gracious hand over my life have made this possible. Thank you for your grace and your love.

Secondly, my appreciation goes to my promoters, Professor Eon Smit and Professor Sylvanus Ikhida, for their guidance, dedication and professionalism. It has been a long journey, but you have been there every step of the way. Your guidance and patience is much appreciated. 'Nginyabonga'.

Thirdly, I would also like to thank my family. Their support, prayers, encouragement and patience made this journey worthwhile. To my wife, Andile, thank you for your unwavering support throughout the journey: you surely made this journey worthwhile. Your encouragement and inspiration have finally paid off. Lonwabo, Mikayla and Philasande, thank you my darlings, your presence in my life was a well-needed push.

Fourthly, my gratitude goes to the National Energy Regulator of South Africa (NERSA) who sponsored my PhD studies. Thank you very much team NERSA. Lastly, my PhD colleagues and friends, Samuel, Sabastine, Monde, Master, Lusanda, Mfusi, Emmanuel, Susan, Seye, Edson, Jose, Fola, Nthabiseng and Mccpowell: thank you for your encouragement and spurring me on. To Samuel and Sabastine, thank you very much for the support and encouragement during the past few months.

ABSTRACT

This thesis empirically examined the link between credit booms and bank fragility in South Africa. Fundamentally, the thesis looked at how the current developments in the domestic credit market affect the banking system, and in particular financial system stability in South Africa. The past two or three decades have seen an unprecedented increase in the level of domestic credit to the private sector. We have used mostly South African Reserve Bank and World Bank time series data for the three empirical studies. The thesis applied the robust autoregressive distributed lags (ARDL) approach by Pesaran, Shin and Smith (2001) and the nonlinear autoregressive distributed lags (NARDL) methodology of Shin, Yu and Greenwood-Nimmo (2014). The thesis contains three empirical studies.

The first empirical study investigated the aggregate drivers of credit booms in South Africa using the causality tests based on the ARDL and Error Correction Model (ECM). Credit growth was analysed in relation to economic growth, types of loans, composition of credit by economic sector, debt-to-income ratio and the business cycle phases. Statistical evidence showed that South Africa has had a strong persistent growth in domestic credit over the past three decades with evidence of procyclical credit provision.

The ARDL and ECM results showed that foreign capital inflows, mortgage loans, real interest rates and GDP per capita were important drivers of credit booms in South Africa. The second empirical study investigated whether excessive credit growth signalled future vulnerabilities in the South African banking sector. The main objective was to examine the growth-risk nexus in bank lending, given the credit booms currently experienced in South Africa. The business cycle was included in the model to reinforce the growth-risk nexus by allowing the study to develop a tri-variate model. The study found that credit risk management was still backward-looking and procyclical even though there were strong moves towards countercyclical models as suggested by the Basel Committee on Banking Supervision (Basel III accord).

The ARDL model revealed the presence of a long-run relationship between credit risk, credit booms and the business cycle while the NARDL model established the presence of an asymmetric cointegration between the three variables. Negative shocks on the business cycle have a higher and more pronounced effect on credit risk than positive shocks while positive shocks to credit have a negative effect on credit risk in South Africa.

The third empirical paper explored the relationship between credit booms, banking sector finance sources and its implications for financial stability in South Africa. It was noted that it was important for the study to identify the sensitivity of the banking sector to funding sources in South Africa. It was established that, like all other banking systems around the world, South African banks also tapped into wholesale funds to satisfy growing local demand for credit.

The empirical results revealed a strong presence of an asymmetric relationship between credit booms and banking sector funding sources. Specifically, the study revealed that in the long run, positive developments in the wholesale funds market had a positive effect on the ability of the banking sector to satisfy credit demand; however, statistical evidence revealed that wholesale funds were highly volatile and susceptible to negative public signals. On the other hand, the study established that in the long run, positive developments in the domestic deposit market had positive effects on credit booms, while in the short run positive developments also had a positive effect on credit booms. Finally, negative shocks in domestic deposits in previous years had negative effects on credit booms.

Based on the above, the study believes that credit booms are too risky to be left alone, and that appropriate monetary policy is a major instrument that is capable of curbing credit booms and limiting over-indebtedness in South Africa. The increase in the level of indebtedness beyond sustainable levels is a potential trigger of financial fragility in the economy. Strong fiscal policy capable of stimulating the finance and the real sector is important if and when a credit bust occurs. It is also important to note that fiscal

discipline is required during the upswing since credit booms do not only flatter the balance sheets of banks and consumers that they extend credit to, but they also flatter government financial accounts.

TABLE OF CONTENTS

Dedication	ii
Acknowledgements	iii
Abstract	iv
CHAPTER ONE: INTRODUCTION TO THE STUDY.....	1
1.1 Background of the study	1
1.2 Problem statement and significance of the study	10
1.3 Research questions.....	15
1.4 Objectives of the study	15
1.5 Organisation and format of the study	16
CHAPTER TWO: LITERATURE REVIEW	18
2.1 Introduction.....	18
2.2 Theory of banking	18
2.3 Credit rationing in financial markets	23
2.4 The credit channel of monetary policy	26
2.5 Potential channels of banking failures.....	30
2.6 Financial fragility and instability	34
2.7 The Minsky theory of financial crises	35
2.7.1 Financial units and financial fragility	36
2.7.2 The Minsky moment (movement from stability to instability)	37
2.7.3 Debt deflation	38
2.7.4 The implication of the Minsky model.....	39
2.8 Business cycle theories.....	40
2.8.1 Implications of the business cycle theories	44
2.9 Summary: Minsky and monetary cycle theories	45

CHAPTER THREE: AGGREGATE DRIVERS OF CREDIT BOOMS IN SOUTH AFRICA ..	48
3.1 Introduction.....	48
3.2 The South African banking system and bank credit.....	50
3.2.1 Background: banking system	50
3.2.2 Bank credit in South Africa.....	54
3.3 Literature review	60
3.4 Empirical analysis and estimation techniques	64
3.4.1 Data source.....	64
3.4.2 Definition of variables	65
3.4.2.1 Credit booms	65
3.4.2.2 Gross domestic product (GDP) per capita	65
3.4.2.3 Real interest rates	65
3.4.2.4 Mortgage loans	65
3.4.2.5 Stock market prices	66
3.4.2.6 Foreign capital flows.....	66
3.5 Empirical model specification	66
3.5.1 ECM-based Granger causality test.....	68
3.6 Empirical results	70
3.6.1 Stationarity tests.....	70
3.6.2 Cointegration test: ARDL bounds test.....	74
3.6.3 ECM-based Granger causality test.....	75
3.7 Conclusion and policy recommendations.....	77
CHAPTER FOUR: CREDIT RISK AND CREDIT BOOMS IN SOUTH AFRICA	80
4.1 Introduction.....	80
4.2 Related literature	82
4.3 Overview of the South African credit market	88

4.4	Empirical techniques and empirical analysis	91
4.4.1	Data sources and definition of variables	91
4.4.1.1	Definition of variables	92
4.4.2	Empirical model specification	92
4.4.3	ECM-based Granger causality test.....	94
4.4.4	Nonlinear autoregressive-distributed lags (NARDL)	94
4.4.5	Empirical analysis.....	96
4.4.5.1	Stationarity tests	96
4.4.5.2	Cointegration test: ARDL bounds test.....	100
4.4.5.3	ECM-based Granger causality test results	101
4.4.5.4	NARDL bounds test: results	103
4.5	Conclusions and policy recommendations	107
CHAPTER FIVE: BANKING SECTOR FUNDING SOURCES AND CREDIT BOOMS		109
5.1	Introduction.....	109
5.2	Related literature	113
5.3	Background: credit in South Africa.....	118
5.4	Empirical analysis and estimation techniques	127
5.4.1	Data sources and definition of variables	127
5.4.1.1	Credit growth (DCG).....	127
5.4.1.2	Wholesale funds (WHOLEG)	128
5.4.1.3	Deposits (LDEPG).....	129
5.4.2	Empirical model.....	129
5.4.3	Empirical analysis.....	132
5.4.3.1	Stationarity tests	132
5.4.3.2	NARDL bounds tests: cointegration results	136
5.5	Conclusions and policy recommendations	141

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS.....	144
6.1 Introduction.....	144
6.2 Summary of findings	146
6.3 Policy recommendations	147
REFERENCES.....	150

LIST OF FIGURES

Figure 1.1: Credit-to-GDP ratio in South Africa	5
Figure 1.2: Credit-to-GDP ratio in South Africa, World, Upper-Middle Income and Sub-Saharan Africa	8
Figure 1.3: Credit-to-GDP ratio in BRICS countries.....	8
Figure 1.4: Nonperforming loans, lending rate and GDP growth in South Africa	8
Figure 1.5: Credit and GDP growth in South Africa	9
Figure 1.6: Interest rate spread, deposit and lending rate in South Africa	10
Figure 2.1: The Stiglitz and Weiss bank optimum interest rate	25
Figure 3.1: Credit-to-GDP ratio in South Africa	56
Figure 3.2: Composition of loans in South Africa	57
Figure 3.3: Composition of loans in South Africa	57
Figure 3.4: Mortgage loans and house prices in South Africa.....	58
Figure 3.5: Composition of bank credit by economic sector	59
Figure 3.6: Credit and GDP growth in South Africa	60
Figure 4.1: Total loan growth and LLP growth in South Africa	89
Figure 4.2: LLP growth and business cycle	90
Figure 4.3: Household debt-to-income ratio.....	91
Figure 5.1: Credit booms financed by non-core liabilities	118
Figure 5.2: Financial intermediation ratio in South Africa.....	121
Figure 5.3: Bank deposits and wholesale funding in South Africa.....	122
Figure 5.4: Growth in bank credit, non-core and core liabilities growth	123
Figure 5.5: Ratio of wholesale funds to deposits in South Africa.....	124
Figure 5.6: Bank credit to total assets ratio in South Africa.....	125

LIST OF TABLES

Table 2.1: The Bhattacharya and Thakor model of financial intermediation	22
Table 3.1: Total asset structure of the South African banking sector	53
Table 3.2: Unit root tests.....	71
Table 3.3: Zivot-Andrews stationarity tests accounting for structural breaks	73
Table 3.4: Bounds F-test for cointegration.....	74
Table 3.5: Breusch–Godfrey serial correlation LM tests	75
Table 3.6: Short and long-run Granger non-causality test	76
Table 3.7: Summary of causality	77
Table 4.1: Standard unit root tests	98
Table 4.2: Zivot-Andrews unit root tests accounting for structural breaks.....	100
Table 4.3: Bounds F-test for cointegration.....	101
Table 4.4: Breusch-Godfrey serial correlation test	101
Table 4.5: Short- and long-run Granger non-causality test	102
Table 4.6: Summary of causality.....	102
Table 4.7: Short- and long-run cointegration results.....	104
Table 5.1: Number of banks in South Africa	119
Table 5.2: Core and non-core deposits, credit growth and bank liquidity.....	125
Table 5.3: Standard unit root tests	133
Table 5.4: Zivot-Andrews unit root tests accounting for structural breaks.....	135
Table 5.5: Cointegration results	137

LIST OF ACRONYMS AND ABBREVIATIONS

ABCT	Austrian Business Cycle Theory
ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
BCBS	Basel Committee on Banking Supervision
BIS	Bank of International Settlements
BRICS	Brazil, Russia, India, China, and South Africa
BW	Bandwidth
DW	Durbin Watson
ECM	Error Correction Model
ECT	Error Correction Term
E-LLM	Expected Loan Loss Model
EU	European Union
FASB	Financial Accounting Standards Board
FDI	Foreign Direct Investment
FIC	Financial Intelligence Centre
FSB	Financial Services Board
GDP	Gross Domestic Product
IASB	International Accounting Standards Board
I-LLM	Incurred Loan Loss Model
IMF	International Monetary Fund
JSE	Johannesburg Stock Exchange
KPSS	Kwiatkowski-Phillips-Schmidt-Shin
LCR	Liquidity Coverage Ratio
LLPs	Loan Loss Provisions
LM	Lagrange Multiplier
MEC	Marginal Efficiency of Capital
MMFs	Money Market Funds
NARDL	Nonlinear Autoregressive Distributed Lags
NCA	National Credit Act
NCR	National Credit Regulator
NDP	National Development Plan

NERSA	National Energy Regulator of South Africa
NPL	Nonperforming loan
OECD	Organisation for Economic Co-operation and Development
PP	Phillips-Perron
QAT	Qualitative Asset Transformation
SARB	South African Reserve Bank
SASSA	South African Social Services Agency
SME	Small and Medium-sized Enterprise
U.S.	United States
VECM	Vector Error Correction Model
ZA	Zivot-Andrews

CHAPTER ONE

INTRODUCTION TO THE STUDY

1.1 BACKGROUND OF THE STUDY

The notion that financial crises are credit booms gone wrong is not new in literature (Borio & Lowe, 2002; Enoch & Ötker-Robe, 2007; Reinhart & Rogoff, 2009a; Borio & Disyatat, 2010; Schularick & Taylor, 2012; Borio, 2014; Rousseau & Wachtel, 2017; Jeanne & Korinek, 2018; Mian & Sufi, 2018). Over the past three decades, several developed and emerging economies have seen rapid credit growth to the private sector, for example, several Asian, Latin American and transition countries¹. In the literature, credit booms occur when credit provided to the private sector expands by more than that extended during a cyclical expansion (Mendoza & Terrones, 2012). According to Gourinchas, Valdes and Landerretche (2001), credit booms are defined as a period when the ratio of private credit to gross domestic product (GDP) deviates from its historical trend. Several studies established that credit booms are generally more associated with banking crises around the world (see, for example, Enoch & Ötker-Robe, 2007; Davis & Karim, 2008; Elekdag & Wu, 2011; Claessens & Kose, 2013; Dell’Ariccia, Igan, Laeven & Tong, 2014; Boissay, Collard & Smets, 2016).

There is a growing list of studies that strongly suggest that credit booms are a manifestation of financial development (finance-growth nexus) in both developed and emerging economies but also warns against a potential lending bubble that could burst in an environment of high financial volatility (Minsky, 1977; Kindleberger, 1978; Demirgüç-Kunt & Detragiache, 1998), increasing fragility in banking (Hilbers, Ötker-Robe, Pazarbasioglu & Johnsen, 2005), and worsening macroeconomic imbalances (Kaminsky & Reinhart, 1999; Gourinchas et al., 2001; Kiss, Nagy & Vonnák, 2006; Aizenman, Jinjark & Park, 2015). It is important to note that credit booms were also put forward as causes of the Great Depression and the recent global financial crisis of 2007-2009 (Eichengreen & Arteta, 2002; Reinhart & Rogoff, 2009b; Demyanyk,

¹ Countries such as Brazil, Argentina, Mexico, Estonia, Romania, China, Indonesia and India.

Koijen, & Van Hemert, 2011; Festić, Kavkler & Repina, 2011; Soedarmono, Sitorus & Tarazi, 2017). Another issue of concern is that banking crisis episodes have more than tripled in the post-liberalisation period of the 1980s and 1990s (Davis & Karim, 2008).

Therefore, credit booms have emerged as a leading indicator of bank fragility² and financial instability in several developed and emerging countries. However, another strand of literature argues that credit booms do not necessarily cause damage to the economy³ (Gourinchas et al., 2001; Borio & Lowe, 2002; Enoch & Ötoker-Robe, 2007; Gorton & Ordonez, 2016). These studies argue that not all credit booms are bad booms, as some do not end in a bust.

Given this, sustained credit growth poses a dilemma to policymakers and researchers around the world when designing financial development strategies (Demirgüç-Kunt & Detragiache, 1998; Kaminsky & Reinhart, 1999; Ghosh, 2010). An increase in credit means more finance that stimulates investment and supports economic growth (Arestis & Demetriades, 1997; Levine, 2002; Levine 2005; Reinhart & Rogoff, 2008a; Abedifar, Hasan & Tarazi, 2016; Seven & Yetkiner, 2016). Other benefits include helping channel savings to firms and households and facilitating financial development (Ghosh, 2010). However, some studies indicate that, if the increase is rapid, such credit may lead to vulnerabilities in the banking sector through looser lending standards (Foos, Norden & Weber, 2010; Festić et al., 2011), a decline in the quality of projects funded (Dell’Ariccia, Igan, Laeven, Tong, Bakker & Vandenbussche, 2012), excessive leverage and asset price bubbles (Demyanyk & van Hemert, 2009; Soedarmono, Sitorus & Tarazi, 2017). Credit booms in some transition economies have been significant enough to raise concerns about whether this trend is simply a manifestation of convergence to the average levels in developed countries, or whether

² Banks face shocks both on their asset and liability side. A shock that initially affects one financial institution can become systemic and affect the entire economy.

³ Only a few lending bubbles have ended in bank fragility and crisis (Gourinchas et al., 2001; Borio & Lowe, 2002; Enoch & Ötoker-Robe, 2007).

it is a case of rapid growth posing a risk to macroeconomic and financial stability (Gersl & Seidler, 2010).

The South African financial system is one of the most developed and advanced on the African continent with the highest levels of credit growth provided through formal channels. The Johannesburg Stock Exchange (JSE) in South Africa is one of the oldest and largest stock exchanges in Africa and ranked amongst the top 20 in the world in terms of capitalisation. The JSE is followed by the Egyptian Stock Exchange (Egypt), the Casablanca Stock Exchange (Morocco), the Nigerian Stock Exchange (Nigeria) and the Namibian Stock Exchange (Namibia). While there are signs of financial deepening in the rest of the African continent, the financial systems remain relatively shallow and underdeveloped compared to other regions (Odhiambo, 2009). The banking sector still dominates the financial system in most African countries and accounts for the biggest proportion of assets (International Monetary Fund, 2016).

The enactment of various financial services legislation and policy reforms has accelerated financial development and financial inclusion in South Africa. The main objective of these changes is to enhance inclusive growth and reduce the problems of unemployment, poverty and inequality. The data shows that there has been a noticeable increase in financial inclusion from 61 per cent in 2004 to 89 per cent in 2016 (World Bank, 2017), while the government plans to increase financial inclusion to 90 per cent by 2030 (Banking Association of South Africa, 2015a). New products such as the mandatory mzansi⁴ accounts and South African Social Services Agency (SASSA) bank cards have drawn the previously excluded into mainstream banking, and this has contributed to high demand for credit. According to the World Bank (2017) report, 54 per cent of adults in South Africa had access to banks, credit unions, cooperatives, post office and microfinance institutions in 2011, while the number had increased to 69 per cent by 2017.

⁴ The mzansi account is an initiative of South Africa's Financial Services Charter and is a low income transactional banking account offered by commercial banks in South Africa.

Statistical evidence shows that the domestic credit to GDP ratio which is often referred to as an important informative signal of financial fragility in the economy (see, for example, Barajas, Chami & Yousefi, 2013 and Davis et al. 2016), has accelerated rapidly over the past three decades in South Africa. Figure 1.1 shows the credit-to-GDP ratio in South Africa from 1970 at different time periods. Prior to the global financial crisis of 2007-09, domestic credit accelerated to 192 per cent of GDP in 2007, up from 76 per cent in 1980 and 91 per cent in 1991. The 192 per cent recorded in 2007 is the highest ratio in South Africa over the past four decades. However, since 2008 there has been a gradual decline in domestic credit in South Africa owing to the knock-on effects of the financial crisis and banks' unwillingness to commit to more credit in an environment of low investor confidence and poor economic growth. During the 2008-2013 period, the credit ratio averaged 178.2 per cent, while there was a further decline from 2014 to 2017. The decline in credit provision indicates that financial institutions are increasingly worried about the rate at which they are providing credit to the private sector.

Importantly, unsecured⁵ loans to the private sector have also accelerated over the past 20 years in South Africa. According to the International Monetary Fund (IMF) (2014), unsecured loans increased by 47 per cent between 2010 and 2012, reaching 11.7 per cent of total bank loans in 2013. These are the same unsecured loans that caused the partial collapse of the micro-lender African Bank. The collapse of the bank created a high level of speculation in the money market funds (MMFs) that had committed major investments to the bank. Although small, the partial collapse of this bank led to the downgrading of the top four commercial banks by rating agencies, while another micro-lender, Capitec, saw a slight decline in the value of its shares.

⁵ Unsecured credit is not collateralised by any assets to which the creditor can have recourse in case of failure by the debtor to meet the credit obligations. The South African Reserve Bank (SARB) views credit cards, overdrafts, personal loans and financing small medium enterprises as forms of unsecured lending.

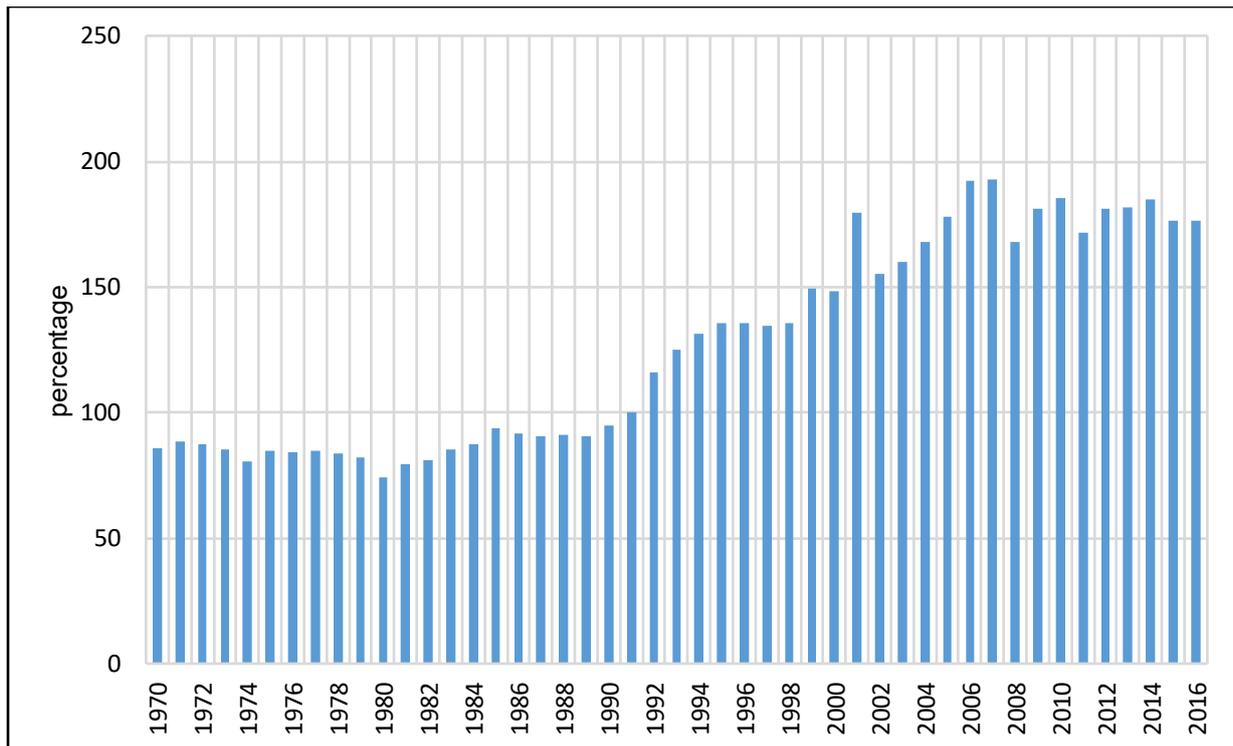


Figure 1.1: Credit-to-GDP ratio in South Africa between 1970 and 2016

Source: World Bank data

It is important to note that the credit-to-GDP ratio in South Africa is substantially higher than the average of Upper Middle Income countries⁶, Sub-Saharan African countries, and the World average (see Figure 1.2). In 2016, the World average stood at 128 per cent while South Africa's ratio was 176.7 per cent. Interestingly, Sub-Saharan Africa's ratio has remained below 60 per cent since the 1970s. This indicates that credit to the private sector has remained very low over the past three to four decades.

⁶ The World Bank classification of upper middle income countries are those in which 2017 GNI per capita was between \$3,896 and \$12,055. The World Bank classifies South Africa as an upper middle income economy.

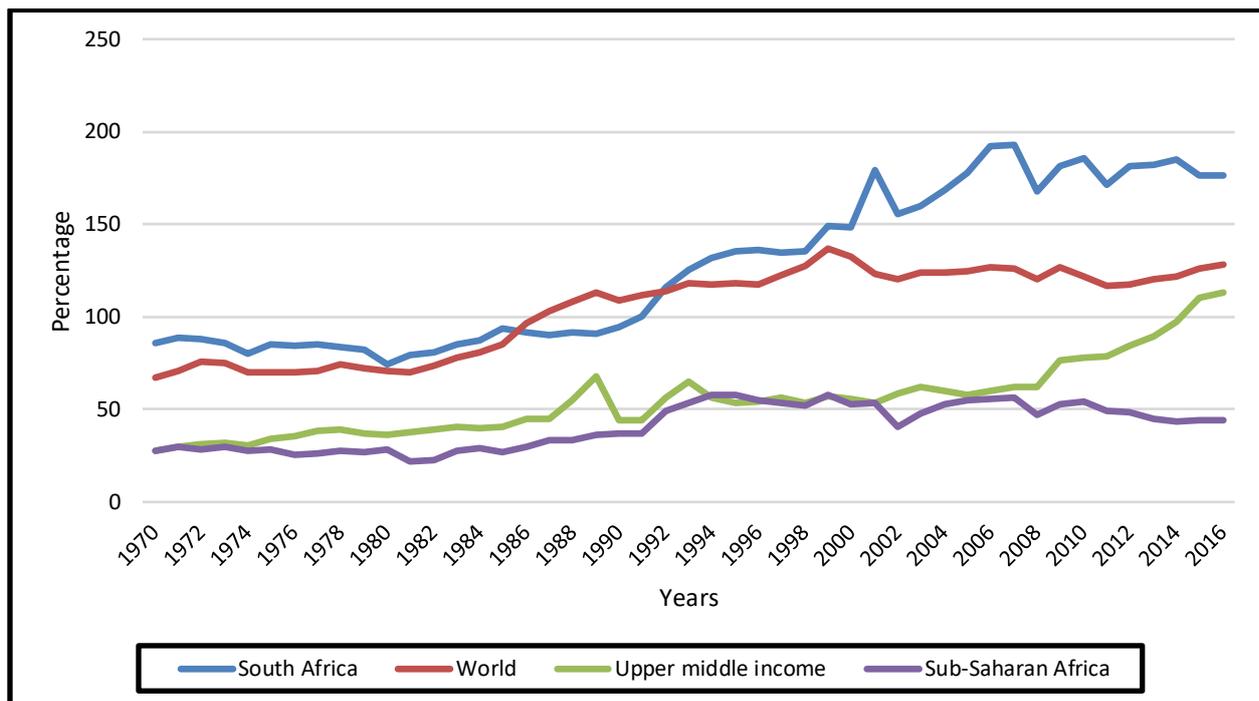


Figure 1.2: Credit-to-GDP ratio in South Africa, World, Upper Middle Income, and Sub-Saharan Africa

Source: World Bank data

In Figure 1.3, we also provide a summary of a comparative analysis amongst the members of the BRICS⁷ trade bloc and again statistics show that between 1970 and 2014 South Africa has had the highest credit-to-GDP ratio, closely followed by China, with Brazil third, while the remaining BRICS nations had a ratio below 70 per cent. Interestingly, since 2015, China's credit ratio has now surpassed that of South Africa with 195 per cent in 2015 and 216 per cent in 2016. Figure 1.3 shows that China's credit is now twice the size of its GDP. However, if one compares the ratio of credit in South Africa and China, one will notice that China's GDP growth has been above 6.9 per cent since 1998, peaking at 14.2 per cent in 2007. It is therefore, not surprising that credit growth has also accelerated during that period; the intuition could be that credit is funding growth in China. However, if one looks at South Africa, credit growth has not resulted in significant economic growth when compared to China.

⁷ The BRICS countries are Brazil, Russia, India, China and South Africa.

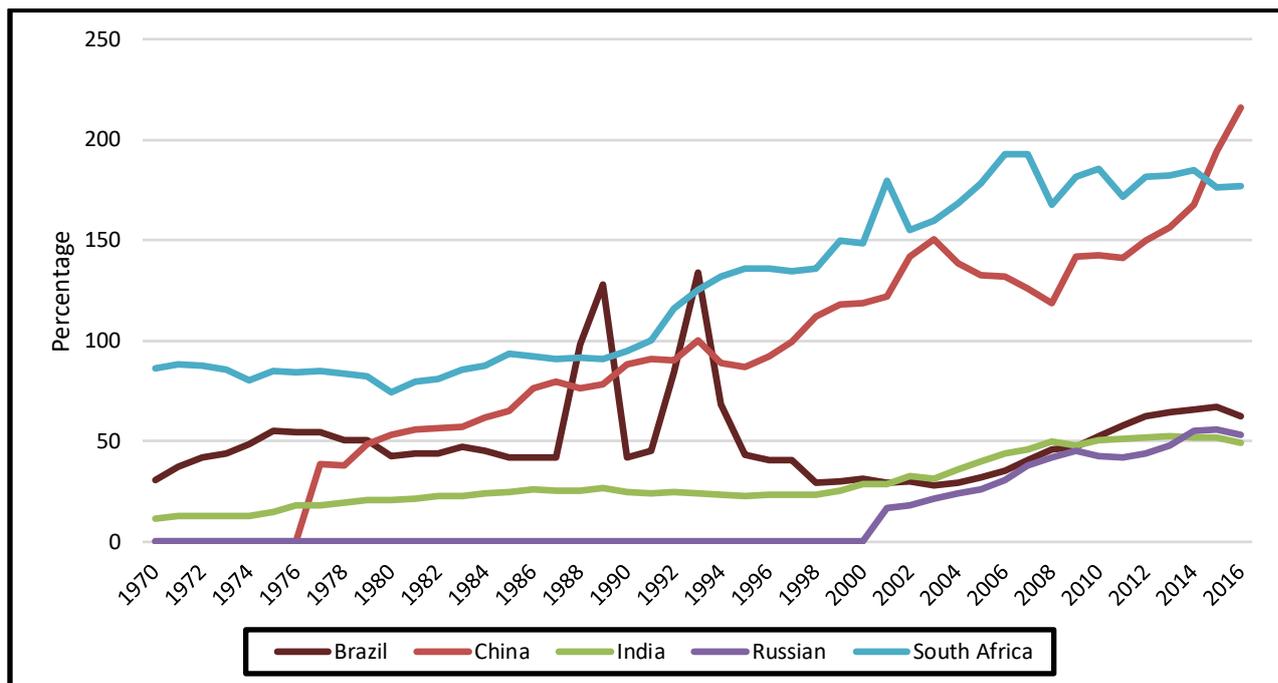


Figure 1.3: Credit-to-GDP ratio in BRICS countries

Source: World Bank data

Episodes of credit booms have also been linked with an accelerated increase in private sector indebtedness, especially at the household level. Household debt in South Africa peaked at 85.7 per cent of disposable income in 2008, up from 52.4 per cent in 2002, representing a 33.3 per cent increase (see Figure 4.3 in Chapter 4). As of 2017, household debt stands at 71.9 per cent of disposable income. Van den Heever (2007) highlights that banks contribute 90 per cent of the total household debt in South Africa. During the 2000s, total debt far exceeded disposable income in South Africa, raising serious concerns with regard to the sustainability of debt and financial system stability (Van Den Heever, 2007). Linked to rising debt, there is the probability of greater loan defaults in loan repayments i.e. an increase in nonperforming loans (NPLs). Figure 1.4 shows the behaviour of NPLs to changes in macroeconomic factors in South Africa. It can be seen that during the 2000s, there was a gradual decline in NPLs from 5 per cent in 1999 to a record low of 1.1 per cent in 2006. However, from 2007 there was a steep increase in NPLs to a record 6 per cent in 2009. An analysis of the relationship between NPLs and economic growth shows that during economic downturns, NPLs increase, while they decrease during the upswing years. We can trace the relationship between NPLs and the lending rate. Since the majority of loans in South Africa are

issued on flexible interest rates (e.g. mortgage loans), as lending rates increase, so does the rate of loan defaults.

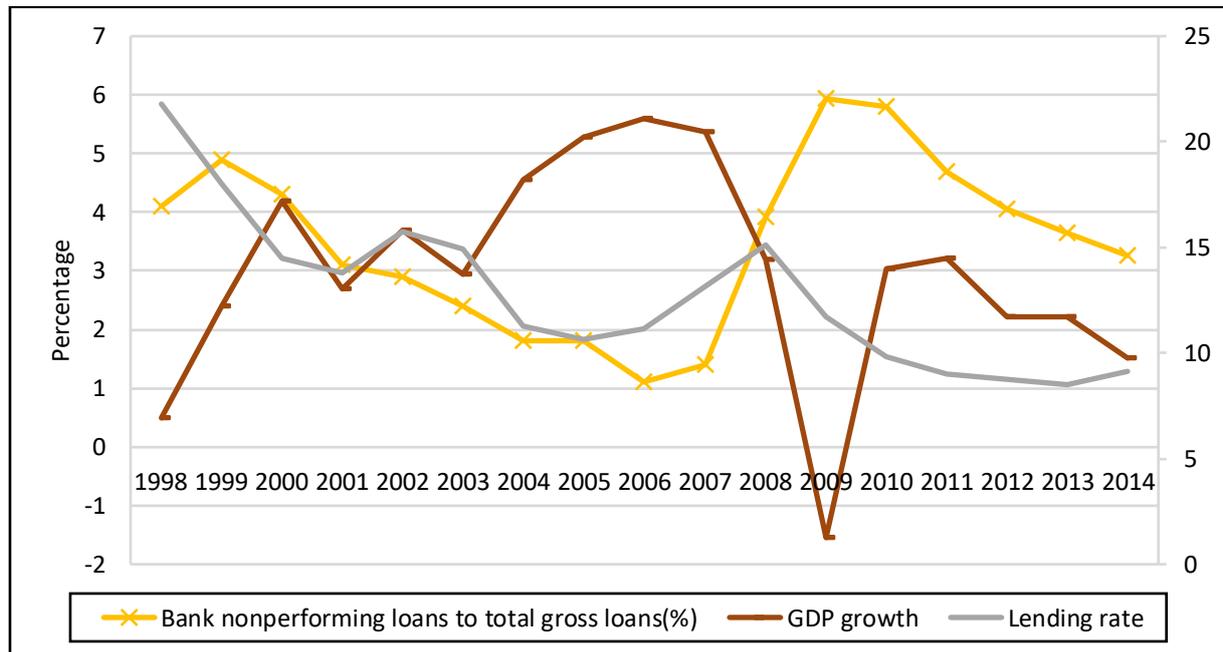


Figure 1.4: Nonperforming loans, lending rate and GDP growth in South Africa

Source: World Bank data

Figure 1.5 depicts the other relationship that explains lending growth in South Africa. In some years, credit seems to grow more than the rate of economic growth. Interestingly, Wolf (2009) analysed the performance of the financial sector during the financial crisis of 2007-09 compared to the rate of GDP growth in the U.S. Wolf (2009) opined that the financial sector had grown rapidly compared to the growth of nominal GDP, and concluded that “instead of being a servant, finance had become the economy’s master” (Wolf, 2009, p. 2). In other words, episodes of rapid credit growth not driven by economic fundamentals pose a threat to the country’s financial system. It can be seen in Figure 1.5 that credit grew much faster than the rate of economic growth in the period 1970 to 2014. For example, in 1980 GDP grew by 6.6 per cent while credit grew by 26 per cent, and in 1990 GDP fell by 0.31 per cent while credit grew by 15 per cent. This trend continued until 2014 as depicted in Figure 1.5.

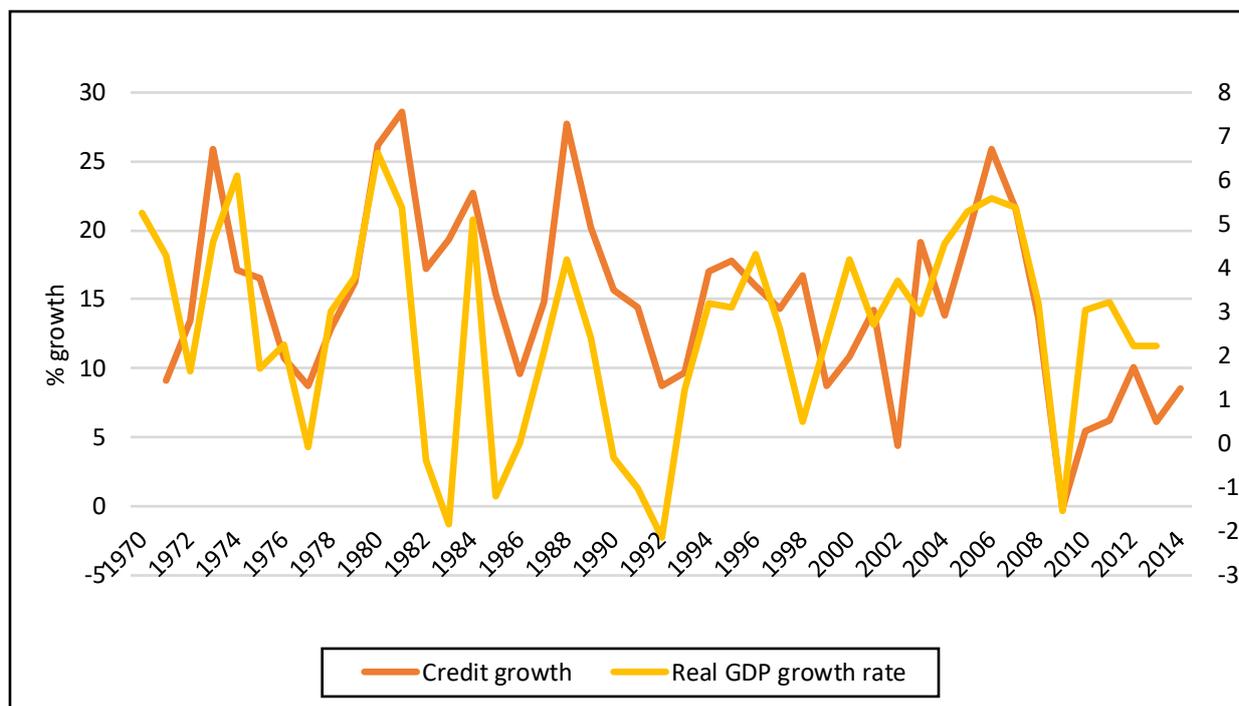


Figure 1.5: Credit and GDP growth in South Africa (1970-2014)

Source: South African Reserve Bank (SARB)

Figure 1.6 depicts the interest rate spread in South Africa i.e. the difference between lending and deposit rates. Figure 1.6 shows that there has been a decline in the interest rate spread, from 6.3 per cent in 1982 to 5.7 per cent in 1999 to 3.3 per cent in 2014. The decline in the interest rate spread signifies a decline in the financial intermediation costs in South Africa. According to Folawewo and Tennant (2008), a higher interest rate spread signifies inefficiencies in the banking system. Based on this analogy, there has been an increase in the level of efficiency in South African financial institutions.

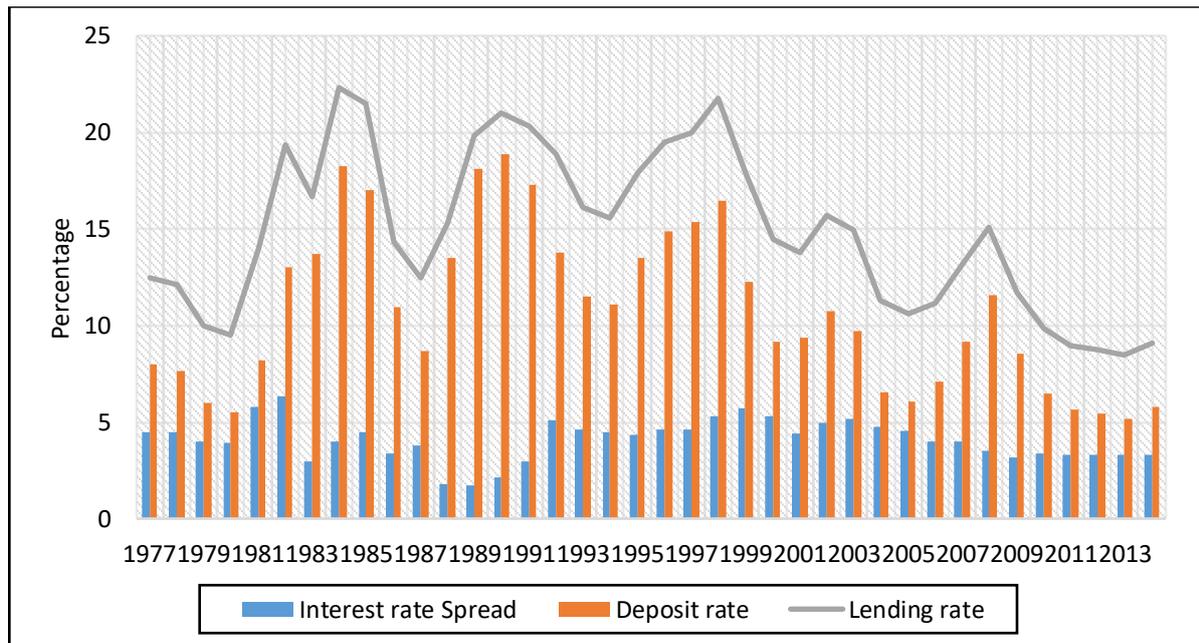


Figure 1.6: Interest rate spread, deposit and lending rate in South Africa (1977-2014)

Source: World Bank data

1.2 PROBLEM STATEMENT AND SIGNIFICANCE OF THE STUDY

The 21st century has witnessed exponential growth. To promote accelerated growth and development, the South African government has introduced a number of financial reforms since 2004. These reforms are envisaged to better align the economic incentives for participants in the financial system with the goal of financial stability. In particular, these reforms seek to broaden financial services and address market failures in the credit markets in order to promote fair and non-discriminatory access to consumer credit, prohibit unfair credit practices, promote responsible credit granting and prohibit reckless credit granting. To this end, the government introduced the Financial Intelligence Centre Act of 2001, the Financial Advisory and Intermediary Services Act of 2002, the Financial Sector Charter of 2004, and the National Credit Act of 2005. These initiatives demonstrate the recognition by the government that access to credit is one of the fundamental issues that will promote commercial activity and stimulate economic growth in the country.

Specifically, the government's broader financial inclusion drive seeks to improve the range, quality and availability of financial services and products, focusing more on the

previously unserved, under-served and financially excluded. The principal objective of government here is to improve access, affordability, appropriateness, usage, quality, consumer financial education, innovation, diversification, and simplicity of financial services and products in South Africa (Banking Association of South Africa, 2015b). There is also an active commitment by all financial institutions and other market participants to promote access to financial services. According to the Banking Association of South Africa (2015b), financial service providers commit to: “actively promoting a transformed, vibrant, and globally competitive financial sector that reflects the demographics of South Africa, and contributing to the establishment of an equitable society by effectively providing accessible financial services to black people and by directing investment into targeted sectors of the economy”. The financial inclusion drive initially set out a 5-year target in 2005 with the following key focus areas: access to mortgage finance, agriculture finance, small and medium-sized enterprise (SME) finance, ‘mzansi’ accounts and transformational infrastructure. In 2010, the government envisaged about 67-70 per cent of all adults in South Africa having access to financial services by the end of 2015. Meanwhile, the National Development Plan (NDP)⁸ set a target of 90 per cent by the year 2030.

Unfortunately, the current developments in the domestic credit market raise serious concerns regarding the possible risk to local banks and in particular financial stability in South Africa. The above-mentioned efforts to broaden access to regular (formal) credit channels, poor bank lending practices and over-reliance on bank credit⁹ have accelerated domestic credit growth in South Africa. The past two to three decades have seen an unprecedented increase in domestic credit to the private sector. In fact, previous studies on South Africa such as Booms and Are (2004), Mendoza and Terrones (2008); Mendoza and Terrones (2012), Gozgor (2014) and Arena, Bouza, Dabla-Norris, Gerling and Njie (2015) highlight that this trend exhibits the characteristics of credit booms. During the past decade, the credit-to-GDP ratio has

⁸ The NDP is a government blueprint plan that seeks to eliminate poverty and reduce inequality in the country by year 2030. This has become the strategic framework for detailed government planning.

⁹ See, for example, Mothibi (2015).

remained above the 150 per cent mark, peaking at 192 per cent in 2007. The ratio of 192 per cent in 2007 surpassed the world highest average of 160 per cent recorded in the same year. According to the World Bank data, the credit-to-GDP ratio has remained below 65 per cent in the sub-Saharan Africa region over the past 20 years, peaking at 73 per cent in 1994. The World Bank data also reveals that credit to the private sector in South Africa has been growing much more rapidly than the economy.

Part of this increase emanates from an increase in the popularity of unsecured lending and mortgage loans provided by local banks to households and firms. Unfortunately, the accelerated increase in unsecured credit is an offshoot of the relaxed lending environment that currently exists in South Africa. According to the SARB, total gross unsecured credit exposure by the top six commercial banks¹⁰ increased by 2.6 per cent to R505.4 billion in 2014. The increase was influenced by a R12.16 billion (4.7 per cent) increase in credit cards and other revolving unsecured loan facilities. This, accompanied by an increase in NPL provisions, high default ratios and macroeconomic factors, is expected to increase the vulnerability of the banking sector. Therefore, it is important to understand that the current credit trends potentially expose the entire banking system to systemic risk, unless efforts are made to correct this imbalance. This threatens one of the core functions of the SARB: that of ensuring financial stability.

One common concern in the literature is that rapid credit growth threatens financial and macroeconomic stability as witnessed during the global financial crisis of 2007-09. Financial crisis literature shows that rapid credit growth increases the moral hazard and adverse selection problems that undermine the stability of the banking system, thus increasing the chances of a banking crisis. It is further noted in the literature that rapid credit growth is a leading indicator of financial instability in the economy (Kaminsky, Lizondo & Reinhart, 1998; Borio & Lowe, 2002; Jordà, Schularick & Taylor, 2011; Kraft & Jankov, 2005; Borio & Drehmann, 2009; Reinhart & Rogoff, 2009b; Gersl & Seidler, 2010; Koong, Law & Ibrahim, 2017). The aftermath of the global financial

¹⁰ Absa, Standard Bank, First National Bank (FNB), Nedbank, Capitec and African Bank.

crisis confirms the importance of understanding, measuring and predicting future banking sector disruptions. The stress emanating from financial system fragility can be fed through to macroeconomic instabilities and lead to severe deterioration of the soundness of the financial system. The costs and disruptions may be greater than the benefits of credit provision in the economy. Therefore, it is beneficial to examine how credit booms contribute to financial instability and crises, especially in a developing country context such as South Africa.

At a global level, studies of this nature have been carried out (King & Levine, 1993; Levine & Zervos, 1998; Rajan & Zingales, 1998; Gourinchas et al., 2001; Borio & Lowe, 2002; Favara, 2003; Enoch & Ötoker-Robe, 2007; Mendoza & Terrones, 2008; Barajas, Dell’Ariccia & Levchenko, 2007; Reinhart & Rogoff, 2009a; Jordà et al., 2011; Claessens, Kose & Terrones, 2012; Arena et al., 2015; Cerutti, Dagher, & Dell’Ariccia, 2017). However, we note that even though such studies have been done, crisis after crisis keeps occurring: the 1987 U.S. stock market crash, the 1994 Mexican currency crisis, the 1997 and 1998 Asian and Russian crises, the global financial crisis of 2007-2009 that started in the United States, the 2011 sovereign debt crisis and, most recently, the Greek debt crisis. These crises have been spectacular and cost countries dearly.

Given the above background, South Africa is an interesting case to explore the link between credit booms and bank fragility for five reasons. First, South Africa has had a rapid acceleration in credit over the past few years and the credit-to-GDP ratio has remained above the average of other comparable regions i.e. Upper Middle-Income countries, Sub-Saharan countries, BRICS countries and the World average. Existing literature shows that the credit-to-GDP ratio provides an informative signal of banking system fragility and that it requires close monitoring (see, for example, Schularick & Taylor, 2012; Koong, Law & Ibrahim, 2017 among others).

Second, the costs associated with bank or financial system failures would be catastrophic for a country such as South Africa with severe fiscal constraints compounded by the three problems of unemployment, poverty and inequality.

Therefore, ongoing studies of this nature are required to determine measures to prevent such failures in the future.

Third, the level of indebtedness in South Africa has peaked over the past 10-12 years as a result of rapid credit growth. At a household level, this is driven by rapid increase in unsecured credit which has left the majority of citizens in a debt trap. The rapid increase in unsecured credit is an offshoot of the relaxed lending environment that currently exist in the country. Reckless lending has become almost systemic in the industry with a rising number of reckless lending cases before the regulatory authorities. The theoretical framework of Minsky (1982) suggests that the debt-income relationships are important in explaining the development of financial fragility. The rising debt levels beyond sustainable levels threatens financial system stability in South Africa.

Fourth, the banking sector accounts for more than 20 per cent of GDP and is ranked as the third biggest employer in South Africa accounting for more than 10 per cent of total employment (Ifeacho & Ngalawa, 2014). Therefore, it is important to note that the failure of the banking sector will have far-reaching consequences in as far as government's effort to grow the economy, and reduce unemployment and poverty, is concerned. It is important that we understand the significance of the South African banking system stability, given its important role in financial and economic development.

Finally, the SARB, which guides monetary policy and ensures financial stability in the country, has not done any research of this nature. Even in its 2017 Bank Supervision Department Annual Report, the SARB highlighted that it cannot guarantee the public that a bank will not fail "since banking would become entirely non-competitive and too expensive if prudential ratios and supervisory measures were designed in a way that would prevent the possibility of failure" (SARB, 2017, p. 2). The SARB highlights that there should be freedom of entry and exit in the banking sector. The argument is that, in the interest of the South African depositors, studies of this nature are important in providing signals on the triggers of bank failures. South Africa has had 30 bank failures

since 1990 (Blackbeard, 2014), and some of these failures have been rather spectacular, for example, BoE Bank (2002), African Bank (2014), African Merchant Bank (2003), Saambou Bank (2002) and Unifer (2002), among others. Importantly, government and the South African Reserve Bank now recognise the economic and social costs associated with bank failures and there is now a proposal to establish the deposit insurance scheme.

1.3 RESEARCH QUESTIONS

In light of the above background and context, this study sought to answer the following key questions:

- 1.3.1 What are the current domestic credit trends in South Africa?
- 1.3.2 What are the fundamental aggregate drivers of credit booms in South Africa?
- 1.3.3 Do credit booms signal future vulnerabilities in the banking system in South Africa?
- 1.3.4 What is the relationship between credit booms, banking sector finance sources and its implications for financial stability in South Africa?
- 1.3.5 What are the ideal policy propositions to achieve non-destabilising booms in South Africa?

1.4 OBJECTIVES OF THE STUDY

The general aim of this study is to examine the relationship between credit booms in South Africa. The specific objectives will be to:

- 1.4.1 Examine current credit trends in South Africa;
- 1.4.2 Identify the aggregate drivers of credit booms in South Africa;
- 1.4.3 Investigate whether excessive credit growth leads to vulnerabilities in the banking system in South Africa;

- 1.4.4 Examine the link between credit booms and banking sector funding sources and its implications for financial stability in South Africa; and
- 1.4.5 Propose policy suggestions for achieving non-destabilising credit booms in South Africa.

1.5 CONTRIBUTION OF THE STUDY

The general contribution of this study is as follows;

- 1.5.1 First, this study makes an important contribution to the discussion on credit booms and their implications for bank fragility in the South African context.
- 1.5.2 Most of the studies on credit booms in South Africa (Booms & Are, 2004; Mendoza & Terrones, 2008; 2012; Gozgor, 2014; Arena et al., 2015) were mainly on establishing the existence of credit booms without necessary identifying the triggers and the associated risk. Hence, this study will be a major contribution to the quantitative literature on credit booms in South Africa.
- 1.5.3 This study is the first that contributes to defining and measuring credit risk in the context of credit booms in South Africa using latest methodologies.
- 1.5.4 While most studies use the credit ratio as an informative signal for financial fragility, this study contributes to this debate by proposing the use of non-core liabilities of the South African banking sector as a complementary measure to establish the stage of the financial cycle and the possible build-up of financial system risk in South Africa.
- 1.5.5 Apart from contributing to policy, this study is a timely addition to the existing country-specific literature on credit booms and burst.

1.6 ORGANISATION AND FORMAT OF THE STUDY

This study contains six chapters as follows: Chapter One provides the background of the study, problem statement, significance of the study and research questions, while Chapter Two is the literature review focusing on banking, business cycle, credit

rationing, financial fragility and instability theories. Chapter Three discusses drivers of credit booms in South Africa, followed by Chapter Four that looks at the relationship between credit risk and credit booms. Chapter Five explores the relationship between banking sector finance sources, credit booms and implications for financial stability, while Chapter Six provides policy recommendations and concludes the study. It is important to note that this is a PhD thesis written in the form of publishable articles. Therefore, the empirical Chapters Three, Four and Five contain their own study background, literature review, research methodology, research findings and policy recommendations. It can, therefore, be expected that certain aspects in this thesis might be reflected in more than one empirical chapter since each of these three chapters can be converted into a publishable article.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

In this chapter, we present general theoretical literature that is relevant to this study. Specific theoretical literature is examined in different empirical studies in subsequent chapters. Therefore, the chapter presents past and present theoretical¹¹ perspectives on business cycles, the role of banks, and the developments that threaten the efficient functioning of banks. The role of financial intermediation in credit creation and quality has become an important topic in contemporary macroeconomic analysis. In theory, deposit-taking institutions have an important role to play in the economy because financial markets are imperfect. Scholtens and van Wensveen (2000) agree that banks exist only because of market frictions and that banks will continue to exist as long as market imperfections continue to exist. However, their role will be limited as soon as market imperfections are reduced or eliminated (Scholtens & van Wensveen, 2000). Banks will lose their functions if savers and borrowers have perfect information about each other directly, without any hiccups, and at reduced costs.

2.2 THEORY OF BANKING

The theory of banking has undergone a number of reconfigurations in the past 3-4 decades owing to a plethora of innovations in banking systems, the occurrence of banking crises, and advances in information economics. This has advanced the understanding of banking, why banks fail, and the costs associated with such failures. It is well documented in the financial intermediation literature that one of the biggest impediments facing intermediaries is information asymmetries, which have a direct effect on transaction costs. Various models present insights into the effect of imperfect information on both buyers and sellers in financial markets (see, for example, Akerlof, 1970; Spence, 1973; Rothschild & Stiglitz, 1976; Bhattacharya & Thakor, 1993). The

¹¹ Empirical literature is covered in detail under different chapters in the dissertation.

consensus among these models is that such impediments distort prices in the financial market. Overcoming the problem of imperfect information is important for the efficient functioning of any market, including financial markets (Akerlof, 1970).

In financial transactions, information asymmetry arises when one part of a financial transaction knows more about an investment project than the other does. Studies show that borrowers often know more about their investment projects than lenders do. Therefore, financial intermediaries play an important role in ameliorating information asymmetries through a number of strategies such as specialised information gathering/collection, a thorough evaluation of projects, ex-post monitoring of borrowers' performance, et cetera.

The provision of liquidity and asset transformation have been emphasised in the literature as the two most important functions of banks (Bhattacharya & Thakor, 1993). In these roles, financial intermediaries enhance efficient resource allocation by reducing the transaction and information costs of channelling funds from savers to borrowers.

In the Diamond and Dybvig (1983) model, banks play an important role in transforming illiquid assets into liquid liabilities. The model highlights that bank investors (traditional depositors) are normally at risk and are uncertain about their future consumption. In the absence of intermediation, these investors would find themselves locked into illiquid long-term investments that pay high interest only to those that consume late, while those that recall their investment prematurely miss out on high returns. According to this model, banks provide an efficient risk-sharing mechanism of returns between long-term and short-term investors. Diamond and Dybvig's (1983) model emphasises that the role played by banks, in this case, makes it possible for both types of investors to share risk and maximise welfare (Claus & Grimes, 2003).

Another important contribution of the Diamond and Dybvig (1983) model relates to the optimal insurance component of a demand deposit contract. The model highlights that

the insurance contract of a demand deposit has an 'undesirable equilibrium' where panicking depositors can suddenly recall their deposits, leading to a bank run. The sudden recall eventually spills over to other depositors who were initially not concerned about the safety of their deposits. According to the model, the shift in expectations by depositors is the main cause of bank runs. In cases where withdrawal volumes are not stochastic (random), "suspension of convertibility of deposits will allow banks both to prevent bank runs and to provide optimal risk-sharing by converting illiquid assets into liquid liabilities" (Claus & Grimes, 2003, p. 10). Stochastic withdrawals are avoided in cases where mandatory deposit insurance exists without affecting intermediaries' ability to transform assets. The empirical literature also supports the idea that bank runs often lead to bank panics that result in the recall of loans and cancellation of productive investments in key economic sectors. In summary, the Diamond and Dybvig (1983) model details the main reasons for the establishment of financial intermediaries and why they are susceptible to runs.

Another important function of financial intermediaries relates to their ability to transform the risk characteristics of investments (assets) emanating from market imperfections. This transformation is done through the elimination of information asymmetry problems. Information asymmetry can occur either ex-ante or ex-post. Ex-ante information asymmetry arises when a lender cannot differentiate between good and bad borrowers and projects, leading to adverse selection. Adverse selection, in this case, arises when interest rates rise to leave a risky pool of borrowers in the market for credit. Financial intermediaries run the risk of lending to high-risk borrowers because those with good projects are not willing to borrow at a higher premium. Bank theory predicts that borrowers who are willing to pay high-interest rates are on average riskier than the others. On the other hand, ex-post information asymmetry arises when borrowers can observe the actual returns after the project has been completed, leading to the moral hazard problem which occurs when borrowers engage in activities most likely to reduce their likelihood to repay the borrowed funds.

In this regard, the importance of financial intermediaries lies in their ability to eliminate information asymmetries by investing significant resources in information gathering at

lower costs compared to other economic agents. This is possible since they eliminate duplication of already existing information (increasing returns to the scale of financial intermediation). Financial intermediaries invest in developing specialised underwriting skills for projects and evaluating potential borrowers. They also take advantage of cross-sectional information and re-use information repeatedly. Intermediaries can communicate information about potential borrowers to investors at lower costs than individual borrowers can (Leland & Pyle, 1977). According to Leland and Pyle (1977), the ability of intermediaries to strictly monitor firms' activities helps solve the moral hazard problem.

Diamond (1984) also predicts that the ability of financial intermediaries to diversify project portfolios (low and high risk) is a compelling factor for their existence. Diversification of the portfolio, in this case, reduces the probability of incurring high costs. Diamond's (1984) assertion is that intermediaries have the costly task of monitoring loan agreements. With a reasonable incentive accrued, intermediaries are able to continuously collect information, monitor agreements and make payments to depositors for funds received. Importantly, Diamond believes that financial intermediaries are asset transformers since they provide depositors with riskless claims while lending to risky borrowers.

In the Bhattacharya and Thakor (1993) model, financial intermediaries provide brokerage and qualitative asset transformation (QAT). Financial intermediaries often specialise in one or more of these functions. The benefit of the brokerage function is a result of cost advantage in information gathering that normally comes from two sources: (i) long-term experience in interpreting delicate signals, and (ii), as Chan, Siegel and Thakor (1990) suggest, brokers take advantage of the cross-sectional customer and temporal re-usable data. Qualitative asset transformation is concerned with term to maturity¹², divisibility, liquidity and credit risk. Table 2.1 below provides an insight into the Bhattacharya and Thakor model of financial intermediation. According

¹² Banks financing assets with longer maturity than liabilities.

to the model, banks' maturity transformation function lies in their ability to provide liquidity to the economy.

Table 2.1: The Bhattacharya and Thakor model of financial intermediation

Financial Intermediary	
Brokerage	Qualitative Asset Transformation
<ul style="list-style-type: none"> • Transaction services (e.g. Cheque-writing, buying/selling securities and safe keeping). • Financial advice (e.g. advise on where to invest, portfolio management) • Screening and certification (e.g. bond ratings). • Origination (e.g. banking initiating a loan to a borrower) • Issuance (e.g. taking security offering to market). • Miscellaneous (e.g. trust activities). 	<ul style="list-style-type: none"> • Term to maturity (e.g. bank financing assets with longer maturity than liabilities). • Divisibility (e.g. mutual fund holding assets with larger unit size than its liabilities). • Liquidity (e.g. a bank funding illiquid loans with liquid liabilities). • Credit risk (e.g. a bank monitoring a borrower to reduce default risk).

Source: Bhattacharya & Thakor (1993)

Looking at the theory of banking in the South African context, we notice that the South African banking system has also undergone a number of changes and adjustments in terms of the regulatory mechanisms. The regulatory authorities seem to understand that constant changes in the regulatory frameworks are necessary to keep abreast of the dynamic nature of the financial sector. The changes include the introduction of the twin-peak regulatory framework (fully introduced in 2018) which caters for innovation and advancements introduced by the financial sector players and measures to prevent a similar crisis in the future (i.e. the global financial crisis of 2007-09).

As predicted by the Diamond and Dybvig (1983) model, the banking sector in South Africa plays an important role in the economy since banks mostly play the role of

transforming illiquid assets into liquid liabilities. It is important to note that, in South Africa, bank credit is still the most dominant source of credit funds for households and enterprises. Therefore, the South African authorities understand the role played by banks (diversify project portfolios, brokerage, qualitative asset transformation, collecting information, et cetera) and that the failure of one or more banks has a significant effect on the overall health of the financial sector and its performance.

2.3 CREDIT RATIONING IN FINANCIAL MARKETS

The theoretical literature on credit rationing dates as far back as Dwight M. Jaffee and Franco Modigliani's theory and test of credit rationing in 1969. Credit rationing refers to a situation in which interest rates do not play their market-clearing role in the financial markets (Semerák, 2001). In other words, it is the denial of credit at any price¹³. Banks would generally ration credit when faced by rigidities: for example, when the interest rates on loans impede the Walrasian market clearing (Jaffee & Modigliani, 1929; Bhattacharya & Thakor, 1993). Two credit rationing channels are identified in the literature, as follows:

- i. Banks group potential borrowers according to their projects' expected returns. Among loan applicants, some borrowers receive loans, while others are rejected even when they are willing to pay higher interest rates.
- ii. According to Stiglitz and Weiss (1981), "there are identifiable groups of individuals in the population who, with a given supply of credit, are unable to obtain loans at any interest rate, even though with a larger supply of credit, they would" (Stiglitz & Weiss, 1981, p. 395).

The pioneering Stiglitz and Weiss (1981) model explained credit rationing in the context of markets with imperfect information i.e. adverse selection and moral hazard. The model predicted that even in equilibrium, markets may be characterised by credit rationing. Stiglitz and Weiss (1981) argued that the main concerns of banks are the

¹³ Financial intermediaries offer credit at a price at which demand exceeds supply.

interest rates received from borrowers and the credit default risk¹⁴. However, the interest charged on loans may potentially affect loan risk in two possible ways: either (i) sorting potential borrowers (adverse selection effect) or (ii) affecting borrowers' action (moral hazard effect). In this case, Stiglitz and Weiss (1981) note that, if interest rates charged on loans affect the nature of transactions, then the credit market may not reach market equilibrium.

According to the Stiglitz and Weiss model, interest rates play a major role in screening 'safe' and 'risky' borrowers in the credit market. This model predicted that, when perfect and costless information assumptions hold, banks would accurately determine borrowers' actions, which might affect loan returns. However, in practice, banks are unable to exert direct control; instead, they formulate loan contracts that induce borrowers to take actions in favour of the bank and in the process to attract low-risk borrowers. The argument is that there is a certain interest rate that maximises the banks' expected returns. Beyond this level, banks would be unwilling to advance credit to households and firms. This scenario is depicted by a forward bending loan supply curve in Figure 2.1.

Figure 2.1 shows the banks' optimum interest rates that maximise expected bank returns. It depicts that the supply of bank loans is a function of the optimal rate (r^*). Banks will not give loans to a borrower who offers to pay above the optimal rate (r^*). Banks assume that such loans are likely to be riskier than an average loan (at r^*). The bank believes that the expected returns on such loans will be lower than returns on current loans made by the bank. Simply put, according to banks, high-interest loans increase the probability of credit default, which could potentially reduce banks' expected returns.

¹⁴ Credit default risk still remains the biggest risk facing the efficient operations of banks around the world (Chatterjee, 2015; Pool, De Haan, & Jacobs, 2015). See Chapter 4 for a detailed discussion on the effects of credit risk.

According to Stiglitz and Weiss (1981), the bank will not give credit to rationed borrowers even at a higher rate in instances where the bank wants to increase expected returns. In the absence of competitive forces to correct for equilibrium, credit rationing often continues. In addition, credit rationing will occur if banks cannot observationally distinguish between those receiving loans (i.e. 'safe' and 'risky'). This model predicted that credit rationing will remain a major feature of credit markets in the near future.

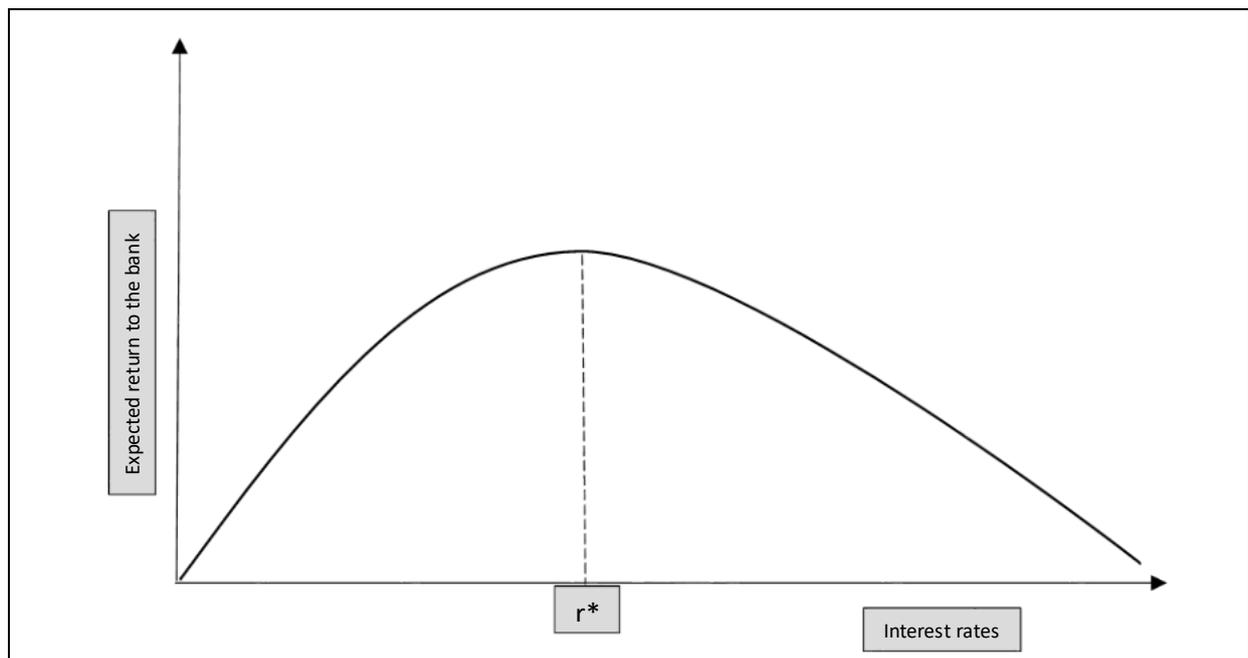


Figure 2.1: The Stiglitz and Weiss bank optimum interest rate

Source: Stiglitz & Weiss (1981)

In summary, the Stiglitz and Weiss (1981) model pertains to the issue of credit rationing and risk management by banks. In a country like South Africa, with high levels of unemployment, poverty and inequality, there is a high incidence of lenders refusing to issue loan contracts to every willing borrower. As suggested by the Stiglitz and Weiss (1981) model, the so-called top four banks in South Africa view information asymmetry problems of moral hazard and adverse selection as serious threats to their viability. The majority of the poor households in South Africa have limited access to formal credit (formal and semi-formal credit markets). According to Okurut (2006), the credit market in South Africa has three broad segments i.e. formal, semi-formal and

informal. The poor and rural dwellers in South Africa are mostly refused formal credit while semi-formal credit accommodates them to a certain extent.

Mutezo (2013) singled out small and medium enterprises (SMEs) in South Africa and pointed out that a number of enterprises are often unable to get credit from the commercial banks due to lack of collateral and their credit history. According to Nieman and Nieuwenhuizen (2009), SMEs account for 97.5 per cent of business enterprises in South Africa and contribute approximately 35 per cent of the country's GDP. Mutezo (2013) also agreed with the credit rationing theory and highlighted that the objective of minimising risk by South African banks influences the decision to reduce credit to SMEs in the country.

The credit rationing model demonstrates that in instances where banks cannot distinguish between 'bad' and/or 'good' borrowers' projects, banks would deploy various methods to minimise credit risk in their loan portfolios. Part of the strategy employed by banks is rationing of credit, especially to SMEs and households without collateral, and especially in a developing country like South Africa. It should be noted that, since credit risk remains the greatest risk faced by banks, credit rationing will remain an important part of bank credit risk management around the world, and South Africa is no exception.

2.4 THE CREDIT CHANNEL OF MONETARY POLICY

Existing literature on the credit channel analyses information asymmetry and other credit market imperfections on expenditure and economic activity and its implications for monetary policy. In the literature, the credit channel refers to a situation where changes in monetary policy alter either the efficiency of the bank credit allocation function or the extent to which borrowers face credit rationing (Claus & Grimes, 2003). It also applies when bank credit and other sources of finance are imperfect substitutes for firms and households. The fact that other bank borrowers have alternative credit

sources¹⁵ does not make the credit channel irrelevant, as long as borrowers view alternative sources as expensive or less convenient (Bernanke, 1993).

The credit channel model by Bernanke and Blinder (1992) is decomposed into two sub-channels, as follows:

- i. the bank-lending channel of monetary policy; and
- ii. the balance sheet (or financial accelerator) channel.

The bank-lending channel is concerned with the decline in the aggregate level of intermediated credit in response to monetary policy tightening (Roosa, 1951; Kashyap, Stein & Wilcox, 1993; Bernanke, 1993; Bernanke & Blinder, 1992). On the other hand, the balance sheet channel predicts a disruption in bank credit because of procyclical movements in the borrower's financial position caused by monetary tightening (Kandrac, 2012). Kandrac (2012, p. 741) argued: "with imperfect information and heterogeneous borrowers, models of the credit channel predict tighter credit standards that lower the share of loans extended to less credit-worthy firms".

It is also established in the literature that adjustments in monetary policy affect credit extension, especially in countries where banks dominate the supply of credit funds. According to Saldenber and Strahan (1999), in these countries, banks are a critical source of liquidity for firms and households in financial distress. Since bank liabilities are short-term in nature, while bank assets¹⁶ are a combination of short- and long-term loans, adjustments in monetary policy have a direct impact on the banks' balance sheet due to a mismatch between assets and liabilities. Monetary policy tightening affects the present value of assets with long-term maturity rather than liabilities (Bernanke & Blinder, 1992). On the other hand, a reduction in the level of interest rates increases the present value of assets rather than liabilities. In this regard, monetary policy tightening reduces the aggregate supply of credit funds, thus affecting the banks' equity value.

¹⁵ Alternative credit sources include the credit market and finance companies.

¹⁶ Banks' assets have a long-term maturity because they "borrow short" and "lend long".

The reduction of credit potentially increases finance costs or reduces bank credit to firms for solvency and liquidity shortfalls. Kashyap et al. (1993) argued that the interest rate spread increases during monetary contractions. One recalls the Asian and U.S. recession of the 1990s where credit to the private sector significantly declined owing to monetary policy contractions. For example, in the U.S., banks were unwilling to provide credit to importers to pay their suppliers (Claus & Grimes, 2003). A credit squeeze for some Asian countries, for example, lasted for months, while in other countries such as Indonesia, it lasted for two years (Grimes, 1998). It is important to note that the duration of a credit squeeze depends on how long it takes to establish new credit channels after a disruption.

As highlighted above, the credit channel literature predicts a bank-lending channel in small or developing economies compared to more established/developed ones. In developing countries such as South Africa, a number of small firms (i.e. SMEs) depend on bank credit as a source of liquidity and investment. When bank funding reduces, small firms cancel or delay key investments, run down inventories and retrench workers, ultimately resulting in a decline in aggregate demand. Furthermore, most households in developing countries directly or indirectly depend on bank credit to finance their expenditure. However, studies, inter alia those of Sofianos, Wachtel and Melnik (1990) and Bernanke and Blinder (1992), predicted that financial innovation and deregulation will not significantly improve the chances of small firms to access capital markets. These studies argue that information asymmetries between foreign capital investors and domestic borrowers will remain a major deterrent for small firms. In the absence of valid information, foreign investors would remain unwilling to commit funds to these small firms.

With agency costs, the impact of monetary policy tightening is further reinforced via the balance sheet or financial accelerator effect. In the credit market, agency costs arise when banks give borrowers control over borrowed funds, leading to moral hazard, adverse selection and monitoring costs. A delegation of control mainly occurs when banks are unable to monitor borrowers' action or share in borrowers' information

costs. Monetary policy contraction lowers the market value (or net worth) of firms and hence lowers the value of assets that firms can use as collateral. When this happens, banks may be unwilling to lend to firms without meaningful collateral. The reduction in the firm's net worth might increase adverse selection, thus increasing the chances for firms to engage in risky investment projects.

The extent to which small or large firms are affected by a credit squeeze lies in their ability to access short-term credit to smooth cash flow declines. On one hand, large firms are likely to respond to falling cash flows by using different sources of funds such as commercial paper and other readily available sources of capital. Therefore, large firms are able to maintain their current production and employment levels even in the face of rising interest rates and declining revenues. In the Gertler and Gilchrist (1994) model, the prediction is that the general balance sheet of small firms would be weaker than those of large firms and that the costs of lending are mostly larger than the loan value. In addition, high failure rates for small firms make it impossible for banks to build long-term relationships. As predicted by the Stiglitz and Weiss (1981) model, banks find it easy to ration credit to small firms whenever faced with a decision to reduce credit provision in the economy. According to the literature (see, for example, Gertler & Gilchrist, 1994; Kashyap, Lamont & Stein, 1994; Oliner & Rudebusch, 1996), small firms find themselves the biggest losers in any monetary policy tightening stance.

The credit channel of monetary policy highlighted by Bernanke and Blinder (1992) is relevant to South Africa. The past three decades have seen monetary policy emerging as one of the most important policies anchoring growth, development and sustainable economic activity in the country. As such, monetary policy movements have a widespread effect as they affect a number of real variables in the economy. For example, the South African Reserve Bank's (SARB) adjustment of the repurchase rate (repo rate) affects a number of variables such as other interest rates, asset prices, the exchange rate, money and credit, expenditure and investment (Smal & De Jager, 2001).

Importantly, SARB monetary policy adjustments have an effect on how South African banks conduct their business with firms and households. The conduct of banks affects access to credit by most bank dependent borrowers which ultimately has an impact on overall spending and output. In 2004, the former SARB Governor highlighted that credit was important in the economic growth processes and that monetary authorities had to ensure that credit expansion was made possible. Importantly, the former Governor opined that monetary authorities needed to understand the true characteristics of the banking system and how banks respond to sudden monetary policy adjustments before designing the best monetary policy framework (Mboweni 2004).

In summary, the credit channel of monetary policy underlines the role played by credit in the economy in general, and in developing countries in particular. Monetary policy tightening or easing plays an important role in credit allocation in South Africa and is an important tool for credit allocation since it has an effect on the external finance premium¹⁷, which translates into a reduction in investment, output and expenditure. The increase in finance costs may have significant effects on the economy if firms' balance sheets are already weak.

2.5 POTENTIAL CHANNELS OF BANKING FAILURES

Bank literature demonstrates that the stability of the financial system is important for economic development around the world (see, for example, Pagano, 1993; Leitão, 2012; Allen & Oura, 2004; Koivu, 2002; Duican & Pop, 2015). In this regard, banks play an important role in the economy, and theory predicts that a banking crisis in all or part of the system may lead to significant costs to the economy. Almost all participants in the banking system lose out when this happens. Theory predicts that shareholders lose their equity holdings, while depositors risk losing all or part of their savings and must pay costs of portfolio reallocation. Bank creditors may miss their payments, while bank-dependent borrowers such as households and small firms risk

¹⁷ Difference between costs of external and internal funds.

losing funding and face further difficulties finding alternative finance sources. Bank failures may develop into a banking crisis leading to an unanticipated contraction in the stock of money and this subsequently leads to a recession (Hoggarth, Reis & Saporta, 2002). Therefore, in this section, we highlight the potential channels of banking crises or failures as suggested in the bank literature.

As discussed in the previous section, banks are deposit-taking financial institutions whose liabilities are short-term, while their assets are a combination of short- and long-term loans. Banks are said to be insolvent if their liabilities are greater than their assets. The borrowers' ability to repay borrowed loans affects banks' assets. As discussed above under the banking theory section, information problems (moral hazard and adverse selection) experienced by banks make them susceptible to credit risk. To counter credit risk, the Stiglitz and Weiss (1981) credit rationing model highlights that banks apply a number of strategies such as strict screening of loan applications, diversification of loan portfolios by lending to customers with different risk profiles, and requesting collateral. The screening of borrowers enables banks to predetermine (ex-ante) profitable and non-profitable projects. This enables profitable projects to be funded (ex-post). However, in a country such as South Africa with high levels of unemployment, poverty and inequality, it should be noted that these strategies do not necessarily reduce credit risk, especially for banks that lend to small developing sectors. In addition, the collateral would be expensive to establish and monitor, and its value is typically subject to volatility. In this regard, bank insolvency may occur when a wave of loan losses occurs, especially when they are more than reserve requirements and equity cushions.

A systemic crisis may occur because of a significant percentage of loan losses relative to bank capital. According to Demirgüç-Kunt and Detragiache (1998), banks that are not well capitalised are more vulnerable to shocks such as declines in asset prices, cyclical output decline and decline in terms of trade, et cetera (Lindgren, Garcia & Saal, 1996; Kaminsky & Reinhart, 1999). These shocks can adversely affect the economic performance of borrowers and ultimately their ability to honour their obligations to the banks. Demirgüç-Kunt and Detragiache (1998) write that "shocks

that adversely affect the economic performance of bank borrowers and whose impact cannot be reduced through risk diversification should be positively correlated with systemic banking crises” (Demirgüç-Kunt & Detragiache, 1998, p. 85).

The credit channel of monetary policy notes that, even in the absence of loan losses, banks’ balance sheets are also vulnerable to short-term adjustments in monetary rates. Since bank assets consist of long-term loans at fixed interest rates, return on assets cannot adjust quickly to counter the short-term policy rate adjustments. This sudden change in the interest rate exposes banks even in instances where this can be transferred to borrowers. Furthermore, short-term policy rate adjustments may affect the borrower’s ability to repay their loans. In some instances, short-term interest rates adjustment may also affect the deposit interest, thus eroding banks’ assets in the immediate future. According to the Mishkin (1996) model, short-term increases in interest rates might be a likely source of systemic risk. He argues that most bank panics in the U.S. were a result of short-term interest rate adjustments.

Literature shows that banks’ ability to borrow in international markets to bridge the domestic funding gap is susceptible to risk. Akerlof, Romer, Hall and Mankiw (1993), Drees and Pazarbasioglu (1995) and Mishkin (1996) demonstrate that a shock in the foreign currency exchange market affects bank profitability. Foreign currency dominated loans were cited as the major cause of banking crises in Chile, Mexico, Nordic countries and Turkey (Drees & Pazarbasioglu, 1995).

Speculative euphoria regarding banks’ asset portfolio quality has also been cited as a possible cause of bank runs¹⁸. Literature shows that this occurs when deposits are not insured (deposit insurance). Since bank assets are illiquid, large withdrawals of deposits may result in liquidity risk. In some cases, bank runs occur simply because depositors are aware of other depositors withdrawing their funds from one or more

¹⁸ Bank runs occur when depositors rush to withdraw their deposits when there is speculation that a certain bank will fail. A bank run is related to a specific bank, while a panic relates to simultaneous bank runs on different banks.

banks. Such actions might force a sudden withdrawal of deposits even in the absence of risks. It should be noted that withdrawal of funds from one bank might not necessarily lead to a bank run (contagion) unless informed depositors take this as a sign of poor asset quality among all banks in the system. Demirgüç-Kunt and Detragiache (1998) argue that bank runs should not occur in countries with compulsory deposit insurance. However, Demirgüç-Kunt and Detragiache (1998) argue that, if the premiums of the compulsory insurance do not fully reflect the riskiness of the bank portfolios, this may lead to reckless bank behaviour, i.e. a moral hazard problem. This occurs because of a mismatch between the level of risk and premiums. However, the moral hazard problem is minimised in instances where there are adequate prudential regulation and strict supervision of banks as recommended by the Basel Committee on Banking Supervision.

Other authors also predict that the introduction of financial liberalisation¹⁹ increases bank risk-taking. Financial liberalisation mostly poses problems in countries with deposit insurance, where banks are tempted to take excessive risk in pursuit of more profits. Again, this leads to moral hazard problems. In countries with a liberalised financial system but with a weak bank supervision framework, banking crises can occur because of widespread fraudulent activities. Banks may be tempted to invest in projects that are too risky or projects that are a sure failure in order to create an opportunity to divert funds for personal use. Akerlof et al. (1993) suggest that looting behaviour by bank managers was the cause of the U.S. and Chile banking crisis of the 1970s.

As predicted by Minsky's model and supported by a number of studies (Calvo, Leiderman & Reinhart, 1995; Bakker & Gulde, 2010; Shin & Shin, 2011; Dell'Ariccia, Igan & Laeven, 2012; Lane & McQuade, 2014; Fielding & Rewilak, 2015), short-term foreign capital inflows into banks also cause banking crises. These studies predict that a sudden withdrawal of foreign investment funds within the financial system creates a

¹⁹ This mostly occurs when financial innovation products such as subprime mortgage loans are allowed in the financial markets as with the subprime mortgage crisis in the U.S.

huge funding gap in the local banking system. This occurs due to either an increase in foreign interest rates or a decline in domestic interest rates and investor confidence. Calvo et al. (1995) predict that this causes liquidity shortages in the financial system.

In countries with a fixed exchange regime, speculative attacks on their currencies might also trigger problems in the financial sector. As speculation increases, the value of the local currency is devalued while bank depositors quickly rush to withdraw their funds and convert them to other investments. This leaves the local banking system with liquidity gaps and in distress. For example, banking problems in Asia, Eastern Europe and Latin America in the 1990s were partly due to sudden withdrawals in short-term foreign capital.

2.6 FINANCIAL FRAGILITY AND INSTABILITY

Financial fragility and financial instability are common terms used interchangeably in the literature. Financial instability refers to the actual outbreak of problems in the financial system. In Mishkin's (1997) model, financial instability "occurs when shocks to the financial system interfere with information flows so that the financial system can no longer do its job of channelling funds to those with productive investment opportunities" (Mishkin, 1997, p. 62). Financial fragility, on the other hand, refers to the vulnerability of the entire financial system to future outbreaks of problems within the financial system. According to Calomiris (1995), it is an unavoidable consequence of a dynamic capitalistic state. The idea of financial fragility dates back to Fisher (1933) and Keynes (1937) who strongly argued that the financing of investment through credit would potentially have devastating effects on the economy. This argument was based on their observations of the great depression and various other bank panics that had occurred around the world.

In the later years, Minsky (1976) contributed to the financial fragility and instability debate by advancing the idea that modern capitalistic economies moved from robust to fragile and unstable financial systems because of their over-reliance on debt to fund investment. In Minsky's theory, the outbreak of the financial crisis is a direct

manifestation of an increase in financial fragility. Wolfson (2002) added that the financial crisis²⁰ was a reaction to increased fragility of the financial system over the course of the business cycle expansion.

2.7 THE MINSKY THEORY OF FINANCIAL CRISES

The Hyman Philip Minsky (1982) theory of financial crises was built upon the theory of business cycles and the dynamics of the economic systems. The theory is an elaboration of Keynesian economics and Schumpeter's business cycle theory. The theory is set out within the context of an expanding economy and has both theoretical and empirical aspects. The readily observed empirical argument is that, over time, capitalist economies move from inflation to debt deflation that can potentially spiral out of control. Minsky writes that "the economic system's reactions to a movement of the economy amplify the movement—inflation feeds upon inflation and debt-deflation feeds upon debt-deflation" (Minsky, 1992, p. 1). In Minsky's view, the capitalistic economy is characterised by high-value capital assets and dynamic financial systems.

The theory concentrates mainly on the process that explains how swings between robustness and fragility generate business cycles in capitalist economies. Minsky argues that "to understand the short-term dynamics of the business cycle and the longer-term evolution of economies it is necessary to understand the financing relations that rule, and how the profit-seeking activities of enterprises, bankers, and portfolio managers lead to the evolution of financial structures" (Minsky, 1993, p. 106). Enterprise profits are the main determinants of system behaviour. Expectations of profits depend upon investment in the future and realised profits are determined by investment: thus, whether or not liabilities are validated depends upon investment. Investment takes place now because investors and their bankers expect investments to take place in the future (Minsky, 1992).

²⁰ In all instances, the central bank as a lender of last resort responds by providing the financial system with enough liquidity to calm nerves and restore confidence within the market.

According to Minsky's theory, instability in financial markets and economic conditions are a direct source of capitalistic economies and the roots of instability are internal to capitalism (Minsky, 1986). The theory assumes that the economy is characterised by a financial system that moves between robustness and fragility and that these are an integral part of the process that generates business cycles. The swings are therefore unavoidable unless governments and central banks intervene. With regard to the financial crisis, Minsky argues that it is attributable to swings in a potentially fragile financial system.

2.7.1 Financial units and financial fragility

Minsky believed that the increase in the level of indebtedness was an important driver of financial fragility, often accompanied by a mismatch between cash inflows and outflows. Minsky's argues that the level of indebtedness is a determinant of the magnitude of financial fragility. In other words, the higher the level of indebtedness, the greater the scale of financial fragility. In the process, Minsky identifies three unique income-debt²¹ relations present in a modern capitalistic economy, as follows:

- i. Hedge finance units (stable);
- ii. Speculative finance units; and
- iii. Ponzi finance units (manias)²².

Minsky found that hedge finance units, which he classified as 'stable', are able to repay their debts upon maturity using cash inflows from operations, while speculative finance units face some level of difficulties in debt repayment. In Minsky's view, speculation refers to "an attempt to bet on the future direction and psychology of the market and also the more general process of financing assets whose value depends on future developments" (Minsky 1976, p. 120). Therefore, speculative finance units are those

²¹ These income-debt relations lead to over-accumulation of credit which helps to explain the development of financial fragility.

²² Ponzi financing often emerges as manias during credit booms, for example heavily debt-financed housing and stock market investments (for a detailed discussed see Matsumoto, 2007).

units that issue new debt to meet their obligations. Ponzi finance units (also referred to as manias) completely fail to repay their debts using cash flows from operations, selling their existing assets or even borrowing from other sources.

Importantly, Minsky's theory highlights that the deepening of speculative financing units (highly leveraged and largely mismatched) leads to a movement of the financial system from a robust to a fragile financial structure. It also points out that if hedge finance units dominated, the economy might become equilibrium seeking and containing. In other words, hedge finance units provide a robust financial system, while speculative investors induce financial fragility. Minsky believed that there is a link between fragility and speculative finance. Under speculative finance, the financial system becomes more fragile, leading to a decline in liquidity and an increase in the debt levels, in both the short and long run.

Minsky argues that, over prolonged periods of stability, the economy moves from a hedge financing structure to speculative and ultimately to Ponzi finance. During this period, both lenders and borrowers increasingly become reckless, where Ponzi borrowing will drive asset prices to a point where the financial system becomes vulnerable. This is caused by the economy seizing up because of the inevitable disillusionment of borrowers. Asset prices stop increasing and start falling rapidly due to declining confidence in the financial system. The financial system becomes illiquid, insolvent and susceptible to bank runs. In Minsky's view, the collapse of speculative and Ponzi units will lead to the collapse of the more stable funds, i.e. the hedge units.

2.7.2 The Minsky moment (movement from stability to instability)

The Minsky 'moment'²³ refers to the gradual movement of the financial system from a stable financial system to a fragile financial system and ultimately to a fully-fledged financial crisis. This is attributed to a rapid increase in lending and debt beyond sustainable levels. Minsky writes that this occurs when the financial system starts

²³ Developed by Minsky in 1998.

introducing financial engineering products in pursuit of large profits. The overuse of these products then increases liquidity in the economy to fund investment projects.

According to Minsky, two theorems are important in explaining business cycles in a capitalistic economy.

- i. The economy has two financial regimes, one stable and one unstable.
- ii. During periods of sustained growth, the economy moves from financial relationships that make for a stable system to one that makes for an unstable system.

Minsky's theory reinforces the idea that financial crisis episodes are a result of capitalism, caused by the pursuit of large profits in the financial markets. According to this view, the pursuit of large profits in a capitalistic system is capable of moving the economy from financial stability to instability.

2.7.3 Debt deflation

According to Minsky, during financial crises, banks' appetite to finance investments declines. The unwillingness to finance these investments decreases credit funds and profits. This then reduces the chances of economic agents honouring their debt repayment obligations. At this point, the possibility of debt deflation becomes imminent as debt defaults increase. This further results in a decline in aggregate demand, thus reducing prices and increasing the real value of outstanding debt repayments. Minsky argues that the central bank as a lender of last resort must intervene during this period. During this period, however, the central bank's role in restoring and preventing debt deflations would not necessarily be enough. Minsky proposes stringent regulations to avoid financial innovation practices and attitudes that lead to exuberant financial instability. Minsky emphasises that "if the central bank interactions are not accompanied by regulations and reforms that restrict financial market practices, then the intervention sets the stage for the financing of an inflationary expansion, once the 'animal spirits' of business people and bankers have recovered from the transitory shock of the crisis" (Minsky, 1982, p. 182).

2.7.4 The implication of the Minsky model

It is important to emphasise the fact that the Minsky model has received great attention since the Asian financial crisis of 1997 and the global financial crisis of 2007-09. The theory has advanced our understanding of the potential causes of financial crisis episodes and the costs associated with such disruptions. Although developed three or four decades ago, the theory offers an effective explanation for more recent international financial market events. Recent studies have used the model to explain why financial crisis episodes occur and how to avoid them in the future.

The key modification of the Minsky predictions is the possibility that investors can make investments across borders. For example, before the 1997 Asian financial crisis, large investments were made in the Asian emerging markets. This was partly due to a decline in interest rates and the emergence of a recession in the U.S. and other developing economies while interest rates were rising in those emerging countries. The rapid increase in profits increased expectations and led to high levels of speculation. The increase in speculative investment also directly led to an increase in financial fragility. This was in line with Minsky's earlier predictions. Wolfson (2002) highlights that without cross-border financial transactions, it is unlikely that financial fragility would have been rapid in the Asian emerging markets. Minsky's view was that, over time, capitalism would lead to financial instability, which could potentially lead to severe financial disruptions, ultimately leading to large bailout costs.

Again, the prediction that economies move from stable financial structures to unstable ones, best explains what later happened during the global financial crisis of 2007-2009 in the U.S. The U.S. financial structure gradually transitioned from hedge finance (stable) to speculative and later to Ponzi lending. Protracted increases in mortgage prices above their long-term price to income ratios were recorded. In Asia, some countries had enjoyed stability and investments from foreign markets which were unhedged because of the stable exchange rates that existed at that time. However, when the speculative gamble in the exchange rate occurred, this later proved to be the cause of the biggest downfall in a number of Asian countries.

As predicted by the Minsky theory, profit maximisation was at the epicentre of the financial crisis of 2007-09. Banks continued tapping into money market funds in order to raise funds to fulfil growing credit demand (see Chapter 5 on bank funding sources). This created a renewed culture of risk-taking amongst both lenders and borrowers. Again, Minsky's view came to light in the U.S. when the economy gradually moved from stable to fragile. Between 2003 and 2004 the U.S. mortgage and lending rates and house prices became highly unsustainable, and by 2007-2008, the economy was hit by a fully-fledged financial crisis.

Importantly, Minsky's punitive measures to prevent financial bubbles have been incorporated by various central banks around the world including the Bank of International Settlements (BIS) Basel Committee on Banking Supervision. These include the following key focus areas:

- i. Requirements for banks to maintain a certain level of liquidity in cash reserves;
- ii. Reduce speculative and Ponzi lending;
- iii. Requirements for banks to contribute to a stability fund during economic upswings for use during economic downturns or crisis times;
- iv. Tight controls on mortgage lending;
- v. Re-emphasis on the role of the central bank as a lender of last resort; and
- vi. The willingness of the central bank to use monetary tightening mechanisms to act on asset price booms.

2.8 BUSINESS CYCLE THEORIES

The aftermath of the Asian and Russian financial crisis of 1997 and 1998, the Mexican currency crisis of 1994 and the global financial crisis of 2007-2009 has seen business cycle theories regaining their popularity in explaining business cycles and policy responses to financial crises around the world. The popular business cycle models are anchored in the monetary and credit system of the economy in explaining business cycle dynamics, and these are often referred to as the monetary business cycle. Early theoretical contributions date back to Ralph G. Hawtrey, John R. Hicks, Ludwig von Mises, Friedrich von Hayek, and Robert E. Lucas (Jr.), among others (Dobrescu, Badea, & Paicu, 2012). According to these models, the business cycle is influenced

by monetary and credit market dynamics. In fact, these models believe that monetary mismanagement lies in the heart of macroeconomic problems and the misallocation of resources in the economy.

The pure monetary model developed by British economist Ralph G. Hawtrey in 1922 is perhaps the most popular business cycle theory. Hawtrey assumed that business cycles are a monetary phenomenon since aggregate demand in the economy is in itself a monetary reflection. He argues that all changes in the economy are a direct manifestation of changes (expansion and contraction) in the money supply. Hawtrey believed that all recessions and depressions experienced in the economy are driven by monetary factors. Hawtrey acknowledged that the banking system plays a critical role in providing money through bank credit in the economy.

Hawtrey argued that enterprise growth is possible because of lower interest rates on bank loans, which induces business investors to demand more credit from the banking system. The increase in bank credit in the economy stimulates enterprise investments, leading to an increase in production, employment and aggregate income. According to this model, the upward cumulative process in economic activity results in an economic boom. However, Hawtrey highlighted that the upward movement will not last forever because banks will eventually curtail the provision of credit. Hawtrey argues that during the upswing, prices of goods and services will rise while foreign exchange reserves will decline, negatively affecting economic growth. The rapid growth of credit during the upswing diminishes the banking system cash reserves. Given this, the banking system will be unable to advance more credit to enterprises and, to control the increase in prices, banks will start recalling outstanding loans from enterprises. By this time, Hawtrey argues, aggregate demand, production and employment will decline to lead to a downward movement in economic activity and ultimately a recession. During the contraction period, the banking system will build up more reserves because of limited demand for credit and the process will restart again with banks issuing new loans to enterprises.

Another interesting theory that provides a compelling explanation of the business cycles is the Austrian business cycle theory (ABCT). The ABCT argues that business cycles are a result of rapid credit growth in the economy caused by monetary policy-induced low-interest rates. The ABCT's earlier contributor, Ludwig von Mises, believed that low policy rates stimulate credit growth and lead to business booms. He argued that cheap credit creates the illusion that bad projects are actually good investments to enterprises. According to von Mises, the growth of credit in the economy is followed by price increases, and enterprises will begin to experience a shortage of funds to maintain capital investment they had initiated. As the cycle of credit growth continues, enterprise worries subside, since they will access more credit to continue their investments. At the end, when credit growth declines, the level of malinvestment is rectified during the recession. Von Mises opined that the level of credit growth in the economy creates room for over-investment and consumption patterns that are not aligned to consumer time preferences and available resources.

Another strong supporter of the Austrian business cycle, Friedrich von Hayek, authored the monetary over-investment theory of business cycles, arguing that equilibrium in the economy can be achieved when investment and consumption are equal. He argued that the state of equilibrium and stability in the economy can be disrupted by changes in money supply and in the investment-savings relationship. Hayek believed that changes in the investment-savings relationship are a result of an increase in investment projects with savings remaining constant.

Hayek predicted that investments increase owing to declining interest rates, an increase in the marginal efficiency of capital (MEC), and an increase in enterprise future expectations. Hayek's theory clearly distinguishes between interest rate changes due to consumer time preferences and changes. Under the consumer preference changes, the production system and prices will adjust according to consumers' time preferences, while under the induced scenario, changes in interest rates present a false market signal leading to inefficiencies in resource allocation during different stages of production. Following Hawtrey's monetary over-investment theory, Hayek also buttressed the notion that the presence of low artificial rates in the

economy create an unsustainable boom where excess funds are channelled into the early stages of the production process. Hayek's theory acknowledges that the inability of the banking system to maintain neutral levels of money supply in the economy causes trade cycles. He believed that a neutral money supply was the only solution to eliminate trade cycles.

Providing another valuable insight, another British economist, John Richard Hicks, developed the Hicks theory of trade cycles. Hicks's model relates the business cycle to the Harrod-Domar growth theory and argues that the business cycle occurs in tandem with the growth in the economy and that business cycles ought to be examined in line with Harrod-Domar's arguments. Hicks believed that the business cycle is a phenomenon of a growing economy. Equilibrium in the economy is reached when the rate of economic growth is equivalent to the natural growth rate, and the investment growth pattern should be equivalent to the savings growth pattern. Hicks argued that equilibrium growth in the economy is possible when both investment and savings rates increase.

New classic economist Robert E. Lucas's monetary business cycle theory also provides an interesting explanation. Lucas developed his model by questioning why capitalist economies' aggregate variables underwent constant fluctuations in trend. Lucas's theory is anchored by the rational expectations concept, which concept means that individuals utilise all available information to predict the price levels of goods and services. Lucas pointed out that this information includes monetary policy shifts, global developments (movements in oil and gas prices and other commodity prices) and in some cases economic theory. Importantly, the Lucas model believes that unforeseen shifts in aggregate demand in the economy are responsible for cyclical fluctuations. He further argued that expected shifts in production and employment cause an expansion in the economy, while unexpected shifts result in a recession caused by a reduction in production and unemployment. Following on the other business cycle theories, Lucas also opined that any unanticipated changes in aggregate demand, for example, money supply, interest rate movements, government fiscal position and global developments have negative repercussions for growth. Lucas's theory assumes

that expected movements in aggregate demand will not alter the state of equilibrium between wages and prices.

Using the rational expectations concept, Lucas writes that individuals expect future changes in money supply when making their future decisions. If the price of goods and wages are indeed flexible, these will be adjusted based on these expectations. Therefore, the expected changes in aggregate demand on the basis of anticipated changes in the money supply will not necessarily have a bearing on both production and employment levels.

However, Lucas notes that an unexpected future decline in aggregate demand brought about by the unexpected decline in the money supply will cause disequilibrium in wages and prices. This will subsequently result in a decline in the level of production and employment in the economy. The continuous decline will ultimately cause a recession in the economy until aggregate demand rises to expected levels. According to Lucas, it is only an unexpected decline in aggregate demand that causes a recession. If the decline in aggregate demand is expected, business and workers will reach a consensus on wage levels that will keep the same level of employment in the economy.

2.8.1 Implications of the business cycle theories

Business cycle theories, especially monetary ones, provide a compelling diagnosis of the causes of the business cycle around the world and South Africa is no exception. The implications of the monetary business cycles are straightforward. First, these models suggest that monetary authorities should not artificially alter the interest rate and money supply because this has a direct effect on credit supply or the level of inflation. Second, monetary authorities should not restrict businesses from pulling out of unprofitable investment projects during economic downswings. The continuous occurrence of financial crisis events around the world and the events leading up to them have reignited interest in a number of business cycle theories. The interest in these theories is influenced by the fact that these theories had warned against rapid

credit growth and asset bubbles. Empirical evidence on the causes and propagation of business cycles confirms some of the theoretical arguments presented above.

For example, Rothbard (2000) studied the Great Depression of 1929-1936 and found that rapid credit growth generated an artificial boom as suggested by the ABCT. In addition, he found that government intervention did not allow investors to pull their funds out of unprofitable projects, which resulted in a protracted recession. Rothbard argues that important financial resources were channelled into unprofitable/unproductive projects in artificially expanding economic sectors. He also found that the continued increase in credit provision and inflation meant that investors could not liquidate unprofitable projects.

Mulligan (2006) found that rapid credit growth induced a short-run increase in production, investment and consumption, while in the long run all three factors significantly declined to result in a recession. Keeler (2001) analysed the U.S. business cycles and found that expansion in the money supply caused business cycles which were driven by an increase in price levels and changes in the nominal interest rates. Powell (2002) argued that in Japan monetary and financial policy expansions protracted and aggravated the recession. O'Driscoll and Shenoy (1976) studied the stagflation period of the 1970s and concluded that rapid credit growth induced nominal demand and, in the process, distorted the pricing of goods and services and facilitated the misallocation of resources. O'Driscoll and Shenoy (1976) argued that credit growth creates artificial consumption expansion because this creates excess income for some households and firms in the economy.

2.9 SUMMARY: MINSKY AND MONETARY CYCLE THEORIES

The Minsky theory and the monetary cycle theories (Hawtrey, Hicks, von Mises, Hayek, and Lucas Jr.) have received great attention since the global financial crisis. These theories have contributed to informing policymakers and academics around the causes of business cycles and in particular financial and banking disruptions. At a

theoretical level, these theories have provided realistic explanations of the causes of business cycles around the world.

The monetary cycle theories discussed here strongly suggest that investment and the accumulation of capital play a significant role in explaining business cycles. These theories argue that economic recessions begin when the level of investment slows and recessions will turn into expansions when the level of investment increases in the economy. Minsky's theory is also built on the concept of business cycles and the dynamics of the economic system. Like the monetary cycle theories, Minsky also emphasises the level of investment (i.e. hedge, speculative and Ponzi units) as a significant contributor to business cycles.

Just like the ABCT that argues that rapid credit growth created over-investment in the economy that was misaligned with consumer time preferences and resources, Minsky also holds that rapid credit growth created high debt levels beyond sustainable levels. Minsky opined that this was possible when financial institutions started introducing financial engineering products in pursuit of large profits.

In this study, the focus is on understanding the relationship between credit booms and banking sector fragility in South Africa, and the Minsky financial instability hypothesis provides a practical explanation of why financial crises occur and how to avoid them in the future. The explanation provided by the Minsky theory is relevant in the South African context since it provides a very detailed demonstration of the possible dangers of credit booms and busts.

This financial crisis of 2007-2009 provides a direct reflection of Minsky's prediction on hedge, speculative and Ponzi finance. It also shows that reckless lending behaviour by banking institutions in pursuit of large profits may gradually move the financial system from stable to fragile, to a full-fledged financial crisis. It is important to note that the current rapid credit growth experienced in South Africa is in general, according to literature (see for example, Mendoza & Terrones, 2012; Schularick & Taylor, 2012),

an important predictor of subsequent financial and economic crisis episodes. Furthermore, the high levels of indebtedness in South Africa are a cause for concern, especially when one considers Minsky's prediction around the dangers of high levels of debt in the economy.

Furthermore, the free movement of foreign capital across countries as predicted by Minsky remains the biggest driver of excess liquidity which feeds credit growth in many countries, and South Africa is no exception²⁴. The empirical results in Chapter Three show that foreign capital inflows have had a significant contribution to credit booms in South Africa.

In summary, this chapter provides a general theoretical perspective of the key factors that explain business cycles and bank failures around the world. The discussion here is also relevant in the South African environment. The rapid acceleration in unsecured²⁵ lending from 2010 to 2013 led to the collapse of the African Bank²⁶. The collapse of the bank created a high level of speculation in the MMFs that had major investments held by the bank. Although small, the collapse of this bank led to the downgrading of the top four commercial banks in South Africa by major rating agencies, while another micro-lender, Capitec, saw a slight decline in the value of its shares. This reminded academics and policymakers about the potential threat of contagion risk to banking stability as suggested in this section. Also, this section provides an important basis for the following chapter on the aggregate drivers of credit booms.

²⁴ See Chapter Three for a detailed discussion of the triggers of credit booms in South Africa.

²⁵ Unsecured loans not collateralised by any assets to which the creditor can have recourse in case of failure by the debtor to meet the credit obligations. SARB views credit cards, overdrafts, personal loans and financing of SMEs as forms of unsecured lending.

²⁶ African Bank is a boutique micro-lender that focuses on small unsecured loans and other investment products.

CHAPTER THREE

AGGREGATE DRIVERS OF CREDIT BOOMS IN SOUTH AFRICA²⁷

3.1 INTRODUCTION

What are the key factors that explain the spectacular credit booms in South Africa? Responding to this question is important, given the acceleration of private sector credit over the past three decades in South Africa. Given the global financial crisis of 2007-09 that was preceded by credit boom episodes around the world, ongoing investigations are required to determine measures to prevent a similar crisis in the future especially in a country like South Africa that already has high unemployment, poverty and inequality problems compounded by persistent high budget deficits. The financial and economic costs of financial system failure are immense and cannot be absorbed by an already stretched South Africa fiscus.

Financial crisis literature shows that credit booms present a policy dilemma in a number of economies, especially developing ones. First, credit booms signal increased access to finance for investment and stimulating economic activity (Aisen & Franken, 2010; Abedifar et al., 2016; Alaabed & Masih, 2016). Other studies, inter alia those of Mendoza and Terrones (2012), Elekdag and Wu (2011), Enoch and Ötoker-Robe (2007) and Arena et al. (2015) suggest that credit booms disrupt financial system stability and potentially cause severe economic turbulence. These studies argue that credit booms are more naturally associated with a banking crisis than with other forms of crises. Some argue that rapid credit growth is an important predictor of subsequent financial and economic crisis episodes (Mendoza & Terrones, 2012; Schularick & Taylor, 2012). Elekdag and Wu (2011) argue that credit booms tend to end abruptly in the form of severe financial and economic disturbances.

²⁷ This chapter has been accepted for publication by the *Journal of Economics and Behavioural Studies*.

In the literature, credit booms occur when credit provision expands by more than that extended during a cyclical expansion (Mendoza & Terrones, 2012). Gourinchas, Valdes and Landerretche (2001) define credit booms as periods which deviate from the historical trend. Booms and Are (2004) highlight that credit booms are associated with excessive growth in private sector credit.

The intention of this chapter is to understand the triggers of the current credit booms in South Africa using annual data for the period 1970-2016. Understanding the triggers of credit booms would allow South Africa policymakers and academics to predict, reduce or even avoid these booms, especially given the potential dangers and costs associated with booms and busts. South Africa currently faces numerous problems, including high unemployment and inequality, low growth and per capita incomes, political instability (Aucoin & Cilliers, 2016), et cetera. Given the important role played by credit in the South African economy any disturbances in the banking and financial system would have adverse consequences for the country.

Furthermore, South Africa presents an interesting case to investigate, given that past and recent studies have confirmed the existence of credit booms in South Africa (see, for example, Booms & Are, 2004; Mendoza & Terrones, 2008; 2012; Gozgor, 2014; Arena et al., 2015). Gozgor (2014) points out that South Africa had the highest mean credit-to-GDP of 185 per cent, followed by China, Malaysia and Thailand respectively using data spanning 1970-2016. Booms and Are (2004) identified 1985 and the 1990s as the years in which credit expansion in South Africa reached its peak. Mendoza and Terrones (2012) identified 2007 as the peak date for credit booms, while recently, Arena et al. (2015) also established the presence of credit booms in South Africa and established that credit booms started in 2005, peaked in 2007 and ended in 2008. However, these studies only established the existence of credit booms without necessarily identifying the main factors triggering this growth. Financial crisis literature points to the fact that various triggers of credit booms are country-specific, with a limited number citing the dominance of external factors. To date, the exact drivers of credit booms in South Africa are unknown, therefore this study is the first of its kind to

attempt to pinpoint the true drivers of credit booms in the country. This study contributes to the larger pool of credit boom literature and country-specific studies.

The rest of the chapter is presented as follows: Section 3.2 discusses the South African banking system and credit growth trends, while Section 3.3 explores relevant theoretical and empirical literature. Section 3.4 presents the estimation techniques and results, and Section 3.5 provides conclusions and policy recommendations.

3.2 THE SOUTH AFRICAN BANKING SYSTEM AND BANK CREDIT

3.2.1 Background: the banking system

The banking sector is one of the most fragile sectors around the world (Denis & Negotei, 2018) and the South African banking sector is no exception (Mishi & Khumalo, 2019). This makes the sector one of the most closely monitored to ensure stability (Blanchard, Dell’Ariccia & Mauro, 2010). Therefore, the importance of the sector in economic development and the stability thereof need no emphasis (Beck, Demirguc-Kunt, Laeven & Levine, 2008).

According to the Reserve Bank (2016), the stability of the sector in South Africa is important to maintain confidence among investors and depositors to reduce or eliminate bank runs or any other threat to the financial system. According to Theobald (2013), South Africa once experienced a near banking crisis in 2001-2002 when three banks, namely BoE, Saambou and Unifer²⁸, exited the market within a three months period. Theobald (2013) further highlights that various authorities in South Africa urgently tried to calm the market by issuing open-ended guarantees on some banks that were facing the contagion effect such as BoE Bank, African Bank, Investec and Nedbank. However, Theobald (2013) indicated that this move did not prevent the three banks from exiting the market even though the guarantees were meant to demonstrate that the banks were safe. Caprio and Klingebiel (1996) noted that there was a major

²⁸ According to Theobald (2003), BoE Bank was the sixth largest bank in South Africa while Saambou and Unifer were the seventh and eighth largest respectively.

systemic risk in the South African financial system in 1997 caused by bank insolvencies. It is, therefore, imperative to note that a banking crisis can occur in banking at any time and that the contagion effect is difficult to overcome.

The South African banking sector is one of the most developed and advanced in Africa (Odhiambo, 2009) and compares favourably with the rest of the world (Banking Association of South Africa, 2013). Mlambo and Ncube (2011) highlight that in 2008, the South African banking sector represented about 40.4 per cent of total banking assets in Africa, 49.9 per cent of bank credit and 42.4 per cent in total bank deposits (Mlambo & Ncube, 2011).

The South Africa banking sector is highly concentrated, oligopolistic and consists of five dominant banks i.e. ABSA (founded 1991), Standard Bank (founded in 1862 in London), First National Bank (founded in 1838), Nedbank (founded in 1888) and Investec (founded in 1974) (Coppock, Forte, Ncube, Ooka, Richards & Vyas, 2008). Table 3.1 shows the total assets structure of the South African banking sector based on aggregate data submitted to the SARB by banks between 2015 and 2016. The total asset structure of banks in South Africa consists of 90.5 per cent of assets held collectively by the top 5 banks, 5.9 per cent by local branches of foreign banks, and 3.5 per cent by other banks (South African Reserve Bank, 2016). There is a significant number of banks registered in South Africa with the majority being foreign-owned. Since 1990²⁹, there has been a gradual move towards fully opening up the financial services industry to local as well as foreign investors, resulting in an increase in the number of banks licenced by the South African Reserve Bank (SARB) and consequently a rapid increase in credit to the private sector.

A significant number of new entrants in the banking sector have begun offering banking products that identify with the formerly unbanked population and low-income

²⁹ During the 1990s, the Bank Act 1990 (Act No. 94 of 1990) was passed into law, and the banking system immediately underwent a process of amalgamation with a number of consolidated banks being registered.

households. The opening up of the sector has successfully attracted significant interest from foreign banks, with a number of them buying shares of the top banks in the country (SARB, 2016). For example, Barclays Group based in the United Kingdom, acquired ABSA in 2005 while in 2007 China's ICBC acquired 20 per cent of the shares of Standard Bank. According to the SARB, there is also a significant number of foreign bank branches registered and operating in South Africa.

According to statistics from the SARB (2016), there were 60 registered banks in 2000, while a significant decline occurred in 2001 to only 43 banks due to small banks failing due to not complying with their licence conditions. By 2013, the sector had 73 active banks, with only 10 listed as locally owned, and 3 mutual banks. As of 2016, there were 74 registered banks, of which 10 are locally owned, 15 are foreign bank branches, 38 are foreign bank representatives, 6 are foreign-controlled banks³⁰ and 3 are mutual banks, of which 2 are currently in liquidation (SARB, 2016). The decline in the number of active banks in South Africa shows the level of volatility in the sector. Since the inception of the Bank Act in 1990, a number of banks have emerged, while at the same time a significant number have failed or filed for liquidation. It should be noted that the banks that have entered and exited the sector over the past 3 decades are often small banks with limited banking assets. The top 5 banks with a market share of 90.5 per cent (discussed above) have remained in the sector over the past 30 years. It is important to note that, based on Table 3.1, the ranking of smaller banks (from 10 and below) alongside the top 5 banks in the country shows the threat they are faced with in the banking market. The two new entrants (Tyme Digital Bank and Discovery Bank) must be prepared to operate in a highly oligopolistic banking market otherwise there are limited chances of growth.

³⁰ The foreign controlled banks included ABSA, formerly owned by Barclays Bank.

Table 3.1: Total asset structure of the South African banking sector in 2018

Ranking	Registered Bank	Total Assets (R million)	Growth (%)
1	Standard Bank	1 254 849	1.64
2	FNB	1 120 747	10.23
3	Absa	983 378	7.51
4	Nedbank	892 006	2.6
5	Investec	415 285	7.29
6	Capitec	87 033	21.34
7	African Bank	31 356	-14
8	Grindrod	16 696	9.91
9	Mercantile	12 892	8.9
10	Bidvest Bank	8 508	21.39
11	Sasfin	7 778	14.97
12	Albaraka	5 930	10.10
13	Ubank	5 224	12.90
14	HBZ Bank	4856	14.97
15	South African Bank of Athens	2 355	3.95
16	Tyme Digital*	1 403	100
17	Habib Overseas Bank	1 186	4.46
18	Discovery Bank*	622	100
*New commercial banking licence			

Source: South African Reserve Bank (2018)

On the regulatory front, the sector is well regulated, with institutions such as the SARB, the Financial Sector Conduct Authority (FSCA), the National Credit Regulator (NCR) and the Financial Intelligence Centre (FIC) overseeing the operations and conduct of the banking sector in order to maintain financial stability in the economy. South African

banks are regulated and supervised through a three-tier system which comprises of Tier I, Tier II and Tier III. Tier I (also known as the top tier) regulatory framework is the Bank Act 1990 (Act No. 94 of 1990) and contains the enduring principles and overarching enabling framework. Tier II (the middle tier) consists of regulations relating to banks, which contain the bulk of internationally agreed stipulations, requirements and standards. Tier III contains directives, circulars and guidance notes issued by the Registrar of Banks mainly to deal with operational matters that change frequently or require urgent attention (SARB, 2016).

It should be noted that the new regulatory frameworks have allowed small banks such as the African Bank and Capitec Bank to penetrate the market. These boutique micro-lenders mainly provide financial services to low-income households and the previously unbanked population. According to the FinScope Report (2014), in 2014 75 per cent of South Africans had access to banks, credit unions, cooperatives³¹ and post office and microfinance institutions representing 27.4 million banked adults. Banking in South Africa is mostly driven by transactional products/services. According to the International Monetary Fund (IMF, 2014), unsecured loans³² in South Africa increased by 47 per cent between 2010 and 2012, reaching 11.7 per cent of total bank loans by 2013. The growth of unsecured loans has become common in South Africa as banks try to offset weak corporate credit demand.

3.2.2 Bank credit in South Africa

Available literature indicates that credit booms have emerged as a leading indicator of banking sector fragility in most countries around the world (Demirguc-Kunt & Detragiache, 1998; Kaminsky & Reinhart, 1999; Barajas et al., 2012). Furthermore, credit booms are often more associated with banking crises rather than with other types of crises (Mendoza & Terrones, 2012). It is important to note that such credit

³¹ In 2018, there were 22 registered Cooperative Financial Institutions in South Africa (SARB, 2018)

³² Unsecured loans do not require collateral and are riskier but more lucrative for banks. The SARB views credit cards, overdrafts, personal loans and financing small medium enterprises as forms of unsecured lending.

booms present opportunities and severe challenges for policymakers around the world and South Africa is no exception.

Given the above background, it is important to provide an analysis of the behaviour of credit in South Africa over the period 1970 to 2016. This will be of great assistance to policymakers, regulatory authorities and academics in comparing the South African growth trends with the rest of the world. Available statistics show that the credit-to-GDP ratio³³ in South Africa has rapidly accelerated over the last 30 years. Figure 3.1 supports the findings of Booms and Are (2004), Mendoza and Terrones (2008; 2012), Gozgor (2014) and Arena et al. (2015) that credit booms exist in South Africa. In Figure 3.1, we observe low levels of credit provision before independence in 1994. This coincides with the apartheid period when South Africa was under broad trade sanctions characterised by huge capital and investment withdrawals. However, we observe a rapid increase in credit from 131.6 per cent in 1994 to a record peak of 192 per cent in 2007. This period covers the new political dispensation that attracted significant foreign capital into the financial sector that increased funds for credit. Furthermore, significant reforms in the sector accompanied by the consolidation of banks increased credit provision. Before the financial crisis, there was also a steep increase in mortgage loans and unsecured loans, mostly from the household sector. To date, the 2007³⁴ peak in the series is the highest ever recorded in South Africa in 46 years, while the lowest was in 1980.

³³ Importantly, a number of studies (Kaminsky, 1999; Goodhart, Miguel, Basurto & Hofmann, 2006) revealed that the ratio of credit-GDP was a good early predictor of future defaults.

³⁴ It should be noted that during this period South Africa was preparing for the hosting of the 2010 FIFA Soccer World Cup. According to the National Treasury (2015), infrastructure investment was envisaged to total R600 billion between 2006-2010 with the construction of stadiums, transport infrastructure, broadcasting and telecommunication, ports of entry infrastructure, et cetera.

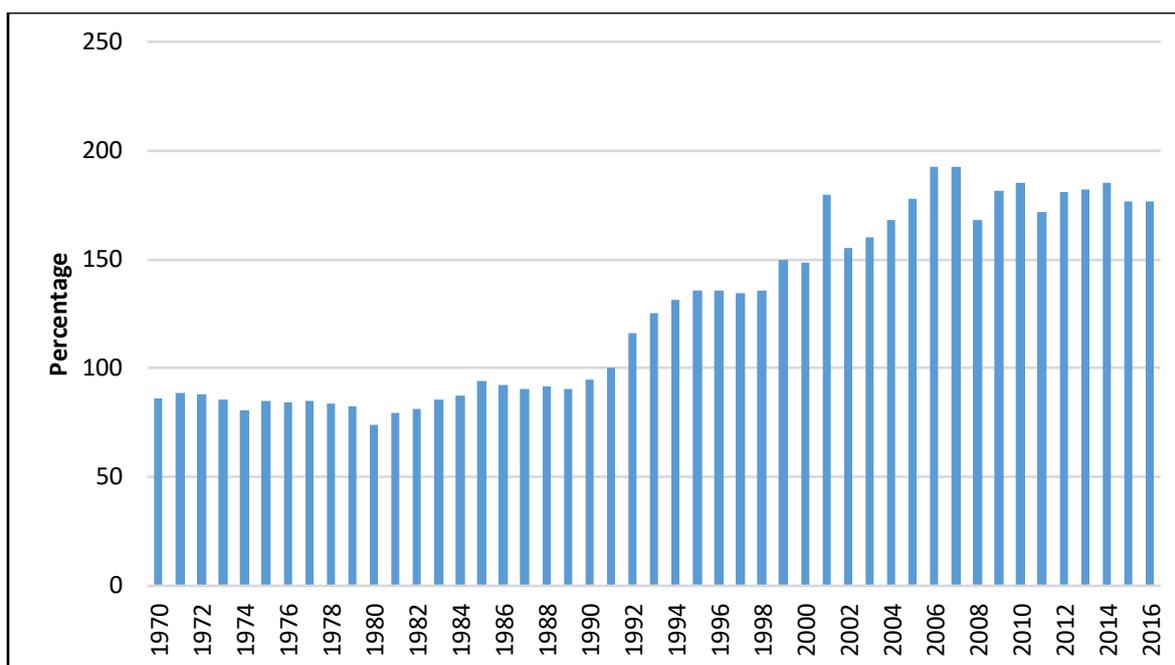


Figure 3.1: Credit-to-GDP ratio in South Africa (1970-2016)

Source: World Bank

Regarding the composition of loans, in 2009, mortgage loans represented the largest share of 51 per cent of total loans while general loans³⁵ and instalment sales contributed 31 per cent and 10 per cent respectively (see Figure 3.2). The rest of the loans were for investments, leasing finance and bills. In 2016, the picture is slightly different: mortgage loans take up 40 per cent while general loans contribute 42 per cent, up from 31 per cent in 2009 (see Figure 3.3). According to the SARB, the changes are due to the rapid increase in unsecured loans to households and corporate sector loans since 2013 (South African Reserve Bank, 2016). Due to the recent subdued economic growth, financial institutions are now in favour of advancing credit to the more financially stable corporate entities, rather than households, due to their perceived risk.

³⁵ General loans include personal loans (mostly unsecured), term loans, structured agreements and any other loans or advances.

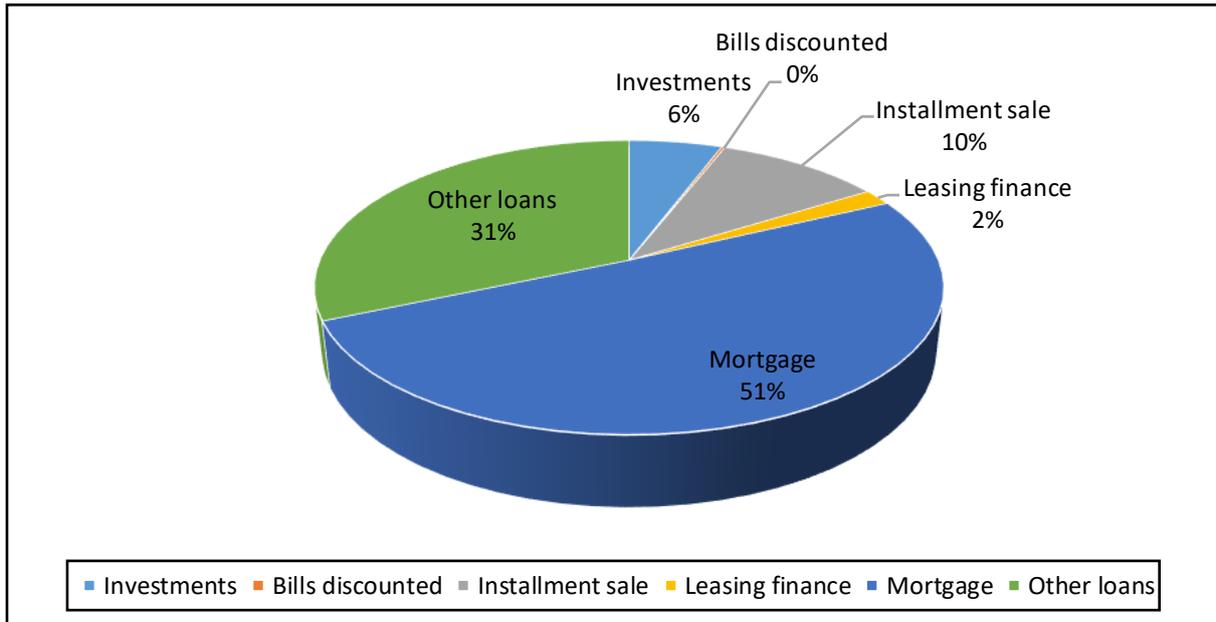


Figure 3.2: Composition of loans in South Africa (2009)

Source: South African Reserve Bank

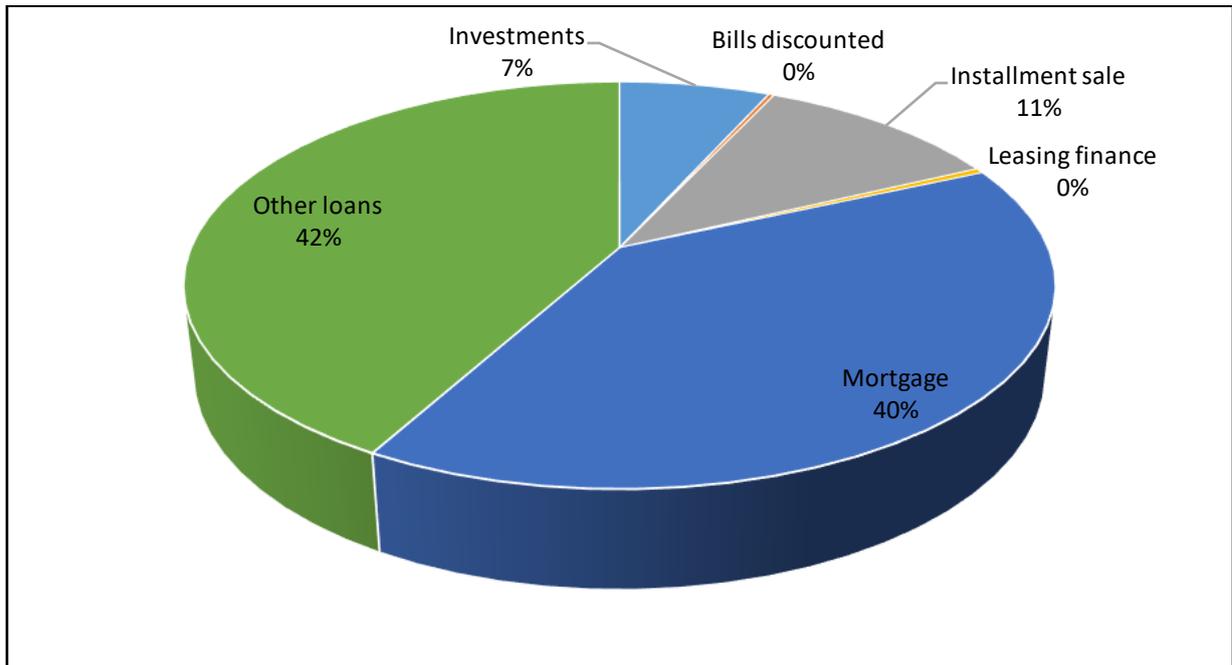


Figure 3.3: Composition of loans in South Africa (2016)

Source: South African Reserve Bank

Mortgage loans and house prices reveal an interesting relationship. As shown in Figure 3.4, during the late 1990s up to 2007, South Africa, like other developed and

emerging markets, saw rapid increases in house prices. In order to catch up with the increasing costs of acquiring houses, mortgage loans also increased during this period, with an average growth of 17 per cent per annum. Interestingly, the gap between property prices and mortgage loans has been gradually widening since the early 1990s. This difference could potentially reflect that banks are not willing to fund the entire property purchase prices. Since 2008, the gap has widened further, an indication that banks have become more risk-averse since the financial crisis of 2007-09. Regarding mortgage to total loans, there has been a gradual increase since the early 1990s. For example, mortgage loans represented 35 per cent and 38 per cent of total loans in 1990 and 2000 respectively. In 2009, mortgage loans peaked at 50.6 per cent of total loans, which were mainly driven by high property prices (see Figure 3.4). However, since 2010, there has been a gradual decrease in mortgage loans, due to the uptake of general loans mainly by the business sector.

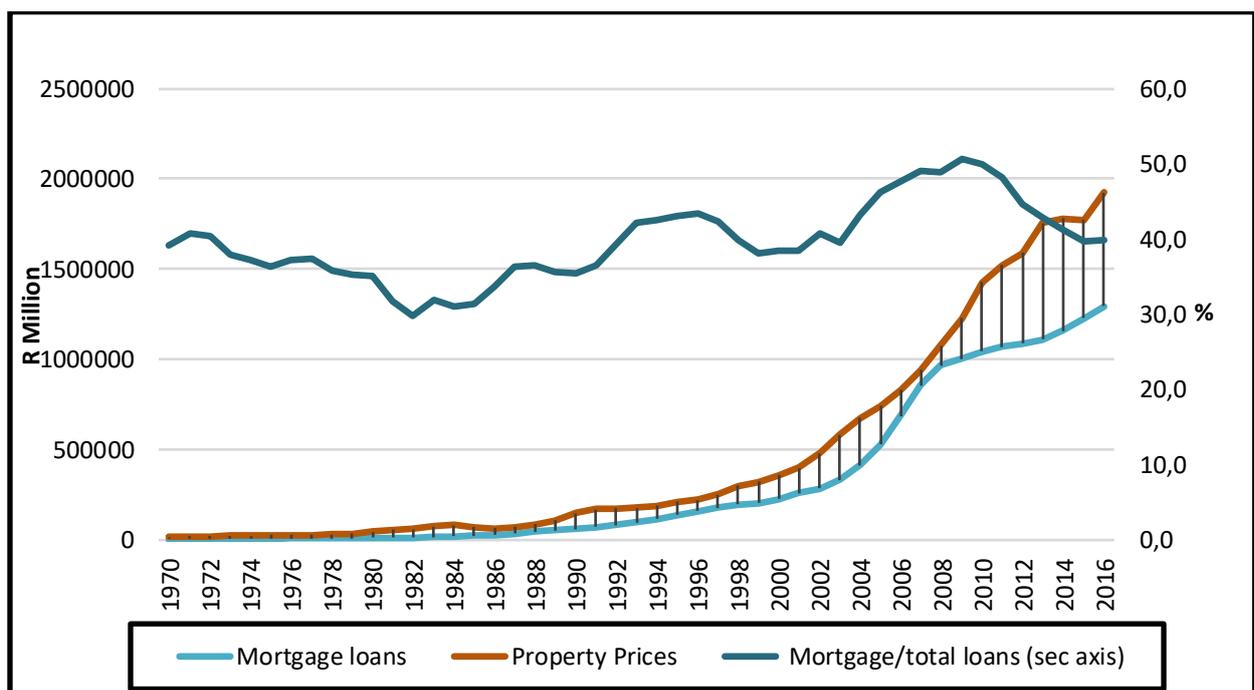


Figure 3.4: Mortgage loans and house prices in South Africa (1970-2016)

Sources: South African Reserve Bank and ABSA Bank

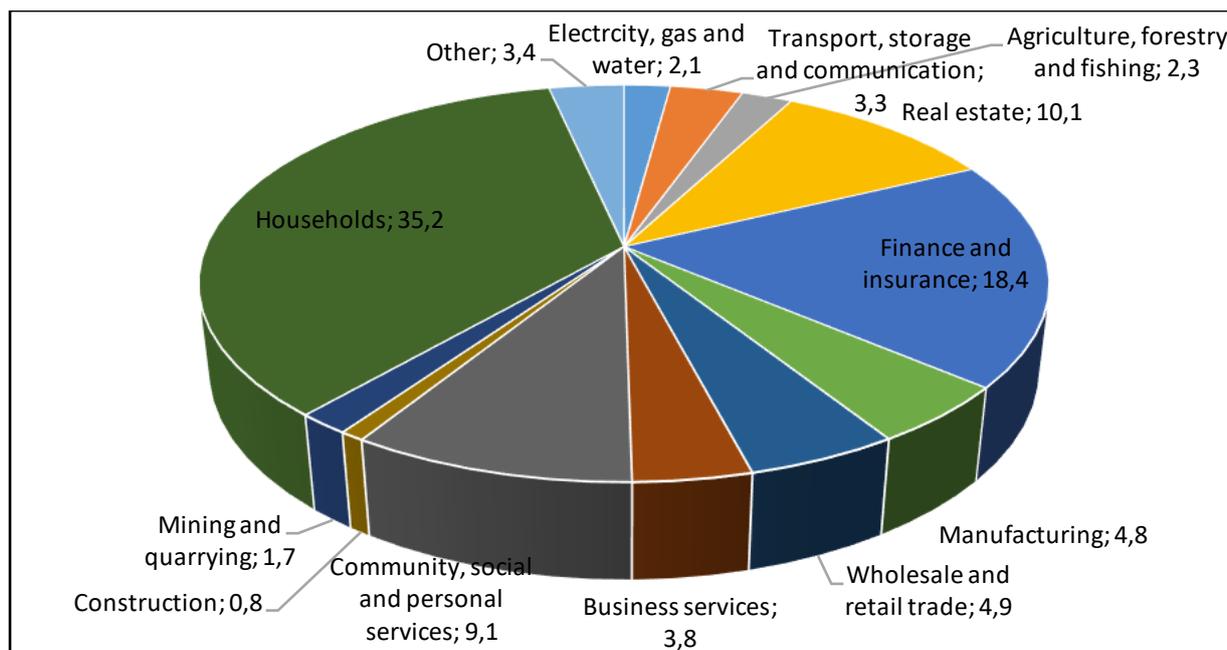


Figure 3.5: Composition of bank credit by economic sector (2016)

Source: South African Reserve Bank

An analysis of credit composition by economic sector reveals that households are the biggest consumers of bank credit in the country. For example, in 2016, households took up 35.2 per cent of total bank credit, followed by finance and insurance, real estate and community, and social and personal services with 18.4 per cent, 10.1 per cent and 9.1 per cent respectively (see Figure 3.5). This shows that households are still the dominant sector reliant on bank credit in South Africa. However, according to the SARB (2016), currently, the agricultural sector is the sector most reliant on bank credit as the sector engages in efforts to recover from the 2016 drought. However, the sector only accounts for 2.3 per cent of total credit provided. The wholesale and retail trade, manufacturing and business services sectors represent 4.9 per cent, 4.8 per cent and 3.8 per cent respectively.

In Figure 3.6 we compared the rate of credit growth and that of GDP growth. Interestingly, credit growth seems to follow the same pattern as economic growth in South Africa but at different magnitudes. For example, in 2006 and 2007, when GDP grew by 5.6 per cent and 5.4 per cent respectively, credit grew by 25.8 per cent and 21.5 per cent respectively. Figure 3.6 suggests that credit provision in South Africa is

procyclical, in other words, it responds to economic upswings and downswings. Interestingly, studies on South Africa, inter alia those of Akinboade and Makina (2009), Fourie, Botha and Mears (2011) and Akinsola and Ikhide (2018), also confirmed the procyclical credit extension in South Africa.

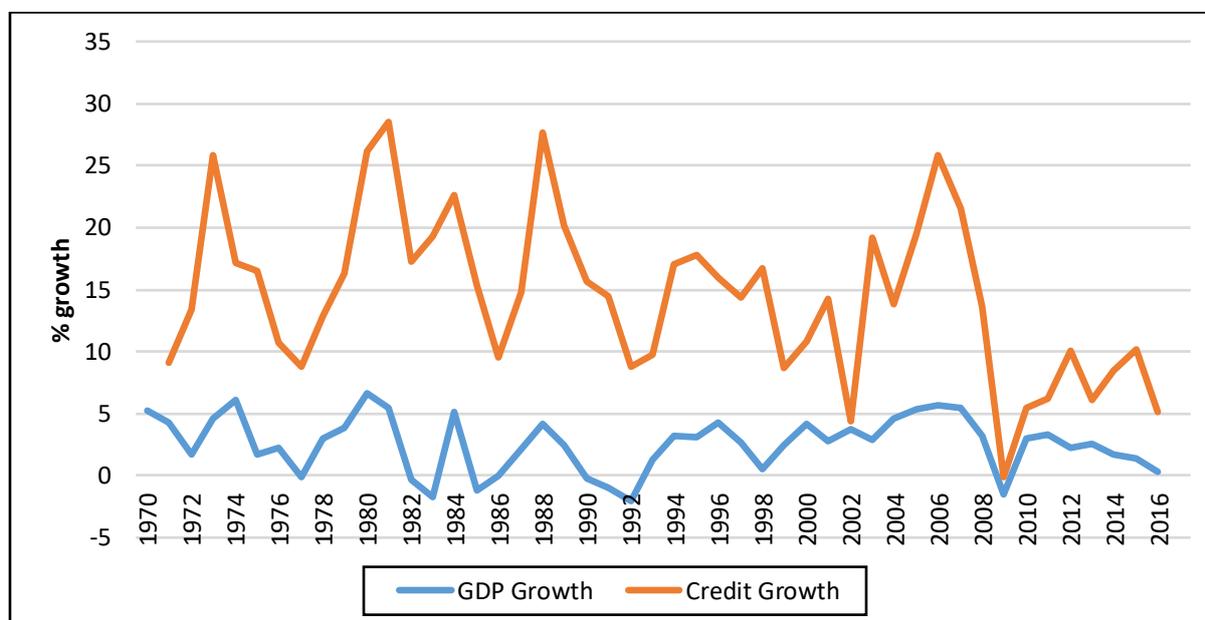


Figure 3.6: Credit and GDP growth in South Africa (1970-2016)

Source: South African Reserve Bank

3.3 LITERATURE REVIEW

In this section, we review empirical studies on the main drivers of credit booms. A number of studies on credit booms have been on mostly advanced and emerging countries and to a lesser extent in developing countries. Interestingly, there have been mixed findings. For example, some studies seem to suggest that factors such as inflation, GDP growth, asset prices, foreign capital and liabilities and the exchange rate play a major role in credit booms while some others suggest internal bank factors such as profitability, NPLs, size of bank capital, ownership, et cetera. We have noted that these conflicting results arise due to differences in research methods, choice of variables, data frequency and even location of the study.

A number of studies have been conducted in various countries, particularly since the global financial crisis (see, for example Goodhart & Hofmann, 2008; Bakker & Gulde,

2010; Mendoza & Terrones, 2008; Aisen & Franken, 2010; Elekdag & Wu, 2011; Glaeser, Gottlieb & Gyourko, 2012; Dell’Ariccia, Igan, Laeven & Tong, 2014; Fielding & Rewilak, 2015; Arena et al., 2015, among others).

For example, before the global financial crisis, Ituwe (1983) had argued that the ability of a bank to provide credit was largely driven by the ‘quantum of cash in its vault’. Interestingly, Bakker and Gulde (2010), regarding nine new European Union (EU) member states, confirmed that factors external to the region such as ‘bad fortunes’ were significant drivers of credit boom-bust cycles while also establishing that rapid credit growth was a result of high liquidity in global markets. Bakker and Gulde (2010) opined that the new EU states were an attractive destination for foreign capital, which most likely accelerated credit availability.

Some recent studies on credit booms have associated the recent financial crisis with buoyant asset prices, in particular property prices, that were not driven by favourable economic fundamentals (Goodhart & Hofmann, 2008; Mendoza & Terrones, 2008; Acharya & Richardson, 2009; Elekdag & Wu, 2011; Dell’Ariccia et al., 2014). These studies highlighted that the increase in the asset prices significantly increases household wealth and collateral which ultimately triggers a higher borrowing appetite³⁶ and credit expansion. For example, Dell’Ariccia et al. (2014) confirmed a link between the decrease in credit standards and increased mortgage securitisation rates as property prices accelerated. The study also found that increased mortgage securitisation greatly affected the lending behaviour of banks during the period leading up to the crisis, while Goodhart and Hofmann (2008) found a strong relationship between shocks in money supply and buoyant property prices.

Another important factor relates to the studies of Elekdag and Wu (2011) on 99 credit booms around the world, Gourinchas, Valdes and Landerretche (2001) on 91 developed and developing countries, and Dell’Ariccia, Igan, Laeven, Tong, Bakker, and Vandebussche (2012) on 170 developed and emerging countries. These studies

³⁶ See Shiller (2014) for a detailed discussion on the role of asset prices in credit booms.

found a strong and positive association between credit booms and loose macroeconomic policy (lower policy rate) in countries that have experienced credit boom episodes. Elekdag and Wu (2011) noted that a lower policy rate inflates the price of assets which increases collateral values, thereby incentivising borrowing and increasing borrowing appetite.

Elekgad and Wu (2011), in particular, mentioned low policy rates as a prominent factor in 13 of the worst credit booms in developed and emerging economies. They revealed that, during the pre-peak years, global interest rates were significantly below the domestic policy rates of the most economies that experienced credit boom episodes. Elekdag and Wu (2011) opined that low policy rates lower the prime rate and ultimately reduce borrowing costs. Dell’Ariccia, Igan and Laeven (2012) identify loose macroeconomic factors as triggers of credit booms. The study also opined that credit boom episodes often occurred in countries that had a fixed exchange rate and poor bank supervision, et cetera. Dell’Ariccia, Igan and Laeven (2012) argued that countries under a fixed exchange rate regime tend to direct their monetary policy stance towards protecting a fixed exchange rate and concentrate less on devising policies to identify and prevent credit boom episodes. Gourinchas et al. (2001) and Stepanyan and Guo (2011) also identified other factors, such as fixed exchange rates, poor regulatory oversight, and domestic deposits³⁷ as major drivers of credit booms in several developed and emerging countries.

Other studies, inter alia those of Gourinchas et al. (2001), Mendoza and Terrones (2008), Rai and Kamil (2010), Stepanyan and Guo (2011), Magud, Reinhart and Vesperoni (2014), Lane and McQuade (2014) and Fielding and Rewilak (2015), demonstrated large capital inflows as a major cause of excessive credit growth during the pre-peak years of credit booms. These studies found a strong asymmetric relationship between credit booms and large foreign capital inflows in several countries. Importantly, Mendoza and Terrones (2008) noted that large inflows of foreign capital are sometimes channelled to the local credit market in the form of

³⁷ Please refer to Chapter 5 on the role of domestic deposits in credit growth.

wholesale funds³⁸ which increase liquidity in the market and fuel excessive credit growth. For example, Stepanyan and Guo (2011) investigated the dynamics of bank credit pre- and post the financial crisis in 38 emerging market economies. They found that countries such as Estonia, Latvia, Romania, Bulgaria and Lithuania had high credit growth rates (>30 per cent) while countries such as Poland, Hungary and the Czech Republic had average growth. They attributed this to their over-reliance on foreign capital as a source of credit growth before the financial crisis³⁹. Stepanyan and Guo (2011) demonstrated that countries that over-relied on foreign capital (pre-crisis) experienced a drastic decline in credit provision after the crisis.

Mendoza and Terrones (2012) also agreed with Stepanyan and Guo (2011), using cross-sectional data covering developed and emerging countries around the world when they suggested that surges in foreign capital played a significant role in accelerating credit growth.

Rai and Kamil (2010) argued that the sources of credit funds (internal or external) in Latin America and Caribbean countries were important prior to and during the financial crisis, with those that depended heavily on foreign funding being the worst affected.

However, Elekdag and Wu (2011) provide an interesting twist to the foreign capital and credit booms relationship in the literature. Elekdag and Wu (2011) opined that not all credit booms are triggered by foreign capital, as some asset classes, such as the property market, private and public equity, foreign direct investments (FDI), fixed income assets and investment in nonfinancial institutions, among others, might have been absorbing these funds. Elekdag and Wu (2011) suggest strong domestic factors as significant drivers of credit growth instead of foreign capital flows.

³⁸ Please refer to Chapter 5 for a detailed discussion on wholesale funding sources.

³⁹ Countries such as Hungary, Latvia, Lithuania and Estonia had a high level of foreign borrowing to credit growth, compared to domestic deposits.

Although the aggregate factors driving credit booms have been studied extensively, as discussed above, the majority of studies cover developed countries with advanced financial systems and institutional structures. Limited evidence exists for African countries and in particular South Africa. This is not surprising, considering the low levels of credit provided through formal channels and the general level of financial development in the continent. Regarding country studies, no study has been conducted in South Africa; we could only find cross-sectional studies on credit booms that incorporate South African data (i.e. Booms & Are, 2004; Mendoza & Terrones, 2008; 2012; Gozgor, 2014; and Arena et al., 2015). For example, in a sample of 24 emerging countries including South Africa, Gozgor (2014) found that South Africa had the highest mean credit-to-GDP ratio of 175.3 on average, followed by China, Malaysia and Thailand. More recently, Arena et al. (2015) also identified the presence of credit booms in South Africa and concluded that the start date was 2005, peaking in 2007 and ending in 2008.

Importantly, these studies (Terrones & Mendoza, 2008; 2012; Gozgor, 2014; Arena et al., 2015) provided compelling insight into the behaviour of credit and further highlighted other additional factors, for example, that equity and property prices were possibly fuelling credit booms in South Africa. The additional factors identified, such as equity and property prices, are consistent with the literature on credit boom-busts. Furthermore, like other countries, positive growth trends during the build-up phase of the crisis in South Africa had a significant impact on credit booms. There is also an emphasis on surges in foreign capital as an important trigger of credit booms in most emerging market economies, including South Africa.

3.4 EMPIRICAL ANALYSIS AND ESTIMATION TECHNIQUES

3.4.1 Data source

The study utilised annual time series data spanning 1970 to 2016 collected from the South African Reserve Bank and World Bank data portal. This period covers the pre-independence years under trade and economic sanctions, post-independence

economic growth and political stability, the global financial crisis of 2007-2009 and the post-crisis period.

3.4.2 Definition of variables

3.4.2.1 Credit booms

This is our variable of interest, and we used the credit-to-GDP ratio as an indicator of credit booms in South Africa as suggested by financial crisis literature (see Schularick & Taylor 2012; Arena et al., 2015; Barajas, Chami & Yousefi, 2016). Given its increase over the years, Barajas et al. (2016) suggest that the ratio provides information on the banking sector mobilisation of funds and how funds are allocated in the economy. Arena et al. (2015) point out that credit booms are related to the permanent increase in the credit-to-GDP ratio in a number of countries that have experienced some form of credit booms.

3.4.2.2 Gross Domestic Product (GDP) per capita

We included GDP per capita as a measure of domestic income in South Africa. High growth in GDP per capita stimulates domestic demand for credit (Gozgor, 2014). However, adverse shocks on economic performance can potentially affect credit supply, especially in developing and emerging countries (Takáts, 2010).

3.4.2.3 Real interest rates

Studies of Terrones and Mendoza (2012), Stepanyan and Guo (2011), Magud et al. (2014), and Arena et al. (2015) demonstrate the relationship between the monetary policy rate and credit booms. Lower real interest rates in the economy signal a monetary policy easing stance and therefore the possibility of rapid growth in credit in the economy, especially in developing and emerging countries (Elekdag & Wu, 2011). We, therefore, expect the lower real interest rates to stimulate rapid credit growth in South Africa.

3.4.2.4 Mortgage loans

Financial crisis literature suggests that mortgage loans played a significant role in triggering credit booms around the world (Demyanyk & van Hemert, 2009; Dell’Ariccia et al., 2014). In this paper, we used total mortgage loans to the private sector obtained from the SARB.

3.4.2.5 Stock market prices

Literature also suggests that real stock market prices are related to credit booms (Booms & Are, 2004; Terrones & Mendoza, 2008). In particular, Terrones and Mendoza (2008) opined that rising stock market prices may possibly trigger excessive borrowing. For this reason, we used the JSE all-share index as a proxy for stock market prices.

3.4.2.6 Foreign capital flows

Much of the literature in this study points out the strong link between surges in foreign capital and credit booms in a number of emerging countries (Elekdag & Wu, 2011; Glaeser et al., 2012; Fielding & Rewilak, 2015). We used annual growth rates calculated using data sourced from the SARB.

3.5 EMPIRICAL MODEL SPECIFICATION

To empirically establish the main drivers of credit booms in South Africa, we apply the robust autoregressive-distributed lags (ARDL) bounds test methodology by Pesaran, Shin and Smith (2001) using data over the period 1970-2016. The ARDL (p,q) approach is chosen because of its superiority over other traditional cointegration approaches (i.e. Engle & Granger; Johansen; Johansen & Juselius, among others). First, this method can be used irrespective of the variables' integration properties (integrated order zero [I(0)] or [I(1)]). Second, the method allows us to derive an ECM through a simple linear transformation without losing the long-run information in the equations. Third, the ARDL model is the most appropriate for small samples and endogeneity is less of a problem because it is free of residual correlation (see Odhiambo, 2010). The estimated ARDL bounds test model is as follows:

$$\begin{aligned} \Delta DCG_t = & \alpha_0 + \sum_{i=1}^{k_1} \lambda_i \Delta DCG_{t-i} + \sum_{i=1}^{m_1} \delta_i \Delta JSEG_{t-i} + \sum_{i=1}^{n_1} \gamma_i \Delta LMLG_{t-i} + \sum_{i=1}^{p_1} \phi_i \Delta FCG_{t-i} \\ & + \sum_{i=1}^{q_1} \varphi_i \Delta RI_{t-i} + \sum_{i=1}^{r_1} \Pi_i \Delta GDP_{t-i} + \beta_1 DCG_{t-1} + \beta_2 JSEG_{t-1} + \beta_3 LMLG_{t-1} \\ & + \beta_4 FCG_{t-1} + \beta_5 MRI_{t-1} + \beta_6 GDP_{t-1} + \varepsilon_{1t} \end{aligned} \quad (3.1)$$

$$\begin{aligned}
\Delta JSEG_t = & \alpha_0 + \sum_{i=1}^{k_2} \lambda_i \Delta JSEG_{t-i} + \sum_{i=1}^{m_2} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_2} \gamma_i \Delta LMLG_{t-i} + \sum_{i=0}^{p_2} \phi_i \Delta FCG_{t-i} \\
& + \sum_{i=0}^{q_2} \varphi_i \Delta RI_{t-i} + \sum_{i=0}^{r_2} \Pi_i \Delta GDP_{t-i} + \beta_1 JSEG_{t-1} + \beta_2 DCG_{t-1} + \beta_3 LMLG_{t-1} \\
& + \beta_4 FCG_{t-1} + \beta_5 RI_{t-1} + \beta_6 GDP_{t-1} + \varepsilon_{2t}
\end{aligned} \tag{3.2}$$

$$\begin{aligned}
\Delta LMLG_t = & \alpha_0 + \sum_{i=1}^{k_3} \lambda_i \Delta LMLG_{t-i} + \sum_{i=1}^{m_3} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_3} \gamma_i \Delta JSEG_{t-i} + \sum_{i=0}^{p_3} \phi_i \Delta FCG_{t-i} \\
& + \sum_{i=0}^{q_3} \varphi_i \Delta RI_{t-i} + \sum_{i=0}^{r_3} \Pi_i \Delta GDP_{t-i} + \beta_1 LMLG_{t-1} + \beta_2 DCG_{t-1} + \beta_3 JSEG_{t-1} \\
& + \beta_4 FCG_{t-1} + \beta_5 RI_{t-1} + \beta_6 GDP_{t-1} + \varepsilon_{3t}
\end{aligned} \tag{3.3}$$

$$\begin{aligned}
\Delta FCG_t = & \alpha_0 + \sum_{i=1}^{k_4} \lambda_i \Delta FCG_{t-i} + \sum_{i=1}^{m_4} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_4} \gamma_i \Delta JSEG_{t-i} + \sum_{i=0}^{p_4} \phi_i \Delta LMLG_{t-i} \\
& + \sum_{i=0}^{q_4} \varphi_i \Delta RI_{t-i} + \sum_{i=0}^{r_4} \Pi_i \Delta GDP_{t-i} + \beta_1 FCG_{t-1} + \beta_2 DCG_{t-1} + \beta_3 JSEG_{t-1} \\
& + \beta_4 LMLG_{t-1} + \beta_5 RI_{t-1} + \beta_6 GDP_{t-1} + \varepsilon_{4t}
\end{aligned} \tag{3.4}$$

$$\begin{aligned}
\Delta Ri_t = & \alpha_0 + \sum_{i=1}^{k_5} \lambda_i \Delta Ri_{t-i} + \sum_{i=1}^{m_5} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_5} \gamma_i \Delta JSEG_{t-i} + \sum_{i=0}^{p_5} \phi_i \Delta LMLG_{t-i} \\
& + \sum_{i=0}^{q_5} \varphi_i \Delta FCG_{t-i} + \sum_{i=0}^{r_5} \Pi_i \Delta GDP_{t-i} + \beta_1 Ri_{t-1} + \beta_2 DCG_{t-1} + \beta_3 JSEG_{t-1} \\
& + \beta_4 LMLG_{t-1} + \beta_5 FCG_{t-1} + \beta_6 GDP_{t-1} + \varepsilon_{5t}
\end{aligned} \tag{3.5}$$

$$\begin{aligned}
\Delta GDP_t = & \alpha_0 + \sum_{i=1}^{k_6} \lambda_i \Delta GDP_{t-i} + \sum_{i=1}^{m_6} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_6} \gamma_i \Delta JSEG_{t-i} + \sum_{i=0}^{p_6} \phi_i \Delta LMLG_{t-i} \\
& + \sum_{i=0}^{q_6} \varphi_i \Delta FCG_{t-i} + \sum_{i=0}^{r_6} \Pi_i \Delta Ri_{t-i} + \beta_1 GDP_{t-1} + \beta_2 DCG_{t-1} + \beta_3 JSEG_{t-1} \\
& + \beta_4 LMLG_{t-1} + \beta_5 FCG_{t-1} + \beta_6 Ri_{t-1} + \varepsilon_{6t}
\end{aligned} \tag{3.6}$$

where DCG = domestic credit as percentage of GDP; JSEG = Johannesburg Stock Exchange all-share index growth rate; LMLG = log of mortgage loans to the private sector growth rate; FCG = foreign capital inflows growth rate; Ri = real interest rates;

GDP = GDP per capita growth rate; k, m, n, p, q, r = optimal lag lengths, Ln is the natural logarithm of variables; $\varepsilon_{1t}\varepsilon_{6t}$ are white noise error terms; and Δ = first difference operator. The study uses the Wald test (joint f-statistic) to determine the lower and upper bounds. To determine the optimum length, we apply the Akaike Information Criterion because of its superiority to other information criteria e.g. the Schwarz Bayesian Criteria (Burnham & Anderson, 2004). The null and alternative hypotheses of no co-integration in Equations 3.1 to 3.6 are $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ and $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq 0$ respectively. We used Pesaran et al. (2001) and Narayan (2005) for two critical values for lower and upper bounds. The lower bound values are developed under the assumption that ARDL variables are integrated order zero while the upper bound values assume variables are integrated order 1.

We proceed to determine whether cointegration exists using three scenarios as follows: (i) we reject the $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ if the calculated F-statistic is greater than the upper bound critical values; (ii) we do not reject $H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$ if the calculated F-statistic is less than the lower bound critical values, and (iii) the study cannot reach a firm conclusion if the calculated F-statistic is between the lower and the upper bound critical values (Pesaran et al., 2001).

3.5.1 ECM-based Granger causality test

After establishing the presence of long-run relationships between variables in Equations (3.1) to (3.6) through the ARDL bounds procedure, we proceed to determine Granger-causality between credit booms and the other variables in the models. We apply the following Granger-causality models (Ho & Odhiambo, 2011; Cherni & Jouini, 2017):

$$\begin{aligned} \Delta DCG_t = & \alpha_0 + \sum_{i=1}^{k_1} \lambda_i \Delta DCG_{t-i} + \sum_{i=1}^{m_1} \delta_i \Delta JSEG_{t-i} + \sum_{i=1}^{n_1} \gamma_i \Delta LMLG_{t-i} + \sum_{i=1}^{p_1} \phi_i \Delta FCG_{t-i} \\ & + \sum_{i=1}^{q_1} \varphi_i \Delta RI_{t-i} + \sum_{i=1}^{r_1} \Pi_i \Delta GDP_{t-i} + \theta_1 ECT_{t-1} + \varepsilon_{7t} \end{aligned} \quad (3.7)$$

$$\begin{aligned} \Delta JSEG_t = & \alpha_0 + \sum_{i=1}^{k_2} \lambda_i \Delta JSEG_{t-i} + \sum_{i=1}^{m_2} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_2} \gamma_i \Delta LMLG_{t-i} + \sum_{i=0}^{p_2} \phi_i \Delta FCG_{t-i} \\ & + \sum_{i=0}^{q_2} \varphi_i \Delta RI_{t-i} + \sum_{i=0}^{r_2} \Pi_i \Delta GDP_{t-i} + \theta_2 ECT_{t-1} + \varepsilon_{8t} \end{aligned} \quad (3.8)$$

$$\begin{aligned} \Delta LMLG_t = & \alpha_0 + \sum_{i=1}^{k_3} \lambda_i \Delta LMLG_{t-i} + \sum_{i=1}^{m_3} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_3} \gamma_i \Delta JSEG_{t-i} + \sum_{i=0}^{p_3} \phi_i \Delta FCG_{t-i} \\ & + \sum_{i=0}^{q_3} \varphi_i \Delta RI_{t-i} + \sum_{i=0}^{r_3} \Pi_i \Delta GDP_{t-i} + \theta_3 ECT_{t-1} + \varepsilon_{9t} \end{aligned} \quad (3.9)$$

$$\begin{aligned} \Delta FCG_t = & \alpha_0 + \sum_{i=1}^{k_4} \lambda_i \Delta FCG_{t-i} + \sum_{i=1}^{m_4} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_4} \gamma_i \Delta JSEG_{t-i} + \sum_{i=0}^{p_4} \phi_i \Delta LMLG_{t-i} \\ & + \sum_{i=0}^{q_4} \varphi_i \Delta RI_{t-i} + \sum_{i=0}^{r_4} \Pi_i \Delta GDP_{t-i} + \theta_4 ECT_{t-1} + \varepsilon_{10t} \end{aligned} \quad (3.10)$$

$$\begin{aligned} \Delta Ri_t = & \alpha_0 + \sum_{i=1}^{k_5} \lambda_i \Delta Ri_{t-i} + \sum_{i=1}^{m_5} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_5} \gamma_i \Delta JSEG_{t-i} + \sum_{i=0}^{p_5} \phi_i \Delta LMLG_{t-i} \\ & + \sum_{i=0}^{q_5} \varphi_i \Delta FCG_{t-i} + \sum_{i=0}^{r_5} \Pi_i \Delta GDP_{t-i} + \theta_5 ECT_{t-1} + \varepsilon_{11t} \end{aligned} \quad (3.11)$$

$$\begin{aligned} \Delta GDP_t = & \alpha_0 + \sum_{i=1}^{k_6} \lambda_i \Delta GDP_{t-i} + \sum_{i=1}^{m_6} \delta_i \Delta DCG_{t-i} + \sum_{i=0}^{n_6} \gamma_i \Delta JSEG_{t-i} + \sum_{i=0}^{p_6} \phi_i \Delta LMLG_{t-i} \\ & + \sum_{i=0}^{q_6} \varphi_i \Delta FCG_{t-i} + \sum_{i=0}^{r_6} \Pi_i \Delta Ri_{t-i} + \theta_6 ECT_{t-1} + \varepsilon_{12t} \end{aligned} \quad (3.12)$$

In Equations 3.7 to 3.12, the study included the lagged error correction term ECT_{t-1} generated from the long-run equilibrium relationship, and θ_1 to θ_6 are the coefficients of the lagged error correction term (ECT).

3.6 EMPIRICAL RESULTS

3.6.1 Stationarity tests

In order to verify that the variables in the equations are not integrated of order 2 ($I(2)$), we apply the standard unit root tests i.e. Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. To confirm the endogenous structural breaks in the series, we apply the Zivot and Andrews (ZA) breakpoint unit root test since standard unit root tests (i.e. ADF, PP and KPSS) in Table 3.2 tends to be biased towards the rejection of the null hypothesis even in the presence of structural breaks in the series. The empirical results in Table 3.2 reveal that there are no variables that are $I(2)$, in other words, most of the variables are stationary after first difference.

The ZA test results in Table 3.3 also confirm that there are no $I(2)$ variables; however, the results identify structural breaks in the variables. There are considerable differences in the location of these structural breaks in the variables. In some instances, the location of breaks is different between a variable in levels and first difference. The first set of breaks occurred during the early 1980s, 1990s and late 2000s. For example, the credit boom (DCG) series break dates are 2006 and 2007, while the foreign capital (FCG) break date is 1999. For the mortgage loans (LMLG) series, the break date is 2008, while the GDP per capita (GDP) break date is 1992. The occurrence of these breaks is not surprising since most coincide with a number of events that took place in South Africa, for example, the imposition and subsequent removal of sanctions, the new political dispensation and the recent financial crisis.

Table 3.2: Unit root tests

Variable	Model	Augmented Dickey-Fuller (ADF)			Phillips-Perron (PP)		Kwiatkowski Phillips Schmidt and Shin (KPSS)		Conclusion
		Lag	$\tau_\tau, \tau_\mu, \tau$	Φ_3, Φ_1	BW	$\tau_\tau, \tau_\mu, \tau$	BW	τ_τ, τ_μ	
DCG	Intercept	0	-3.679***	13.537***	1	- 3.745***	3	0.397**	Stationary: Integrated of order 0
	Intercept and Trend	0	-4.231***	9.183**	5	-3.949***	1	0.106*	
	None	0	-1.424		6	-1.029			
DDCG	Intercept	0	-7.548***	56.966***	13	-10.403***	13	0.255*	
	Intercept and Trend	0	-7.521***	28.306***	0	-12.382***	15	0.183***	
	None	0	-7.635**		13	-10.502***			
JSEG	Intercept	0	-6.313***	39.857***	17	-8.653***	18	0.194*	Stationary: Integrated of order 0
	Intercept and Trend	1	-6.135***	15.768***	17	-8.565***	18	0.193**	
	None	0	-4.587***		2	-4.549***			
DJSEG	Intercept	5	-6.310***	27.308***	44	-25.072***	27	0.363**	
	Intercept and Trend	5	-6.323***	23.423***	44	-32.645***	27	0.312	
	None	5	-6.393***		44	-25.365***			
LMLG	Intercept	0	-2.079	4.324	2	-2.144	5	0.374**	Non-stationary: Integrated of order 1
	Intercept and Trend	0	-2.517	3.203	2	-2.603	4	0.132**	
	None	0	-0.942		1	-0.943			
DLMLG	Intercept	0	-6.530***	42.644***	1	-6.530***	1	0.0470*	
	Intercept and Trend	0	-6.474***	20.985***	2	-6.476***	2	0.0410*	
	None	0	-6.591***		1	-6.590***			
FCG	Intercept	0	-7.064***	49.894***	3	-7.059***	3	0.147*	Stationary: Integrated of order 0
	Intercept and Trend	0	-7.033***	24.747***	3	-7.031***	4	0.098*	
	None	0	-5.855***		2	-5.921***			
DFCG	Intercept	0	-12.959***	167.947***	23	-36.291***	15	0.193*	
	Intercept and Trend	0	-12.811***	82.073***	23	-37.566***	15	0.180***	
	None	0	-13.109***		23	-36.885***			
Ri	Intercept	0	-3.245**	10.527***	2	-3.211**	4	0.494***	Non-stationary: Integrated of
	Intercept and Trend	0	-3.783**	7.592**	2	-3.785**	3	0.163***	
	None	0	-2.670***		2	-2.568**			

DRI	Intercept	1	-6.675***	33.736***	7	-9.645***	5	0.108*	order 0
	Intercept and Trend	4	-5.863***	17.486***	7	-9.470***	5	0.110*	
	None	1	-6.751***		7	-9.792***			
GDP	Intercept	0	-4.263***	18.175***	2	-4.254***	3	0.201*	Non-stationary: Integrated of order 0
	Intercept and Trend	0	-4.314***	9.305**	3	-4.246***	2	0.127**	
	None	0	-4.229***		2	-4.215***			
DGDP	Intercept	1	-7.001***	37.948***	44	-19.63***	45	0.500***	
	Intercept and Trend	1	-6.914***	24.766***	44	-19.23***	45	0.500	
	None	1	-7.085***		44	19.173***			

Notes: Superscripts ***, **, * denote 1%, 5% and 10% level of significance respectively.

The critical values for ADF are as follows: with intercept - 3.581 (1%), -2.927 (5%) and -2.601 (10%); Intercept and trend -4.171 (1%), -3.511 (5%) and -3.186 (10%); with no intercept and no trend -2.616 (1%), -1.948 (5%) and -1.612 (10%).

PP critical values are: with intercept, 3.581152 (1%), -2.927 (5%) and -2.601 (10%); with intercept and trend, -4.171 (1%), -3.511 (5%) and -3.186 (10%); with no intercept and no trend -2.616 (1%), -1.948 (5%) and -1.612 (10%).

Critical values for KPSS tests: with intercept, 0.739 (1%), 0.463 (5%) and 0.347 (10%); with intercept and trend, 0.216 (1%), 0.146 (5%) and 0.119 (10%).

ADF critical values for Φ_3 , Φ_1 are obtained from the Dickey and Fuller (1981) tables for the empirical distribution Φ_1 and Φ_3 .

Source: Author's calculations using Eviews 10

Table 3.3: Zivot-Andrews stationarity tests accounting for structural breaks: 1970-2016

Variables	Model	Lag	t-stat	Breakpoint
DCG	Intercept	0	-4.847**	2007
	Intercept & Trend	0	-4.837**	2006
JSEG	Intercept	0	-7.193***	1980
	Intercept & Trend	0	-7.075***	1980
LMLG	Intercept	0	-4.573**	2008
	Intercept & Trend	0	-4.609*	2008
FCG	Intercept	2	-14.169***	1999
	Intercept & Trend	2	-13.478***	1999
Ri	Intercept	0	-5.718***	1980
	Intercept & Trend	0	-5.434***	1980
GDP	Intercept	0	-5.037***	1992
	Intercept & Trend	0	-5.157**	1992
Variables in First Difference				
DDCG	Intercept	0	-8.051***	1988
	Intercept & Trend	0	-7.934***	1988
DJSEG	Intercept	0	-9.427***	1981
	Intercept & Trend	0	-9.285***	1980
LMLG	Intercept	0	-7.532***	2009
	Intercept & Trend	0	-7.398***	2009
DFCG	Intercept	0	-14.533***	2001
	Intercept & Trend	0	-14.938***	2001
DRi	Intercept	0	-8.273***	1980
	Intercept & Trend	0	-8.431***	1980
DGDP	Intercept	0	-8.385***	1984
	Intercept & Trend	0	-8.271***	1984
<p>Notes: Superscripts ***, **, * denote significance at 1%, 5% and 10% respectively.</p> <p>The Zivot-Andrews breakpoint tests critical values with intercept are as follows -4.949 (1%), -4.444 (5%) and -4.194 (10%) and critical values with intercept and trend are -5.348 (1%), -4.860 (5%) and -4.607 (10%).</p> <p>The test selected a maximum of 9 lags.</p>				

Source: Author's calculations using Eviews 10

3.6.2 Cointegration Test: ARDL bounds test

Table 3.4 presents the empirical results of ARDL bounds F-test for Equations 3.1-3.6 to establish the long-run relationship when DCG, JSEG, LMLG, FCG, Ri and GDP are modelled as endogenous variables. The results show that there is a long-run relationship between variables in Equations 3.1, 3.2, 3.5 and 3.6. This is confirmed by the calculated F-statistics of Equations 3.1, 3.2, 3.5 and 3.6 that are greater than the 5 per cent critical values of Narayan (2005) and Pesaran et al. (2001). In Equations 3.3 and 3.4, the calculated F-statistic is lower than the 5 per cent critical values of both Pesaran et al. (2001) and Narayan (2005). Therefore, the null hypothesis of no cointegration is rejected in Equations 3.1, 3.2, 3.5 and 3.6 and it is concluded that the variables have a long-run relationship when credit boom, GDP per capita, stock market prices and real interest rates are dependent variables.

Table 3.4: Bounds F-test for cointegration

Dependent Variable	Function		F-Test Statistic			
DCG	DCG (JSEG, LMLG, FCG, Ri, GDP)		4.671**			
JSEG	JSEG (DCG, LMLG, FCG, Ri, GDP)		19.115***			
LMLG	LMLG (DCG, JSEG, FCG, Ri, GDP)		1.952			
FCG	FCG (DCG, JSEG, LMLG, Ri, GDP)		3.407			
Ri	Ri (DCG, JSEG, LMLG, FCG, GDP)		9.172***			
GDP	GDP (DCG, JSEG, LMLG, FCG, Ri)		4.441**			
CRITICAL VALUES						
	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Pesaran et al. (2001)	3.06	4.15	2.39	3.38	2.08	3.0
Narayan (2005)	3.674	5.019	2.694	3.829	2.276	3.38
Notes: Superscripts ***, **, * denote, 1%, 5% and 10% level of significance respectively. Narayan (2005) critical values: case III: unrestricted intercept and no trend. Pesaran et al. (2001) critical values: unrestricted intercept and no trend.						

The Breusch–Godfrey serial correlation LM tests results presented in Table 3.5 indicate that the equations do not suffer from serial correlation. In other words, the equations are correctly specified.

Table 3.5: Breusch–Godfrey serial correlation LM tests

DCG	F-statistics	1.214	Prob. F(2,21)	0.315
	Obs*R ²	4.135	Pro. Chi-square(2)	0.127
JSEG	F-statistics	0.167	Prob. F(2,21)	0.847
	Obs*R ²	0.675	Pro. Chi-square(2)	0.713
LMLG	F-statistics	0.837	Prob. F(2,21)	0.447
	Obs*R ²	3.173	Pro. Chi-square(2)	0.204
FCG	F-statistics	0.252	Prob. F(2,16)	0.780
	Obs*R ²	1.313	Pro. Chi-square(2)	0.519
Ri	F-statistics	0.041	Prob. F(2,28)	0.960
	Obs*R ²	0.125	Pro. Chi-square(2)	0.940
GDP	F-statistics	0.630	Prob. F(2,23)	0.541
	Obs*R ²	2.284	Pro. Chi-square(2)	0.319

Source: Author's calculations using Eviews 10

3.6.3 ECM-based Granger causality test

Having established the cointegration amongst the variables in the 6 equations, we proceeded to determine the Granger-causality between variables when DCG, JSE, LMLG, FCG, Ri and GDP are dependent variables. Although the presence of cointegration in Equations 3.1, 3.2, 3.5 and 3.6 indicate the possibility of Granger-causality in at least one direction, it does not reveal the direction of temporal causality (Narayan & Smyth, 2005; Ho & Odhiambo, 2011). To detect the short-run causality we apply the Wald test (F-Statistics) of lagged differences of the independent variables and the long-run causality using the significance of the t-statistics of the lagged ECT in Equations 3.7 to 3.12. However, we can only generate the lagged ECT t-statistic from Equations 3.7, 3.8, 3.11 and 3.12 in which the long-run relationship was detected. Table 3.6 presents the short and long-run causality test results.

Table 3.6: Short and long-run Granger non-causality test

Dependent Variable	Causal direction	F-statistic	ECT t-statistic	R ²
Domestic credit growth (DCG)	Stock Market prices (JSEG) → Domestic credit growth (DCG)	2.226(0.131)	-0.821(-6.421)***	0.88
Stock Market prices (JSEG)	Domestic credit growth (DCG) → Stock Market prices (JSEG)	3.524(0.049)**	-1.420(-11.974)***	0.89
Domestic credit growth (DCG)	Mortgage loans (LMLG) → Domestic credit growth (DCG)	7.610(0.000)***	-0.821(-6.421)***	0.88
Mortgage loans (LMLG)	Domestic credit growth (DCG) → Mortgage loans (LMLG)	10.580(0.000)***	-	0.85
Domestic credit growth (DCG)	Foreign Capital (FCG) → Domestic credit growth (DCG)	5.388(0.012)**	-0.821(-6.421)***	0.88
Foreign Capital (FCG)	Domestic credit growth (DCG) → Foreign Capital (FCG)	3.078(0.054)*	-	0.94
Domestic credit growth (DCG)	Real Interest rates (Ri) → Domestic credit growth (DCG)	3.812(0.016)**	-0.821(-6.421)***	0.88
Real Interest rates (Ri)	Domestic credit growth (DCG) → Real Interest rates (Ri)	10.678(0.003)***	-0.129(-8.776)***	0.75
Domestic credit growth (DCG)	GDP per capita (GDP) → Domestic credit growth (DCG)	3.877 (0.0108)**	-0.821(-6.421)***	0.88
GDP per capita (GDP)	Domestic credit growth (DCG) → GDP per capita (GDP)	5.353(0.0030)***	-0.398(-6.209)***	0.83

The results in Table 3.6 confirm a long-run bidirectional causality between Stock Market prices (JSEG) and credit booms (DCG). This is supported by a significant (1 per cent level) and negative lagged ECT. However, short-run causality between Stock Market prices (JSEG) and credit booms is not supported by the Wald test, since the F-statistic is not significant at 5 per cent. We also find a long-run unidirectional causal relationship running from mortgage loans to credit booms. This is confirmed by a significant and negative lagged ECT as expected. However, we find short-run bidirectional causality between mortgage loans and credit booms which is confirmed by significant F-statistics for both the credit booms and mortgage loans equations. Furthermore, as expected, our results confirm short and long-run unidirectional causal flow running from foreign capital to credit booms. The direction of causality is confirmed in the credit boom equation by a negative and significant lagged ECT and the F-statistics of the Wald test. Table 3.7 provides a summary of causality between credit boom, stock market prices, mortgage loans, foreign capital, real interest rates and GDP per capita.

Table 3.7: Summary of causality

Variables	Direction of causality	Conclusion
Credit booms (DCG) and stock market prices (JSEG)	Long-run bidirectional causality flow between credit booms and stock market prices, and short-run unidirectional causality from credit booms to stock market prices.	Credit booms and stock market prices Granger-cause each in the long run. Credit booms Granger-cause stock market prices in the short run.
Credit booms (DCG) and mortgage loans (LMLG)	Long-run unidirectional causality from mortgage loans to credit booms and short-run bidirectional causality between mortgage loans and credit booms.	Mortgage loans Granger-cause credit booms in the long run. Mortgage loans and credit booms Granger-cause each other in the short run.
Credit booms (DCG) and foreign capital (FCG)	Long-run unidirectional causality from foreign capital to credit booms and a short-run bidirectional causality.	Foreign capital flows Granger-cause credit booms in the long run. Foreign capital and credit booms Granger-cause each other in the short run.
Credit booms (DCG) and real interest rates (Ri)	Short- and long-run bidirectional causality between credit booms and real interest rates.	Real interest rates and credit booms Granger-cause each other in both the short and long run.
Credit booms (DCG) and GDP per capita (GDP)	Short- and long-run bidirectional causality between GDP per capita and credit booms.	GDP per capita and credit booms Granger-cause each other both in the short and long run.

3.7 CONCLUSION AND POLICY RECOMMENDATIONS

This study has investigated the aggregate drivers of credit booms in South Africa using data for the period 1970-2016. We applied the ARDL bounds testing methodology and the error correction model. Previous studies on this subject cover developed and emerging markets with advanced financial markets while the literature on Africa, and in particular South Africa, is limited. The study leads to several important empirical findings. First, we found a strong persistent pattern of rapid credit growth in South Africa with the credit-to-GDP ratio peaking at 192 per cent in 2007. This also confirmed previous cross-country studies of Mendoza and Terrones (2012), Gozgor (2014), and Arena et al. (2015). Furthermore, we found evidence of procyclical credit provision in

South Africa. This was also confirmed by studies of Akinboade and Makina (2009), Fourie et al. (2011) and Akinsola and Ikhide (2018). Second, stock market prices and credit booms Granger-cause each other in the long run, while unidirectional causality runs from credit booms to stock market prices in the short run. This relationship is well supported in the literature on credit booms around the world (Booms & Are, 2004; Schularick & Taylor, 2012).

Third, we established that mortgage loans Granger-cause credit booms in the long run, while we find directional causality in the short run. The long-run relationship between the growth of mortgage loans and rapid credit growth is supported by studies in other countries (Demyanyk & van Hemert, 2009; Drehmann, Borio & Tsatsaronis, 2011). Empirical studies show that the growth of mortgage loans increases property prices and improves households' wealth and subsequently increases the amount of credit to the private sector.

Fourth, as expected, foreign capital flows induce credit booms in the long run while we found bidirectional causality in the short run. The long-run empirical results are important in explaining credit booms in a number of countries and South Africa is no exception. This finding supports Minsky's assertion that the free movement of capital across countries will be the main source of excess liquidity which will fund rapid credit growth around the world. Studies on South Africa (see, for example, Terrones & Mendoza, 2012; Gozgor, 2014) also support this finding. The free movement of foreign capital across borders has already been experienced in this country. During the build-up phase of the financial crisis, South Africa received a high influx of portfolio funds from international credit markets and some of these have found themselves within the banking sector and may be used to finance credit.

Finally, both the real interest rates and GDP per capita have a bidirectional relationship with credit booms in South Africa. The link between domestic macroeconomic policies is consistent with the literature on credit booms. The low-interest-rate environment before 2007 seems to have fuelled credit booms. Previous studies, inter alia those of

Elekdag and Wu (2011), Dell’Ariccia, Igan and Laeven (2012), and Glaeser et al. (2012), support our findings on the role of interest rates in credit booms.

The findings of this study point to important policy implications. The identification of the triggers of credit booms is important for policymakers in order to gauge and formulate appropriate strategies to reduce the risk of a crisis or, at least, limit its consequences in the economy. We argue policymakers to increase their surveillance of the banking sector, given the social and economic costs associated with bank failures. The Reserve Bank should develop early warning indicators to distinguish between good and bad booms. In conclusion, we argue that regulatory authorities should not take a ‘wait-and-see’ approach in dealing with the credit booms, given the dilemma these present. South Africa needs to adopt a proactive macroprudential regulation to build buffers for use during credit busts.

CHAPTER FOUR

CREDIT RISK AND CREDIT BOOMS IN SOUTH AFRICA

4.1 INTRODUCTION

The severity of the global financial crisis of 2007-2009 triggered a continuous investigation into the causes and possible solutions to avoid a similar crisis. Credit booms were at the epicentre of the financial crisis. Empirical assessments reveal that these credit booms present a dilemma for policymakers in a number of emerging and developing countries, and South Africa is no exception. Credit booms in some instances mean more finance that stimulates and supports investment and economic growth (Arestis & Demetriades, 1997; Levine, 2002; 2005; Reinhart & Rogoff, 2008a; Abedifar, Hasan & Tarazi, 2016; Seven & Yetkiner 2016). In a country such as South Africa, it represents a welcome 'catch-up' from historic low levels to finance consumption and huge capital expenditure backlogs.

In contrast, sustained credit booms can lead to vulnerabilities in the banking sector which can end in serious financial and economic disruptions (Pazarbasioglu, Johnsen, Hilbers & Ötoker, 2005; Duenwald, Gueorguiev & Schaechter, 2007; Gorton, 2009; Foos et al., 2010; Festić et al., 2011; Soedarmono, Sitorus & Tarazi, 2017). The suggestion is that credit booms not supported by strong economic fundamentals and output growth may have a negative effect on the banking system (Ozili & Outa, 2017). According to the literature, credit booms signal poor underwriting standards in the economic upswing which ultimately affect credit risk in the downturns (Salas & Saurina, 2002; Berger & Udell, 2004; Jiménez & Saurina, 2006; Foos et al., 2010; Ozili & Outa, 2017).

Bank loans represent the biggest assets in the South African banking sector and, as such, unanticipated credit losses can manifest in severe disruptions, especially in an

environment where bank credit is the dominant source of finance for households and firms. Credit risk, therefore, relates to the potential loss incurred by banks in the event that a counterparty fails to fulfil their contractual obligations on time and it is affected by systematic (external) and idiosyncratic (internal) factors (Yurdakul, 2014; Chatterjee, 2015; Pool, De Haan & Jacobs, 2015).

The principal setting of the study is influenced by three conditions; first, there has been a rapid acceleration in credit growth over the past years in South Africa and this presents a potential risk in the banking sector in the event of a shock to the economy. Raising levels of indebtedness also presents a risk to the banking system as predicted by the Minsky theory of financial crises. There is a high probability of greater loan defaults (accelerated increase in unsecured credit) in the economy in the event of a shock to the system. Second, the performance of the South African economy has remained subdued over the years with the economy unable to attract substantial investment and create adequate employment. Available literature (Mian & Sufi, 2018; Coimbra & Rey, 2018) shows that the poor performance of the economy is a trigger for credit risk. Third, the performance of most state-owned enterprises (SOEs) poses a serious default risk to South African banks who have extended significant amounts of loans to them.

Given the above, the intention of this study is to empirically determine whether excessive credit growth signals future vulnerabilities in the banking sector in South Africa. We answer this question by assessing the growth-risk nexus in bank lending, using annual time series data from 1992-2017. Based on the literature in the subsequent sections, the study includes the business cycle as an intermittent variable to reinforce the growth-risk argument made in this study. Literature shows that the business cycle⁴⁰ is an important factor for both credit growth and credit risk management (see, for example, Aydemir & Guloglu, 2017; Mian & Sufi, 2018; Coimbra & Rey, 2018).

⁴⁰ See Chapter Two for a detailed discussion on the business cycle.

The rest of the chapter is organised as follows: Section 4.2 explores relevant theoretical and empirical literature on credit booms, credit risk and the business cycle, and Section 4.3 provides an overview of the credit market in South Africa. Section 4.4 is the methodology section, which presents the estimation techniques and the empirical analysis, while Section 4.5 provides policy recommendations and concludes the study.

4.2 RELATED LITERATURE

This section looks at the empirical literature on the importance of credit risk management, how banks define credit risk, and the main factors driving credit risk around the world. A number of studies have attempted to establish the growth-risk nexus in bank lending. Importantly, most studies define their preferred measure of credit risk, since there is no single method preferred in the literature. In this chapter, we have relied on existing literature on financial system stress testing (Moretti, Stolz, & Swinburne, 2008; Havrylchuk, 2010; Oros & Salisteanu, 2015; Pool et al., 2015; Curcio, de Simone & Gallo, 2017) and have adopted bank loan loss provisions (LLPs) as a proxy for credit risk in South Africa. LLPs are funds set aside to act as shock absorbers for current and future loan losses (Cummings & Durani, 2016). In other words, LLPs are used to mitigate risk by absorbing losses emanating from their bank loan portfolios. LLPs are an important component of the banking sector since they provide sensitive information to a wider audience. The use of LLPs has gained popularity in stress testing programmes since 2007-2008 (see, for example, Moretti et al., 2008; Havrylchuk, 2010; Oros & Salisteanu, 2015; Pool et al., 2015; Curcio et al., 2017).

Importantly, due to changes in reporting requirements by the South African Reserve Bank (SARB), data on nonperforming loans (alternative proxy) in South Africa is not available spanning our study period. LLPs can either be procyclical or countercyclical depending on whether they are backward-looking (non-discretionary) or forward-looking (discretionary). Backward-looking LLPs take into consideration past events, such as the number of problem loans, with LLPs increasing or decreasing during upswings or downswings respectively, and they are the most common around the

world (Bouvatier & Lepetit, 2012; Pool et al., 2015; Soedarmono, Pramono & Tarazi, 2017).

Forward-looking LLPs are built up in the upswing for use during downswings, countercyclical in nature and based on the expected loan default risk over the business cycle (Bikker & Matzemakers, 2005; Bouvatier & Lepetit, 2008; Cummings & Durrani, 2016). Importantly, since the global financial crisis of 2007-2009, the Basel Committee on Banking Supervision (BCBS) through the Basel III accord has recommended the use of forward-looking credit risk models, arguing that backward-looking models are outdated and exacerbate procyclicality. BCBS's argument is that banks tend to relax credit standards during upswings due to their positive anticipation of economic and future fortunes and hence increase the probability of default in the downswings (Berger & Udell, 2004; Wezel, 2010; Bushman & Williams, 2012). According to Soedarmono, Pramono and Tarazi (2017), the banking sector becomes risk-averse during downturns and limits credit provision which in turns dries up liquidity in the market and deepens the economic recession. For this reason, the Basell III framework recommendation is that banks should build countercyclical capital buffers during upswings for use during bad times to avoid credit restrictions during downswings.

On the theoretical front, various arguments are presented on the importance of banks in financial system stability and economic development (see Levine, 2002; Abedifar et al., 2016). With the established role of banks, a crisis in all or part of the system may lead to significant costs to the economy. Almost all participants lose out when this happens. Shareholders lose their equity holdings, while depositors risk losing all or part of their savings and the costs of portfolio reallocation. Bank creditors may miss their payments, while bank-dependent borrowers risk losing funding and potentially face difficulties in finding alternative sources. According to Hoggarth, Reis and Saporta (2002), bank failures may develop into a crisis, resulting in an unanticipated contraction in the stock of money and subsequently a recession. Banks are deposit-taking financial institutions whose liabilities are short-term, while their assets are mainly short- and long-term loans to households and firms, hence banks are insolvent if their liabilities are greater than their assets (Demirgüç-Kunt & Detragiache, 1998).

According to literature (Bonfim, 2009; Ali & Daly, 2010; Castro, 2013; Chatterjee, 2015; Pool et al., 2015), ex-post credit default risk is the biggest challenge facing the banking sector. Banks use various models to minimise this risk, by, for example, screening loan applications, diversifying loan portfolios (lending to customers with different risk profiles) or requesting collateral. Screening borrowers enables a bank to predetermine (ex-ante) profitable and non-profitable projects. It also enables profitable projects to be funded (ex-post). However, theory predicts that diversification does not necessarily eliminate credit default risk, especially in banks that lend to certain non-performing economic sectors in developing countries. Collateral is also expensive to establish and monitor, and its value is typically subject to volatility (Demirgüç-Kunt & Detragiache, 1998).

Importantly, bank insolvency may occur when a wave of loan losses (NPLs) occur, especially when they are more than reserve requirements and equity cushions (Mishkin, 1996). A systemic crisis may occur because of a significant percentage of loan losses relative to bank capital. Demirgüç-Kunt and Detragiache (1998, p. 85) explain that: “shocks that adversely affect the economic performance of bank borrowers and whose impact cannot be reduced through risk diversification should be positively correlated with systemic banking crises”. In this regard, shocks are positively associated with systemic banking crises and banks that are not adequately capitalised are more vulnerable to shocks. According to Lindgren, Garcia, and Saal (1996) and Kaminsky and Reinhart (1999), the decline in asset prices, cyclical output decline and deterioration in the terms of trade are some of the shocks that cause loan losses and subsequently bank crises.

Since bank assets consist of long- and short-term loans at fixed interest rates, sudden adjustments in interest rates affect banks' return on assets⁴¹. Banks are exposed in instances where this change in the interest rate cannot be quickly transferred to

⁴¹ Banks' return on assets cannot adjust quickly to counter the impact of short-term interest rate changes.

borrowers. Mishkin (1996) asserts that short-term interest rate increases may be a likely source of systemic risk. He opined that the most recent banking problems in the U.S. were associated with sudden adjustments in the level of interest rates.

On the empirical front, there are burgeoning studies that demonstrate that during economic upswings, banks underestimate credit risk and accelerate credit provision, while overestimating credit risk during downswings and therefore reducing credit growth. This credit risk management practice accelerates economic recession i.e. the procyclicality of credit provision and risk management (Berger & Udell, 2004; Soedarmono, Sitorus & Tarazi, 2017a; Ozili & Outa, 2017).

For example, Bikker and Matzemakers (2005) looked at 800 banks in 29 OECD countries and confirmed the dependency of provisioning behaviour on changes in the macroeconomic performance while also establishing that banks increase provisioning during downturns and decrease them during upturns.

Some studies also found that banks' behaviour reflected developments in the business cycle, and established that excessive credit growth in the upswing affected bank stability for years ahead, for example, 3-4 years in Spain (Salas & Saurina, 2002), 3-4 years on 16,000 banks across 16 major countries (Foos et al., 2010) 2-3 years in Australia (Hess, Grimes & Holmes, 2009), and in central and eastern Europe (Festić et al., 2011). In particular, Salas and Saurina (2002) found that excessive loan growth resulted in high loan losses 2-3 years into the future.

Other studies (for example, Pool et al., 2015; Soedarmono, Pramono & Tarazi, 2017; Bouvatier & Lepetit, 2012; Ozili & Outa, 2017) have demonstrated the procyclicality of backward-looking credit risk management practices around the world. For example, in 12 OECD countries, Pool et al. (2015) established that LLPs were mostly procyclical and backward-looking. They argued that LLPs had a negative effect on credit provision and strengthened business cycle volatility. Using a sample of Islamic banks, Soedarmono et al. (2017) found that, although there was a move away from the

'incurred loan loss model' (I-LLM⁴²) to the new 'expected loan loss model' (E-LLM⁴³) within Islamic banks, banks' provisioning behaviour remained procyclical, with macroeconomic factors playing a significant role. Bouvatier and Lepetit (2012) confirmed that non-discretionary LLPs amplified banks' lending fluctuations in developed and emerging markets (Europe, Japan, US, Central and South America, and South and East Asia) with a stronger effect on emerging countries. Recently, Ozili and Outa (2017) observed that LLPs were procyclical and exacerbated a recession if unanticipated. Ozile and Outa (2017) gave an example of an increase in LLPs to counter the effects of credit losses during the financial crisis of 2007-09 in the US.

Interestingly, another group of studies suggests that credit risk management through LLPs must be related to the credit cycle (Packer & Zhu, 2012; López, Tenjo & Zárate, 2014; Cummings & Durani, 2016). These studies opined that credit risk in downturns was a direct manifestation of rapid credit growth during upswings. They also highlighted that banks should be mindful of the underlying risk built up during the episodes of rapid credit growth and subsequently build up LLPs for use during downturns as recommended by the BCBS. In particular, López et al. (2014) in Colombia found that bank loans advanced during rapid credit upswings had a high default risk compared to loans granted during downswings. In Australia, Cummings and Durani's (2016) study found evidence of countercyclical buffer provisions in more than 66 per cent of banks in operation. Furthermore, they found that lending growth was a major deciding factor in the banks' credit risk assessment models.

⁴² According to the Financial Accounting Standard Board (FASB) and International Accounting Standard Board (IASB), in the incurred loan loss model (I-LLM), LLPs are set aside after NPLs have been realised. The I-LLM is backward-looking and does not enable banks to create provisions during economic booms, which in turn triggers procyclical effects on credit growth.

⁴³ According to the FASB and IASB, in the E-LLM, LLPs are created prior to loans being granted, allowing banks to have sufficient LLP reserves in good times to enable lending expansion during downturns (Soedarmono, Pramono & Tarazi, 2017).

Despite the growing literature on the growth-risk nexus, unfortunately, only limited studies focus on rapid credit growth and credit risk in developing countries and in particular Africa (see, for example, Ikhida, 2003; Akinboade & Makina, 2009; Havrylchyk, 2010; Ozili & Outa, 2017). Ozili and Outa (2017) established that African banks' provisioning behaviour was procyclical and reflected the business cycle, and that in some instances LLPs were used for income smoothing. The two studies in South Africa, Akinboade and Makina (2009) and Havrylchyk (2010), established the procyclicality of bank lending and LLPs. For example, Akinboade and Makina (2009) analysed the linkage between bank lending behaviour and the business cycle, where they found a link between procyclical behaviour in bank lending and LLPs. Later, Havrylchyk (2010) appreciated the importance of the LLP in stress testing by including it as a proxy in her study. Havrylchyk (2010) appreciated the importance of LLPs in stress testing the South African financial system and opined that the high level of mortgage loans to the private sector exposed the banks to risk associated with changes in interest rates and property prices. Importantly, the results of these studies in South Africa are consistent with the notion that lending practices and credit risk management tend to be procyclical over the business cycle. This implies that rapid credit growth amplifies the build-up of credit risk in the banking system.

This study follows that of Havrylchyk (2010) on South Africa; however, two major drawbacks are worth noting regarding the Havrylchyk (2010) study: (i) various events have occurred which have since changed the dynamics in the South African banking sector and the economy. For example, the credit-to-GDP ratio has remained above 160 per cent, there has been an increase in unsecured credit, top commercial banks have been twice downgraded and subdued economic performance over the past 10 years; (ii) the findings might no longer be relevant since it only utilised data over the period 1994 to 2007: this period does not cover the post-crisis years. In 2016, South Africa's sovereign credit rating was downgraded to 'junk' status, coupled with high

political and policy uncertainty. The country continues to face numerous structural imbalances, i.e. high unemployment, poverty, shortage of skills, inequality⁴⁴, et cetera.

4.3 OVERVIEW OF THE SOUTH AFRICAN CREDIT MARKET

The South African financial sector is one of the most advanced and well-structured on the African continent (Odhiambo, 2009). The sector has undergone a number of changes over the past three decades, including the introduction of the Bank Act, 1990 (Act No. 94 of 1990), the National Credit Act, 2005 (No. 34 of 2005) (NCA), and the regulation of credit provision through the National Credit Regulator⁴⁵. Regulatory institutions such as the South African Reserve Bank (SARB), Financial Services Board (FSB), National Credit Regulator (NCR) and Financial Intelligence Centre (FIC), among others, oversee the operations of the financial system in South Africa. In particular, the NCA is concerned with reforms in overdrafts, credit cards, instalment agreements, micro-loan services, et cetera. These reforms were necessitated by the failure of financial institutions to exercise due consideration in the provision of credit specifically in the wake of increasing debt levels in the country. It is envisaged that these new reforms will foster changes in financial institutions' lending behaviour (Chipeta & Mbululu, 2012).

As discussed above, this study uses LLPs as a proxy for credit risk in South Africa. Figure 4.1 presents the growth rates of total bank loans and LLPs⁴⁶ from 1992-2017. We observe that in some instances an increase in credit growth is accompanied by an increase in LLPs in the following year. For example, during the 1990s, credit growth

⁴⁴ These are systematic risk factors (i.e. changes in the macroeconomic factors, economic policies and political changes) which often affect credit risk in the economy (Yurdakul, 2014; Chatterjee, 2015; Pool, De Haan & Jacobs, 2015).

⁴⁵ These changes seek to protect private and collective interest within the South African credit market.

⁴⁶ The South Africa Reserve Bank requires banks to report both credit exposure and LLPs per sector.

averaged 15 per cent while LLPs grew by 24.4 per cent. Interestingly, between 2000 and 2007, credit growth accelerated (18.2 per cent) owing to good economic fortunes, while LLPs (5.5%) grew at a moderate rate. However, when credit growth declined from a peak of 28.15 per cent in 2007, LLPs suddenly jumped from 30 per cent growth in 2007 to a peak of 122 per cent in 2008, while credit growth decreased from 22.4 per cent to 14.2 per cent. We also note that, since 2009, bank credit growth has averaged around 5.7 per cent while LLP growth has hovered around 7.8 per cent. Subdued economic conditions during the past decade have forced local banks to slightly reduce the credit growth in the private sector as depicted in Figure 4.1.

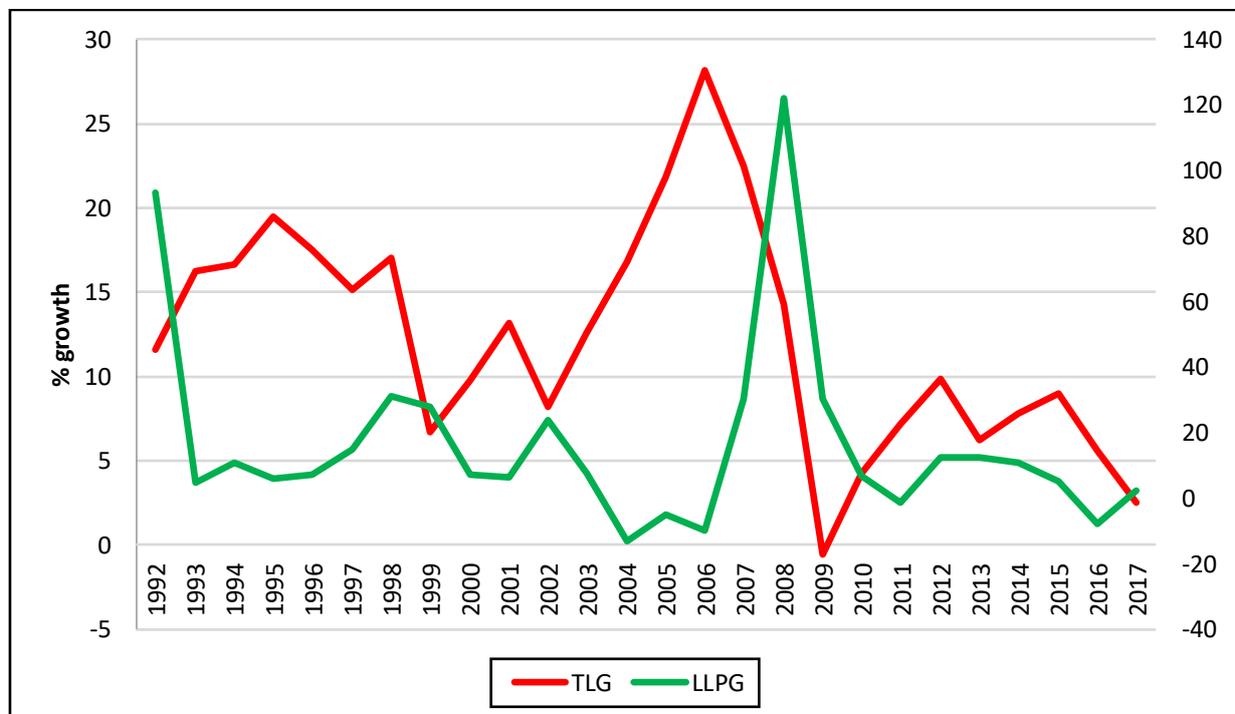


Figure 4.1: Total loan growth and LLP growth in South Africa (1992-2017)

Source: South African Reserve Bank

As discussed in the literature above, credit risk is linked to the business cycle, and in Figure 4.2 we attempt to establish the link between the business cycle and LLPs in South Africa. LLPs seem to respond to business cycle fluctuations, i.e. during the upswings, LLPs decline, while during economic downswings, LLPs increase significantly. For example, between 2003 and 2006, when the business cycle indicator was positive, LLP growth averaged -5.2 per cent while between 2007 and 2010 when

the business cycle indicator was negative, LLP growth averaged 47 per cent. Therefore, our observations are in line with LLP studies in general (for example, Pool et al., 2015; Ozili & Outa, 2017) and in particular, the Akinboade and Makina (2009) study that established that bank LLPs were largely driven by business cycle fluctuations in South Africa (see Figure 4.2).

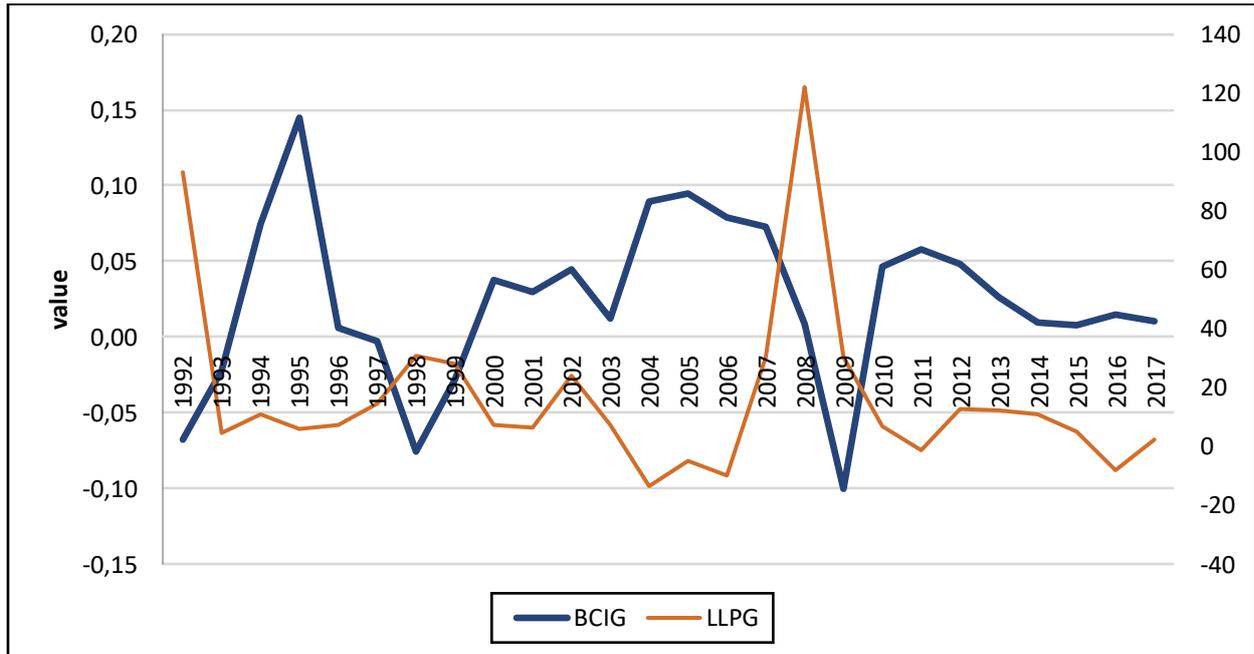


Figure 4.2: LLP growth and the business cycle

Source: South African Reserve Bank

The rapid increase in credit provision has also seen an increase in household debt, as shown by the debt to disposable income ratio in Figure 4.3. The ratio has remained above 65 per cent since 2005, reaching a peak of 86 per cent in 2008. According to First National Bank (2014), the household debt-service risk index was at 6.06 points (high-risk range), which was 0.56 points higher than the tolerance range of 5.5. Mortgage loans contribute to the largest share of household debt to disposable income. According to Statistics South Africa, mortgage loans⁴⁷ contributed 54 per cent of total loans in 2009, 7 per cent in 2010 and 43 per cent in 2016 respectively.

⁴⁷ Most mortgage loans in South Africa are issued on flexible interest rates.

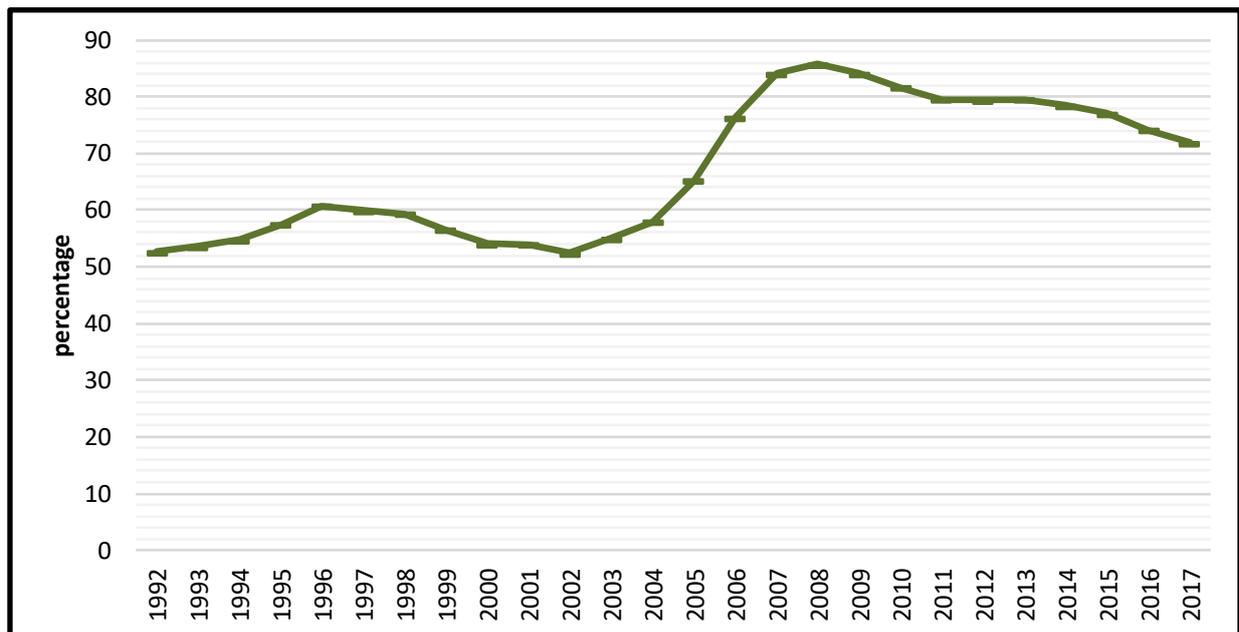


Figure 4.3: Household debt-to-income ratio

Source: South African Reserve Bank

Although the BCBS has recommended the use of forward-looking credit risk management models since 2007-2009, statistics show that credit risk management in South Africa still exhibits backward-looking (non-discretionary) characteristics. As shown in Figures 4.2 and 4.3, prior to the financial crisis, bank lending appetite was at its highest, characterised by high risk-taking by banks with the debt-to-income ratio rapidly increasing from 2004 onwards. However, the post-crisis years saw credit risk increasing, thus compelling banks to relook at their risk appetite and credit provision strategies.

4.4 EMPIRICAL TECHNIQUES AND EMPIRICAL ANALYSIS

4.4.1 Data sources and definition of variables

In this chapter, we used annual time-series data obtained from the South African Reserve Bank (SARB) which covers the period from 1992 to 2017.

4.4.1.1 Definition of variables

4.4.1.1.1 Bank credit risk (CR)

Credit risk in this study is proxied by LLPs which have been used in various prominent studies such as Salas and Saurina (2002), Pool et al. (2015), and Cummings and Durrani (2016), among others.

4.4.1.1.2 Business Cycle Indicator (BC)

In the literature, the build-up of bank systemic risk is sometimes driven by business cycle fluctuations in a number of countries (see, for example, López et al., 2014; Ozili & Outa, 2017, among others). During economic upswings, banks increase credit to households and firms because loan defaults are relatively low. In this period, banks even issue loans to low-quality borrowers with the hope of maximising returns. However, during the downturn, loan defaults begin to surface since households and firms are unable to service their outstanding debt. We use the annual Composite Coincident Business Cycle Index published by the South African Reserve Bank. This indicator reflects South Africa's aggregate economic activity and includes indicators of sales, income, employment and production in the economy. Akinsola and Ikhide (2018) argued that this was the ideal indicator of the business cycle in South Africa compared to real GDP growth.

4.4.1.1.3 Total loans (CRED)

Relying on Foos et al. (2010) and Festic et al. (2011), we included total loans to the private sector as a proxy for credit booms to establish the growth-risk nexus in bank lending. The literature reviewed here shows that excessive credit growth affects bank credit risk management through LLPs. According to Keeton (1999) and Castro (2013), excessive credit growth provides a signal that banks are relaxing their credit standards, which ultimately reveals the low quality of loans in circulation.

4.4.2 Empirical model specification

In order to establish the growth-risk nexus in bank lending in South Africa, we apply the robust autoregressive-distributed lags (ARDL) bounds testing procedure by Pesaran, Shin and Smith (2001) using 1992-2017 data. The ARDL procedure is

preferred because of its superior qualities over other traditional cointegration methods⁴⁸ and is suitable for small sample sizes such as the one used in this study. This approach can also be applied irrespective of the regressors' order of integration and allows variables to have different lag lengths. Furthermore, an error correction model (ECM) can be derived through a simple linear transformation, integrating both short- and long-run adjustment without losing long-run information. The estimated ARDL (p, q) bounds test model is as follows:

$$\Delta CR_t = \alpha_0 + \sum_{i=1}^{k_1} \lambda_i \Delta CR_{t-i} + \sum_{i=1}^{m_1} \delta_i \Delta BC_{t-i} + \sum_{i=1}^{n_1} \gamma_i \Delta CRED_{t-i} + \beta_1 CR_{t-1} + \beta_2 BC_{t-1} + \beta_3 CRED_{t-1} + \varepsilon_{1t} \quad (4.1)$$

$$\Delta BC_t = \alpha_0 + \sum_{i=1}^{k_2} \lambda_i \Delta BC_{t-i} + \sum_{i=1}^{m_2} \delta_i \Delta CR_{t-i} + \sum_{i=1}^{n_2} \gamma_i \Delta CRED_{t-i} + \beta_1 BC_{t-1} + \beta_2 CR_{t-1} + \beta_3 CRED_{t-1} + \varepsilon_{2t} \quad (4.2)$$

$$\Delta CRED_t = \alpha_0 + \sum_{i=1}^{k_3} \lambda_i \Delta CRED_{t-i} + \sum_{i=1}^{m_3} \delta_i \Delta CR_{t-i} + \sum_{i=1}^{n_3} \gamma_i \Delta BC_{t-i} + \beta_1 CRED_{t-1} + \beta_2 CR_{t-1} + \beta_3 BC_{t-1} + \varepsilon_{3t} \quad (4.3)$$

where CR = bank credit risk; BC = business cycle indicator; CRED = total credit to the private sector; k, m, n = optimal lag length; $\varepsilon_{1t} - \varepsilon_{3t}$ are white noise error terms; and Δ = first difference operator. We employed the bounds test procedure based on the joint F-statistic (Wald test). We used the Akaike Information Criterion (AIC) to determine the lag length of models because of its superiority to other information criteria i.e. the Schwarz Bayesian Criteria (Burnham & Anderson, 2004). The null hypothesis of no cointegration between the variables in Equations 4.1, 4.2 and 4.3 is $H_0: \beta_1 = \beta_2 = \beta_3 = 0$ against the alternative hypothesis of no cointegration, which is $H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$. Narayan (2005) and Pesaran et al. (2001) each present two sets

⁴⁸ Cointegration methodologies such as Engle and Granger, Johansen, Johansen and Juselius and many more.

of critical values for small and large samples. The lower bound values assume that ARDL variables are $I(0)$, while the upper bound values assume variables are $I(1)$. The study proceeded to determine whether cointegration exists using three scenarios, as follows: (1) the study rejects the null hypothesis of no cointegration if the calculated F-statistic is greater than the $I(1)$ critical values; (2) the study does not reject the null hypothesis of no cointegration if the calculated F-statistic is lower than the $I(0)$ critical values; and (3) there is inconclusive inference if the calculated F-statistic is between $I(0)$ and the $I(1)$ critical values.

4.4.3 ECM-based Granger causality test

After establishing the existence of long-run relationships in Equations 4.1 – 4.3 using the ARDL bounds test, we proceeded to determine Granger-causality. Relying on Cherni and Jouini (2017), we applied the following Granger-causality models:

$$\Delta CR_t = \alpha_0 + \sum_{i=1}^{k_1} \lambda_i \Delta CR_{t-i} + \sum_{i=1}^{m_1} \delta_i \Delta BC_{t-i} + \sum_{i=1}^{n_1} \gamma_i \Delta CRED_{t-i} + \varphi_1 ECT_{t-1} + \varepsilon_{4t} \quad (4.4)$$

$$\Delta BC_t = \alpha_0 + \sum_{i=1}^{k_2} \lambda_i \Delta BC_{t-i} + \sum_{i=1}^{m_2} \delta_i \Delta CR_{t-i} + \sum_{i=1}^{n_2} \gamma_i \Delta CRED_{t-i} + \varphi_2 ECT_{t-1} + \varepsilon_{5t} \quad (4.5)$$

$$CRED_t = \alpha_0 + \sum_{i=1}^{k_3} \lambda_i \Delta CRED_{t-i} + \sum_{i=1}^{m_3} \delta_i \Delta CR_{t-i} + \sum_{i=1}^{n_3} \gamma_i \Delta BC_{t-i} + \varphi_3 ECT_{t-1} + \varepsilon_{6t} \quad (4.6)$$

In Equations 4.4 to 4.6, we included the lagged error correction term (ECT_{t-1}) generated from the long-run relationship, and φ_1 to φ_3 as the coefficients of correction in disequilibrium.

4.4.4 Nonlinear Autoregressive-Distributed Lags (NARDL)

After establishing Granger-causality, we proceeded to verify the nature of the cointegration relationship between credit risk, business cycle and credit booms identified in Equation 4.4 by exploring the symmetric and asymmetric relationship

using Shin, Yu and Greenwood-Nimmo's (2014) nonlinear ARDL model. The NARDL methodology is a recent extension of the Pesaran et al. (2001) ARDL bounds approach and takes into consideration nonlinear and asymmetric cointegration between variables while also differentiating between short- and long-run impacts of exogenous variables on the endogenous variables.

Equation 4.1 above assumes linearity and symmetry in the way credit risk is related to credit booms and the business cycle. However, according to Shin et al. (2014), this might not necessarily be true because there is a possibility of nonlinearity and asymmetry in the way credit risk is related to credit booms and the business cycle. Given this, it is important to capture the non-linear and asymmetric cointegration between credit risk, credit booms and the business cycle. We transform Equation 4.1 into a NARDL Equation 4.7 as follows:

$$\Delta CR_t = \alpha_0 + \sum_{i=1}^{k_1} \lambda_i \Delta CR_{t-i} + \sum_{i=1}^{m_1} \delta_i \Delta BC_{t-i} + \sum_{i=1}^{n_1} \gamma_i \Delta CRED_{t-i} + \rho CR_{t-1} + \theta_1^+ BC_{t-1}^+ + \theta_2^- BC_{t-1}^- + \theta_3^+ CRED_{t-1}^+ + \theta_4^- CRED_{t-1}^- + \varepsilon_t \quad (4.7)$$

where $\lambda_i, \delta_i, \gamma_i$ = short-run coefficients; $\theta_1, \theta_2, \theta_3, \theta_4$ = long-run parameters. The difference between the short-run coefficients λ_i, δ_i and γ_i measure the impact of the business cycle (BC) and credit booms (CRED) on credit risk (CR), while the long-run coefficients $\theta_1, \theta_2, \theta_3, \theta_4$ measure the time and reaction speed towards equilibrium. We applied the Wald test procedure in order to establish the long-run asymmetry ($\theta = \theta^+ = \theta^-$) and short-run asymmetry ($\lambda = \lambda^+ = \lambda^- ; \delta = \delta^+ = \delta^- ; \gamma = \gamma^+ = \gamma^-$) for the variables in Equation 4.7. We further applied the bounds test procedure that is based on the joint F-statistic (Wald test).

To establish the effects of positive and negative changes of the regressors, we proceeded to decompose them into their positive and negative components X_t^+ and X_t^- which represent the partial sums of positive and negative movements in X_t as follows:

$$X_t^+ = \sum_{j=1}^t \Delta X_j^+ = \sum_{j=1}^t \max(\Delta x_j, 0)$$

(4.8)

$$X_t^- = \sum_{j=1}^t \Delta X_j^- = \sum_{j=1}^t \min(\Delta x_j, 0)$$

(4.9)

where X represents the regressors BC_t and $CRED_t$.

To determine the presence of an asymmetric long-run relationship, we employed the Shin et al. (2014) bounds test which is a joint test for all lagged regressors. Banerjee, Dolado and Mestre (1998) and Pesaran et al. (2001) each present critical values, i.e. t-statistics and the F-statistic, respectively. Banerjee et al.'s (1998) null hypothesis t-statistic test is $H_0: \theta = 0$ while the alternative hypothesis is $H_1: \theta < 0$, while Pesaran et al.'s (2001) null hypothesis is $H_0: \theta^+ = \theta^- = \theta = 0$. Importantly, the rejection of the null hypothesis for both the t-statistic and F-statistic signifies the presence of a long-run relationship among variables in Equation 4.7.

4.4.5 EMPIRICAL ANALYSIS

4.4.5.1 Stationarity tests

The study employed three traditional unit root tests: PP (Phillips & Perron, 1988), KPSS (Kwiatkowski, Philips, Schmidt & Shin, 1992) and ADF (Dickey & Fuller, 1979) in order to verify that the variables in the equations are not integrated of order 2 ($I(2)$). The empirical results of the unit root test in levels and first differences are presented in Table 4.1 and the results show that there are no variables that are $I(2)$. Simply put, most of the variables are stationary after first difference.

We applied the Zivot and Andrews's (ZA) breakpoint unit root test to confirm the results presented in Table 4.1. The ZA tests take into consideration the presence of endogenous structural breaks in the series. The use of the ZA test is motivated by the

fact that the ADF, PP and KPSS tests tend to be biased towards the null hypothesis in the presence of a structural break in the series. The breakpoint test also provides an insight into the possibility of a shift in the vector of cointegration (Charfeddine & Khediri, 2016). As shown in Table 4.2, the ZA test confirms that there are no variables that are $I(2)$. In Table 4.2, the Zivot and Andrews (ZA) unit root test results take into account the presence of endogenous structural breaks and show that the majority of variables are $I(2)$; however, the test has identified structural breaks for every series. The breaks differ slightly from one series to the other; however, the majority of breaks occurred around the 2000s, mainly 2007, 2008 and 2009. The outcome and occurrence of these breaks are not surprising since most coincide with the global financial crisis of 2007-2008. In this regard, the ZA test results are consistent with the financial crisis literature that highlighted the financial and economic disruptions suffered by world economies.

Table 4.1: Standard unit root tests

Variable	Model	ADF			PP		KPSS	
		Lag	$\tau_\tau, \tau_\mu, \tau$	Φ_3, Φ_1	BW	$\tau_\tau, \tau_\mu, \tau$	BW	τ_τ, τ_μ
CR	Intercept	0	-2.639	4.529	2	-2.622	1	0.158*
	Intercept and Trend	0	-3.457*	7.303	2	-3.451*	15	0.126*
	None	0	-1.189		0	-1.189		
DCR	Intercept	0	-6.118***	37.434***	12	-11.406***	7	0.227***
	Intercept and Trend	0	-5.927***	17.905***	13	-11.859***	7	0.150*
	None	0	-6.289***		12	-11.867***		
CRED	Intercept	0	-1.788	3.197*	1	-1.977	3	0.313***
	Intercept and Trend	0	-2.417	3.215*	1	-2.578	2	0.081***
	None	0	-1.102		0	-1.102		
DCRED	Intercept	0	-4.349***	18.922***	2	-4.336**	1	0.084***
	Intercept and Trend	0	-4.272**	9.139***	2	-4.257**	1	0.044***
	None	0	-4.405***		1	-4.407***		
BC	Intercept	0	-2.669	3.462	2	-3.078	2	0.171*
	Intercept and Trend	0	-3.150	5.567*	2	-3.552*	0	0.083***
	none	0	-2.094		0	-2.094		
DBC	Intercept	0	-5.090***	25.917***	6	-6.403***	4	0.164***
	Intercept and Trend	0	-5.007***	12.559**	5	-6.125***	4	0.095***
	None	0	-5.204***		6	6.646***		

Notes: Superscripts ***, **, * denote 1%, 5% and 10% level of significance respectively.

Critical values for ADF are as follows: with intercept - 3.724 (1%), -2.986 (5%) and -2.632 (10%); Intercept and trend -4.374 (1%), -3.603 (5%) and -3.238 (10%); with no intercept and no trend -2.660 (1%), -1.955 (5%) and -1.609 (10%).

PP critical values are: with intercept, -3.724 (1%), -2.986 (5%) and -2.632 (10%); with intercept and trend, -4.374 (1%), -3.603 (5%) and -3.238 (10%); with no intercept and no trend -2.660 (1%), -1.955 (5%) and -1.609 (10%).

Critical values for KPSS tests: with intercept, 0.739 (1%), 0.463 (5%) and 0.347 (10%); with intercept and trend, 0.216 (1%), 0.146 (5%) and 0.119 (10%).

ADF critical values for Φ_3 , Φ_1 are obtained from the Dickey and Fuller (1981) tables for the empirical distribution Φ_1 and Φ_3 .

Table 4.2: Zivot-Andrews unit root tests accounting for structural breaks: 1992-2017

Variables	Model	Lag	t-stat	Breakpoint
CR	Intercept	0	-10.286***	2008
	Intercept & Trend	5	-7.280***	2007
DCR	Intercept	3	-8.445***	2008
	Intercept & Trend	3	-7.581***	2008
CRED	Intercept	3	-3.889	2013
	Intercept & Trend	2	-4.234	2003
DCRED	Intercept	0	-5.634***	2009
	Intercept & Trend	2	-4.234	2003
BC	Intercept	0	-4.226*	2009
	Intercept & Trend	3	-3.499	2003
DBC	Intercept	3	-6.194***	2009
	Intercept & Trend	0	-5.555***	1996

Notes: Superscripts ***, **, * denote significance at 1%, 5% and 10% respectively.

The ZA critical values with intercept only -4.226 (1%), -4.443 (5%) and -4.193 (10%) and critical values with intercept and trend are -5.347 (1%), -4.859 (5%) and -4.607 (10%).

The test selected a maximum of 5 lags.

4.4.5.2 Cointegration test: ARDL bounds test

After confirming that our variables are not $I(2)$, we proceeded to establish the ARDL bounds test. Table 4.3 shows the results of the bound F-test for Equations 4.1, 4.2 and 4.3 when Credit Risk, Business Cycle and Credit Booms are modelled as dependent variables. The ARDL bounds test confirms the presence of long-run relationships in all equations, as depicted by the calculated F-statistic that is greater than the 1 per cent and 5 per cent of both Pesaran et al. (2001) and Narayan's (2005) critical values. In other words, Table 4.3 confirms the rejection of the null hypothesis of no cointegration in Equations 4.1, 4.2 and 4.3; therefore, a long-run relationship exists between variables Credit Risk, Business Cycle and Credit Booms when they are dependent variables.

Table 4.3: Bounds F-test for cointegration

Dependent Variable	Function	F-Test Statistic				
CR	CR (BC, CRED)	6.501***				
BC	BC(CR, CRED)	4.531**				
CRED	CRED (CR, BC)	7.142***				
CRITICAL VALUES						
	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
Pesaran et al. (2001)	4.13	5.00	3.10	3.87	2.63	3.35
Narayan (2005)	5.15	6.26	3.53	4.42	2.91	3.69
Notes: Superscripts ***, **, * denote significance at 1%, 5% and 10% respectively. Critical values for the bounds test for 30 observations are taken from Narayan (2005) case II: restricted intercept and no trend, and Pesaran et al. (2001) critical value table: restricted intercept and no trend.						

We proceeded to test the variables in Equations 4.1 to 4.3 for serial correlation. Table 4.4 shows the Breusch-Godfrey serial correlation LM test of serial correlation and the results confirm that the models do not suffer from serial correlation.

Table 4.4: Breusch-Godfrey serial correlation test

CR	F-statistics	0.120	Prob. F(2,13)	0.882
	Obs*R ²	0.438	Pro. Chi-square(2)	0.803
BC	F-statistics	0.424	Prob. F(2,6)	0.672
	Obs*R ²	2.726	Pro. Chi-square(2)	0.255
CRED	F-statistics	0.178	Prob. F(2,13)	0.838
	Obs*R ²	0.166	Pro. Chi-square(2)	0.734

Source: Eviews calculations

4.4.5.3 ECM-based Granger causality test results

Once we had confirmed the presence of cointegration in Equations 4.1 to 4.3, we proceeded to establish the Granger-causality between variables when Credit Risk, Business Cycle and Credit Booms are modelled as dependent variables. Although the

presence of cointegration in Equations 4.1 to 4.3 indicates the possibility of Granger-causality in at least one direction, we still needed to run the Granger-causality test to confirm the exact direction of causality among variables. The results of the short- and long-run non-causality test are reported in Table 4.5.

Table 4.5: Short- and long-run Granger non-causality test

Dependent Variable	Causal direction	F-statistic (Wald Test)	ECT t-statistic	R ²
Credit Risk (CR)	Business cycle (BC) → Credit Risk (CR)	0.468(0.757)	-1.329(-4.014)***	0.69
Business cycle (BC)	Credit Risk (CR) → Business cycle (BC)	6.091(0.015)**	-1.323(-7.992)***	0.89
Credit Risk (CR)	Total loan growth (CRED) → Credit Risk (CR)	6.097(0.011)**	-1.301(-5.405)***	0.69
Credit boom (CRED)	Credit Risk (CR) → Credit boom (CRED)	5.447(0.0167)**	-0.044(-5.851)***	0.71

The empirical findings in Table 4.5 show a long run bi-directional causality between credit risk and the business cycle as shown by a negative and statistically significant (1 per cent level) coefficient of the lagged error correction term (ECT). However, in the short run, causality only runs from credit risk to the business cycle, as confirmed by a statistically significant F-statistic of the Wald test. Table 4.5 also shows a unidirectional causality between credit risk and credit boom, both in the short and long run. The long- and short-run causality is supported by a negative and statistically significant (1 per cent level) coefficient of the lagged ECT and a statistically significant F-statistic respectively. Table 4.6 below provides a summary of causality based on the findings in Table 4.5.

Table 4.6: Summary of causality

Variables	Direction of causality	Conclusion
Credit Risk (CR) and Business Cycle (BC)	Long-run bidirectional causality between credit risk and the business cycle and short-run unidirectional causality running from credit risk to the business cycle.	Credit risk and business cycle Granger-cause each other in the long run. Credit risk Granger-causes the business cycle in the short run.

Credit Risk (CR) and Credit Boom (CRED)	Long- and short-run bidirectional causality	Credit risk and credit booms Granger-cause each other in the long run. Credit boom and credit risk Granger-cause each other in the short run.
---	---	--

4.4.5.4 NARDL bounds test: results

Having confirmed the presence of cointegration in our variables using the Pesaran et al. (2001) ARDL bounds test, we proceeded with Shin et al.'s (2014) NARDL model. Table 4.7 presents the NARDL short- and long-run cointegration results for Equation 4.7. First of all, the NARDL results confirm the ARDL findings that there is a long-run relationship between credit risk, business cycle and credit boom for the period 1992-2017 in South Africa. This is confirmed by the calculated F-statistic of 56.99061 which is significant at 1 per cent and greater than the Pesaran et al. (2001) critical values.

Secondly, the business cycle and credit booms explain about 99.9 per cent ($R^2 = 0.999$) of credit risk in South Africa. The ECT in the model explains the slight variation (0.01 per cent) in credit risk. The model does not suffer from serial autocorrelation (χ_{SC}^2) or heteroscedasticity problem (χ_{HET}^2), and the functional form of the model is properly specified (χ_{FF}^2) (see Table 4.7). The findings indicate that the empirical results are reliable and consistent.

Third, the short- and long-run WALD tests (W_{LR} and W_{SR}) confirm the significance of asymmetry at 1 per cent. Therefore, the NARDL F-statistic of 56.99 suggests that there is a long-run asymmetric relationship between credit risk, business cycle and credit booms in South Africa.

Table 4.7: Short- and long-run cointegration results

Variable	Coefficient	Prob	
Long Run			
Constant	89.285***	0.009	
LCR_{t-1}	-10.107***	0.009	
BC_{t-1}^+	22.763***	0.011	
BC_{t-1}^-	-34.449***	0.012	
$LCRED_{t-1}^+$	-0.006***	0.010	
$LCRED_{t-1}^-$	-0.539	0.290	
Short Run			
ΔLCR_{t-1}	7.875***	0.010	
$\Delta LCRED^+$	0.262***	0.015	
$\Delta LCRED_{t-2}^+$	-0.245***	0.020	
ΔBC_{t-1}^-	6.846***	0.006	
$\Delta CRED_{t-2}^-$	0.161***	0.015	
ΔBC^-	38.987***	0.012	
$\Delta LCRED_{t-1}^+$	-0.289***	0.007	
ΔBC^+	1.287	0.160	
ΔBC_{t-1}^+	-13.049***	0.009	
$\Delta LCRED_{t-1}^-$	0.400***	0.009	
ΔLCR_{t-2}	5.839***	0.010	
$\Delta LCRED^-$	-0.232***	0.010	
ΔBC_{t-2}^+	-4.800***	0.010	
ΔBC_{t-2}^-	-7.164***	0.013	
R^2	0.999		
Adjusted R^2	0.989		
Pesaran et al. (2001)	56.990***		
χ_{SC}^2	0.218	(0.721)	
χ_{HET}^2	0.583	(0.793)	
χ_{FF}^2	0.531	(0.598)	
$W_{LR,BC}$	73.094[0.013]***	$W_{SR,BC}$	67.574[0.014]***
$W_{LR,CRED}$	51.215[0.000]***	$W_{SR,CRED}$	89.993[0.011]***

4.4.5.4.1 Long run

The NARDL results reveal that, in the long run, a positive shock to the business cycle has a positive effect on credit risk in South Africa. This is supported by a positive and significant coefficient of 22.76. This shows that any positive developments in the business cycle positively change the financial well-being of households and firms, which helps increase the probability of repayment of credit.

The negative shocks during a business cycle have a negative impact on credit risk in South Africa. This is supported by a negative and significant coefficient of 34.449. As demonstrated in the literature (Borio & Lowe, 2001; Pederzoli & Torricelli, 2005; Jiménez & Saurina, 2006), the business cycle plays an important role in credit risk. Rapid credit growth in the upswings manifests in credit risk in the downswings. The results show that negative shocks have a higher and more pronounced effect on credit risk than positive shocks. The long-run findings on the relationship between business cycle and credit risk validate the fact that the occurrence of nonperforming loans in South Africa were linked to the performance of the economy. We demonstrated in Figure 1.4 that nonperforming loans in South Africa increased during the downswing while they decreased during the upswing years. Drawing on these findings, related to the business cycle, we advise banks not to compromise their credit standards by accelerating credit provision in the upswing. Such lending practices negatively affect the performance of bank loans in the downswings.

In the long run, positive shocks during credit booms have a negative effect on credit risk. This is supported by a negative and significant coefficient (-0.006***). This suggests that any excessive credit growth has a negative effect on credit risk. This finding is not surprising for South Africa, as rapid credit growth has created high levels of over-indebtedness that have manifested during the past 10-12 years, with the debt ratio peaking at 85.7% in 2008 and averaging around 75% between 2010 and 2017. Furthermore, the sharp increase in credit, especially unsecured loans, is a recipe for credit risk in the long term. These are the same unsecured loans that caused the collapse of Islamic Bank in 1997, Saambou in 2002 and African Bank in 2014, among others. According to Minsky's theoretical framework, high levels of debt caused by

over-accumulation of credit helps explain the development of financial fragility in an economy. Furthermore, the effects of a rapid credit growth on credit risk are well supported in the literature (see, for example, Hilbers et al., 2005; Demyanyk et al., 2011; Ozili & Outa, 2017; Soedarmono, Sitorus & Tarazi, 2017). On the other hand, negative shocks during a credit boom have a negative effect on credit risk, however insignificant. According to the Austrian business cycle theory, cheap credit often creates the illusion that bad projects are actually good investments to households and firms. However, when credit growth starts declining, consumers do not have an incentive to continue servicing their debts because the promise to receive more credit is no longer available.

4.4.5.4.2 Short run

In the short run, negative shocks to the business cycle in the very short term (lag 0 and lag 1) have positive effects on credit risk, while negative shocks to the business cycle at lag 2 have a negative effect on credit risk in the short run. This suggests that negative shocks to the business cycle have varying effects on credit risk depending on the number of lags. Positive shocks to the business cycle at lag 1 (-13.049^{***}) and lag 2 (-4.800^{***}) have a negative effect on credit risk while positive shocks to the business cycle in the very short term have a positive (1.287) effect, however statistically insignificant. This is because positive shocks to the business cycle within the same year (very short term) do not necessarily bring about immediate effects on credit risk; the insignificant coefficient is therefore not surprising in this case.

Positive shocks during credit booms in the very short term (0.262^{***}) have a positive and significant impact on credit risk, while positive shocks at lag 1 (-0.289^{***}) and lag 2 (-0.245^{***}) have a negative effect on credit risk. This, in essence, means that positive shocks during a credit boom in the very short term improve credit risk, while positive shocks to total credit at lags 1 and 2 have a negative effect on credit risk. Negative shocks during a credit boom in the very short term (-0.232^{***}) have a negative and significant effect on credit risk, while negative shocks at lag 1 (0.400^{***}) and lag 2 (0.161^{***}) have a positive and significant impact on credit risk. This shows that short-run shocks to rapid credit growth yield different effects on credit risk depending on the magnitude.

4.5 CONCLUSIONS AND POLICY RECOMMENDATIONS

In this chapter, we have empirically explored whether credit booms led to future vulnerabilities in the banking sector in South Africa, applying time-series data from 1992-2017. In other words, we have explored the growth-risk nexus in bank lending. The business cycle is included as an intermittent variable to reinforce the growth-risk argument in this chapter.

Statistical evidence reveals that credit risk management models are still backward-looking and exhibit procyclicality. This means that the South African banking sector is yet to implement the BCBS Basel II recommendations of forward-looking credit risk management models. Our results are in line with the studies of Ikhida (2003), Akinboade and Makina (2009), Havrylchyk (2010) and Ozili and Outa (2017) on South Africa.

Econometric models reveal evidence of a long-run relationship between credit risk, credit booms and business cycle in South Africa. For example, we found that credit risk and the business cycle Granger-cause each other in the long run, while in the short run, credit risk Granger-causes the business cycle. Credit risk and credit booms Granger-cause each other, in both the short and long run.

Furthermore, the NARDL revealed strong evidence of an asymmetric long-run relationship among the variables in the models. Specifically, in the long run, positive shocks to the business cycle have a positive impact on credit risk, while negative shocks to the business cycle have negative effects on credit risk. In other words, negative developments in the economy increase the risk of credit defaults in South Africa. This is important because it emphasises the significance of the business cycle as a determinant of credit risk and this is in line with the growth-risk literature (see Soedarmono, Sitorus & Tarazi, 2017; Ozili & Outa, 2017). Positive shocks during credit booms have negative effects on credit risk. This finding suggests that rapid credit growth yields higher credit risk for banks and poses risk to the banking system. In the

short run, negative and positive shocks during a business cycle and credit booms have different effects on credit risk, depending on the lag length. These different effects are all rooted in the credit risk literature reviewed in this chapter.

On the policy front, we note that, while overcoming credit booms is important for minimising systemic risk, regulatory authorities and policymakers should be mindful of the role played by bank credit in a country such as South Africa still suffering from high levels of unemployment, poverty and inequality. The banking sector should adopt sophisticated methods of credit risk measurement through quantitative credit models which make it possible to quantify credit risk accurately. South African authorities should move with speed in the implementation of BCBS countercyclical capital buffer recommendations in full. While Government and regulatory bodies should discourage credit booms not related to consumption and investment booms in South Africa, we propose that forums should be established through relevant institutions to preach and encourage a culture of building up savings compared to overreliance on credit to fund day-to-day consumption. Lastly, we recommend strict penalties for credit providers found guilty of reckless lending in South Africa.

CHAPTER FIVE

BANKING SECTOR FUNDING SOURCES AND CREDIT BOOMS

5.1 INTRODUCTION

Since the global financial crisis of 2007-09, the identification and prediction of banking and financial crises have dominated discussions amongst policymakers around the world. There is a burgeoning literature on the finance-growth nexus that suggests that excess finance (in the form of credit booms) is a direct manifestation of financial deepening in a number of developed and emerging market economies (see, for example, Minsky, 1986; Levine, Loayza & Beck, 2000; Reinhart & Rogoff, 2009b; Rousseau & Wachtel, 2011; Hansen & Sull, 2013; Kraft & Jankov, 2015; Davis, Mack, Phoa, & Vandenabeele, 2016; Koong et al., 2017).

In particular, Kaminsky and Reinhart (1999) and Rousseau and Watchel (2011) opined that excess finance starts as 'economic lifeblood' to end as an 'economic toxin' for a number of countries that have experienced credit booms which induced financial or banking crises. Studies, inter alia those of Jordà et al. (2011) and Davis et al. (2016), suggest that rapid domestic credit growth leads to excess finance (credit booms) and that large asset price variations ultimately trigger banking and financial crisis episodes. Caggiano, Calice and Leonida (2014) also add market liquidity problems that lead to systemic insolvencies.

Importantly, there is a growing list of studies that strongly suggest that banking sector sources of finance are highly correlated with credit cycles, liquidity⁴⁹ shocks and

⁴⁹ The Bank of International Settlements (BIS, 2008) defines bank liquidity as the ability of the banking sector to accumulate assets and honour its obligations as they become due without incurring significant losses.

financial stability (see, for example, Diamond & Dybvig, 1983; Adrian & Shin, 2010; Huang & Ratnovski, 2011; and Jung & Kim, 2015, among others).

Just like any other business enterprises, the banking sector requires funds to finance their operations. The banking sector can either borrow funds (bank liabilities) or utilise their own funds (owners' equity). In terms of bank liabilities, there are two broad categories: the first relates to the traditional retail bank deposits mobilised from households and businesses, and the second source relates to wholesale funds sourced through institutional markets (Huang & Ratnovski, 2009; Adrian & Shin, 2010; Shin & Shin, 2011; Amidu, 2013; Jung & Kim, 2015; Lozano & Guarín, 2014; Guarin & Lozano, 2017).

Finance mobilised through retail deposits⁵⁰ relates to the core liabilities of the banking sector and consists of short and medium-term deposits from the non-bank domestic creditors (see Adrian & Shin, 2010; Shin & Shin, 2011; Huang & Ratnovski, 2011; Amidu, 2013; Lozano & Guarin, 2014; Jung & Kim, 2015; Guarin & Lozano, 2017). Retail deposits constitute the largest source of finance for the banking sector and its growth is linked to the aggregate household wealth and the overall performance of the economy (Lozano & Guarin, 2014).

On the other hand, wholesale funds are generally classified as non-core liabilities of the banking sector and are generally sourced from institutional markets such as repos, call loans, short-term foreign bank debt, long-term bank debt securities, et cetera. (Guarin & Lozano, 2017). Jung and Kim (2015) argue that the banking sector acquires wholesale funds from institutional markets to supplement the limited supply of funds sourced through retail deposits⁵¹ to finance growing demand for credit during credit

⁵⁰ Bank deposits include demand deposits, savings deposits, term deposits (with different maturity dates) and small deposits.

⁵¹ Huang and Ratnovski (2011, p. 250) concluded that retail deposits were “unsophisticated, passive and scarce”.

boom periods. Shin and Shin (2011) established that these funds grew⁵² in line with the economy's credit cycle. However, they also argued that this finance source was highly volatile in nature. Guarin and Lozano (2017) agreed and suggested that the increasing popularity of wholesale funding in the banking system serves to fulfil the growing demand for credit to maximise investment opportunities in the credit market.

Empirical literature (Demirgüç-Kunt & Huizinga, 2010; Elekdag & Wu, 2013; López-Espinosa, Moreno, Rubia, & Valderrama, 2012; Damar, Meh, & Terajima, 2013; Lozano & Guarin, 2014; Jung & Kim, 2015) also shows that wholesale funds can potentially create excess leverage in the market. According to these studies, excess liquidity exposes the entire financial system to liquidity risk and vulnerabilities when negative shocks occur leading to large scale withdrawals. Large holdings of wholesale funds often signal banks' willingness to face greater risk exposure (Hahm, Shin & Shin, 2013). In fact, the changes in the dynamics of wholesale funds reflect the underlying pace of credit growth relative to the trend and the exposure to systemic risk as well as the vulnerability of the entire financial system (see, for example, Elekdag & Wu, 2013; Shin & Shin, 2011; Huang & Ratnovski, 2011; Hahm et al., 2013; and Lozano & Guarin, 2014 among others). For example, Hahm et al. (2013) argue that a credit boom is reflected in the composition of banking system liabilities when core liabilities "cannot keep up with the asset growth and banks have to turn to other funding sources (non-core liabilities) to finance their lending" (Hahm et al., 2013, p. 3). In support, Shin and Shin (2011) add that the movements in the composition of non-core bank liabilities reflect the risk premium and the state of the financial cycle in the economy.

Against this background, the intention of this chapter is to answer the following critical question: What is the relationship between banking sector funding sources, credit booms and the implications for financial stability in South Africa? This study is particularly relevant for South Africa because of the following reasons; first, having established in previous chapters the triggers of credit booms in South Africa and how credit booms affect credit risk, it is important to determine the interaction between bank

⁵² There is an established view which ultimately compels banks to seek alternative funding.

funding sources and credit booms and how this relationship affects financial system stability. Second, SARB (2017) highlighted that non-core bank funding (wholesale funds) represented 41 per cent of total banking sector funds while bank core funds (bank deposits) represented only 26.3 per cent. The ratio of credit to domestic deposits (financial intermediation ratio) has remained above 100 per cent since 1992 (see Figure 5.2). In fact, the ratio peaked at 165 per cent in 2009, up from 120 per cent in 1992 and 114 per cent in 2002. Since 2010, the ratio has remained above 145 per cent. This ratio suggests that credit provision in South Africa far exceeds the level of funds mobilised through domestic deposits. This, in essence, suggests that South African banks, like all other international banks, could be relying on funds other than domestic deposits to fund growing credit demand in the country. In this context, capturing how positive and negative variations in banking sector funding sources affect rapid credit growth provides policymakers with a broader perspective on the sensitivity of risk to financial system stability.

The empirical analysis applies the Shin et al. (2014) robust nonlinear autoregressive distributed lags (NARDL) cointegration methodology using time series data from 1992-2017 obtained from the South African Reserve Bank (SARB). The NARDL method is used to decompose the nonlinear and asymmetric link between the sources of finance and credit booms and the implications for financial stability. Importantly, results that emerge from this chapter will be important for countercyclical macro-prudential policy formulation in South Africa. Despite the growing literature on this subject (Huang & Ratnovski, 2011; Amidu, 2013; Hahm et al., 2013; Lozano & Guarín, 2014; Jung & Kim, 2015; Gaurin & Lozano, 2017, among others), studies on emerging and developing countries are non-existent. To our knowledge, the empirical nonlinear and asymmetric relationship between credit booms and banking sector finance sources is the first study of its kind and provides an important empirical contribution to the banking and financial stability literature in South Africa.

The rest of the chapter is structured as follows: Section 5.2 presents relevant literature on types of bank funding sources and credit growth, Section 5.3 explores the South

African credit market, Section 5.4 introduces the empirical methodology and analysis, and Section 5.5 provides conclusions and brief policy recommendations.

5.2 RELATED LITERATURE

In this section, we discuss the theoretical arguments on the role of banks in liquidity creation and financial stability. This section also looks at empirical studies on the relationship between bank funding sources and credit booms, their sustainability, and the risk attached to each funding source. From a theoretical perspective, a number of arguments have been presented regarding the effects of banks' liquidity creation on financial system stability. According to financial intermediation literature, liquidity creation is one of the most important roles performed by banks in the economy and occurs both on the liability and the asset side of banks' balance sheets (Diamond & Dybvig, 1983). On the liability side, liquidity creation occurs when banks fund long-term projects using both transaction deposits and wholesale short-term funds. Importantly, the associated exposure to liquidity risk is a fundamental feature of banks. It acts as a discipline tool and supports the efficient operation of the banking system (Diamond & Rajan, 2000).

There are competing views presented in the literature regarding bank finance sources and their vulnerability to liquidity and market risk. One school of thought in support of wholesale funds argues that these funds instil market discipline by allowing sophisticated financial investors to exercise strict monitoring and oversight over the banking system (Calomiris, 1999). Calomiris (1999) and others argue that wholesale funding is useful in offsetting the unexpected withdrawal of bank deposits from insolvent financial institutions. However, another strand of research argues that short-term wholesale funds are affected by negative public signals that compel wholesale financiers to withdraw their funds (Huang & Ratnovski, 2011). Negative market news discourages wholesale investors from exercising their monitoring, triggering the withdrawal of these funds and creating huge liquidity gaps in the system. Vazquez and Federico (2015) argue that over-reliance on short-term wholesale funds in order to finance their balance sheets was a leading factor in the build-up to the financial crisis in the United States.

On the empirical front, there are burgeoning studies that focus on rapid credit growth and finance sources (see Demirgüç-Kunt & Huizinga, 2010; Huang & Ratnovski, 2011; Shin & Shin, 2011; Damar et al., 2013; Lozano & Guarín, 2014; Vazquez & Federico, 2015; Guarín & Lozano, 2017). These studies focus mainly on the interaction between the credit cycle, liquidity creation, financial stability and sources of finance for the banking sector. The majority of the studies emphasise the potential risk to financial stability generated by the banking sector practice of increasing short-term wholesale funds in their portfolios. For example, Huang and Ratnovski (2009) on Organisation for Economic Co-operation and Development (OECD) countries and Canadian banks, Damar et al. (2013) on Canadian banks, and Lozano and Guarín (2014) on Colombian banks demonstrated that finance sources such as wholesale funds exposed the banking sector to liquidity risk and financial fragility and ultimately caused economic turbulence.

Using a sample of 1,334 large banks across 101 countries, Demirgüç-Kunt and Huizinga (2010) analysed the implications of banks' activities and funding strategies on risk and returns during the period leading up to the financial crisis of 2007-09. The study found that non-deposit wholesale funding lowered the rate of return on assets, compared to retail deposit funding. They argued that wholesale funds came in the form of increased bank fragility in a number of countries in the sample. Importantly, Demirgüç-Kunt and Huizinga (2010) concluded that banks' strategies of short-term funding in the form of non-deposit wholesale funding was very risky and consistent with the collapse of the banking system in the United States.

The seminal work of Shin and Shin (2011) on Korean banks also supported the negative findings on the banking systems' reliance on wholesale funds. They noted that in periods of rapid credit growth, traditional funding sources (core liabilities) were not sufficient to cover the growing demand for bank credit. Consequently, banks would seek alternative finance sources other than core liabilities. They classified this alternative finance as banking sector non-core liabilities which take the form of short-term foreign exchange liabilities. Shin and Shin (2011) concluded that bank non-core

liabilities were susceptible to exchange rate depreciation and increased borrowing spreads.

Following up on Shin and Shin's (2011) study, Hahm et al. (2013) used a panel probit regression analysis in a sample of developing and emerging countries to determine the predictive power of the non-core liabilities ratio for currency and credit crises. They found that the non-core liabilities ratio was an important predictor of credit and currency crises in a number of countries in the sample. The study concluded that credit booms were reflected in the banking sector's composition of liabilities and that non-core liabilities provided a useful signal for future financial vulnerabilities.

López-Espinosa et al. (2012) used CoVaR methodology to measure the contribution of a number of factors to systemic risk on a set of large international bank data covering 18 countries. They found that short-term wholesale funds were a key trigger of risk episodes in a number of countries. López-Espinosa et al. (2012) argued in support of the Basel Committee on Banking Supervision's stance on introducing standards for banks' net stable funding (NSF)⁵³ ratio and punishing banks for undesirable exposure to liquidity risk.

In Colombia, Lozano and Guarín (2014) used a logit regression model to establish the relationship between financial vulnerability and bank finance sources. The study established that, like other countries, wholesale funding of credit growth had become very popular in the Colombian banking industry. Lozano and Guarín (2014) argued that banks' practices of overreliance on wholesale funds was a potential source of financial fragility. In conclusion, the study recommended the use of monitoring tools to determine the finance sources to guard against future bank disruptions.

⁵³ According to Basel III, the net stable funding ratio is meant to "promote resilience over a longer time horizon by creating incentives for banks to fund their activities with more stable sources of funding on an ongoing basis" (BIS, 2018).

Providing a different view, some studies (see, for example, Calomiris, 1999; Goodfriend & King, 1998; Van den End & Tabbæ, 2012, among others) have attempted to demonstrate the positive side of wholesale funding for the banking sector. These studies highlighted the positive impact on the banking sector tapping into the wholesale funds market as compared to the traditional retail deposits model. In particular, they argued that wholesale funds were free from the local deposit supply constraints and that the financiers of wholesale funds provided market discipline because of their level of sophistication (Calomiris, 1999). These studies also noted that retail deposits are relatively unsophisticated and risk-insensitive since, in most cases, they are covered by deposit insurance. They further argued that this was possible since wholesale financiers had the means to gather information on bank transactions (bank-financed projects) compared to retail deposit funders (Goodfriend & King, 1998). Goodfriend and King (1998) suggested that wholesale funds were important in refinancing unexpected local deposit withdrawals, while Van den End and Tabbæ (2012) established that wholesale funds were pursued for the purpose of guaranteeing liquidity.

However, recent studies (Shin, 2009; Demirgüç-Kunt & Huizinga, 2010; Acharya, Gale & Yorulmazer, 2011; Huang & Ratnovski, 2011; Hahm et al., 2013; Georgescu, 2015) have challenged the suggestions of Calomiris (1999) and Goodfriend and King (1998), arguing that the over-reliance on this finance option has dire consequences for the banking system and financial stability as witnessed in the U.S. They contended that wholesale funds were susceptible to sudden withdrawals in the event of noisy public signals (Shin, 2009; Huang & Ratnovski, 2011; Hahm et al., 2013; Georgescu, 2015). Shin (2009) in particular cited the United Kingdom which experienced a sudden withdrawal of wholesale funds as a result of negative noise generated by the global financial crisis of 2007-2009.

Other studies, inter alia those of Adrian and Shin (2010), Damar et al. (2013) and Dewally and Shao (2013), demonstrated the link between wholesale funds, asset prices and leverage. Dewally and Shao (2013) in particular established that banks which used wholesale funds showed a higher degree of procyclical leverage than

users of retail deposit funds. They found that the relationship varied from one market to another and depended on a country's risk attitude.

Another interesting angle relates to the studies of Demirgüç-Kunt and Huizinga (2010) on 1,334 banks in 101 countries, Craig and Dinger (2013) on 589 US banks, Amidu (2013) on 978 banks in 55 countries, and Ritz and Walther (2015) on Eurozone commercial banks. These studies assessed the substitution risk from banking sector retail deposits to wholesale funds. These scholars concurred that there was a general increase in bank risk when the banking system substitutes retail deposits for a wholesale funding strategy across a sample of international banks.

Figure 5.1 depicts Hahm et al.'s (2013) banking sector balance sheet before and after a credit boom. As shown in the bottom panel of Figure 5.1, before a credit boom, the banking system operates as usual, mobilising and receiving traditional retail deposits and issuing credit to the households and firms. However, as shown in the top panel, when credit demand grows rapidly because of new borrowers, the pool of mobilised deposits cannot keep pace, and banks are forced to borrow from foreign creditors (non-core liabilities) to finance the gap. Shin and Shin (2011) supported this assertion by indicating that the amount of foreign currency liabilities held by the banking system indicates the levels of liquidity and the vulnerability of the system to capital outflows. It is clear that when domestic deposits do not grow in line with credit supply, the banking sector's balance sheet is transformed with non-core funding sources. Hahm et al. (2013, p. 4) concluded that "a higher incidence of noncore funding will be associated with above-trend growth in credit and compressed risk premiums". In summary, Figure 5.1 demonstrates that when retail deposits are relatively 'sticky' and do not necessarily grow in tandem with credit supply, the banking sector balance sheet will contain a large amount of non-core liabilities.

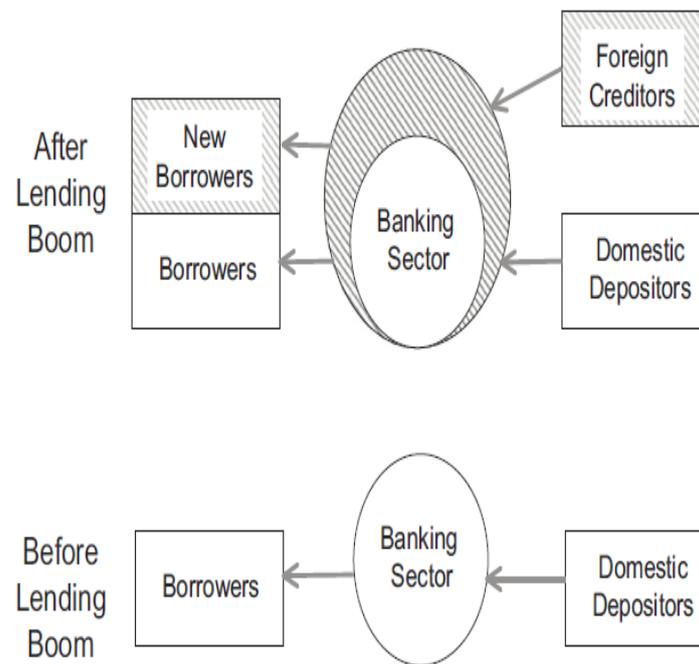


Figure 5.1: Credit booms financed by non-core liabilities

Source: Hahm et al. (2013)

5.3 BACKGROUND: CREDIT IN SOUTH AFRICA

During the 1990s, the Bank Act (Act No. 94 of 1990) was passed into law and the banking system immediately underwent a process of consolidation with a number of mergers and acquisitions registered⁵⁴. Post-independence South Africa was characterised by an influx of mainly small to medium banks that were most interested in servicing the low-income groups or the previously excluded section of the population. A number of these banks were funded by the interbank market and continued to exhibit elements of financial instability (Loate & Viegli, 2017).

⁵⁴ For example, one of the current top four biggest banks in South Africa, ABSA, was formed through the merger of Allied (Allied Building Society), Volkskas Co-operative and United Bank.

According to the South African Reserve Bank (2016), the banking landscape is characterised by five big banks⁵⁵ which control about 90.5 per cent of total banking assets in South Africa. These banking assets are mostly funded by deposits, current accounts and other forms of credit which constitute 86 per cent of all total banking liabilities (South African Reserve Bank, 2017). Table 5.1 shows the total number of banks registered or licenced in terms of the Bank Act, 1990 (Act No. 94 of 1990) in South Africa from 2007-2017.

Table 5.1: Number of banks in South Africa

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Number of banks	19	19	18	17	17	17	17	17	17	17	19
Foreign bank branches	14	14	13	13	12	14	14	14	15	15	15
Total	33	33	31	30	29	31	31	31	32	32	34

Source: South African Reserve Bank (2018)

Like all other banks around the world, the South African banks' balance sheets include liabilities and assets⁵⁶. The liabilities side of the balance sheets includes domestic deposits⁵⁷, foreign currency deposits, foreign currency funding to the domestic sector and foreign sector, debt securities, share capital and reserves and other liabilities to the public. The asset side includes banknotes and coins, gold coins, mortgage advances, credit cards, foreign currency, loans and advances, shares and other

⁵⁵ The top five banks in South Africa are ABSA Bank, Standard Bank, Nedbank, First National Bank and Investec.

⁵⁶ This includes credit cards, home loans, commercial mortgages, lease and instalment debtors, et cetera.

⁵⁷ Bank deposits include cash managed, cheque and transmission deposits, savings, short, medium, and long term deposits, and other deposits.

investments. According to the SARB (2017), the banking sector was mainly funded by deposits which constituted 86.4 per cent of banking sector liabilities in 2017, down from 87.6 per cent in 2016 while derivatives and other trading liabilities were 7.4 per cent and 4 per cent respectively. Importantly, bank wholesale funding remained the most dominant source of funding for banks and represented 44.1 per cent of total bank funds in 2017, up from 41 per cent in 2016. Bank deposits constituted 26.3 per cent of total bank funds in 2017, down from 26.6 per cent in 2016.

As discussed above, banks require substantial finance to fulfil their liquidity creation role which plays an important part in financial stability and the economy in general. Figure 5.2 shows the intermediation ratio in South Africa. Figure 5.2 shows that the level of intermediation has remained above 120 per cent since 1992. In other words, this shows that bank credit provision exceeds the level of funds mobilised by banks in the form of domestic deposits. The suggestion here is that the banking sector uses funding sources other than the domestic deposit market to fund growing demand for credit in the country. Literature shows that this is possible if the domestic financial market is integrated with other financial systems around the world (see, for example, Lane & McQuade, 2014; Magud et al., 2014; Fielding & Rewilak, 2015). The ratio also demonstrates the level of domestic credit growth in South Africa over the past 25 years.

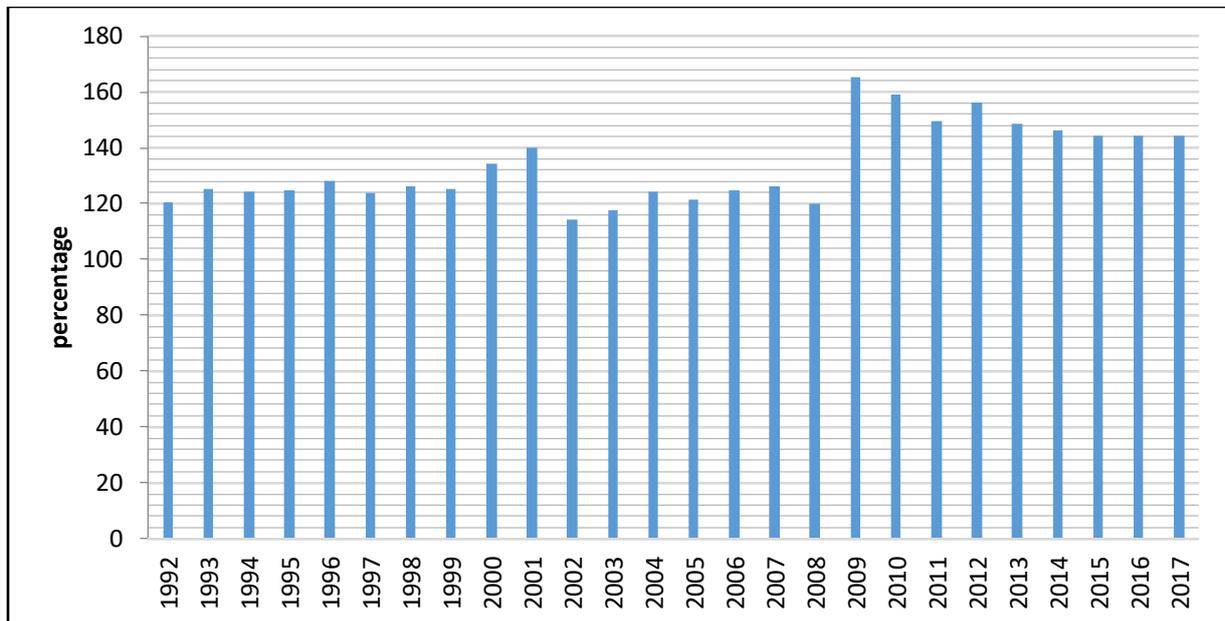


Figure 5.2: Financial intermediation ratio in South Africa (1992-2017)

Source: International Financial Statistics

In Figure 5.3, we compare the growth in retail deposits (core liabilities) and wholesale funds (non-core liabilities) in South Africa over the period 1992-2017. There is an interesting pattern between bank deposits and wholesale funds. As confirmed in the literature above, we notice the volatile nature of wholesale funds compared to the relatively stable bank deposits. For example, we notice a 19 per cent decline in wholesale funds in 1999, followed by a 28 per cent increase in 2000, a 54 per cent growth in 2001 followed by a 0.079 per cent decline in 2002, and significant growth from 2004 (25 per cent) to 2007 (51 per cent). This growth in wholesale funds is not surprising since it coincides with the period leading up to the financial crisis when the banking sector decided to tap into the wholesale funds market to finance the growing demand for credit in the economy. The bank deposits trend follows a smooth trajectory except for a slight dip during the 2007-2008 financial crisis, i.e. 0.4 per cent growth in 2009. The retail deposit trends in South Africa confirm that traditional bank deposits are relatively stable as suggested in the literature; however, they are susceptible to sudden withdrawals by depositors as witnessed between 2008 and 2009.

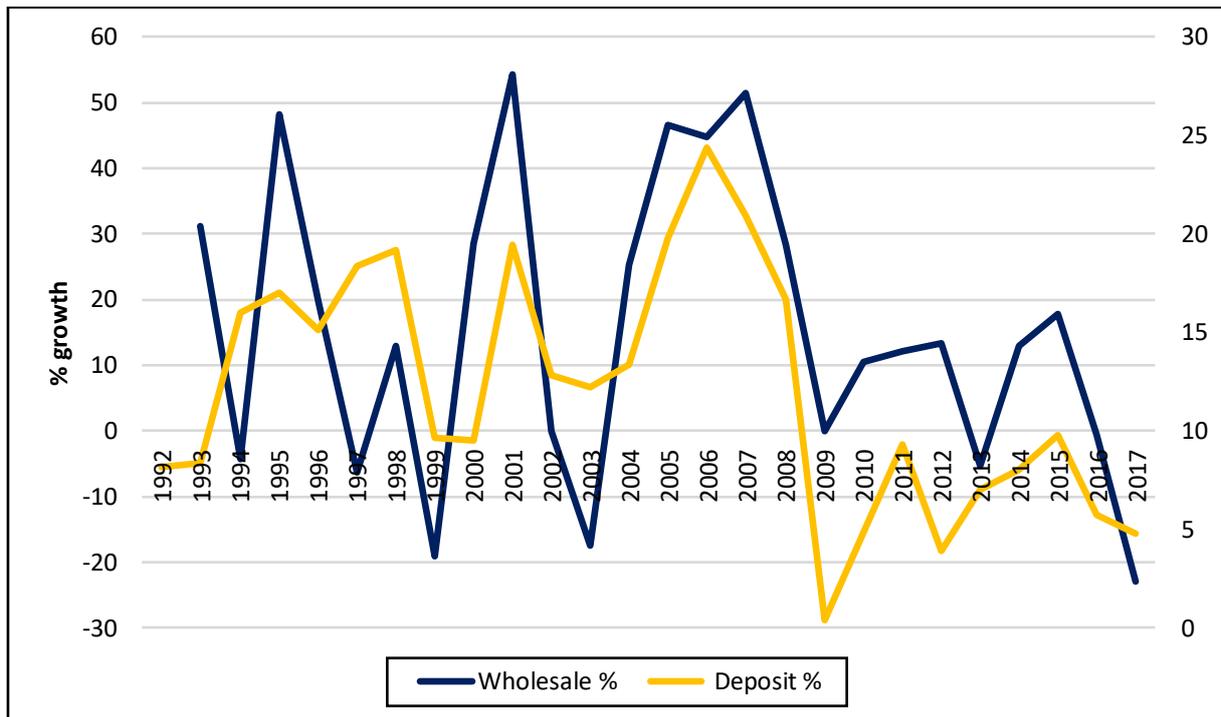


Figure 5.3: Bank deposits and wholesale funding in South Africa (1992-2017)

Source: South African Reserve Bank and author's calculations

In Figure 5.4, we establish the link between credit growth, wholesale (non-core) and deposit finance. Again, there is an interesting pattern in the relationship between credit growth and wholesale funds and bank deposits. Specifically, we notice that wholesale funds are highly volatile, as shown by the unpredictable swings; however, to a certain extent, the funding follows the trend of credit growth over the years. For example, when credit growth declines, wholesale funds also decline, and when credit growth increases, wholesale funds also increase. During the build-up phase of the financial crisis of 2007-09, we notice a sharp increase in both credit growth and wholesale funds and, similarly, a decline in credit growth at the height of the crisis is accompanied by a decline in wholesale funds. Importantly, our observations are in line with bank and financial crisis literature regarding the use of wholesale funds to bridge the shortfall in bank funding to support the growing demand for credit.

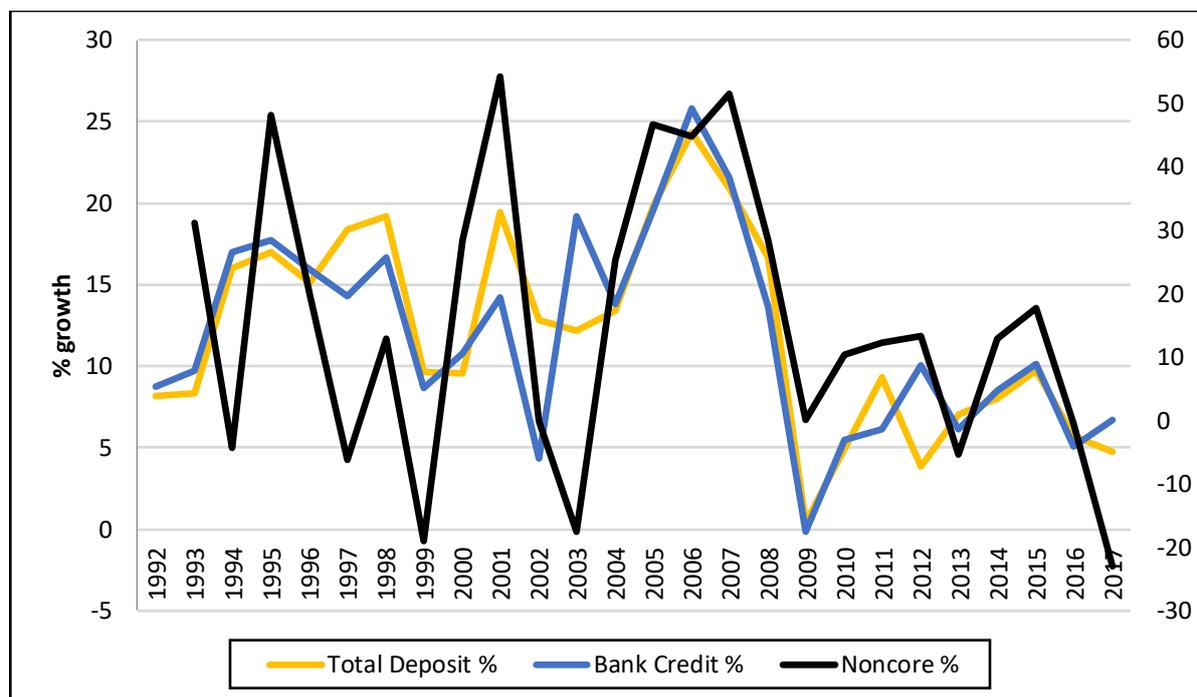


Figure 5.4: Growth in bank credit, non-core and core liabilities growth

Source: South African Reserve Bank and author's calculations

In Figure 5.5 we observe a substantial variation in the ratio of wholesale funds in relation to deposits in South Africa, ranging from the first peak of 16 per cent in 1996, 0.8 per cent in 1999, and 17.4 per cent in 2007, to a peak of 22.5 per cent in 2012. However, since 2016, the ratio has slightly declined from the 2012 peak, with 15.4 per cent recorded in 2017. The steep increase in wholesale funds indicates that South African banks were taking up more wholesale funds (foreign currency liabilities) to supplement their local deposits as explained in the literature. However, this wholesale-induced excess liquidity exposes domestic banks to vulnerabilities as shown by the level of volatility in the series. Overall, there is a slight deviation from the trend in the ratio, with the first between 1994 and 1997, the second between 2001 and 2006 and the third between 2007 and 2013. The first deviation coincided with the build-up phase of the 1997 Asian financial crisis. The second deviation occurred during the build-up phase of the financial crisis of 2007-09 where the domestic credit/GDP ratio accelerated to an average of 172 per cent between 2001 and 2006, reaching 192.5 per cent in 2006. The third deviation relates to the start and end of the financial crisis where domestic credit/GDP ratio peaked at 192.6 per cent in 2007.

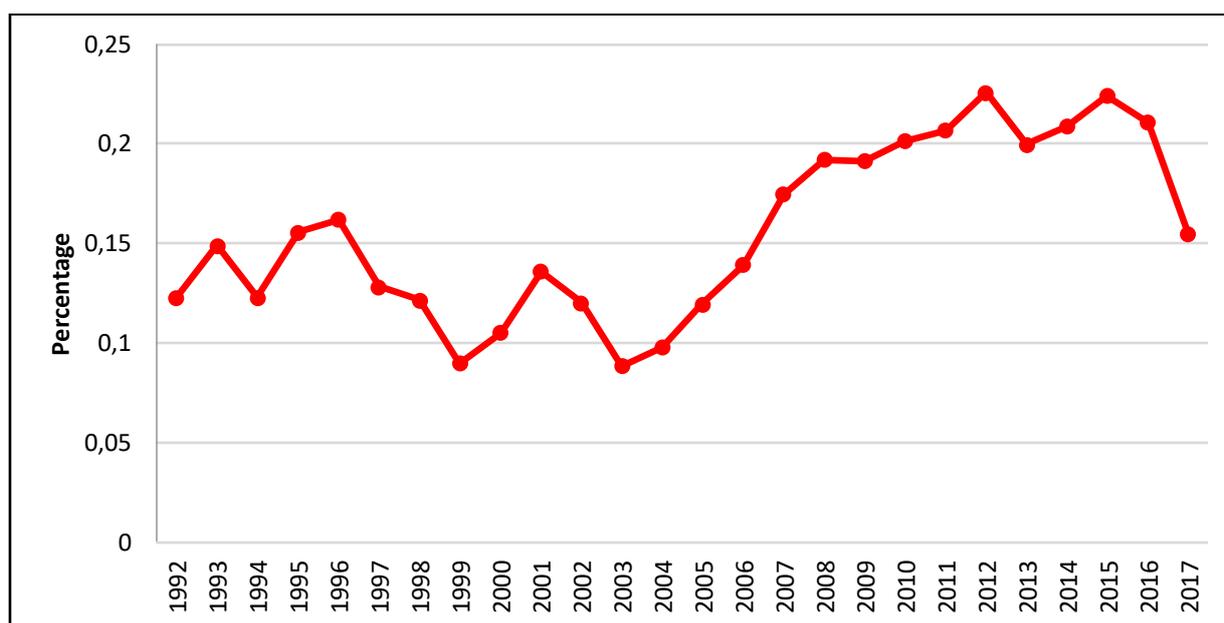


Figure 5.5: Ratio of wholesale funds to deposits in South Africa

Source: South African Reserve Bank and author's calculations

Figure 5.6 shows the ratio of bank credit to total assets in the South African banking system. This ratio measures the share of total bank loans outstanding as a percentage of banking sector assets and shows the portion of banking sector assets that are tied up in illiquid bank loan assets (Marozva, 2015). Figure 5.5 shows that the ratio was an average of 60.8 per cent between 1992 and 2017. This means that, in general, 60.8 per cent of banking sector assets are tied up in illiquid loan assets, confirming that the core business of banks is that of providing credit to the private sector. It is worth noting that in 1995 the ratio peaked at 71.3 per cent while the lowest ratio was recorded in 2003 at 52.5 per cent. The maximum and minimum values of this ratio suggest that in 1995 banks were slightly aggressive with 71.3 per cent of their assets as loans, while the number declined to 52.5 per cent in 2003. According to Berger and Bouwman (2009), the higher the ratio, the more susceptible the banking sector is to liquidity risk⁵⁸ while the lower the ratio, the lower the risk. Borio and Lowe (2004) indicate that this ratio provides useful information on the state of the financial cycle and the level of

⁵⁸ This scenario would suggest that the banking system might fail to honour its obligations because bank loans are illiquid.

vulnerability in the banking system. Table 5.2 shows bank liquidity, banking sector core and non-core finances, and credit growth in South Africa from 1992 to 2017.

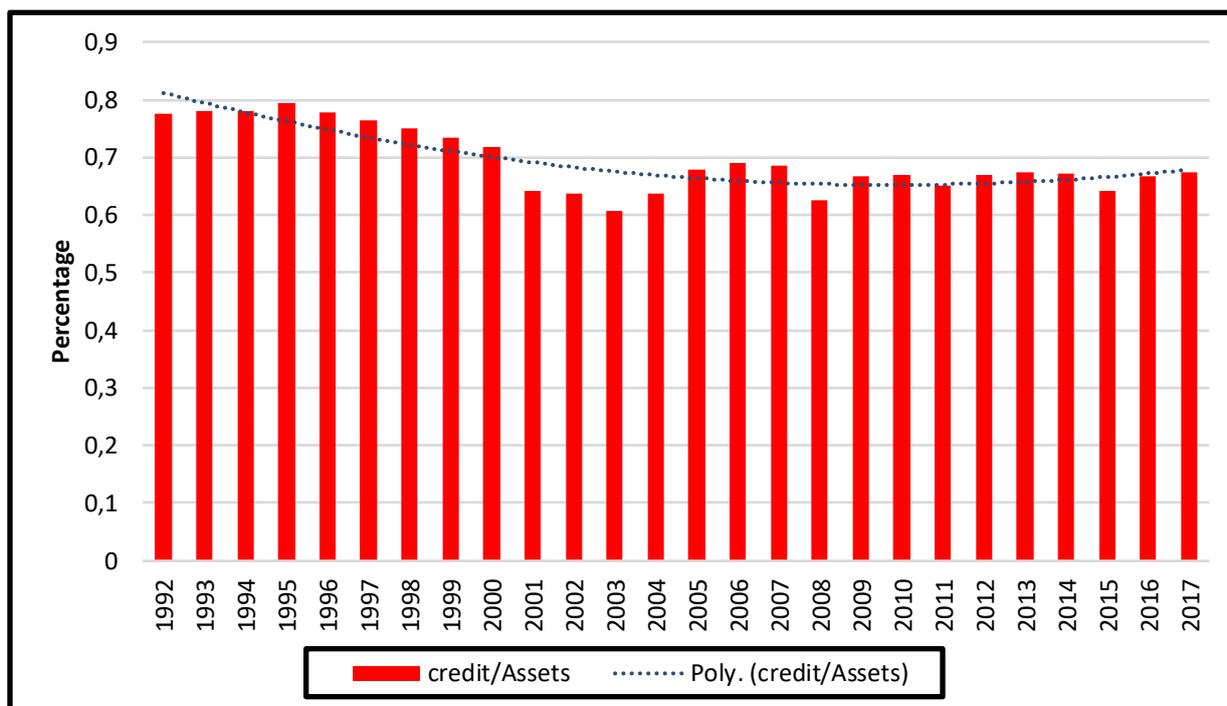


Figure 5.6: Bank credit to total assets ratio in South Africa (1992-2017)

Source: South African Reserve Bank and author's calculations

Table 5.2: Core and non-core deposits, credit growth and bank liquidity

	Credit/Assets	Core liabilities growth	Non-core liabilities growth	Credit growth
1992	0,65	8,19		11,58
1993	0,69	8,37	31,22	16,24
1994	0,69	16,02	-4,23	16,63
1995	0,71	17,00	48,18	19,51
1996	0,71	15,15	19,76	17,48
1997	0,70	18,37	-6,24	15,14
1998	0,69	19,20	12,90	17,04
1999	0,66	9,62	-18,99	6,70
2000	0,64	9,54	28,44	9,78
2001	0,57	19,46	54,19	13,15

2002	0,59	12,84	-0,08	8,17
2003	0,53	12,19	-17,45	12,58
2004	0,57	13,37	25,24	16,79
2005	0,62	19,79	46,65	21,83
2006	0,64	24,38	44,82	28,15
2007	0,64	20,93	51,44	22,44
2008	0,59	16,67	28,35	14,27
2009	0,62	0,42	0,01	-0,57
2010	0,62	4,89	10,42	4,24
2011	0,60	9,29	12,21	7,20
2012	0,62	3,89	13,36	9,82
2013	0,63	7,03	-5,26	6,20
2014	0,62	8,00	12,91	7,78
2015	0,58	9,77	17,79	9,01
2016	0,61	5,70	-0,60	5,57
2017	0,61	4,77	-23,02	2,51

Source: South African Reserve Bank and author's calculations

Given the above background, the South African Reserve Bank has demonstrated that it understands the importance of promoting the soundness of the banking system and financial stability and has made great strides in implementing the BCBS Basel III principles for 'sound liquidity risk management and supervision' as part of the liquidity framework. In 2011, SARB decided to include the BCBS Basel III proposals in its bank regulatory and supervisory instruments in order to ensure a resilient liquidity risk profile i.e. liquidity coverage ratio⁵⁹ (LCR) and NSF⁶⁰ ratio. The proposal was to implement the LCR and NSF proposals in a phased approach starting from 2015 to 2018, in line with the timelines of the BCBS (South Africa Reserve Bank, 2011). Since then, there has been a strong commitment from SARB to continuously review the implications of the liquidity framework on credit provision and economic growth and identify the

⁵⁹ The LCR is concerned with the maintenance of high-quality liquid assets that are easy to convert to cash within a 30-day period to meet liquidity requirements.

⁶⁰ According to the SARB (2011), the objective of the NSF ratio is to promote the medium- and long-term financing of the banking sector's assets and activities.

unintended consequences when they arise, especially for an emerging economy such as South Africa.

5.4 EMPIRICAL ANALYSIS AND ESTIMATION TECHNIQUES

5.4.1 Data sources and definition of variables

The study uses annual time series data obtained from the South African Reserve Bank database spanning the period 1992 to 2017.

5.4.1.1 Credit growth (DCG)

In Chapter 3 and 4, we discussed in detail the level of credit growth in South Africa. Bank loans in South Africa represent the biggest assets in the banking sector. Statistics show that in 2017, total banking assets amounted to R5 157 billion, up from R4 877 billion in 2016. This represented an annual growth of 5.7 per cent in 2017 up from a 1 per cent growth in 2016. According to the SARB (2017), the growth in banking sector assets was mainly due to an increase in loans and advances to the private sector, investment, short-term negotiations and derivatives. Loans are, therefore, a very important source of livelihood for South African banks. It is important to highlight that banking sector assets are mainly funded by deposits, current accounts and other creditors. Financial crisis literature suggests that excessive credit growth has been an informative signal of banking system fragility in countries that endured banking or financial crisis episodes (see, for example, Davis et al. (2016); Koong et al., 2017, among others). In particular, Davis et al. (2016) highlighted two important sources of risk and vulnerability: (i) rapid growth of credit to the private sector and sharp deviations in asset prices, and (ii) the decrease in market liquidity. Davis et al. (2016) suggested that rapid credit growth was linked to declining bank liquidity⁶¹. Based on the suggestion in the literature (Barajas, Chami & Yousefi, 2013; Davis et al., 2016) that the ratio of credit to GDP acts as an important informative signal of financial fragility in the economy, we have adopted the same credit measure.

⁶¹ Rapid credit growth depends on the amount of liquidity in the banking system (Pilbeam, 2005). During rapid credit growth, banks' holding of liquid assets is reduced.

5.4.1.2 Wholesale funds (WholeG)

Statistics from the South African Reserve Bank show that wholesale funding has remained the dominant source of funds for the banking sector. Interestingly, just in 2016, wholesale funding stood at 41% of total banking sector funds; however, in 2017, there was a 3.1 per cent increase to 41.1% (SARB, 2017). This is an interesting fact, considering that literature shows that during credit boom episodes, when domestic deposits cannot keep pace with the rate of asset growth, the banking sector seeks alternative finance in the form of wholesale funds mainly from institutional markets to finance their lending (Borio & Lowe, 2004).

Existing literature (see for example Feldman & Schmidt, 2001; Shin & Shin, 2011; Elekdag & Wu, 2011; Hahm et al., 2013) suggests that monetary aggregates often serve as informative signals on the state of the financial cycle in an economy by providing an insight into the magnitude and changing structure of the liabilities of the banking sector. In particular, Shin and Shin (2001) and Hahm et al. (2013) agree that large compositions of noncore liabilities of the banking sector, especially the banking sector's liabilities as a portion of the foreign sector, serve as an indicator of vulnerabilities in the banking sector which could lead to a crisis. Shin and Shin (2011) argue that banking sector liabilities, especially those linked to the foreign sector, constitute a major share of non-core bank liabilities in a number of emerging countries with open capital markets since the local wholesale market is not adequately developed to support rapid credit expansion (Shin & Shin, 2011). Borio and Lowe (2004) point out that the credit to money ratio provides information about the level of domestic credit growth in the economy. A higher ratio suggests that the composition of bank liabilities is an informative signal that domestic credit to the private sector is growing faster than core liabilities, compared to noncore liabilities, to support growing credit demand.

Hahm et al. (2013) suggested that credit booms were reflected by the composition and size of non-core banking sector liabilities. In this case, we have relied on Hahm et al. (2013) and Shin and Shin's (2011) studies in calculating non-core liabilities of the banking sector. We have adopted the formula as follows: banking sector's liabilities

to the foreign sector plus M3⁶² minus M2⁶³. We expect high levels of wholesale funding to have a positive influence on credit booms in South Africa as suggested by the literature.

5.4.1.3 Deposits (LDEPG)

Relying on previous studies (for example, Kim et al., 2003; Elekdag & Wu, 2011 and Huang & Ratnovski, 2011) that suggest that the level of deposits is linked to the performance of the economy, we have used the ratio of total banking sector deposits to nominal GDP (LDEPG) as a proxy for total deposits in South Africa. In the literature discussed in Section 5.2, various studies (see Kim, Kliger & Vale, 2003; Demirgüç-Kunt & Huizinga, 2010; Jung and Kim, 2015), opined that domestic deposits are a stable source of long-term finance for the banking sector. Bank deposits in South Africa mainly consist of current accounts, fixed and notice deposits and call deposits, the largest component being the fixed and notice deposits which in 2017 represented 28.5 per cent, while current account and call deposits represented 20.9 per cent and 19 per cent respectively (SARB, 2017). Bank deposits in South Africa have averaged 12 per cent growth between 1992 and 2017. We expect growth in the ratio of deposit to nominal GDP to have a positive impact on credit booms in South Africa.

5.4.2 Empirical model

To determine the relationship between rapid credit growth and banking sector sources of finance in South Africa, we apply Shin, Yu and Greenwood-Nimmo's (2014) robust nonlinear autoregressive-distributed lags (NARDL) cointegration methodology. The NARDL model is an asymmetric extension of the conventional linear autoregressive distributed lags ARDL (p, q) of Pesaran, Shin and Smith (2001). The NARDL approach

⁶² M3, sometimes referred to as 'near, near' money, is defined as M2 plus institutional market funds (money market funds); short-term repos and larger liquid assets. It includes less liquid assets that are more closely associated with finances of larger finance institutions and big businesses than with small corporations and private individuals.

⁶³ M2, sometimes referred to as 'near' money, is defined as M1 (physical currency and coins, demand deposits, travellers' cheques, et cetera) plus savings deposits, mutual funds, money market securities, other time deposits, et cetera.

is preferred in this study because it enables us to capture the nonlinear and asymmetric nature of the relationship we are investigating. This methodology is suitable because macroeconomic variables often possess asymmetric and nonlinear characteristics that can be brought to the fore by the NARDL approach. Importantly, the Shin et al. (2014) approach is preferred over other methods such as the smooth transition model or the vector error correction model (VECM) because of its superior qualities in dealing with small sample sizes (Sek, 2017). Unlike the other traditional cointegration techniques, the NARDL method can also be applied with a mixture of regressors' orders of integration, i.e. 1(0) or I(1), and it also takes care of the multicollinearity problem by selecting the appropriate lag order for all variables in the model (Shin et al., 2014; Sek, 2017).

The conventional linear ARDL (p, q) model developed by Pesaran et al. (2001) is expressed as follows:

$$\gamma_t = \sum_{i=1}^p \lambda_i \gamma_{t-i} + \sum_{i=0}^q \delta_i' \chi_{t-i} + \varepsilon_t \quad (5.1)$$

where γ_t = dependent variable; λ_i = vector of scalars; $\chi_t = k \times 1$ vector of exogenous variables; $\delta_i' = k \times 1$ coefficient vectors for χ_t variables and ε_t = disturbance term. We can rewrite Equation (5.1) in an error correction format as follows:

$$\Delta DCG_t = \alpha_0 + \sum_{i=1}^{k_1} \lambda_i \Delta DCG_{t-i} + \sum_{i=1}^{m_1} \alpha_1 \Delta DEPG_{t-i} + \sum_{i=1}^{n_1} \alpha_2 \Delta \text{WholeG}_{t-i} + \theta_1 DCG_{t-1} + \theta_2 DEPG_{t-1} + \theta_3 \text{WholeG}_{t-1} + \varepsilon_{1t} \quad (5.2)$$

where DCG = ratio of credit/GDP; DEPG = domestic deposits; WholeG = wholesale funds; k, m, n = optimal lag length for the dependent and independent variables and Δ = first difference operator. The ARDL (p, q) Equation (5.2) assumes the linearity and symmetry in the way rapid credit growth is related to deposit finance and wholesale funding. However, this assumption might be too restrictive, given the potential nonlinearity in macroeconomic variables, and in particular rapid credit growth, deposits and wholesale funding. Given this, we re-specify Equation (5.1) using the recently developed robust NARDL cointegration technique developed by Shin et al. (2014) which captures the non-linear and asymmetric cointegration between variables.

The NARDL cointegration approach is as follows:

$$\begin{aligned} \Delta DCG_t = & \alpha_0 + \sum_{i=1}^{k_1} \alpha_1 \Delta DCG_{t-i} + \sum_{i=1}^{m_1} \alpha_2 \Delta DEPG_{t-i} + \sum_{i=1}^{n_1} \alpha_3 \Delta WholeG_{t-i} + \rho DCG_{t-1} \\ & + \theta_1^+ DEPG_{t-1}^+ + \theta_2^- DEPG_{t-1}^- + \theta_3^+ WholeG_{t-1}^+ + \theta_4^- WholeG_{t-1}^- + \varepsilon_t \end{aligned} \quad (5.3)$$

where $\alpha_1, \alpha_2, \alpha_3$ = short-run coefficients; and $\theta_1, \theta_2, \theta_3, \theta_4$ = long-run parameters. Importantly, the difference between the short-run parameters $\alpha_1 - \alpha_3$ measures the immediate impact of the independent variables (DEPG and WholeG) on the dependent variable (DCG), while the long-run parameters $\theta_1, \theta_2, \theta_3, \theta_4$ measure the reaction speed and time towards equilibrium. We employ the Wald test to establish the long-term asymmetry ($\theta = \theta^+ = \theta^-$) and the short-term asymmetry ($\alpha = \alpha^+ = \alpha^-$) for the variables in the model. We employed the bounds test procedure based on the joint F-statistic (Wald test). Relying on Burnham and Anderson (2004), we used the Akaike Information Criterion (AIC) to determine the lag length of variables in Equation 5.3. Burnham and Anderson (2004) opined that the AIC was superior to other information criteria, i.e. the Schwarz Bayesian Criteria.

The regressors can be decomposed into their positive (Equation 5.4) and negative (Equation 5.5) components X_t^+ and X_t^- which are the partial sums of positive and negative movements in X_t as follows:

$$X_t^+ = \sum_{j=1}^t \Delta X_j^+ = \sum_{j=1}^t \max(\Delta x_j, 0) \quad (5.4)$$

$$X_t^- = \sum_{j=1}^t \Delta X_j^- = \sum_{j=1}^t \min(\Delta x_j, 0) \quad (5.5)$$

where X represents DCG_t and $WholeG_t$. To establish the presence of an asymmetric long-term relationship, we employ the Shin et al. (2014) bounds test which is a joint test for all lagged regressors. Banerjee, Dolado and Mestre (1998) and Pesaran et al. (2001) each present critical values, i.e. t-statistics and the F-statistic, respectively. The null hypothesis of the Banerjee et al. (1998) t-statistic test is $H_0: \theta = 0$ against the alternative hypothesis $H_1: \theta < 0$, while the null hypothesis of the Pesaran et al. (2001) F-statistic tests is $H_0: \theta^+ = \theta^- = \theta = 0$. The rejection of the null hypothesis in both the

t-statistic and F-statistic tests indicates the existence of a long-run relationship among the variables.

5.4.3 Empirical analysis

5.4.3.1 Stationarity tests

In theory, the NARDL model of Shin et al. (2014) requires that variables should be integrated order zero ($I(0)$) or integrated order one ($I(1)$) to establish cointegration in variables. In other words, stationarity tests are only meant to verify that variables are not $I(2)$. To verify this, we applied three traditional unit root tests: Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Kwiatkowski, Philips and Shin (KPSS). Table 5.3 presents the unit root tests results of ADF, PP and KPSS and, in general, the results show that there are no $I(2)$ variables.

Table 5.3: Standard unit root tests

Variable	Model	ADF			PP		KPSS	
		Lag	$\tau_\tau, \tau_\mu, \tau$	Φ_3, Φ_1	BW	$\tau_\tau, \tau_\mu, \tau$	BW	τ_τ, τ_μ
DCG	Intercept	0	-2.144	4.599**	4	-2.223	3	0.651*
	Intercept and Trend	0	-2.545	3.834**	0	-2.545	3	0.185*
	None	0	0.735		7	1.242		
DDCG	Intercept	0	-6.816	46.460***	6	-7.547***	8	0.317***
	Intercept and Trend	0	-7.014***	24.615***	15	-14.953***	24	0.500
	None	0	-6.609***		3	-6.870***		
DEPG	Intercept	0	-2.337	5.463**	2	-2.354	2	0.361**
	Intercept and Trend	0	-2.995	4.826**	4	-2.849	2	0.122**
	None	0	1.066		6	-0.844		
DDEPG	Intercept	0	-5.031***	25.312***	9	-6.292***	11	0.309***
	Intercept and Trend	0	-5.040***	12.705***	9	-7.714***	15	0.281
	None	1	-5.140***		8	-6.236***		
WholeG	Intercept	5	0.124	3.834**	3	-2.129	2	0.632*
	Intercept and Trend	1	-4.662***	7.382***	5	-3.423**	4	0.115***
	none	5	-1.964**		12	-1.097		
DWholeG	Intercept	4	-6.059***	12.805***	16	-8.211***	19	0.412**
	Intercept and Trend	4	-5.946***	10.349***	15	-8.212***	18	0.387
	None	4	-5.188***		13	-6.267***		

Notes: Superscripts ***, **, * denote 1%, 5% and 10% level of significance respectively.

The critical values for ADF are as follows: with intercept - 3.737 (1%), -2.991 (5%) and -2.635 (10%); Intercept and trend -4.394 (1%), -3.612 (5%) and -3.243 (10%); with no intercept and no trend -2.664 (1%), -1.955 (5%) and -1.608 (10%).

PP critical values are: with intercept, -3.737 (1%), -2.991 (5%) and -2.635 (10%); with intercept and trend, -4.394 (1%), -3.612(5%) and -3.243 (10%); with no intercept and no trend -2.664 (1%), -1.955 (5%) and -1.608 (10%).

Critical values for KPSS tests: with intercept, 0.739 (1%), 0.463 (5%) and 0.347 (10%); with intercept and trend, 0.216 (1%), 0.146 (5%) and 0.119 (10%).

ADF critical values for Φ_3 , Φ_1 are obtained from the Dickey and Fuller (1981) tables for the empirical distribution Φ_1 and Φ_3 .

Source: Author's calculations from Eviews v10.

Our study included the ZA (Zivot and Andrews, 1992) unit root test which takes into account the presence of endogenous structural breaks. The use of the ZA test is motivated by the fact that the traditional ADF, PP and KPSS unit root tests tend to be biased towards the rejection of the null hypothesis in the presence of a structural break in the series (Kim & Perron, 2009).

Table 5.4 presents the ZA unit root empirical results and the findings confirm Table 5.3 that there are no 1(2) variables. However, the ZA tests confirm the presence of structural breaks in each series. The structural breaks differ from one series to another; however, most of the breaks occurred around 2000, 2008 and 2015. The majority of these breaks coincided with the dot com bubble burst that caused the 2000 stock market crash, the global financial crisis of 2007-09 and the recovery phase after the financial crisis with the Johannesburg Stock Exchange (JSE) ending 2015 up by nearly 2 per cent, reflecting the potential depth of liquidity in the market. Importantly, the ZA test identified breaks that are consistent with banking and financial crisis literature around the world.

Table 5.4: Zivot-Andrews unit root tests accounting for structural breaks

Variables	Model	Lag	t-stat	Breakpoint
DCG	Intercept	0	-4.192	2000
	Intercept & Trend	0	-4.229	2000
DDCG	Intercept	0	-8.434***	2008
	Intercept & Trend	0	-8.221***	2008
DEPG	Intercept	1	-5.816***	2008
	Intercept & Trend	1	-6.103***	2008
DDEPG	Intercept	1	-7.407***	2009
	Intercept & Trend	5	-8.065***	2008
WHOLEG	Intercept	1	-4.799**	2007
	Intercept & Trend	3	-5.309**	1999
DWHOLEG	Intercept	4	-7.149***	2015
	Intercept & Trend	4	-7.688***	2015

Notes: Superscripts ***, **, * denote significance at 1%, 5% and 10% respectively.

The ZA critical values with intercept only -4.949 (1%), -4.443 (5%) and -4.193 (10%) and critical values with intercept and trend are -5.347 (1%), -4.859 (5%) and -4.607 (10%). % lags were selected for the tests.

5.4.3.2 NARDL bounds tests: cointegration results

Having fulfilled the precondition of the Shin et al. (2014) NARDL that there is no variable integrated of order 2 (I(2)), we proceeded with the cointegration test. The short- and long-run cointegration results are presented in Table 5.5.

First of all, we notice that wholesale funds and domestic deposits explain 95.5 per cent ($R^2 = 0.955$) of rapid domestic credit growth in South Africa. In other words, wholesale funds and domestic deposits explain 95.5 per cent of rapid credit growth while the error correction term in the model explains the rest of the variation in rapid credit growth (4.5 per cent). The results show that the model does not suffer from autocorrelation as reflected by the Durbin Watson (DW) test statistic (2.023). The model also does not suffer from serial autocorrelation as confirmed by (χ^2_{SC}) in Table 5.3. The Ramsey Reset test (χ^2_{FF}) confirms that our model is properly specified; in other words, the functional form of our model is properly designed. We also note that our model does not suffer from the heteroscedasticity (χ^2_{HET}) problem. The above tests indicate that our empirical results are reliable and consistent.

Importantly, the cointegration results of the NARDL bounds F-test confirm the presence of a long-run relationship among domestic credit growth, wholesale funds and domestic retail deposits for the period 1992-2017. This is confirmed by the calculated F-statistic (9.505) which is greater than the Pesaran et al. (2001) 1 per cent critical values. It should be noted that the Wald tests for both the long and short run (W_{LR} and W_{SR}) indicate the significance of asymmetry (see Table 5.5). These Wald test findings reveal the existence of a short-run and long-run nonlinear and asymmetric relationship between rapid credit growth, wholesale funds and deposit finance. These results also suggest that excluding the intrinsic nonlinearities among these variables may produce wrong inferences. The NARDL F-statistic (9.5052) confirms that rapid

credit growth, wholesale funds and retail deposit finance have a long-run asymmetric relationship in the South African economy.

Table 5.5: Cointegration results

Variable	Coefficient	t-Statistic	Prob.
Long Run			
Constant	1682.602***	5.884	0.002
LDCG _{t-1}	-35.470***	-5.786	0.002
WholeG _{t-1} ⁺	21.342***	4.332	0.007
WholeG _{t-1} ⁻	22.446	0.777	0.472
DEPG _{t-1} ⁺	2.192***	3.704	0.013
DEPG _{t-1} ⁻	-0.170	-0.127	0.903
Short Run			
ΔWholeG ⁻	-10.124*	-1.943	0.109
ΔLDCG _{t-2}	-15.034***	-4.065	0.009
ΔWholeG _{t-2} ⁺	-13.786***	-4.084	0.009
ΔWholeG _{t-1} ⁺	-9.720**	-2.647	0.045
ΔDEPG _{t-1} ⁺	5.311***	4.019	0.010
ΔWholeG ⁺	11.600***	3.479	0.017
ΔDEPG _{t-1} ⁻	-2.248***	-3.741	0.013
ΔDEPG ⁺	5.920***	3.079	0.027
ΔDEPG _{t-2} ⁻	-0.793	-1.440	0.209
ΔWholeG _{t-2} ⁻	4.348**	2.035	0.097
ΔDEPG _{t-2} ⁺	3.940***	3.023	0.029
R ²	0.955		
Adjusted R2	0.811		
Durbin Watson	2.023		
χ_{SC}^2	0.087	[0.918]	
χ_{HET}^2	9.177	[0.905]	
χ_{FF}^2	1.074	[0.305]	
Pesaran et al. (2001) F-statistic	9.505***		
$W_{LR,WholeG}$	22.742[0.00]***	$W_{SR,WholeG}$	6.140[0.036]***
$W_{LR,DEPG}$	4.012[0.101]*	$W_{SR,DEPG}$	6.140[0.036]**

Notes: Superscripts ***, **, * denote significance at 1%, 5% and 10% respectively while “+”, “-” represent positive and negative variations.

WholeG⁺ and WholeG⁻ are long-run estimates associated with positive and negative variables.

χ_{SC}^2 is the Breusch-Godfrey serial correlation LM test of serial correlation, χ_{HET}^2 denotes the heteroscedasticity tests and χ_{FF}^2 denotes the functional form test. W_{LR} and W_{SR} denote the long- and short-run asymmetries (Wald test) for the two independent variables respectively.

5.4.3.2.1 Long run

In the long run, a positive shock to wholesale funds has a positive impact on rapid credit growth in South Africa (a positive and significant coefficient of 21.342 at 1 per cent). This suggests that any positive shock in wholesale funding boosts credit booms in South Africa. During the build-up phase of the financial crisis of 2007-09, South Africa recorded a large influx of portfolio funds from developed markets around the world. Some of these portfolio funds found themselves in the South Africa banking sector which may have been used to finance excess demand for credit. Global quantitative easing after the financial crisis also saw an increase in net capital inflows into the country's bond market increasing from R7 billion in 2007 to R92 billion in 2012 (National Treasury, 2015).

Lower or sometimes negative interest rate regimes in some developed markets have attracted foreign currency deposits into the South African banking sector because of the favourable returns in the South African environment. For example, according to the South African Reserve Bank data, foreign currency liabilities of the banking sector accelerated greatly in 2005, 2006, 2007 and 2008 recording 87 per cent, 109 per cent, 142 per cent and 20 per cent respectively. However, after the financial crisis, foreign currency liabilities grew at -11 per cent in 2009, -4 per cent in 2010 and 7 per cent in 2011. Internally, there was an increase in the percentage of banking sector liabilities from institutional market funds and other large corporations during the build-up phase of the financial crisis, for example, 44 per cent in 2005, 39 per cent in 2006 and 41 per cent in 2007.

As discussed in the literature above, overreliance on wholesale funds can be detrimental to banks in the event of investors reversing their investment in the South African market to 'safe haven' destinations. There is also a possibility of central banks around the world abandoning quantitative easing in favour of normalising monetary policy. This might create a vacuum in emerging market countries such as South Africa. It is our finding that the composition and size of wholesale funds have created a significant source of finance for the banking sector and stimulated credit expansion in the economy. This finding is in line with bank literature around the world (Elekdag & Wu, 2011; Shin & Shin, 2011; Vazquez & Federico, 2015; De Haan, Van den End & Vermeulen, 2017) which suggests that the banking sector often relies on wholesale funds to finance the expansion of their balance sheets.

A negative shock on wholesale funding also has a positive impact on rapid credit growth, however insignificant. It is possible that a negative shock on wholesale funding compels the banking sector to relook at their strategies of mobilising domestic deposits. We recall that the financial crisis of 2007-09 exposed the level of fragility of wholesale funds markets. At their peak, offshore funding markets became very illiquid with funding costs increasing significantly. During this period, banks suddenly increased their appetite for domestic funding. Pressure is exacted on banks to build resilient funding profiles by prioritising stable finance sources such as deposit funding.

In the long run, a positive shock to retail deposits has a positive and significant (1 per cent level of significance) impact on rapid credit growth in South Africa. Although the negative shock on retail deposits has a negative impact, it is insignificant. This finding shows that in the long run, a positive shock to retail deposits stimulates credit expansion through a more stable source of finance than wholesale funds. The negative shock to retail deposits would actually have a negative impact on the growth of credit to the private sector. Statistics show that deposits significantly contribute to the South African banking assets, hence it is expected that a negative shock on the growth of deposits would have a knock-on effect on credit growth and ultimately on the banking assets. Drawing on this finding, we urge the local banking sector to devise strategies of growing retail deposits in line with the level of credit growth. Strategies

should include the possibility of increasing interest rates offered to depositors to attract a large pool of deposits. Indeed, the financial crisis exposed the level of fragility of wholesale funds markets. At their peak, wholesale funding markets became highly illiquid with funding costs increasing significantly. During this period, banking institutions suddenly increased their appetite for domestic funding. Regulatory authorities should encourage the banking sector to build resilient funding profiles by prioritising stable funding sources such as retail deposit finance. From a policy point of view, the government should introduce policy measures that incentivise households and firms to save, while at the same time boosting economic performance which ultimately increases households' level of wealth.

5.4.3.2.2 Short run

A negative shock in wholesale funds is negatively related to rapid credit growth in the very short term (lag 0) (negative and significant coefficient of -10.124), which suggests that negative developments in the wholesale funds market reduce rapid credit growth in the short run. This understanding is important for the banking sector in guarding against overdependence on wholesale funds to bridge their finance gaps. The banking sector will need to attract or source other short-term funds to avoid liquidity challenges.

Importantly, in the very short term (lag 0), we find a positive shock in wholesale funds positively impacts rapid credit growth (positive and significant coefficient of 11.600). This finding suggests that positive developments in the wholesale funds market quickly find their way into the banking system in the form of loans to the private sector. This is not surprising, given that developments in the financial markets have a bearing on the performance of the local market. This finding reinforces the idea that wholesale funds are heavily influenced by international developments, which are in most cases beyond the control of local banks.

However, we find that positive shocks in wholesale funds at lags 1 and 2 (-9.720 and -3.786) respectively have a negative impact on rapid credit growth. These findings

suggest that previous years' positive shocks yield a negative impact on the ability of banks to increase borrowing in the following period.

A positive shock in retail deposits has a positive impact on rapid credit growth in the very short term (positive and significant coefficient of 5.920). In addition, positive shocks in retail deposits at lags 1 and 2 (5.311 and 3.940 respectively) have a positive impact on rapid credit growth. This is true, given the fact that retail deposits are a major source of finance in South Africa. Positive developments in retail deposits present an opportunity for banks to build up more stable funds to lend out to borrowers.

However, negative shocks in retail deposits in previous periods (at lag 1, coefficient of 2.248 and, at lag 2, coefficient of -0.793) have a negative impact on rapid credit growth. This means that banks' ability to increase credit allocation in the following period is negatively impacted by the previous period's retail deposits. As discussed by Shin and Shin (2011), and Lozano and Guarín (2014), bank deposits are the most dominant source of funding for banks, and, as such, any negative short-term developments will impact negatively on the ability of banks to increase credit provisions.

5.5 CONCLUSIONS AND POLICY RECOMMENDATIONS

In Chapter Five, we empirically explored the relationship between credit booms, banking sector finance sources and their implications for financial stability in South Africa using time series data from 1992 to 2017. We applied the robust nonlinear ARDL model of Shin et al. (2014) which enabled us to test the symmetric or asymmetric relationship of variables in both the short and long run. Statistical evidence showed that the ratio of credit to domestic deposits (financial intermediation ratio) in South Africa is currently above 100 per cent, an indication that South African banks indeed use other funding sources to fund excess credit demand in South Africa.

Econometric results strongly supported the presence of an asymmetric cointegration relationship between credit boom and banking sector funding sources. The results also

showed that positive shocks on wholesale funds had a positive impact on the ability of the banking sector to satisfy growing credit demand. In the short run, negative shocks in wholesale funding yield a negative impact on credit booms. Our long- and short-run results on wholesale funding are consistent with international literature on bank funding sources (Shin, 2009; Huang & Ratnovski, 2011; Hahm et al., 2013; Georgescu, 2015) that support the notion that overreliance on wholesale funds poses a serious risk to financial stability as experienced during the financial crisis. It is also worth noting that the Basel Committee on Banking Supervision is of the view that banks should be penalised by regulatory authorities for failure to maintain a stable funding ratio that minimises the exposure to liquidity risk.

The increasing use of wholesale funds is evident in South Africa and suggests that the banking sector is increasingly becoming dependent on these less stable funds to sustain rising domestic credit levels. From a policy point of view, our study supports the Basel Committee on Banking Supervision's key 'Basel III regulatory framework' reforms to facilitate more resilient banking systems around the world by proposing that regulatory authorities penalise banks that are in breach of the net stable funding ratio.

Such a move is likely to reduce the level of systemic contagion in both the banking sector and the entire financial system. This is important in managing the role played by wholesale funds in propagating systemic risk in financial markets. We argue for the South African Reserve Bank to fully monitor and identify all banks that are in breach of their directive issued in line with section 6(6) of the Banks Act, 1990, which came into effect on 1 January 2018.

The interaction between domestic deposit and credit booms also presents interesting asymmetric findings. In the long run, positive shocks in domestic deposits have a positive and significant impact on credit booms in South Africa. However, negative shocks on domestic deposits yield a negative but insignificant impact. The finding on the effect of positive shocks on credit booms is well supported in the literature (Kim et al., 2003; Demirgüç-Kunt, 2010; Jung & Kim, 2015). It should be noted that the transformation of the banking sector and the financial inclusion drive after

independence in 1994 attracted a greater proportion of the previously excluded and unbanked population into mainstream banking. All these programmes coupled with strong economic growth increased the pool of deposits in the economy.

In the short run, indeed, positive shocks on domestic deposits have a positive impact on credit booms. This short-run finding is not surprising since domestic deposits anchor credit growth in South Africa and the rest of the world. However, negative shocks in domestic deposits in previous years have had a negative impact on credit booms. As discussed in the literature, deposits are highly susceptible to sudden withdrawals as witnessed between 2007 and 2009 (see Figure 5.6). Indeed, such negative shocks affect the ability of banks to provide credit to the private sector.

On the policy front, while most studies use the credit-to-GDP ratio as an informative signal on banking and financial fragility in the economy, we propose the use of non-core banking sector liabilities as a complementary measure to estimate the stage of the financial cycle and the potential build-up of financial risk in the South African economy. We suggest that the regulatory authorities in South Africa should consider pressurising banks to build more resilient funding profiles by lessening their dependence on unstable funding sources to improve their net stable funding ratio. Therefore, we propose the speedy and full implementation of BCBS's proposals for strict penalties for banks in breach of the net stable funding ratio. Furthermore, Government and regulatory authorities must encourage a culture of savings at a domestic level to boost banks' efforts in mobilising deposits in the economy. Lastly, South African banks should develop promotional strategies in deposit mobilisation through the use of information technology, market segmentation, pricing strategies, et cetera, in order to maximise their pool of stable funds.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1 INTRODUCTION

This study has examined the relationship between credit booms and bank fragility in South Africa. Banking literature shows that credit booms are generally associated with banking crises around the world. The principal setting of the study was influenced mainly by the following key motivations: (1) rapid credit growth over the past few years compared to other regions, with credit ratio peaking at 192 per cent in 2007 and remaining above 178% from 2008; (2) the costs associated with financial system failures would have dire consequences in South Africa given the huge fiscal deficit and the three problems (i.e. unemployment, poverty and inequality) that the government is busy addressing; (3) high levels of indebtedness over the past 10-12 years; (4) the banking sector in South Africa accounts for 20 per cent of GDP and is a major employer in the country, and its failure will have dire consequences for the economy and therefore it must be closely guarded. Theoretical and empirical literature reviewed in this study shows that the banking sector is one of the most fragile in the economy and its fragility may lead to a fully-fledged financial crisis, with the result that it must be closely monitored to ensure its stability. The majority of the data used in this study covers the period 1990 to 2017 and was obtained from Statistics South Africa and the South African Reserve Bank.

To understand the behaviour of credit in South Africa, and the extent of the problem, we analysed domestic credit trends in the country and also compared it with other regions and countries. In particular, we analysed credit growth in relation to economic growth, types of loans, the financial intermediation ratio, composition of credit by economic sector, debt-to-income ratio, total asset structure of the banking sector, bank deposits, and the business cycle phases.

First, using the Pesaran et al. (2001) autoregressive distributed lag (ARDL) econometric model, we modelled the drivers of credit booms in South Africa using data from 1970 to 2016. This was important in order to help policymakers and regulatory authorities to predict, reduce or even avoid these credit booms that are not associated with investment or consumption booms, especially given the potential dangers and costs associated with booms and busts.

Second, we proceeded to test whether these credit booms signal future vulnerabilities in the South African banking sector (growth-risk nexus in bank lending) using the ARDL and Shin et al. (2014) nonlinear ARDL (NARDL) methodology. Understanding this nexus was important since loans represented the biggest asset in the South African banking sector and the fact that loans are the biggest and the most obvious source of credit risk faced by banks around the world; South Africa with its rapid credit growth is no exception. Therefore, the empirical analysis of credit risk in relation to credit booms is important since it reveals alarm signals when the banking sector is vulnerable to shocks.

Third, using the ARDL methodology we investigated the relationship between credit booms, banking sector finance sources and their implications for financial stability in South Africa. In this case, we found burgeoning literature (Adrian & Shin, 2010; Elekdag & Wu, 2011; Huang & Ratnosvski, 2011; Jung & Kim, 2015) that suggested that banking sector sources of finance were significantly associated with the credit cycle, liquidity shocks and financial stability. This study was important for South Africa given that the financial intermediation ratio has remained above the 100 per cent mark: an indication that credit provision exceeds the levels of funds mobilised through bank deposits. The use of wholesale funds has become very popular in South Africa over the years given the rapid growth in credit. Therefore, identifying the sensitivity of the banking sector to funding sources is important for South Africa.

6.2 SUMMARY OF FINDINGS

First, statistical evidence reveals a strong persistent pattern of rapid credit growth in South Africa, specifically around the early 1990s to mid-2000s, accompanied by an increase in private sector appetite for credit. Furthermore, we found evidence of procyclical credit provision in South Africa. This was confirmed by other studies on South Africa for example, Akinboade and Makina, 2009, Fourie et al. (2011) and Akinsola and Ikhida (2018). The presence of credit booms in South Africa was identified and confirmed by previous panel studies of Mendoza and Terrones (2008, 2012), Gozgor (2014) and Arena et al. (2015) during the past two decades. The study also established that episodes of credit booms were linked with increased levels of debt in South Africa, especially at the household level.

Second, empirical evidence from the econometric models revealed that factors such as foreign capital inflows, stock market prices, mortgage loans, real interest rates, and GDP per capita were the main triggers of credit booms in South Africa. As confirmed by country studies (Aisen & Franken, 2010; Bakker & Gulde, 2010; Mendoza & Terrones, 2012), foreign capital inflows have been for some time the biggest driver of credit growth in countries that have experienced credit booms.

Third, the study found evidence of backward-looking credit risk management models in South Africa, in spite of the Basel Committee on Banking Supervision (Basel III accord) recommendations that banks should move towards countercyclical credit risk models. Our findings on credit risk management in South Africa are in line with previous studies of Ikhida (2003), Akinboade and Makina (2009), Havrylchyk (2010) and Ozili and Outa (2017) on South Africa. The study also established that credit booms and business cycles were important drivers of credit risk in South Africa. Importantly, the study established that rapid domestic credit growth yielded higher credit risk for banks and posed serious threats to financial stability, especially in the downswing.

Fourth, the study established that, like all other banks around the world, the South Africa banking sector also relied upon and consistently used wholesale funds to supplement domestic deposits in order to satisfy growing credit demand. The econometric model, in this case, revealed a strong presence of an asymmetric relationship between credit booms and banking sector funding sources. Specifically, the study revealed that, in the long run, positive developments in the wholesale funds market have a positive effect on the ability of the banking sector to satisfy credit demand. The study established that, in the long run, positive developments in the domestic deposit market have positive effects on credit booms, while in the short-run positive developments also have a positive effect on credit booms. The study also found that negative shocks in domestic deposits in previous years have had negative effects on credit booms.

Based on the above, two sets of conclusions regarding credit booms pose a dilemma to policymakers when designing financial development strategies, especially for emerging and developing countries. Credit booms and financial stability both have an impact on overall macroeconomic outcomes. In this study, literature demonstrated that credit booms can promote economic growth but at the same time can trigger financial crisis. Another dilemma for policymakers is the task of isolating good booms from bad booms. Unhealthy excessive levels of credit are difficult to differentiate from healthy ones. Healthy credit booms are often underpinned by strong investment and consumption growth and contribute significantly to financial and economic development as confirmed by business cycle theories reviewed in this study.

6.3 POLICY RECOMMENDATIONS

The findings contained in this study point to important policy implications for South Africa. First, the identification of the triggers of credit booms is important for policymakers in order to gauge and formulate appropriate strategies to reduce the risk of a crisis or, at least, limit its consequences in the economy. We argue policymakers to increase their surveillance of the banking sector, given the social and economic costs associated with bank failures. The Reserve Bank should develop early warning

indicators to distinguish between good and good booms. In conclusion, we argue that regulatory authorities should not take a 'wait-and-see' approach in dealing with the credit booms, given the dilemma these present. South Africa needs to adopt a proactive macroprudential regulation to build buffers for use during credit busts.

Second, while overcoming credit booms is important for minimising systemic risk, regulatory authorities and policymakers should be mindful of the role played by bank credit in a country such as South Africa still suffering from high levels of unemployment, poverty and inequality. The banking sector should adopt sophisticated methods of credit risk measurement through quantitative credit models which make it possible to quantify credit risk accurately. South African authorities should move with speed in the implementation of BCBS countercyclical capital buffer recommendations in full. While Government and regulatory bodies should discourage credit booms not related to consumption and investment booms in South Africa, we propose that forums should be established through relevant institutions to preach and encourage a culture of building up savings compared to overreliance on credit to fund day-to-day consumption. Lastly, we recommend strict penalties for credit providers found guilty of reckless lending in South Africa.

Concerning banking sector sources of finance, while most studies use the credit-to-GDP ratio as an informative signal on banking and financial fragility in the economy, we propose the use of non-core banking sector liabilities as a complementary measure to estimate the stage of the financial cycle and the potential build-up of financial risk in the South African economy. We suggest that the regulatory authorities in South Africa should consider pressurising banks to build more resilient funding profiles by lessening their dependence on unstable funding sources to improve their net stable funding ratio. Therefore, we propose the speedy and full implementation of BCBS's proposals for strict penalties for banks in breach of the net stable funding ratio. Furthermore, Government and regulatory authorities must encourage a culture of savings at a domestic level to boost banks' efforts in mobilising deposits in the economy. Lastly, South African banks should develop promotional strategies in

deposit mobilisation through the use of information technology, market segmentation, pricing strategies, et cetera, in order to maximise their pool of stable funds.

In summary, we believe that credit booms are too risky to be left alone, and appropriate monetary and fiscal policy is in principle a major instrument that is capable of curbing credit booms and limiting over-indebtedness. It is important for authorities to understand that fiscal discipline is required during the upswing since credit booms not only flatter the balance sheets of banks and consumers they extend credit to, they also flatter government accounts.

REFERENCES

- Abedifar, P., Hasan, I., & Tarazi, A. (2016). Finance-growth nexus and dual-banking systems: Relative importance of Islamic banks. *Journal of Economic Behaviour & Organization*, 132, 198-215.
- Acharya, V. V., & Richardson, M. P. (2009). *Restoring financial stability: how to repair a failed system* (Vol. 542). Available at: <https://books.google.co.za/books?hl=en&lr=&id=yQvilGISRpwC&oi=fnd&pg=PR11&ots=mWY-nCEwh&sig=4kP3eBuJyLTLGpVxP-raLQ4RGfM#v=onepage&q&f=false>.
- Acharya, V. V., Gale, D., & Yorulmazer, T. (2011). Rollover risk and market freezes. *The Journal of Finance*, 66(4), 1177-1209.
- Adrian, T., & Shin, H. S. (2010). Liquidity and leverage. *Journal of Financial Intermediation*, 19(3), 418-437.
- Aisen, A., & Franken, M. (2015). Bank credit during the 2008 financial crisis: a cross-country comparison. *Journal Economía Chilena (The Chilean Economy)*, 18(1), 26-49.
- Aisen, M. A., & Franken, M. (2010). *Bank credit during the 2008 financial crisis: A cross-country comparison* (No. 10-47). International Monetary Fund.
- Aizenman, J., Jinjara, Y., & Park, D. (2015). *Financial development and output growth in developing Asia and Latin America: A comparative sectoral analysis*. NBER Working Paper No. 20917. National Bureau of Economic Research.
- Akerlof, G. A. (1970). The market for "lemons": Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, 84(3), 488-500.
- Akerlof, G. A., Romer, P. M., Hall, R. E., & Mankiw, N. G. (1993). Looting: the economic underworld of bankruptcy for profit. *Brookings Papers on Economic Activity*, 1993(2), 1-73.

Akinboade, O. A., & Makina, D. (2009). Bank lending and business cycles: South African evidence. *African Development Review*, 21(3), 476-498.

Akinsola, F. A., & Ikhide, S. (2018). Is commercial bank lending in South Africa procyclical? *Journal of Financial Regulation and Compliance*, 26(2), 203-226.

Alaabed, A., & Masih, M. (2016). Finance-growth nexus: Insights from an application of threshold regression model to Malaysia's dual financial system. *Borsa Istanbul Review*, 16(2), 63-71.

Ali, A., & Daly, K. (2010). Macroeconomic determinants of credit risk: Recent evidence from a cross country study. *International Review of Financial Analysis*, 19(3), 165-171.

Allen, F., & Oura, H. (2004). *Sustained economic growth and the financial system*. Institute for Monetary and Economic Studies, Bank of Japan. Available at: <http://finance.wharton.upenn.edu/~allenf/download/Vita/sustained.pdf>.

Amidu, M. (2013). The effects of the structure of banking market and funding strategy on risk and return. *International Review of Financial Analysis*, 28, 143-155.

Arena, M., Bouza, S., Dabla-Norris, M. E., Gerling, M. K., & Njie, L. (2015). *Credit booms and macroeconomic dynamics: Stylized facts and lessons for low-income countries*. International Monetary Fund. Available at: https://econpapers.repec.org/paper/imfifwpa/15_2f11.htm.

Arestis, P., & Demetriades, P. (1997). Financial development and economic growth: Assessing the evidence. *The Economic Journal*, 107(442), 783-799.

Arnold, B., Borio, C., Ellis, L., & Moshirian, F. (2012). Systemic risk, macroprudential policy frameworks, monitoring financial systems and the evolution of capital adequacy. *Journal of Banking & Finance*, 36(12), 3125-3132.

Aucoin, C., & Cilliers, J. (2016). Economics, governance and instability in South Africa. *Institute for Security Studies Papers*, 2016(293), 1-24.

Aydemir, R., & Guloglu, B. (2017). How do banks determine their spreads under credit and liquidity risks during business cycles? *Journal of International Financial Markets, Institutions and Money*, 46, 147-157.

Bakker, B. B., & Gulde, A. M. (2010). The credit boom in the EU new member states: Bad luck or bad policies? *IMF Working Papers*, 1-45.

Banerjee, A., Dolado, J., & Mestre, R. (1998). Error-correction mechanism tests for cointegration in a single-equation framework. *Journal of Time Series Analysis*, 19(3), 267-283.

Bank for International Settlements. (2018). *Net stable funding ratio*. Available at: <https://www.bis.org/fsi/fsisummaries/nsfr.pdf>.

Banking Association of South Africa, (2014). *South African banking sector overview*. Retrieved from <https://www.banking.org.za/docs/defaultsource/publication/bankingsector-overview.pdf>

Banking Association of South Africa. (2015a). The Banking Association South Africa banking summit – 2015 report. Available at: <https://www.banking.org.za/news/the-banking-association-south-africa-banking-summit-2015/>.

Banking Association of South Africa. (2015b). Towards a financial inclusion strategy. Available at: <http://www.banking.org.za/index.php/our-industry/>.

Barajas, A., Chami, R., & Yousefi, S. R. (2016). The finance and growth nexus re-examined: Do all countries benefit equally? *Journal of Banking and Financial Economics*, 1(5), 5-38.

Barajas, A., Dell’Ariccia, G., & Levchenko, A. (2007). Credit booms: The good, the bad, and the ugly. Available at http://www.nbp.pl/Konferencje/NBP_Nov2007/Speakers/Dell_Ariccia.pdf.

Beck, T., Demirguc-Kunt, A. S. L. I., Laeven, L., & Levine, R. (2008). Finance, firm size, and growth. *Journal of Money, Credit and Banking*, 40(7), 1379-1405.

Berger, A. N., & Bouwman, C. H. (2009). Bank liquidity creation. *The Review of Financial Studies*, 22(9), 3779-3837.

Berger, A. N., & Udell, G. F. (2004). The institutional memory hypothesis and the procyclicality of bank lending behaviour. *Journal of Financial Intermediation*, 13(4), 458-495.

Bernanke, B. S. (1993). Credit in the macroeconomy. *Quarterly Review*, (Spr), 50-70.

Bernanke, B. S., & Blinder, A. S. (1992). The federal funds rate and the channels of monetary transmission. *The American Economic Review*, 82(4), 901-921.

Bhattacharya, S., & Thakor, A. V. (1993). Contemporary banking theory. *Journal of Financial Intermediation*, 3(1), 2-50.

Bikker, J. A., & Metzmakers, P. A. (2005). Bank provisioning behaviour and procyclicality. *Journal of International Financial Markets, Institutions and Money*, 15(2), 141-157.

Blackbeard, M. (2014), "Training notes: List of bank failures in South Africa, 1990 - 2014", South African Reserve Bank.

Blanchard, O., Dell'Ariccia, G., & Mauro, P. (2010). Rethinking macroeconomic policy. *Journal of Money, Credit and Banking*, 42, 199-215.

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

Bonfim, D. (2009). Credit risk drivers: Evaluating the contribution of firm-level information and of macroeconomic dynamics. *Journal of Banking and Finance*, 33(2), 281-299.

Booms, W. A. C., & Are, H. (2004). Are credit booms in emerging markets a concern? *World Economic Outlook*. Available at: <http://www.cedem.org/Base%20Documentos/Banco%20Mundial/Global%20Economic%20Outlook/WEO%202004%20ABRIL/chapter4.pdf> .

Borio, C. (2014). The financial cycle and macroeconomics: What have we learnt? *Journal of Banking & Finance*, 45, 182-198.

Borio, C. E., & Lowe, P. (2004). *Securing sustainable price stability: Should credit come back from the wilderness?* (No. 157). Bank for International Settlements.

Borio, C., & Disyatat, P. (2010). Global imbalances and the financial crisis: Reassessing the role of international finance. *Asian Economic Policy Review*, 5(2), 198-216.

Borio, C., & Drehmann, M. (2009). Assessing the risk of banking crises – revisited. *BIS Quarterly Review*, 29.

Borio, C., & Lowe, P. (2002). Assessing the risk of banking crises. *BIS Quarterly Review*, 7(1), 43-54.

Bouvatier, V., & Lepetit, L. (2008). Banks' procyclical behaviour: Does provisioning matter? *Journal of International Financial Markets, Institutions and Money*, 18(5), 513-526.

Bouvatier, V., & Lepetit, L. (2012). Effects of loan loss provisions on growth in bank lending: some international comparisons. *International Economics*, 132, 91-116.

Burnham, K. P., & Anderson, D. R. (2004). Multimodel inference: Understanding AIC and BIC in model selection. *Sociological Methods & Research*, 33(2), 261-304.

Bushman, R. M., & Williams, C. D. (2012). Accounting discretion, loan loss provisioning, and discipline of banks' risk-taking. *Journal of Accounting and Economics*, 54(1), 1-18.

Caggiano, G., Calice, P., & Leonida, L. (2014). Early warning systems and systemic banking crises in low income countries: A multinomial logit approach. *Journal of Banking & Finance*, 47, 258-269.

Calomiris, C. W. (1995). Financial fragility: Issues and policy implications. *Journal of Financial Services Research*, 9(3), 241-257.

Calomiris, C. W. (1999). Building an incentive-compatible safety net. *Journal of Banking & Finance*, 23(10), 1499-1519.

Castro, V. (2013). Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. *Economic Modelling*, 31, 672-683.

Cerutti, E., Dagher, J., & Dell'Ariccia, G. (2017). Housing finance and real-estate booms: A cross-country perspective. *Journal of Housing Economics*, 38, 1-13.

Chan, Y. S., Siegel, D., & Thakor, A. V. (1990). Learning, corporate control and performance requirements in venture capital contracts. *International Economic Review*, 365-381.

Charfeddine, L., & Khediri, K. B. (2016). Financial development and environmental quality in UAE: Cointegration with structural breaks. *Renewable and Sustainable Energy Reviews*, 55, 1322-1335.

Chatterjee, U. K. (2015). Bank liquidity creation and asset market liquidity. *Journal of Financial Stability*, 18, 139-153.

Cherni, A., & Jouini, S. E. (2017). An ARDL approach to the CO2 emissions, renewable energy and economic growth nexus: Tunisian evidence. *International Journal of Hydrogen Energy*, 42(48), 29056-29066.

Chipeta, C., & Mbululu, D. (2012). The effects of the National Credit Act and the global financial crisis on domestic credit extension: Empirical evidence from South Africa. *Journal of Economic and Financial Sciences*, 5(1), 215-228.

Claessens, S., & Kose, M. A. (2013). *Financial crises: Explanations, types and implications*. CAMA Working Paper No. 06/2013. Centre for Applied Macroeconomic Analysis, Crawford School of Public Policy, The Australian National University.

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

Claus, I., & Grimes, A. (2003). *Asymmetric information, financial intermediation and the monetary transmission mechanism: A critical review*. Treasury Working Paper Series 03/19, New Zealand Treasury.

Coimbra, N., & Rey, H. (2018). Financial cycles and credit growth across countries. *AEA Papers and Proceedings*, 108, 509-12.

Coppock, M., Forte, D., Ncube, B., Ooka, E., Richards, K., & Vyas, A. (2008). Basic information about South Africa. Retrieved from <http://fic.wharton.upenn.edu/fic/africa/South%20Africa%20Final.pdf>.

Craig, B. R., & Dinger, V. (2013). Deposit market competition, wholesale funding, and bank risk. *Journal of Banking & Finance*, 37(9), 3605-3622.

Cummings, J. R., & Durrani, K. J. (2016). Effect of the Basel Accord capital requirements on the loan-loss provisioning practices of Australian banks. *Journal of Banking & Finance*, 67, 23-36.

Curcio, D., De Simone, A., & Gallo, A. (2017). Financial crisis and international supervision: New evidence on the discretionary use of loan loss provisions at Euro Area commercial banks. *The British Accounting Review*, 49(2), 181-193.

Damar, H. E., Meh, C. A., & Terajima, Y. (2013). Leverage, balance-sheet size and wholesale funding. *Journal of Financial Intermediation*, 22(4), 639-662.

Davis, E. P., & Karim, D. (2008). Comparing early warning systems for banking crises. *Journal of Financial Stability*, 4(2), 89-120.

Davis, J. S., Mack, A., Phoa, W., & Vandenabeele, A. (2016). Credit booms, banking crises, and the current account. *Journal of International Money and Finance*, 60, 360-377.

De Haan, L., van den End, J. W., & Vermeulen, P. (2017). Lenders on the storm of wholesale funding shocks: Saved by the central bank? *Applied Economics*, 49(46), 4679-4703.

Dell'Ariccia, G., Igan, D., & Laeven, L. (2008). The relationship between the recent boom and the current delinquencies in subprime mortgages. *The First Global Financial Crisis of the 21st Century*, 7.

Dell'Ariccia, G., Igan, D., & Laeven, L. U. (2012). Credit booms and lending standards: Evidence from the subprime mortgage market. *Journal of Money, Credit and Banking*, 44(2-3), 367-384.

Dell'Ariccia, G., Igan, D., Laeven, L., & Tong, H. (2014). Policies for macrofinancial stability: Dealing with credit booms and busts. *Financial crises: Causes, consequences, and policy responses*, 325-364.

Dell'Ariccia, G., Igan, D., Laeven, L., Tong, H., Bakker, B., & Vandebussche, J. (2012). *Policies for macrofinancial stability: How to deal with credit booms*. IMF Staff Discussion Note SDN/12/06.

Demirgüç-Kunt, A., & Detragiache, E. (1998). The determinants of banking crises in developing and developed countries. *IMF Staff Papers*, 45(1), 81-109.

Demirgüç-Kunt, A., & Huizinga, H. (2010). Bank activity and funding strategies: The impact on risk and returns. *Journal of Financial Economics*, 98(3), 626-650.

Demyanyk, Y., & Van Hemert, O. (2009). Understanding the subprime mortgage crisis. *The Review of Financial Studies*, 24(6), 1848-1880.

Denis, V., & Negotei, I. A. (2018). Analysis of financial stability: The construction of a new composite financial stability index for Euro area. *Ovidius University Annals, Economic Sciences Series*, 18(1), 264-270.

Dewally, M., & Shao, Y. (2013). Leverage, wholesale funding and national risk attitude. *Journal of International Financial Markets, Institutions and Money*, 23, 179-195.

Diamond, D. W. (1984). Financial intermediation and delegated monitoring. *The Review of Economic Studies*, 51(3), 393-414.

Diamond, D. W., & Dybvig, P. H. (1983). Bank runs, deposit insurance, and liquidity. *Journal of Political Economy*, 91(3), 401-419.

Diamond, D. W., & Rajan, R. G. (2000). A theory of bank capital. *The Journal of Finance*, 55(6), 2431-2465.

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74(366a), 427-431.

Dickey, D. A., & Fuller, W. A. (1981). Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica: Journal of the Econometric Society*, 1057-1072.

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.

Drees, B., & Pazarbasioglu, C. (1995). *The Nordic banking crises: Pitfalls in financial liberalization?* IMF Working Paper No. 95(61).

Drehmann, M., Borio, C., & Tsatsaronis, K. (2011). Anchoring countercyclical capital buffers: The role of credit aggregates. *International Journal of Central Banking*, 7(4), 189-240.

Duenwald, C., Gueorguiev, N., & Schaechter, A. (2007). Too much of a good thing? Credit booms in transition economies: The cases of Bulgaria, Romania, and Ukraine. In *Rapid credit growth in central and eastern Europe* (pp. 236-263). London: Palgrave Macmillan.

Duican, E. R., & Pop, A. (2015). The implications of credit activity on economic growth in Romania. *Procedia – Economics and Finance*, 30, 195-201.

Eichengreen, B., & Arteta, C. (2002). Banking crises in emerging markets: Presumptions and evidence. *Financial Policies in Emerging Markets*, 47-94.

Elekdag, S., & Wu, M. Y. (2011). *Rapid credit growth: Boon or boom-bust?* IMF Working Paper WP/11/241. Available at: https://books.google.co.za/books?hl=en&lr=&id=Cq_ir4WWYQ8C&oi=fnd&pg=PA3&ots=84X72Jf90M&sig=R27brPqG73bEaNi71idNNPcIIS8#v=onepage&q&f=false

Elekdag, S., & Wu, Y. (2013). Rapid credit growth in emerging markets: Boon or boom-bust? *Emerging Markets Finance and Trade*, 49(5), 45-62.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: Journal of the Econometric Society*, 251-276.

Enoch, C. & Ötoker-Robe, İ. (eds.). (2007). *Rapid credit growth in central and eastern Europe: Endless boom or early warning?* Springer. Available at <https://link.springer.com/book/10.1057/9781137001542?page=1>

Favara, G. (2003). *An empirical reassessment of the relationship between finance and growth*. IMF Working Paper No. 03/123. Available at https://papers.ssm.com/sol3/papers.cfm?abstract_id=879199.

Feldman, R. J., & Schmidt, J. (2001). Increased use of uninsured deposits. *Fedgazette*, (Mar), 18-19. Available at: <https://ideas.repec.org/a/fip/fedmgq/y2001imarp18-19nv13no.2.html>.

Festić, M., Kavkler, A., & Repina, S. (2011). The macroeconomic sources of systemic risk in the banking sectors of five new EU member states. *Journal of Banking & Finance*, 35(2), 310-322.

Fielding, D., & Rewilak, J. (2015). Credit booms, financial fragility and banking crises. *Economics Letters*, 136, 233-236.

FinScope. (2014). *South Africa 2014 survey results: Financial inclusion in South Africa*. Johannesburg. Available at: <http://finmark.org.za/finscope-south-africa-2014-survey-results/>.

First National Bank. (2014). Property barometer: Household sector debt-service risk. First National Bank. Available at: https://cdn.ymaws.com/www.saiv.org.za/resource/collection/B70457DF-B11F-442D-94B2-8B1BF7C28C2F/FNB_Property_Barometer_FNB_Household_Debt_Service_Risk_Index_22_Mar_2018.pdf

Fisher, I. (1933). The debt-deflation theory of great depressions. *Econometrica: Journal of the Econometric Society*, 337-357.

Folawewo, A. O., & Tennant, D. (2008). *Determinants of interest rate spreads in Sub-Saharan African countries: A dynamic panel analysis*. Paper prepared for the 13th Annual African Econometrics Society Conference, 9-11 July 2008, Pretoria (pp. 9-11).

Foos, D., Norden, L., & Weber, M. (2010). Loan growth and riskiness of banks. *Journal of Banking & Finance*, 34(12), 2929-2940.

Fourie, L., Botha, I., & Mears, R. (2011). Credit extension in South Africa: A business cycle perspective for the period 1985 to 2009. *African Journal of Business Management*, 5(34), 13074-13083.

Georgescu, O. M. (2015). Contagion in the interbank market: Funding versus regulatory constraints. *Journal of Financial Stability*, 18, 1-18.

Gersl, A., & Seidler, J. (2010). Excessive credit growth as an indicator of financial (in)stability and its use in macroprudential policy. CNB *Financial Stability Report 2010/2011*, 112-122.

Gertler, M., & Gilchrist, S. (1994). Monetary policy, business cycles, and the behaviour of small manufacturing firms. *The Quarterly Journal of Economics*, 109(2), 309-340.

Ghosh, S. (2010). Credit growth, bank soundness and financial fragility: Evidence from Indian banking sector. *South Asia Economic Journal*, 11(1), 69-98.

Glaeser, E. L., Gottlieb, J. D., & Gyourko, J. (2012). Can cheap credit explain the housing boom? In *Housing and the financial crisis* (pp. 301-359). University of Chicago Press.

Goodfriend, M., & King, R. G. (1998). *The new neoclassical synthesis and the role of monetary policy*. Federal Reserve Bank of Richmond, Discussion Paper Series No. 98-5.

Goodhart, C., & Hofmann, B. (2008). House prices, money, credit, and the macroeconomy. *Oxford Review of Economic Policy*, 24(1), 180-205.

Goodhart, M. C., Basurto, M. A. S., & Hofmann, B. (2006). *Default, credit growth, and asset prices* (No. 6-223). International Monetary Fund.

Gorton, G. B. (2009). *Slapped in the face by the invisible hand: Banking and the panic of 2007*. Available at http://ssrn.com/abstract_1401882.

Gorton, G., & Ordonez, G. (2016). Good booms, bad booms. *Journal of the European Economic Association*.

Gourinchas, P. O., Valdés, R., Landerretche, O., Talvi, E., & Banerjee, A. V. (2001). Lending Booms: Latin America and the World. *Economía*, 1(2), 47-99.

Gozgor, G. (2014). Determinants of domestic credit levels in emerging markets: The role of external factors. *Emerging Markets Review*, 18, 1-18.

Grimes, A. (1998). The Asian financial crisis: How long will the downturn last? *New Zealand Economic Papers*, 32(2), 215-224.

Guarin, A., & Lozano, I. (2017). Credit funding and banking fragility: A forecasting model for emerging economies. *Emerging Markets Review*, 32, 168-189.

Hahm, J. H., Shin, H. S., & Shin, K. (2013). Noncore bank liabilities and financial vulnerability. *Journal of Money, Credit and Banking*, 45(s1), 3-36.

Hansen, N. J., & Sulla, O. (2013). Credit growth in Latin America: Financial development or credit boom. *Economic Studies Magazine*, 25(1), 51-80.

Havrylchyk, O. (2010). *A macroeconomic credit risk model for stress testing the South African banking sector*. Available online at <https://mpira.uni-muenchen.de/21639/>.

Hawtrey, R. G. (1927). The monetary theory of the trade cycle and its statistical test. *The Quarterly Journal of Economics*, 41(3), 471-486.

Hayek, F. A. (1931). *Prices and production* (1st ed.). London: Routledge.

Hayek, F. A. (1941). *The pure theory of capital*. Chicago: University of Chicago Press.

Hayek, F. A. (1933). *Monetary Theory and the Trade Cycle*. Translated by N. Kaldor and H. M. Croome. London: Jonathan Cape.

Hess, K., Grimes, A., & Holmes, M. (2009). Credit losses in Australasian banking. *Economic Record*, 85(270), 331-343.

Hicks, J. R. (1950). *A Contribution to the Theory of the Trade Cycle* (Vol. 126). Oxford: Clarendon Press.

Hilbers, P., Ötoker-Robe, I., Pazarbasioglu, C., & Johnsen, G. (2005). *Assessing and managing rapid credit growth and the role of supervisory and prudential policies*. IMF Working Paper No. 05/151. Available at https://papers.ssm.com/sol3/papers.cfm?abstract_id=782908.

Ho, S. Y., & Odhiambo, M. N. (2011). Finance and poverty reduction in China: An empirical investigation. *International Business & Economics Research Journal*, 10(8), 103-114.

Hoggarth, G., Reis, R., & Saporta, V. (2002). Costs of banking system instability: Some empirical evidence. *Journal of Banking & Finance*, 26(5), 825-855.

Huang, R., & Ratnovski, L. (2009). *Why are Canadian banks more resilient?* IMF Working Paper No. 09/152. International Monetary Fund.

Huang, R., & Ratnovski, L. (2011). The dark side of bank wholesale funding. *Journal of Financial Intermediation*, 20(2), 248-263.

Ifeacho, C., & Ngalawa, H. (2014). Performance of the South African banking sector since 1994. *Journal of Applied Business Research (jabr)*, 30(4), 1183-1196.

Ikhide, S. (2003). Was there a credit crunch in Namibia between 1996–2000? *Journal of Applied Economics*, 6(2), 269-290.

International Monetary Fund. (2011). *World economic outlook: Slowing growth, rising risks*. Washington, United States. Available at: <https://www.imf.org/en/Publications/WEO/Issues/2016/12/31/Slowing-Growth-Rising-Risks>.

International Monetary Fund. (2014). *South Africa: financial system stability assessment*. IMF Country Report No. 14/340. Washington, D.C.: International Monetary Fund. Available at: <https://www.imf.org/external/pubs/ft/scr/2014/cr14340.pdf>.

International Monetary Fund. (2016). *2016 Financial access survey, a key tool to foster financial inclusion*. Washington, DC: International Monetary Fund. Available at: <https://www.imf.org/en/News/Articles/2016/10/03/PR16441-IMF-Releases-the-2016-Financial-Access-Survey>.

Ituwe, C. E. (1983). *Elements of practical banking*. Ibadan: University Press.

Jaffee, D. M., & Modigliani, F. (1969). A theory and test of credit rationing. *The American Economic Review*, 59(5), 850-872.

Jaffee, D. M., & Russell, T. (1976). Imperfect information, uncertainty, and credit rationing. *The Quarterly Journal of Economics*, 90(4), 651-666.

Jeanne, O., & Korinek, A. (2018). Managing credit booms and busts: A Pigouvian taxation approach. *Journal of Monetary Economics*.

Jiménez, G., & Saurina, J. (2006). Credit cycles, credit risk, and prudential regulation. *International Journal of Central Banking*.

Johansen, S. (1988). Statistical analysis of cointegration vectors. *Journal of Economic Dynamics and Control*, 12(2-3), 231-254.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, 52(2), 169-210.

Jordà, Ò., Schularick, M., & Taylor, A. M. (2011). Financial crises, credit booms, and external imbalances: 140 years of lessons. *IMF Economic Review*, 59(2), 340-378.

Jung, H., & Kim, D. (2015). Bank funding structure and lending under liquidity shocks: Evidence from Korea. *Pacific-Basin Finance Journal*, 33, 62-80.

Kaminsky, G. L., & Reinhart, C. M. (1999). The twin crises: The causes of banking and balance-of-payments problems. *American Economic Review*, 89(3), 473-500.

Kaminsky, G., Lizondo, S., & Reinhart, C. M. (1998). Leading indicators of currency crises. *IMF Staff Papers*, 45(1), 1-48.

Kandrac, J. (2012). Monetary policy and bank lending to small firms. *Journal of Macroeconomics*, 34(3), 741-748.

Kashyap, A. K., Lamont, O. A., & Stein, J. C. (1994). Credit conditions and the cyclical behavior of inventories. *The Quarterly Journal of Economics*, 109(3), 565-592.

Kashyap, A. K., Stein, J. C., & Wilcox, D. W. (1993). Monetary policy and credit conditions: Evidence from the composition of external finance. *The American Economic Review*, 83, 78-98.

Keeler, J. P. (2001). Empirical evidence on the Austrian business cycle theory. *Review of Austrian Economics*, 14(4), 331-351.

Keeton, W. R., & Morris, C. S. (1999). Why do banks' loan losses differ? *Economic Review*, 72(5), 3-21.

Keynes, J. M. (1937). The general theory of employment. *The Quarterly Journal of Economics*, 51(2), 209-223.

Kim, D., & Perron, P. (2009). Unit root tests allowing for a break in the trend function at an unknown time under both the null and alternative hypotheses. *Journal of Econometrics*, 148(1), 1-13.

Kim, M., Kliger, D., & Vale, B. (2003). Estimating switching costs: The case of banking. *Journal of Financial Intermediation*, 12(1), 25-56.

Kindleberger, C. P., & Aliber, R. Z. (2011). *Manias, panics and crashes: A history of financial crises*. Palgrave Macmillan.

King, R. G., & Levine, R. (1993). Finance and growth: Schumpeter might be right. *The Quarterly Journal of Economics*, 108(3), 717-737.

Kiss, G., Nagy, M., & Vonnák, B. (2006). Credit growth in Central and Eastern Europe: Trend, cycle or boom. In *Conference "Finance and Consumption Workshop: Consumption and Credit in Countries with Developing Credit Markets"*, Florence (pp. 16-17).

Koivu, T. (2002). *Do efficient banking sectors accelerate economic growth in transition countries?* Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1015710.

Koong, S. S., Law, S. H., & Ibrahim, M. H. (2017). Credit expansion and financial stability in Malaysia. *Economic Modelling*, 61, 339-350.

Kraft, E., & Jankov, L. (2005). Does speed kill? Lending booms and their consequences in Croatia. *Journal of Banking & Finance*, 29(1), 105-121.

Kwiatkowski, D., Phillips, P. C., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root? *Journal of Econometrics*, 54(1-3), 159-178.

Lane, P. R., & McQuade, P. (2014). Domestic credit growth and international capital flows. *The Scandinavian Journal of Economics*, 116(1), 218-252.

Leitão, N. C. (2012). Bank credit and economic growth: A dynamic panel data analysis. *Economic Research Guardian*, 2(2), 256-267.

Leland, H. E., & Pyle, D. H. (1977). Informational asymmetries, financial structure, and financial intermediation. *The Journal of Finance*, 32(2), 371-387.

Levine, R. (2002). Bank-based or market-based financial systems: Which is better? *Journal of Financial Intermediation*, 11(4), 398-428.

Levine, R. (2005). Finance and growth: Theory and evidence. *Handbook of Economic Growth*, 1, 865-934.

Levine, R., & Zervos, S. (1996). *Capital control liberalization and stock market development*. World Bank Policy Research Working Paper 1622.

Levine, R., & Zervos, S. (1998). Stock markets, banks, and economic growth. *American Economic Review*, 537-558.

Levine, R., Loayza, N., & Beck, T. (2000). Financial intermediation and growth: Causality and causes. *Journal of Monetary Economics*, 46(1), 31-77.

Lindgren, C.-J., Garcia, G. G., & Saal, M. I. (1996). *Bank soundness and macroeconomic policy*. Washington, D.C.: International Monetary Fund. Available at: https://books.google.co.za/books?id=Jpjvll6nzaUC&lr=&source=gbs_navlinks_s.

Loate, T., & Viegli, N. (2016). *Banking stability and keeping up with the riches*. Available at: http://macro.soc.uoc.gr/docs/Year/2017/papers/paper_1_122.pdf.

López, M., Tenjo, F., & Zárata, H. (2014). Credit cycles, credit risk and countercyclical loan provisions. *Ensayos sobre Política Económica*, 32(74), 9-17.

López-Espinosa, G., Moreno, A., Rubia, A., & Valderrama, L. (2012). Short-term wholesale funding and systemic risk: A global CoVaR approach. *Journal of Banking & Finance*, 36(12), 3150-3162.

Lozano, I., & Guarín, A. (2014). Banking fragility in Colombia: An empirical analysis based on balance sheets. *Ensayos sobre Política Económica*, 32(75), 48-63.

Magud, N. E., Reinhart, C. M., & Vesperoni, E. R. (2014). Capital inflows, exchange rate flexibility and credit booms. *Review of Development Economics*, 18(3), 415-430.

Marozva, G. (2015). Liquidity and bank performance. *The International Business & Economics Research Journal*, 14(3), 453-462.

Matsumoto, Y. (2007). *Financial fragility and instability in Indonesia*. London, Routledge.

Mboweni, T. T. (2004). The South African sector – an overview of the past 10 years. *Address by Mr TT Mboweni, Governor of the South African Reserve Bank, at the Year-end Media Cocktail Function*, 14.

Mendoza, E. G., & Terrones, M. E. (2008). *An anatomy of credit booms: Evidence from macro aggregates and micro data*. NBER Working Paper No. 14049. National Bureau of Economic Research.

Mendoza, E. G., & Terrones, M. E. (2012). An anatomy of credit booms and their demise. *Journal Economía Chilena*, 15(2), 4-32.

Mian, A., & Sufi, A. (2018). Finance and business cycles: The credit-driven household demand channel. *Journal of Economic Perspectives*, 32(3), 31-58.

Minsky, H. P. (1976). *John Maynard Keynes*. Springer. Available at: https://books.google.co.za/books?hl=en&lr=&id=Gy6xCwAAQBAJ&oi=fnd&pg=PA19&dq=John+Maynard+Keynes&ots=3bzC_sUgNt&sig=y_f9s9zslT4S_J4H7UssH0Qvdfo#v=onepage&q=John%20Maynard%20Keynes&f=false.

Minsky, H. P. (1977). The financial instability hypothesis: An interpretation of Keynes and an alternative to "standard" theory. *Challenge*, 20(1), 20-27.

Minsky, H. P. (1982). *Can it happen again? Essays on instability and finance*. Armonk, NY: M. E. Sharpe.

Minsky, H. P. (1986). *Stabilizing an unstable economy: The lessons for industry, finance and government*. New Haven: Yale University Press.

Minsky, H. P. (1992). *The financial instability hypothesis*. Working Paper No. 74. Annandale-on-Hudson, NY: Levy Economics Institute of Bard College.

Mishi, S., & Khumalo, S. A. (2019). Bank stability in South Africa: What matters? *Banks & Bank Systems*, 14(1), 122-136.

Mishkin, F. S. (1996). *Understanding financial crises: A developing country perspective*. NBER Working Paper No. 5600. National Bureau of Economic Research. Available at: <https://www.nber.org/papers/w5600>.

Mishkin, F. S. (1997). The causes and propagation of financial instability: Lessons for policymakers. *Maintaining financial stability in a global economy*, 55-96.

Mlambo, K., & Ncube, M. (2011). Competition and efficiency in the banking sector in South Africa. *African Development Review*, 23(1), 4-15.

Moretti, M., Stolz, S., & Swinburne, M. (2008). Stress testing at the IMF. IMF Working Paper WP/08/206. Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.499.102&rep=rep1&type=pdf>.

Mothibi, G. (2015). An assessment of car buyers' understanding of balloon payment method in relation to the National Credit Act in South Africa. *Journal of Law, Policy and Globalization*, 35, 1-9.

Mulligan, R. F. (2002). A Hayekian analysis of the term structure of production. *Quarterly Journal of Austrian Economics*, 5 (2), 17-33.

Mulligan, R. F. (2006). An empirical examination of Austrian business cycle theory. *Quarterly Journal of Austrian Economics*, 9(2), 69-93.

Mutezo, A. (2013). Credit rationing and risk management for SMEs: The way forward for South Africa. *Corporate Ownership & Control*, 10(2), 153-163.

Narayan, P. K. (2005). The saving and investment nexus for China: Evidence from cointegration tests. *Applied Economics*, 37(17), 1979-1990.

Narayan, P. K., & Smyth, R. (2005). Electricity consumption, employment and real income in Australia: Evidence from multivariate Granger causality tests. *Energy Policy*, 33(9), 1109-1116.

National Treasury. (2015). *Budget review*. Available at: <http://ntintranet/documents/national%20budget/2015/review/FullReview.pdf>.

Nieman, G., & Nieuwenhuizen, C. (2009). *Entrepreneurship: A South African Perspective*. 3rd Impression. Pretoria: Van Schaik Publishers.

O'Driscoll, G. P., & Shenoy, S. R. (1976). Inflation, recession, and stagflation. In E. G. Dolan (ed.), *The Foundations of Modern Austrian Economics* (pp. 185-211). Kansas City: Sheed & Ward.

- Odhiambo, N. M. (2009). Energy consumption and economic growth nexus in Tanzania: An ARDL bounds testing approach. *Energy Policy*, 37(2), 617-622.
- Odhiambo, N. M. (2010). Energy consumption, prices and economic growth in three SSA countries: A comparative study. *Energy Policy*, 38(5), 2463-2469.
- Okurut, F. N. (2006). Access to credit by the poor in South Africa: Evidence from Household Survey Data 1995 and 2000. *Stellenbosch: University of Stellenbosch*.
- Oliner, S. D., & Rudebusch, G. D. (1996). Is there a broad credit channel for monetary policy? *Economic Review, Federal Reserve Bank of San Francisco*, 3-13.
- Oros, O. E., & Salisteanu, S. F. (2015). Loan loss provisioning: A case study of Romanian system smoothing pro-cyclicality. *Procedia – Economics and Finance*, 26, 862-868.
- Ozili, P. K., & Outa, E. (2017). Bank loan loss provisions research: A review. *Borsa Istanbul Review*, 17(3), 144-163.
- Packer, F., & Zhu, H. (2012). *Loan loss provisioning practices of Asian banks* (No. 375). Bank for International Settlements. Available at: <https://econpapers.repec.org/paper/bisbiswps/375.htm>.
- Pagano, M. (1993). Financial markets and growth: An overview. *European Economic Review*, 37(2-3), 613-622.
- Pazarbasioglu, C., Johnsen, G., Hilbers, M. P. L. C., & Ötoker, M. I. (2005). *Assessing and managing rapid credit growth and the role of supervisory and prudential policies*. IMF Working Paper No. 05/151. International Monetary Fund.
- Pederzoli, C., & Torricelli, C. (2005). Capital requirements and business cycle regimes: Forward-looking modelling of default probabilities. *Journal of Banking & Finance*, 29(12), 3121-3140.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289-326.

Pesaran, M. H., Shin, Y., & Smith, R. P. (1999). Pooled mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association*, 94(446), 621-634.

Phillips, P. C., & Perron, P. (1988). Testing for a unit root in time series regression. *Biometrika*, 75(2), 335-346.

Pilbeam, K. (2005). *Finance and financial markets*. London: Macmillan International Higher Education.

Pool, S., De Haan, L., & Jacobs, J. P. (2015). Loan loss provisioning, bank credit and the real economy. *Journal of Macroeconomics*, 45, 124-136.

Powell, B. (2002). Explaining Japan's recession. *Quarterly Journal of Austrian Economics*, 5(2), 35-50.

Rai, K., & Kamil, H. (2010). *The global credit crunch and foreign banks' lending to emerging markets: Why did Latin America fare better?* IMF Working Paper No. 10/102. International Monetary Fund.

Rajan, R., & Zingales, L. (1998). Financial dependence and growth. *American Economic Review*, 88(3), 559-86.

Reinhart, C. M., & Rogoff, K. S. (2008). Is the 2007 US sub-prime financial crisis so different? An international historical comparison. *American Economic Review*, 98(2), 339-44.

Reinhart, C. M., & Rogoff, K. S. (2009a). The aftermath of financial crises. *American Economic Review*, 99(2), 466-72.

Reinhart, C. M., & Rogoff, K. S. (2009b). *This time is different: Eight centuries of financial folly*. New Jersey: Princeton University Press.

Reinhart, C., Calvo, G., & Leiderman, L. (1995). *Capital inflows to Latin America with reference to the Asian experience* (No. 13840). University Library of Munich, Germany.

Ritz, R. A., & Walther, A. (2015). How do banks respond to increased funding uncertainty? *Journal of Financial Intermediation*, 24(3), 386-410.

Roosa, R. V., & Robert, V. (1951). *Interest rates and the central bank, money trade and economic growth: In honor of John Henry Williams*. New York: MacMillan

Rothbard, M. N. (2000). *America's Great Depression* (5th ed.). Auburn, AL: Ludwig von Mises Institute.

Rothschild, M., & Stiglitz, J. (1976). Equilibrium in Competitive Insurance Markets: An essay on the economics of imperfect information. *The Quarterly Journal of Economics*, 90(4), 629-649.

Rousseau, P. L., & Wachtel, P. (2002). Inflation thresholds and the finance-growth nexus. *Journal of International Money and Finance*, 21(6), 777-793.

Rousseau, P. L., & Wachtel, P. (2011). What is happening to the impact of financial deepening on economic growth? *Economic Inquiry*, 49(1), 276-288.

Rousseau, P., & Wachtel, P. (2017). Episodes of financial deepening: Credit booms or growth generators? In P. Rousseau & P. Wachtel (eds.), *Financial systems and economic growth: credit, crises, and regulation from the 19th century to the present* (Studies in Macroeconomic History, pp. 52-75). Cambridge: Cambridge University Press.

Saidenberg, M. R., & Strahan, P. E. (1999). Are banks still important for financing large businesses? *Current Issues in Economics and Finance*, 5(12).

Salas, V., & Saurina, J. (2002). Credit risk in two institutional regimes: Spanish commercial and savings banks. *Journal of Financial Services Research*, 22(3), 203-224.

Scholtens, B., & Van Wensveen, D. (2000). A critique on the theory of financial intermediation. *Journal of Banking & Finance*, 24(8), 1243-1251.

Schularick, M., & Taylor, A. M. (2012). Credit booms gone bust: Monetary policy, leverage cycles, and financial crises, 1870-2008. *American Economic Review*, 102(2), 1029-61.

Sek, S. K. (2017). Impact of oil price changes on domestic price inflation at disaggregated levels: Evidence from linear and nonlinear ARDL modelling. *Energy*, 130, 204-217.

Semerák, V. (2001). *Credit cycles – theory and application on the Czech Republic*. Available at: <https://dspace.cuni.cz/handle/20.500.11956/89544>.

Seven, U., & Yetkiner, H. (2016). Financial intermediation and economic growth: Does income matter? *Economic Systems*, 40(1), 39-58.

Shiller, R. J. (2014). Speculative asset prices. *American Economic Review*, 104(6), 1486-1517.

Shin, H. S. (2009). Reflections on Northern Rock: The bank run that heralded the global financial crisis. *Journal of Economic Perspectives*, 23(1), 101-19.

Shin, H. S., & Shin, K. (2011). *Procyclicality and monetary aggregates*. NBER Working Paper No. 16836. National Bureau of Economic Research.

Shin, Y., Yu, B., & Greenwood-Nimmo, M. (2014). Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In *Festschrift in honor of Peter Schmidt* (pp. 281-314). New York, NY: Springer.

Smal, M. M., & de Jager, S. (2001). *The monetary transmission mechanism in South Africa*. Pretoria: South African Reserve Bank.

Soedarmono, W., Pramono, S. E., & Tarazi, A. (2017). The procyclicality of loan loss provisions in Islamic banks. *Research in International Business and Finance*, 39, 911-919.

Soedarmono, W., Sitorus, D., & Tarazi, A. (2017). Abnormal loan growth, credit information sharing and systemic risk in Asian banks. *Research in International Business and Finance*, 42, 1208-1218.

Sofianos, G., Wachtel, P., & Melnik, A. (1990). Loan commitments and monetary policy. *Journal of Banking & Finance*, 14(4), 677-689.

Song, F., & Thakor, A. V. (2007). Relationship banking, fragility, and the asset-liability matching problem. *The Review of Financial Studies*, 20(6), 2129-2177.

South African Reserve Bank of South Africa. (2011). Bank Supervision Department Annual Report. (2011). South African Reserve Bank. Available at: <https://www.resbank.co.za/Lists/News%20and%20Publications/Attachments/5048/01%20Annual%20Report%202011.pdf>.

South African Reserve Bank. (2016). Regulation and Supervision. South African Reserve Bank. Available at: <https://www.resbank.co.za/RegulationAndSupervision/Pages/RegulationAndSupervision-Home.aspx>.

South African Reserve Bank. (2017). Bank Supervision Department Annual Report 2017. South African Reserve Bank. Available at: <https://www.resbank.co.za/Lists/News%20and%20Publications/Attachments/8507/01%20BankSupAR2017.pdf>.

Spence, M. (1973). Job market signalling. *Quarterly Journal of Economics*, 87(3), 355-374.

Stepanyan, V., & Guo, K. (2011). *Determinants of bank credit in emerging market economies*. IMF Working Paper No. 11-51. International Monetary Fund. Available at: https://econpapers.repec.org/paper/imfifwpa/11_2f51.htm.

Stiglitz, J. E., & Weiss, A. (1981). Credit rationing in markets with imperfect information. *The American Economic Review*, 71(3), 393-410.

Takáts, E. (2010). Was it credit supply? Cross-border bank lending to emerging market economies during the financial crisis. *International Banking and Financial Market Developments*, 3, 49.

Theobald, S. (2013). *The risk of unsecured lending in South Africa*. Leriba Consulting.

Van den End, J. W., & Tabbae, M. (2012). When liquidity risk becomes a systemic issue: Empirical evidence of bank behaviour. *Journal of Financial Stability*, 8(2), 107-120.

Van den Heever, J. (2006). Household debt, interest rates and insolvencies in South Africa. *IFC Bulletin No. 26*, 52-61. Available at <http://piketty.pse.ens.fr/files/IFC%20Conference%202006.pdf#page=56>.

Vazquez, F. & Federico, P., 2015. Bank funding structures and risk: Evidence from the global financial crisis. *Journal of Banking & Finance*, 61, 1-14.

Von Mises, L. (1966). *Human action*. Alabama: Ludwig von Mises Institute.

Wezel, T. (2010). *Dynamic loan loss provisions in Uruguay: Properties, shock absorption capacity and simulations using alternative formulas*. IMF Working Paper No. 10/125. International Monetary Fund. Available at: https://econpapers.repec.org/paper/imfifwpa/10_2f125.htm.

Wolf, M. (2009). Seeds of its own destruction. *Financial Times*, 8(3). Available at <http://tomweston.net/Seedsdestruction.pdf>.

Wolfson, M. H. (2002). Minsky's theory of financial crises in a global context. *Journal of Economic Issues*, 36(2), 393-400.

World Bank. (2017). Universal financial access by 2020. Available at <http://www.worldbank.org/en/topic/financialinclusion/brief/achieving-universal-financial-access-by-2020>.

Yurdakul, F. (2014). Macroeconomic modelling of credit risk for banks. *Procedia – Social and Behavioural Sciences*, 109, 784-793.

Zivot, E., & Andrews, D. W. K. (1992). Further evidence of the great crash, the oil price shock and the unit-root hypothesis. *Journal of Business and Economic Statistics*, 10, 251-70.