UNIVERSITY OF ZULULAND

# Shadow Banking, Financial Stability and Economic Performance:

# Implications for Regulation in Emerging Economies

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## DECLARATION

**I Sheunesu Zhou,** hereby declare that this thesis is my own work, and except where otherwise indicated the research document is entirely mine.

The thesis contained herein has never been submitted for another degree or examination at any other university.

All works that originate from other persons' writings including graphs and tables have been duly referenced to acknowledge the owners of the works.

This thesis contains my initiative and writing. It is devoid of other persons' writings unless fully and specifically acknowledged wherever referenced from other sources. The following were adhered to whenever quotations are made:

1. In a situation of verbatim quotation, the writings are referenced and quotation marks used to indicate that they belong to the acknowledged author(s);

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Name of Student: Sheunesu Zhou

Signature: _____

**CERTIFICATE OF APPROVAL**

I declare that this thesis is from the student's own work and citations have been made where other sources of information have been used. The thesis is therefore submitted with my approval.

Sign _____ Date _____

Professor D.D Tewari

**ACKNOWLEDGEMENTS**

*"Every good and perfect gift is from above, coming down from the Father of the heavenly lights, who does not change like shifting shadows." James 1:17*

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**PUBLICATIONS FROM THE STUDY**

It should also be acknowledged that the following peer reviewed publications have been made (or are expected) from the study:

1. Zhou, S. and D. D. Tewari (2019). "Shadow Financial Services and Firm performance in South Africa." Cogent Economics & Finance: 1603654.

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3. Zhou, S.; Tewari, D.D. 2019. Shadow Banking, Cross Border Shocks and Financial Stability in Emerging Economies: A Global VAR Analysis. African Journal of Business and Economic Research *(Forthcoming).*

**DEDICATION**

To my parents Elias and Ketilia Zhou; my wife Takamudashe and our daughter Makanaka Channah.

**ABSTRACT**

Shadow banking became a topical issue in advanced economies during and after the global financial crisis of 2007/2008. The importance of the study of the shadow banking sector stems from the need to identify the channels through which it benefits the economy and also channels through which it can become detrimental to economic performance through propagation of systemic risk. Available literature, however, does not provide evidence on the impact of the growth of the shadow banking system on both financial stability and macroeconomic performance in emerging economies. This study contributes to the extant literature on financial innovation by providing evidence on the linkages between the shadow banking sector, economic performance and stability of financial systems across national borders in emerging economies.

The study firstly reviews literature on shadow banking focusing on the channels through which shadow banking impacts the macro-economy, financial stability and monetary policy. Five empirical papers, each with a unique contribution to literature are used to show the impact of shadow banking on various macro-economic and financial variables using a panel of emerging market economies. Firstly, the study employs the Pooled Mean Group technique to estimate a model in which economic growth is a function of shadow banking and other variables. The results show that shadow banking is positively related to economic growth. The second paper analyses the impact of shadow banking on bank risk across national borders within a Global Vector Auto-regressive (GVAR) framework. The findings show increased financial fragility as a result of a negative shock in shadow banking at the global level in the majority of economies under study. Furthermore, the study identifies financial contagion across national borders amongst emerging countries and between emerging countries and advanced economies through the shadow banking sector.

In another paper, the study investigates the relationship between shadow banking and monetary policy using the Panel Vector Auto-regression (PVAR) technique. The findings point to the existence of a negative relationship between the monetary policy rate and shadow bank growth. Contractionary monetary policy results in reduction in shadow bank activity. In addition, the study establishes a positive response of shadow banking to a positive shock in bank liquidity. The fourth empirical paper focuses on the interaction between shadow

banking, monetary policy and risk-taking behaviour of banks. The study finds shadow banking to be an important component of the monetary policy transmission mechanism in emerging countries. High risk increases the impact of monetary policy on shadow banking whereas lower risk weakens monetary policy transmission through the shadow banking system. Furthermore, the study argues for linkages between shadow banking and bank risk taking in the monetary policy transmission mechanism; the findings show that high risk taking occurs through the shadow banking sector. The fifth empirical paper investigates the impact of shadow banking activities on firm profitability in South Africa with the aim to establish whether South African firms benefit from shadow financial services or otherwise. Single equation cointegration methods and three measures of firm profitability were employed in the study. Several macroeconomic and bank specific variables were used as control variables. The results are mixed; showing that shadow banking has a negative impact on traditional banks' profitability but has a positive impact on non-financial firms and the overall measures of firm profitability. The results indicate that both non-financial firms and non-bank financial institutions are benefiting from the expansion in shadow banking activities. Targeted functional regulation is suggested in order to promote economic activities in the shadow banking sector whilst at the same time limiting possible risks that may arise.

Other policy implications arising from the study points firstly, to the need to craft regulatory measures that encourage monitoring of shadow banking activities to curb contagion effects that can transfer to other jurisdictions. Secondly, regulation should also allow for growth and development of shadow banking assets to enhance economic growth. Lastly, policy coordination is necessary to ensure that the impact of monetary policy on financial markets is accounted for during policy formulation.

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| | |
|---|---|
| ABCP | Asset Backed Commercial Paper |
| ABS | Asset Backed Securities |
| ADF | Augmented Dickey Fuller |
| BIS | Bank for International Settlements |
| BRICS | Brazil, Russia, India, China and South Africa |
| CDO | Collateralized Debt Obligations |
| CRA | Credit Rating Agencies |
| DOLS | Dynamic Ordinary Least Squares |
| DSGE | Dynamic Stochastic General Equilibrium |
| ECB | European Central Bank |
| EU | European Union |
| FED | Federal Reserve |
| FEVD | Forecast Error Variance Decomposition |
| FMOLS | Fully Modified Ordinary Least Squares |
| FOF | Flow of Funds |
| FSB | Financial Stability Board |
| FVC | Financial Vehicle Corporations |
| GDP | Gross Domestic Product |
| GFC | Global Financial Crisis |
| GFEVD | Generalised Forecast Error Variance Decompositions |
| GIRF | Generalised Impulse Response Functions |
| GMM | Generalised Method of Moments |
| GVAR | Global Vector Auto-regressive |
| ICA | Investment Companies Act |
| IMF | International Monetary Fund |
| IRF | Impulse Response Functions |
| MBS | Mortgage Backed Securities |
| MMF | Money Market Funds |

| | |
|---|---|
| NBFI | Non-Bank Financial Intermediaries |
| NCR | National Credit Regulator |
| NDFI | Non-Depository Financial Institutions |
| OECD | Organisation for Economic Cooperation and Development |
| OFI | Other Financial Intermediaries |
| PMG | Pooled Mean Group |
| PVAR | Panel Vector Auto-regressive |
| REIT | Real Estate Investment Trusts |
| SARB | South African Reserve Bank |
| SME | Small and Medium Enterprises |
| UK | United Kingdom |
| RF | Regulated Finance |
| URF | Unregulated Finance |
| US | United States of America |
| VAR | Vector Auto-regressive |

# CHAPTER 1

# INTRODUCTION

## 1.1 Background and Problem Statement

The Global Financial Crisis (GFC) and recession of 2007-2009 elicits enquiry into the sustainability of the shadow banking system. This exists when financial institutions undertake to transfer risk, and provide maturity and liquidity transformation outside the formal banking system (Adrian and Ashcraft, 2016). Tang and Wang (2015) proffer two arguments for banks' participation in shadow banking activities; firstly, it provides regulatory arbitrage, giving financial institutions a broader spectrum in which to increase their earnings without regulatory boundaries. This argument is underscored by the fact that in most jurisdictions, including South Africa (SARB, 2016), prudential supervision does not cover most shadow banking activities. Secondly, shadow banking increases complexity and opacity of financial instruments and processes, thereby allowing shadow banks to earn more profit than traditional banks but at the same time increasing risk borne by investors. Shadow banking impacts regulators negatively by decreasing the effectiveness of regulation which could destabilize financial markets. In addition, the opaque nature of shadow banking can be detrimental to the protection of investors' interests, increasing risk and worsening investor confidence in financial markets. This kind of financial innovation therefore brings challenges to regulators and investors, and could destabilize markets as in the GFC. On the contrary, Ackermann et al. (2012) argue that shadow banking if managed properly could result in increased market efficiency, diversification, better risk management, and increased liquidity.

The extant literature on the role of non-bank financial intermediaries (NBFI) have demonstrated their importance in economic development (Rateiwa and Aziakpono, 2017). However, these studies do not distinguish between NBFI involved in risky shadow banking activities and other non-depository financial corporations that do not participate in shadow banking such as insurance companies and pension funds. McCulley (2009) and Meeks et al. (2017) show that shadow banks are involved in high risk taking and high leverage transactions which pose a threat to the financial system. In addition, shadow banking assumes bank like functions without government backstop or deposit insurance. Thus, unlike banks or other NBFI, shadow banks pose more threat to systemic stability. This proposition is supported by

a voluminous literature analyzing the role of shadow banks in the GFC (Pozsar et al., 2013, Shin, 2009, Singh and Pozsar, 2011, Stein, 2010). There is however, a dearth of studies that investigate the economic benefits of shadow banking and a lack of empirical research on the impact of shadow banking on the macro-economy in emerging countries (Bengtsson, 2016, Tang and Wang, 2015). In addition, theoretical works on shadow banking tend to focus more on advanced economies with a limited number of studies having focused on emerging economies despite the rise in shadow banking activities in countries such as China, Brazil, India and many other emerging economies (Acharya et al., 2013, Nelson et al., 2018).

Shadow banking activities have grown remarkably in the past two decades. Globally, shadow banking was estimated at 117% of the global gross domestic product (GDP) in 2012 (Li, 2014). Using the broad measure of shadow banking in 2014, shadow banking grew to 127% of world GDP before hiking to 150% in 2015 (FSB, 2016). The Financial Stability Board (FSB) shows that using the broad measure of shadow banking, emerging countries had the highest growth rate in 2014 and 2015 (FSB, 2015). More worrying for most emerging markets is that shadow banking growth has outpaced GDP growth. Also, shadow banking sector in the US; the country with the largest shadow banking sector, outgrew its prior crisis levels. The same is observed in the Euro area. In South Africa alone, shadow banking expanded from 20% of GDP in 2002 to 50% of GDP in 2008, though its growth has slowed down in recent years. In other emerging markets, shadow banking activities have been on the rise. Moody reports that China's shadow banking reached a peak of 87% to GDP by December 2016 before falling to 70% at the end of 2019 at the back of a deleveraging policy (Moody's, 2018). This increase in shadow banking activities poses a greater threat to financial stability where regulation evolution fails to cater for some of these activities. However, there is insufficient documented evidence on the growth of shadow banking in emerging market economies to give policy makers a clear understanding of the role and effects of shadow banking on the economy. Beside the lack of formal studies, Ackermann et al. (2012) note that efforts to reduce the negative effects of shadow banking should be taken without inhibiting the revenue generating capabilities of these activities. To curb the negative effects of shadow banking activities whilst at the same time maintaining its positive impact on credit extension, regulators have to consider the diversity of the institutions involved in shadow banking activities and heterogeneity of financial systems (Rick, 2010). For instance, smaller financial firms and investors may be

unable to meet some of the credit requirements of mainstream bank entities which are enforced by regulation. Suffice to state that there is need therefore to explore characteristics of shadow banking that are peculiar to emerging markets.

Shadow banking includes credit intermediation activities by both banking and non-banking financial institutions which are not part of traditional banking activities. The Financial Stability FSB (2015) describes shadow banking as credit intermediation outside the formal banking sector. According to Li (2014), this general description does not reveal the differences in the types of activities categorised as shadow banking in different jurisdictions. Whilst in the traditional banking system, credit intermediation is done by institutions (commercial banks) whose deposits are insured and/or supported by the central bank's backstop facility, shadow banking activities do not carry any such insurance (Adrian and Ashcraft, 2016). Therefore by nature, shadow banking is a highly risk form of intermediation (Adrian et al., 2015). Malatesta et al. (2016) identifies three functions fulfilled by shadow banks: maturity transformation, credit transformation and liquidity transformation. In performing these functions, shadow banks have been able to reduce the cost of intermediation, lower cost of credit and increase access to credit. As argued in Ackermann et al. (2012), through the identified functions, shadow banking if properly regulated can complement mainstream banks through increased access to credit, which can in turn promote economic growth.

Increased financial innovation in the form of shadow banking is expected to impact economic performance positively given that it can potentially drive credit creation and generate capital for productive firms (Boot and Marinč, 2010, Laeven, 2014, Laeven et al., 2015, Michalopoulos et al., 2009). In addition, shadow banking can increase market efficiency through disintermediation and decentralization of financial services (Schwarcz, 2011). Shadow banking could therefore augment economic growth in emerging countries through its impact on both investment and consumption. Emerging market economies thrive to sustain high levels of economic growth and so could benefit from shadow banking activities as firms access more credit to expand their operations. Given that industrial developmaent in emerging and developing countries is mainly supported by small and medium enterprises who cannot access credit from banks, shadow banking could be an effective source of credit (FSB, 2017). On the contrary, the growth of shadow banking raises concerns about the stability of the

financial system (Li, 2014). As demonstrated during the GFC, shadow banking activities increase propagation of risk and can lead to huge output losses as those experianced during the GFC.

Existing literature on shadow banking sector in emerging countries is mainly theoretical, illustrating its growth both in the pre-crisis period and in the post crisis era (Cozer, 2015, Li, 2014, Mehrling, 2012). Although such narratives offer a strong case against the growth of and possible risks created by shadow financial activities, they do little however in revealing the underlying macro-economic benefits of shadow banking; and he inter-relationship between shadow banking and other economic factors. In most cases reference is only made to the GFC, during which shadow banks played a central role in propagating systemic risk. In some sections however, academics and practitioners are beginning to accept the idea that shadow banking could reinforce financial stability and contribute to economic growth if undertaken within the confines of regulation (Khan, 2015). Therefore, the present study seeks to reveal the channels through which the shadow banking sector impact the financial system as a whole and also the economy in the context of emerging markets. The study will also investigate the influence shadow banking has on financial stability across national borders due to financial linkages amongst emerging countries, considering the increase in South to South trade.

The growth of the shadow banking industry post-GFC has also raised challenges for policy makers and academics in both developed and emerging market economies (Adrian and Ashcraft, 2016, Hsu et al., 2013, Tang and Wang, 2015). Several studies have attempted to analyse shadow banking and its implications for regulation, mainly using the role of shadow banking during the GFC as in Rick (2010) and Huang (2015). Adrian and Ashcraft (2016) for instance argue that shadow banking raises concerns about systemic risk and pose a challenge on the existing regulatory frameworks, since the bulk of shadow banking activities are not regulated. Contrary to these views, Khan (2015) argues that the bulk of studies emphasizing the role of shadow banking in worsening financial stability tends to ignore the innumerable benefits that can accrue from a well-functioning shadow banking system (Khan, 2015). Therefore, the question to be answered is, whether the rapid growth of shadow banking in emerging countries is a threat to stability of financial systems or is a potential accelerator of economic activity?

Furthermore, debate has also risen on the relationship monetary policy and shadow banking, raising questions on whether the dichotomy between macro-prudential and monetary policy can still be maintained (Adrian and Liang, 2014, Chen et al., 2017, Gambacorta, 2009, Lopreite, 2012, Wang and Zhao, 2016). Whilst to a large extent this is an extension of the debate on financial stability versus monetary stability goals, it is envisaged that monetary policy instruments have a bearing on financial markets and bank risk taking, and by extension shadow banking. This suggests close interlinkages between monetary policy and macro-prudential policy, which Smets (2014) argues raises coordination and time inconsistent problems in policy analysis[1]. A more worrying feature arises where shadow banking is not covered by the macro-prudential framework, limiting regulators' strength in fighting financial fragility that may arise through this sector. Two main issues can be drawn from this interaction, firstly, monetary policy has an impact on shadow banking growth (Nelson et al., 2018, Wang and Zhao, 2016, Choi and Choi, 2017). The second issue is that shadow banking has an impact on the monetary policy transmission mechanism, specifically, shadow banking is found to reduce the effectiveness of monetary policy (Verona et al., 2013).

Two new channels of monetary policy are worthy discussing to complete the current discussion on monetary policy and shadow banking; notably, the risk taking channel of monetary policy of Borio and Zhu (2012) and the shadow banking channel of monetary policy suggested by Xiao (2018). In the risk taking channel of monetary policy, changes in the policy rate have an impact on bank risk taking. A contractionary monetary policy for instance reduces bank liquid liabilities and has a negative impact on risk taking. On the contrary, an easy monetary policy stance encourages high risk taking as banks have increased access to liquid assets. As a corollary, an increase in bank risk taking can result in increased shadow banking activities in the event that banks are involved in shadow banking as suggested by Harutyunyan et al. (2015). The study undertakes to empirically test this proposition in Chapter 6 of this study. Whilst Xiao (2018) is not the first to identify an association between monetary policy and shadow banking, they explicitly suggest the existence of a shadow banking channel

[1] The study of specific macro-prudential policy is beyond the scope of this study. The study does not endeavour to analyse macro prudential policy as shadow banking is generally not covered by existing macro prudential policy. However, the spirit of this study is to provide evidence that could be useful for policy makers as they craft policies suitable for sustaining stability in financial markets.

of monetary policy. Their findings are similar to Verona (2013) and show that tight monetary policy increases shadow banking. Banks raise deposits from shadow banking system during monetary contraction but withdraw from this market during monetary expansion. Thus, the existence of the shadow banking channel reduces the impact of monetary policy (Xiao, 2018).

Another new strand of literature relates shadow banking to liquidity creation (Moe, 2012). Negative liquidity shocks are expected to increase shadow banking activity as financial market agents seek a substitute for the reduction in liquidity in the system. This view sees shadow banks as providers of liquidity. However, in a model of shadow banking, Moreira and Savov (2017) show that shadow banking increases liquidity during normal times but negatively impacts liquidity during periods of crisis. Understanding the relationship between liquidity and shadow banking becomes important for policy makers to keep track of market liquidity developments and counter any withdrawal of liquid assets from the market to avoid crises. It can also be shown that liquidity creation by the shadow banking system is closely related to the shadow monetary channel on monetary policy as banks find a haven in shadow banks for liquidity during periods of monetary tightening (Xiao, 2018, Choi and Choi, 2017).

The study also focuses on literature relating to the role of shadow banking in cross border financial shocks. Cross border financial transactions are largely financed by shadow banks and are highly fragile in times of crises, whether in the receiving country or in the financing country (Wheeler and Governor, 2015). Whilst there is evidence that shadow banks play a vital role in cross border financing, no study directly tests the impact that growth in shadow banking has on the transmission of contagion across national borders. The theory on contagion risk has three main dimensions. Firstly, there are studies analyzing contagion between the financial sector and the real sector (Dungey et al., 2010). These studies mainly analyse the channels through which financial instability impacts firm performance and growth. The second strand of this literature focuses on contagion between financial entities in the same jurisdiction, mainly through balance sheet linkages (Degryse and Nguyen, 2007). The third group of studies has taken to analyse contagion risk across national borders, mainly focusing on transmission of financial shocks across national borders (Galesi and Sgherri, 2013, Olafsson, 2018). Whilst the tradition has been to use equity prices as the main financial variable to measure contagion with, there has been a surge recently in studies incorporating bank specific variables in trying

to understand the propagation of financial shocks. The present study focuses on the third group of literature and seeks to provide evidence on transmission of financial risk through the shadow banking sector from one jurisdiction to the other.

In light of the above, it is also noteworthy that shadow banking has strengthened the interconnectedness of Global Financial Markets (Pozsar et al., 2013) and the rapid growth of shadow banking raises the question: what is the impact of shadow banking on a country's trading partners' financial systems? The study therefore makes an enquiry into the role played by shadow banking in effecting financial shocks across national borders through shadow financial liabilities. Available literature on international capital flows does not explicitly provide insight into the role played by shadow banking in the global financial system.

Furthermore, the preceding points to lack of evidence on the risk sharing ability and the impact of shadow banking on real economic variables in emerging market economies. Whilst some studies have found shadow banking to contribute to instability (Hsu et al., 2013), others have argued that it can enhance financial stability (Cozer, 2015). Véron (2013) argues that the debate on shadow bank effects is still in its infancy, mainly because of incomparable and unreliable data. Whereas, the majority of papers have criticized shadow banking as the main cause of the GFC, Véron (2013) finds that shadow banking tends to reinforce financial stability. Thus, there seems to be no agreement on the desirability of shadow banking activities, as on one side they are supposed to result in higher economic performance through increased credit extension and robust financial systems, whilst on the other side, the same activities pose a threat to financial stability (Adrian and Ashcraft, 2016). This study fills this gap by finding specific impact of shadow banking activities on economic growth, monetary policy transmission, firm performance and cross border financial stability in emerging markets.

### 1.2 Research Questions

1. What are the effects of the growth of shadow banking on economic growth and firm performance in emerging countries?
2. Does the growth of shadow banks and shadow banking activity impact financial stability of trading partners in emerging markets?

3. How does the conduct of monetary policy and changes in bank liquidity conditions impact the growth of shadow banking in emerging countries; and is there a clear distinction between the price stability and financial stability goals of the regulator?
4. What is the relationship between shadow banking and bank risk; and how does this relationship impact monetary policy transmission mechanism?

### 1.3 Aim and Objectives of the Research

The main aim of this study is to investigate the growth and impact of shadow banking activities on other economic variables in emerging economies. Shadow banking poses risk to financial markets whilst at the same time it has demonstrated to be important in increasing credit in the economy. The study therefore seeks to analyse its impact and identify channels through which it affects the whole macro-economy. The specific objectives of the study are listed below:

1. To investigate the relationship between shadow banking and economic growth; and firm performance in emerging economies.
2. To understand the role of shadow banks in exacerbating financial instability across borders due to financial linkages amongst emerging economies.
3. To analyse the impact of shadow banking on monetary policy transmission and bank liquidity in emerging economies.
4. To investigate the relationship between shadow banking and bank risk within the monetary policy transmission mechanism.

### 1.4 Hypotheses

1. There is a bi-directional relationship between Shadow banking and economic growth; and there is a positive relationship between firm performance and shadow bank growth.
2. There is a negative relationship between growth of shadow banking in one jurisdiction and financial stability of its trading partners.
3. Tightening monetary policy increases shadow banking activities.
4. Shadow banking has a negative relationship with bank risk.

### 1.5 Contribution to the Body of Knowledge

The study seeks to extend knowledge by providing empirical evidence on the impact of shadow banking on real economic performance, financial stability and monetary policy in emerging economies. Building on previous works, the main theoretical contribution of this study relates to identifying channels through which shadow banking impacts the real economy or propagates financial instability. According to Bengtsson (2016), research on shadow banking is still in its infancy, yet there is need to fully understand it if regulators will be successful in limiting its negative effects. There is need to explore the several dimensions through which shadow banking impacts the real economy. Moreover, other authors (Schwarcz, 2011, Khan, 2015) have argued that there could be many benefits accruing from shadow banking, but most studies have only emphasized the negative role as that experienced during the GFC.

In particular, the study contributes to the body of knowledge in the following ways:

1. The study develops a theoretical model linking shadow banking to economic growth using the Solow growth model. A variant of the Cobb Douglas production function is used in which investment is assumed to be financed by two types of finance; regulated finance and unregulated finance. Unregulated finance is taken to represent shadow banking, whereas regulated finance represents all other formal channels of financing investment. The model is tested using data and shadow banking is found to influence growth positively.
2. The second contribution of the study is also found in Chapter 4. The study is the first to investigate the relationship between shadow banking and economic growth for emerging economies. A novel finding from this analysis is that shadow banking has real effects on the economy and positively impacts economic activity.
3. In Chapter 5, the study illustrates for the first time the linkages between shadow banking and financial stability across different economies. The study is the first to investigate the effects of shadow banking growth in one jurisdiction on financial stability of another jurisdiction. In particular, shocks in shadow banking are found to have an impact on financial stability of emerging economies.

4. The study also contributes to literature by applying the global VAR technique in analysing shadow banking and bank stability shocks across countries. The technique is relatively new but more suited to analysing data dynamics between different countries. This is the first study to utilise the technique in the context of analysing shadow bank shocks.
5. In Chapter 6, the study evaluates shock transmissions between monetary policy rate, bank liquidity and shadow banking. Related studies have only attempted to provide an explanation on how the policy rate responds to shadow banking without accounting for effects of bank liquidity. The study extends literature in this dimension by accounting for linkages between shadow banking, bank liquidity and monetary policy. Of particular interest is the finding that a positive shock in bank liquidity results in an increase in shadow banking, which could be explained by the presence of strong linkages between formal banks and shadow banks.
6. Another contribution of the study is in developing a theoretical model for the determination of shadow banking in Chapter 7. The study develops a theoretical model based on loan demand and loan supply theory. The model shows that shadow banking is determined by the inflation rate, GDP growth, the central bank policy rate and the discount rate in the money market. The model is tested using data on 15 emerging economies and at least three estimation techniques.
7. Chapter 7 further contributes to literature on monetary policy transmission by testing the relationship amongst shadow banking, risk taking and monetary policy. Unlike previous studies which separate between the risk taking channel of monetary policy and the shadow banking channel of monetary policy, the present study shows that increases in risk taking in emerging economies occur through the shadow banking sector.
8. Chapter 8 contributes to literature on the real effects of shadow banking. The study analyses the impact of shadow banking on firm profitability by distinguishing between non-financial firms, banks and all listed firms. In addition to establishing real effects of shadow banking, the study also tests the proposition that formal bank activity has a trade-off with shadow banking activity for South Africa. The findings point to the existence of a trade-off between shadow bank growth and profitability of mainstream banks.

## 1.6 Scope and Limitations of the Study

This study investigates the growth and impact of shadow banking on the macro economy in emerging economies. The study concentrates on four main focus areas, which are topical issues in financial economics at the time of writing; the contribution of shadow banking to economic growth, the impact of shadow banking on firm performance, the role of shadow banking in propagation of risk across borders and the relationship between shadow banking and monetary policy. The study does not however entail a granular study of individual shadow bank assets or activities mainly due to lack of publicly available data and the amount of financial resources that may accompany such surveys.

The main limitation of the study is the lack of long time series data on shadow banking. A limited number of countries participate in the Financial Stability Board (FSB) shadow bank monitoring programme and for these countries data is available starting in 2002. The study considers other proxies of shadow banking used in literature to build the panel data sets used in the study. However, the panel is still restricted to at most 15 emerging economy countries.

## 1.7 Outline of the Study

The rest of the study proceeds as follows; Chapter 2 provides contemporary developments in shadow banking across emerging market economies. Chapter 3 provides an extensive literature review on shadow banking, financial stability, monetary policy and economic growth. The review focuses on literature and theories that form the foundation to the papers presented in Chapters 4-8. In Chapter 4, the study investigates the relationship between shadow banking and economic growth in emerging market economies. The study employs a panel regression analysis covering ten emerging market economies. Chapter 5 presents an analysis of financial contagion transmission through the shadow banking sector. A Global VAR model is used to analyse the impact of shadow banking on financial stability across the borders of 15 emerging economies. The relationship between monetary policy shocks, liquidity and shadow banking is analysed within a panel VAR framework in Chapter 6. Chapter 7 analyses the nexus between monetary policy, risk-taking and shadow banking; and Chapter 8 uses South Africa as a case to establish the relationship between firm profitability and shadow banking. Chapter 9 concludes the thesis and provides policy recommendations. A schematic outline of the study is provided in Figure 1.1 below.

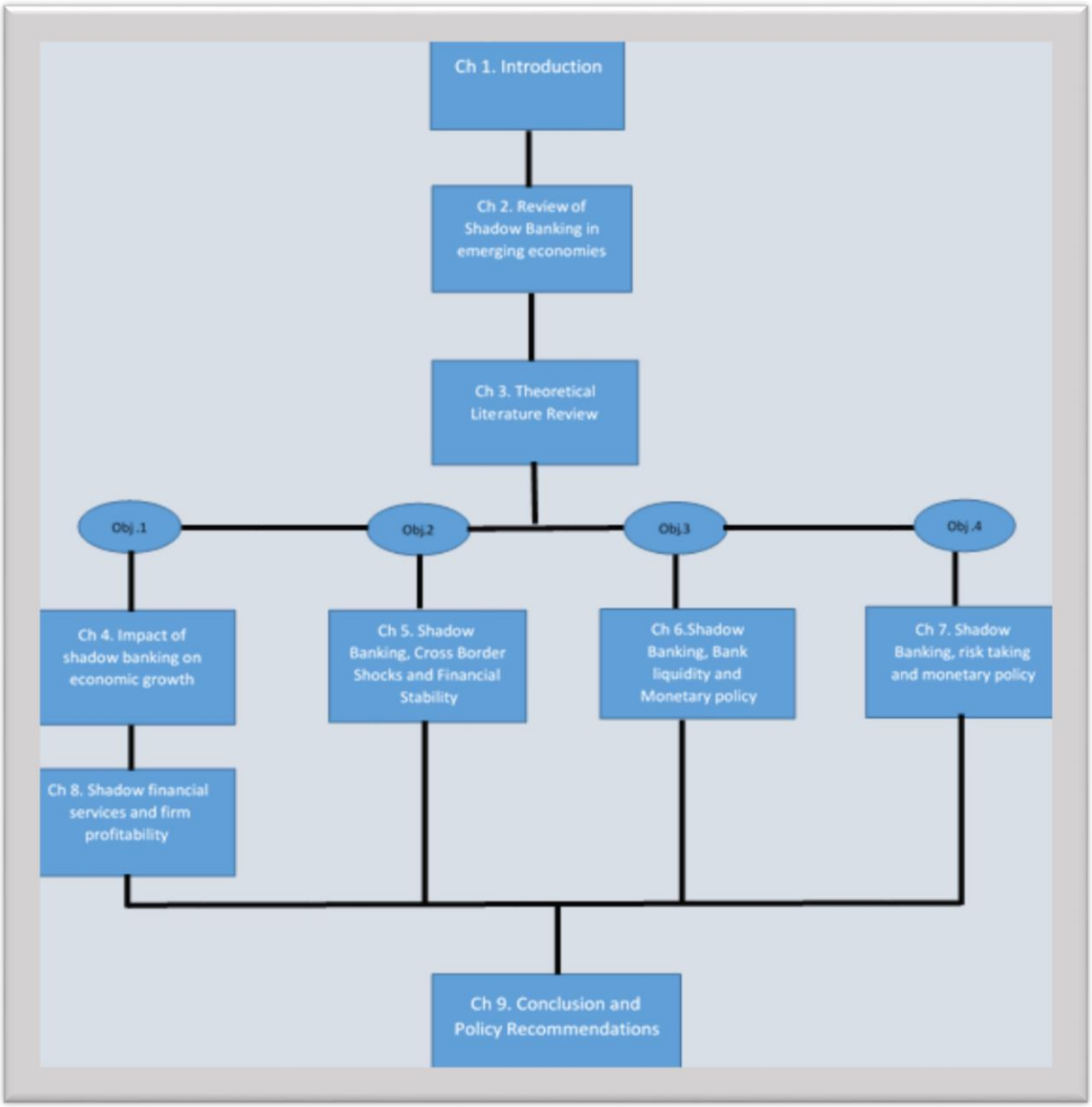


Figure 1.1. Schematic Structure of the Study

### 1.8 Definition of Key Terms used in the Study

A number of key words used in the study needs to be defined to enhance understanding:

**Shadow Banking:** Refers to financial conduct involving credit intermediation fully or partially outside the regular banking system (FSB, 2017). The technical definition used in the study is derived from FSB (2016)'s broad measure of shadow banking and also (Harutyunyan et al., 2015)'s definition that classifies shadow financial liabilities as those emanating from shadow banks both within the country and also from outside.

**Systemic risk:** Describe the spread of financial instability from a single entity into the whole financial system, resulting in a wide spread financial crisis.

**Panel data:** Panel data as used in the study refers to data with both cross-sectional and time series dimensions. An unbalanced panel exists where data units for some cross-sections or time series are not available. A panel data set without any data or observation gaps is referred to as a balanced panel.

**Financial innovation:** Describes the use of new processes, products and institutions to improve financial intermediation.

**Credit Transformation:** Involves the use of securitisations to manage credit risk and improve credit quality. Securitisation involves the pooling together of financial assets (underlying), transferring them to a Special Purpose Vehicle (SPV) and issuing out new trenched financial securities whose priorities differ.

# CHAPTER 2

# DEVELOPMENT AND GROWTH OF SHADOW BANKING IN EMERGING ECONOMIES

In this Chapter, the study provides an overview of shadow banking activities, instruments and functions. The description covers the main types of activities classified under shadow banking and the different role players in the shadow banking system. A brief review of contemporary shadow banking issues is presented for selected countries and information is provided on assets of shadow banking entities in emerging countries. Furthermore, the Chapter illustrates how the Shadow banking sector is positioned within the financial sector and the interactions between the so called 'shadow banks' and formal banking institutions. The Chapter proceeds as follows: Section 1 and 2 reviews the definitions and measurement approaches for shadow banking respectively. In Section 3, the study presents a schematic model of a financial sector with shadow banks and in Section 4, a review of shadow banking in selected emerging market economies is provided. In Section 5, the study describes the functions of shadow banks and in Section 6 shadow banking is linked to financial instability on the background of its role during the GFC.

## 2.1 Definition of Shadow Banking

Several definitions have been used in literature to describe shadow banking. Although each definition emphasises one or two aspects of shadow banking, their differences are not in any way inconsequential. It is therefore important to analyse the different definitions and their implications for measurement of shadow banking activity in different financial markets. The definitions of shadow banking can be broadly categorised as either institutions based or activities based or both (Malatesta, 2015). Institutions based definitions classify shadow banks according to the originator of shadow bank assets. Certain institutions are therefore classified as shadow banks in a distinct way. The activity approach to measuring shadow banking involves identifying activities according to a set criterion without looking at the type of financial institution per se. The second approach provides more insight into shadow banking activities by all financial firms, inclusive of formal banking institutions. It is however more challenging to implement as it requires knowledge about the activities undertaken by

the different role players in the financial industry and the risk attributes of their instruments (FSB, 2013).

McCulley (2009) was the first writer to use the term shadow banking. He refers to shadow banking as comprising of banks that operate outside the traditional banking system with no public backstop. However, it is possible according to McCulley (2009) that shadow banks can have private backstop facilities such as those offered by commercial banks and other non-bank private financial institutions. Two major characteristics can be deducted from McCulley (2009)'s description, firstly the positioning of shadow bank and the shadow banking system. Pozsar et al. (2013) suggest that shadow banking occurs in a unique system that inter-links shadow banks. Shadow banks are therefore defined according to their differences with traditional banks and their positioning in the financial markets. In this light, shadow banking is classified as such because it falls outside the regulatory realm under which formal banks operate regardless of similar functions they fulfil.

However, a central criticism to (McCulley, 2009) definition is their failure to acknowledge the participation of formal banking institutions in shadow banking as argued by (Harutyunyan et al., 2015). In this respect, McCulley (2009) assumes a clear dichotomy between shadow banks and formal banking institutions, a proposition that does not hold in practice. Thus the institutional approach to defining shadow banking does not capture the concept completely.

The second aspect of McCulley (2009)'s description relates to the absence of a public backstop. Shadow banks extend credit that is not supported by any public backstop as opposed to traditional banks whose credit is supported by central banks and in other countries deposits are insured by deposit insurance. The lack of public support and insurance puts shadow banking activities at very high risk compared to traditional banking (Pozsar et al., 2013). Liquidity risk is high in shadow banking compared to formal banking since commercial banks can drop back on the central bank discount window in the event that their liquid deposits dry up. In some cases, however, as mentioned earlier, traditional banks and private insurance companies provide support to shadow banks.

Pozsar et al. (2013) describe shadow banking as consisting of "credit, maturity, and liquidity transformation that takes place without direct and explicit access to public sources of liquidity or credit backstops." Their explanation resonates with McCulley (2009)'s definition and emphasizes the risky nature of shadow banking activities compared to formal banking activities. Whilst formal banks undertake credit, maturity and liquidity transformation with a cushion provided by the central bank or deposit insurance, shadow banks engage in the same functions without that backstop. In addition, shadow bank credit is to a large extent financed through leverage posing more risk in the event of default like what transpired during the GFC.

A definition that has become popular and generally accepted is proffered by the FSB. The FSB has undertaken a unique measuring exercise targeted ensuring financial stability at the global level. The FSB (2017:1) defines shadow banking as:

*"credit intermediation involving entities and activities (fully or partly) outside the regular banking system."*

This definition is important on two fronts. First, it captures the possibility that all institutions, including traditional commercial banks can be involved in shadow banking activities, which resonates with other literature that recognizes the role formal banks play in shadow banking activities (Harutyunyan et al., 2015). Thus shadow banking activity is not limited to those financial intermediaries outside the formal banking sector. Formal banks and other non-bank financial institutions can also participate in shadow banking activities through interaction with other financial intermediaries (OFIs). The FSB uses two technical definitions of shadow banking, broad measure, which consist of assets of Other Financial Intermediaries (OFIs) and the narrow measure based on the economic function approach.

The second *caveat* of the definition is its emphasis on activities rather than institutions only. Various activities have been classified under shadow banking, albeit being heterogeneous across countries (Pozsar et al., 2013). The narrow measure of shadow banking of the FSB captures this heterogeneity, allowing shadow banking activities to differ from one market to another, implying differences in types of risks threatening the different financial markets. In addition, the functional approach also enables analysis of risk propagation from the shadow

banking sector to the formal banking industry and the economy as a whole. Categorizing shadow banking using activities is therefore an important part of defining shadow banking.

Another definition of shadow banking is provided in Harutyunyan et al. (2015) who argues for participation of both banks and non-bank financial intermediaries in shadow financial transactions. Thus, shadow banking is defined as financial conduct outside the formal banking system involving both non-bank financial institutions and banking institutions. The narrow definition of shadow banking used by the FSB supports this idea by classifying shadow banking according to economic function as opposed to non-bank financial intermediaries only (FSB, 2016). This definition allows the researcher to incorporate all financial activities that take place without liquidity or credit backstop whether they are undertaken by formal institutions, non-depository financial institutions (NDFI) or other financial institutions (OFI) (Li, 2014, Harutyunyan et al., 2015, Adrian and Ashcraft, 2016). Whilst OFIs are generally regarded as shadow banks, NDFIs cannot be classified as such although they are non-bank financial institutions. However both formal banks and NDFIs often engage in shadow banking activities such as securitisation of assets and provide finance/leverage to shadow banking entities (Harutyunyan et al., 2015).

The study also alludes to the differences in shadow banking activities from one country to another as pointed by Acharya et al. (2013). Therefore, our definition does not in any way limit the institutions, activities and products/services classified as shadow banking to one market. Instead, the study, acknowledges differences in shadow banking activities and institutions as reported by central banks, especially for those participating in the FSB shadow banking monitoring exercise. Generally, in the US and Europe, shadow banking activity comprises complex financial activities involving securitisations and trenching of various structured securities. In emerging countries such as China and South Africa, Finance companies and Money mutual funds take a leading role respectively (FSB, 2016). Acharya et al. (2013) reports that in the case of India, shadow banks consist of non-bank financial corporations that lend as a substitute for direct bank lending in rural areas with no bank access.

Another important aspect of shadow bank definition is regulation. According to the FSB (FSB, 2012), most shadow banking activities fall outside the regulation frameworks of the markets in which they are undertaken. The argument explains why shadow banking has been associated with regulatory arbitrage. The study does not explicitly define shadow banking as unregulated funding although this definition is not completely wrong but it is also not totally correct as the post GFC era has seen some of the activities classified under shadow banking being covered by new regulations (FSB, 2017).

To conclude the discussion on the definition of shadow banking, it is important to highlight as some have noted that the name 'shadow banking' does not in itself suggest a negative connotation towards the sector (Nesvetailova, 2014). The term according to Nesvetailova (2014) is intended to reveal the opacity and lack of information on this important and growing sector. To put emphasis on the positive gains from shadow banking activities, others have suggested alternative names, such as 'market financing' or 'alternative financing' (Adrian and Jones, 2018). Although the study continues to use the term shadow banking, it takes cognisance of the fact that the sector is important as it provides more financing to firms in the event that the formal banking sector in constrained. Furthermore, the study adopts the definition suggested by the FSB as a working definition for this work.

### 2.2 Measurement of Shadow Banking

The preceding discussion allows us to analyse the different approaches to measuring shadow banking that exists in literature. In this section, the study undertakes a review of the main approaches that have been used by different authors and institutions to measure shadow banking. A note is in order however, because shadow banking activity is opaque in nature, it is inhibitive to any intentions to measure its size and growth over time. Another characteristic of shadow banking that affects its measurement is its continuous evolution with time. New financial innovations continue to be introduced in markets over time making the composition of shadow banking activities and assets susceptible to change.

Malatesta (2015) states that several institutions and researchers have defined shadow banking differently and used different formulas to calculate shadow banking. Kocjan et al. (2012) from Deloitte make a survey of shadow banking definitions and tabulate seven

definitions of shadow banking. It is by no means unclear that in recent time there are more definitions and explanations for shadow banking compared to the time of their publication. In this Section, the study provides an outline of some measurement approaches used in literature and by research institutions to measure shadow banking. Section 2.2.1 discusses the FSB's shadow banking measure. Subsequent sections describe attempts to measure shadow banking by the European Union (EU), Organization for Economic Cooperation and Development (OECD), the International Monetary Fund and also some individual authors.

### 2.2.1 Financial Stability Board Approach

The FSB Global Shadow banking monitoring report is released annually by the FSB for about 29 participating countries[2] as of the day of writing. They compute two measures of shadow banking, the broad measure and the narrow measure. The FSB broad measure comprises assets of Other Financial Intermediaries (OFIs). According to the FSB classification OFIs are, "all financial intermediaries not classified as banks, central banks, public financial institutions, pension funds, insurance companies, or financial auxiliaries". Their method of monitoring shadow banking involves two steps; firstly, it encompasses all non-bank credit intermediation to demarcate the "Monitoring Universe of Non-Bank Financial Intermediation" (MUNFI) or simply non-bank financial intermediaries (NBFI) (FSB, 2016). The second step is narrowing focus to specific non-bank credit intermediators where actions that pose systemic risk and regulatory arbitrage can be identified.

The FSB data is primarily constructed from Flow of Funds data and central bank supervision data. As alluded for before, the first stage of the process, which the Board termed "macro mapping" allows for the gathering of data across all non-bank financial intermediaries. The second stage is where sub-components of NBFI that make up the OFI sector are defined. The decomposition of the OFI sector includes MMFs, REITs, real estate funds, central counterparts, Hedge Funds, Broker Dealers, structured financial vehicles, Finance Companies, Financial holding companies, money lenders and other investment funds. Their importance however in the overall measure differ with jurisdictions and their impact on systemic risk are

[2] Participating Countries: Argentina, Australia, Brazil, Canada, Cayman Islands, Chile, China, Hong Kong, Indonesia, India, Japan, Korea, Mexico, Russia, Saudi Arabia, Singapore, South Africa, Switzerland, Turkey, United Kingdom, United States, Belgium, France, Germany, Ireland, Italy, Luxembourg, Netherlands, Spain

dependent on the extent to which linkages with the formal banking sector exist. Structured finance vehicles for example, can be owned by a bank and could be stated on the bank's balance sheet. Finally, to construct the broad shadow banking measure, total assets of OFIs are employed. The study discusses components of the broad measure and the narrow measure in the ensuing sub-sections.

#### 2.2.1.1 Components of Other Financial Intermediaries (OFIs)

The study treats OFIs as the broader measure of shadow banking as indicated in the FSB (2016) report. The discussion of OFI components given here is not exhaustive due to heterogeneity in shadow banking institutions in different jurisdictions but covers the major institutions.

*Money Market Funds*

Murphy et al. (2008) define a money market fund as, "an open-end investment company that is registered under the Investment Company Act of 1940 (*ICA)* (or relevant local regulator) and that has as its investment objective the generation of income and preservation of capital through investment in short-term, high-quality debt securities". Some of the instruments in which MMFs invest include treasury bills, negotiable certificates of deposit, debentures and banker's acceptances. According to (FSB, 2017), MMFs are mostly concentrated in the US and China, whose share of total MMFs assets is more than 50% of the total value of MMFs. However, MMFs comprise a significant part of OFIs in most emerging economies including South Africa, Saudi Arabia and Brazil.

The downside of MMFs as explained in Kacperczyk and Schnabl (2013) is their distortion of credit intermediation–adding another layer of intermediation between banks and non-financial firms, which creates potential for destabilization of markets. Money market funds have strong incentive for high risk taking, hence, close monitoring is required. The distinction between MMFs and commercial banks is that MMFs do not collect deposits but sell shares to investors. They therefore, do not face maturity mismatch as banks would. However, in the event of precipitated withdrawal of invested funds by investors, MMFs can be forced to fire sale assets to pay required funds (Urga et al., 2017). Urga et al. (2017) also argues or reduced

impact on systemic risk from MMFs during periods of crisis due to unavailability of liquidity in the market.

*Real Estate Investment Trusts*

Real Estate Investment Trusts (REITs) are investment vehicles which directly and indirectly own, lease, operate urban real estate through mortgages, mortgage derivatives and mortgage based securities. Investors in a REITs receive income from the distributions made out of real estate leasing operations. Investors gain diversification benefits from investing in REITs as their return is neither correlated with stocks or bonds. Case (2013) argues that investment in REITs improves portfolio liquidity compared to other types of real estate investments. Whilst the FSB (FSB, 2017) reports a slowing growth rate of REITs in 2016, at the global level, REITs still command approximately 2% of total OFIs assets.

Chaudhry et al. (2004) identify idiosyncratic factors that describe risk inherent in REITs. Their study notes that REITs leverage, liquidity and capital are important determinants of idiosyncratic risk in REITs. According to FSB (2013), Agency Mortgage REITs risk exposure is three fold, being exposed to funding risk, interest rate risk and prepayment risk. Furthermore, high leverage characterizing REITs makes them inherently risk and provides high chances of propagation of systemic risk in the event of a negative shock on its asset. However, an investor is also exposed to short term volatility which is unnatural of real estate as a result of portfolios that include other assets.

*Finance Companies*

These include firms that are involved in credit extension but cannot be classified as depository institutions. The technical definition differs with jurisdictions. However, their main activities comprise lending on leverage including leasing, mortgage financing and factoring instalment sales. Most finance companies are linked to retail companies of durable goods; whose clients they finance. Thus, their return comes in two parts, return from the lent money and also profit on sale of products (Barron et al., 2008). Barron et al. (2008) however, argues that whilst finance companies can obtain a higher return, they tend to assume higher risk compared to formal banks. The FSB (FSB, 2017) shows that Finance companies comprise approximately 4% of the total assets of OFIs. In South Africa for example, three main types of finance companies

are identifiable, vehicle finance, retail finance and consumer finance companies. Although some of these companies are regulated as part of bank Holding companies, majority of these companies are stand-alone companies and lie outside the regulatory mandate of the central bank. South Africa has since established the National Credit Regulator (NCR) to carter for all finance companies (FSB, 2013).

*Structured Finance vehicles*

Structured Finance vehicles pool together investment assets and derive income from taking advantage of the discrepancies in short term and long-term lending using structured financial assets. At the core of structured financing is the concept of securitisation which allows a firm to pool and repackage financial assets, and issue new trenched investment assets to new investors (Criado and Rixtel, 2008). Structured financial assets, including Mortgage Based securities, Asset Backed securities, credit default swaps and Collateralized Debt Obligations were at the centre of the 2007/2008 GFC. According to the FSB (2017), although structured finance has been on the decline globally since the GFC, some emerging economies have seen upsurge in structured financial assets. Furthermore, their report indicates that structured financial vehicles possess high risk in credit intermediation compared to other shadow bank activities. Therefore, a worrying aspect of these structured financial assets is their high riskiness. Thus, whenever there is a rush to safe assets, investors switch from structured financial assets to less risk assets such as government debt.

*Investment Funds*

Bengtsson (2013) investigates the role of investment funds in the shadow banking process. The study identifies several functions performed by investment funds in shadow credit intermediation. Investment funds finance credit intermediation through purchases of short term debt instruments issued by banks, investing in structured credit instruments and also through the use of credit derivatives. By assuming these roles, investment funds undertake liquidity and maturity transformation functions of banks (FSB, 2017). Furthermore, the use of credit derivatives by funds point to the assumption of the role of credit intermediation which is traditionally assigned to banks. Investment funds are therefore undertaking the role of credit transformation.

*Trust Companies*

Trust companies are the main form of shadow banks in China accounting for more than 80% of the assets of all trust companies globally (Li, 2014). According to FSB (FSB, 2017), Trust companies are also the largest component of the shadow banking sector in China measured at US$2.9 trillion as at the end of 2016. Due to regulatory intervention, the sector underwent structural changes between 2008 and 2009. However, since the GFC, it has grown at a faster rate than before the GFC. Trust companies assume the role of commercial banks by lending to private companies. They range from trusts managing individual assets, trusts managing assets for a group of people to trusts that manage properties (FSB, 2017). Trust companies are exposed to both liquidity and credit risk and lack of strict regulation can increase their exposure to negative financial market shocks. In addition, close linkages with the banking sector provides a channel for propagation of financial shocks arising within the Trust company sector to the rest of the financial sector contributing to systemic risk.

#### 2.2.1.2 FSB Narrow Measure

The FSB's narrow measure of shadow banking is based on five economic function classifications of shadow banking activities. Each economic function describes an activity that poses risk to the financial system. The premise behind an economic function approach is its ability to capture activities and institutions in an evolving financial services sector (FSB, 2013). Definitions of the five economic functions are given in Table 2.1 below.

Table 2.1: Economic Functions Definition and Entities

| | EF1 | EF2 | EF3 | EF4 | EF5 |
|---|---|---|---|---|---|
| Activity | Includes managing collective investment vehicles with traits that make them susceptible to runs. | Loan issuing dependent on short term funding | Intermediation of market activities that is dependent on short term funding or on secured funding of clients assets | Facilitation of credit creation | Securitisation-based credit intermediation and funding of financial entities |
| Institutions | Fixed income funds, mixed income funds, | Finance companies, leasing companies, | Broker-dealers | Credit insurance companies, | Securitisation vehicles |

| | | | | | |
|---|---|---|---|---|---|
| | credit hedge funds, real estate funds | factoring companies, consumer credit companies | | financial guarantors, monolines | |

Source: FSB (2015)

Entities and activities under each economic function category pose different types of risks to the general financial system. Collective investment vehicles for instance face threat of runs in the event of a precipitated withdrawal of funds by investors. Securitisation on the other hand, can lead to excessive liquidity and maturity transformation, and use of leverage. FSB (2013) argues that shadow banking activities can therefore pump up asset price increases and increase credit supply in the same way regulated financial institutions do. Their downside is their ability to precipitate a run, however without any public backstop, creating a worse scenario compared to failure of a regulated banking firm. Due to heterogeneity in financial markets, the nature of risks threatening different financial markets depends on the kind of activity that is dominant in a given jurisdiction.

### 2.2.2 International Monetary Fund Approach

Harutyunyan et al. (2015) employ a different methodology based on liabilities of banking institutions. They follow the work of Hahm et al. (2013) who divide bank liabilities into core and non-core liabilities. In delimiting institutions involved in shadow banking, they recognize that all financial institutions involved in credit intermediation were most likely to be involved in origination of shadow financial liabilities. Their definition includes commercial banks as well as money market funds in addition to other financial institutions. To construct their measure of shadow banking, core liabilities are defied as stable sources of financing for banks consisting mainly of deposits. Non-core liabilities cover all sources of financing lying outside the core liabilities definition, inclusive of cross boarder funding.

According to Hahm et al. (2013), an accelerated growth in credit without an accompanying increase in deposits lead banks to seek for other source of funding. The funding sources make up the none-core liabilities component of bank liabilities. Instruments covered in the non-core liability definition includes repurchase agreements, restricted deposits, money market

funds and foreign currency deposits. This is similar to Harutyunyan et al. (2015) who further construct a quarterly data set for several countries.

The approach of Harutyunyan et al. (2015) constructs two measures of shadow banking known as: a broad measure and a narrow measure. Shadow banking instruments included in the definition include restricted deposits, debt securities, loans and MMF shares/units. Their major distinction on the two is done using the transaction counterparts. In both measures, issuers of shadow financial assets include banks, MMFs and OFIs. On the counterparty side, households, non-financial firms, government and non-residents are included. The narrow measure only includes part of other financial corporations (OFCs). In contrast, the broad measure includes all OFCs and all depository corporations. This is summarized in Figure 2.1 below.

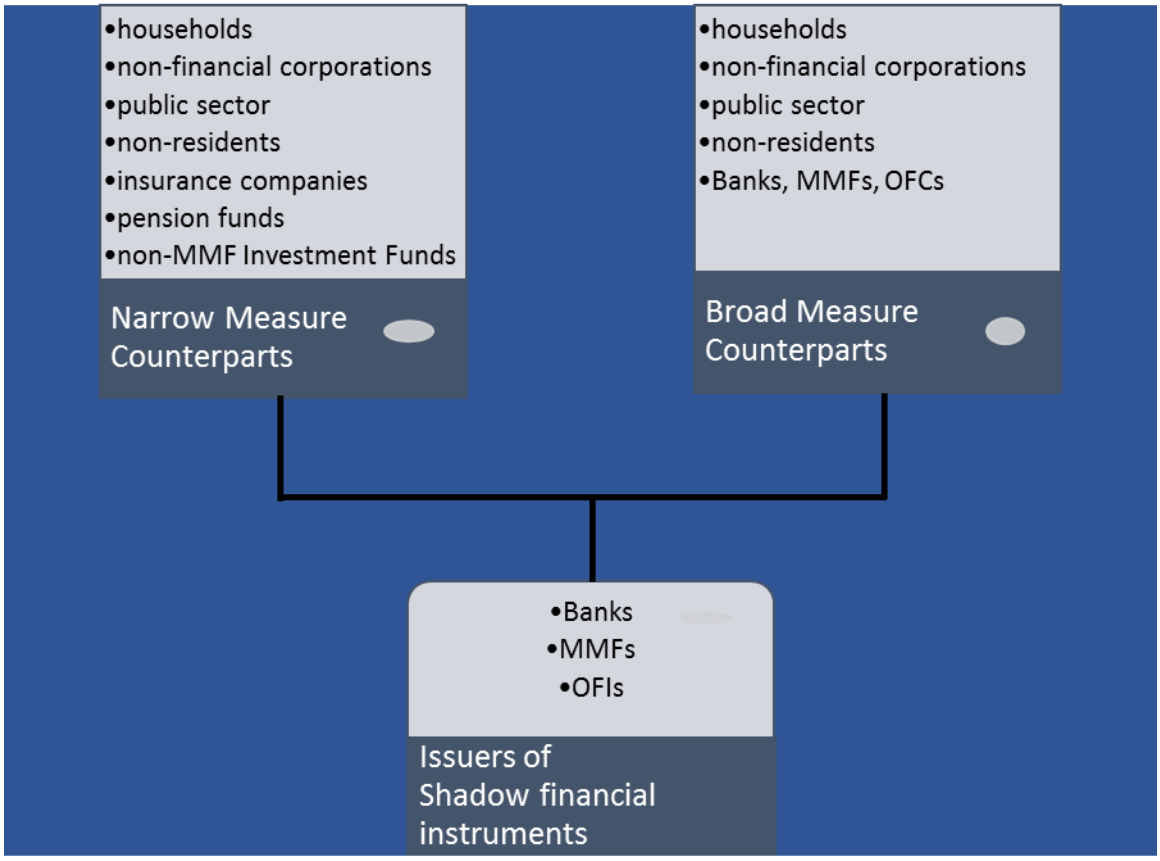


Figure 2.1: Broad and Narrow Shadow Bank Measures (IMF approach)
Source: Harutyunyan et al. (2015)

***Comparison***

Comparing the FSB measure and Harutyunyan et al. (2015), one can point out major differences that exist, especially in the compilation of the narrow measures and the basic approaches used in both papers. The FSB identifies OFIs inclusive of MMFs as the main issuers of shadow assets whereas Harutyunyan et al. (2015) includes Banks in addition to OFIs and MMFs as issuers of bank assets. The underlying approaches in the two methodologies differ fundamentally in that the FSB enumerate assets of issuers whereas Harutyunyan et al. (2015) construct their measure by concentrating on the financing source (liabilities) of financial firms. The narrow measure definition used by the FSB however broadens the catchment of issuers by taking a functional approach, which could also include banks (FSB, 2013).

### 2.2.3 Organisation for Economic Co-operation and Development (OECD)

The OECD also collects data on financial transactions and balance sheets of financial intermediaries, including depository corporations and other financial intermediaries (Hagino and Cavieres, 2012). Hagino and Cavieres (2012) show that the leverage ratios for both OFIs and banks can be used to identify the source of potential financial risk. Although they do not detail how member countries compute the value of OFI assets, the study shows that there have been efforts to collect information on securitisations using questionnaires with a view to understanding the phenomenon. The OECD however does not compute its own measure of securitisation or shadow banking but employs data from ECB and BIS (Hagino and Cavieres, 2012).

### 2.2.4 EU Shadow Bank Monitoring

The European Systemic Risk Board has undertaken to provide shadow bank risk monitoring for the Euro area and has released annual reports on shadow bank in the Euro area and the European Union (EU) since 2016. According to Grillet-Aubert et al. (2016), the main aim for monitoring shadow banking was to provide a platform to identify and close any regulatory gaps. The ECB employs both the institution based measure and an activity based measure for shadow banking. The institution measure includes OFIs and other investment vehicles identified as risky. In 2015, shadow banking comprised 37% of total financial assets of the EU and 28% for the Euro Area. By the end of 2017, these had risen to 45% and 34% respectively.

These entities are engaged in wholesale funding, confirming interlinkages with the rest of the financial sector (Risk, 2018).

The activities based measure emanate from the FSB narrow shadow banking measure. The measure identifies activities that can potentially increase risk in the financial system. Activities covered include leveraged transactions, securities lending and transactions in the repo market. Grillet-Aubert et al. (2016) argue that repos encourage high leverage build ups and therefore could result in increase in vulnerabilities. Securities lending is a form of credit and depends much on the collateral available which can also carry reinvestment risk. Another activity considered is credit enhancement which has the potential to change the risk structure in the balance sheet for both the seller and the buyer of protection.

### 2.2.5 Other Attempts at Estimating Size of Shadow Banks

Several other authors attempt to construct measures or estimate the size of the shadow banking system in different markets (Bakk-Simon et al., 2011, Godfrey and Golden, 2012, Pozsar et al., 2013). The underlying principle in all the studies is the use of flow of funds (FOF) data as the major source of shadow banking data. Pozsar et al., (2013) for instance consider liabilities relating to Mortgage Backed Securities (MBS), other Asset Backed Securities (ABS) and other Government sponsored enterprises' liabilities. Godfrey and Golden (2012) however employ data from the Irish central bank and demonstrate that it is possible to inflate the value of the shadow banking system if one uses the FSB classification without paying close attention to data characteristics.

Bakk-Simon et al. (2011) identify core components of shadow banking for the Euro area focusing on securitisation activity, assets managed by MMFs and the repo market. They find ABS, CDO, commercial and asset backed commercial paper as defining features of securitisation activity for the Euro. The same is echoed for the US by Pozsar et al. (2013), suggesting some similarities in shadow banking activity in the US and Euro. In addition, they use data on monetary statistics from the ECB to account for value of assets managed by MMFs. The third aspect of Bakk-Simon et al. (2011)'s definition also resonates well with other studies for the US and Europe – repos are an integral part of shadow banking financing in both markets (FSB, 2017, Pozsar et al., 2013).

Using the FSB template and definition, Jackson and Matilainen (2013) also construct a broad measure of shadow banking for the Euro area. Their study employ balance sheet data from the European System of Central Banks (ESCB) and data from Euro area financial accounts, which provide flow of funds data. The composition of their estimates is not different however from the FSB since they used the FSB definitions for the various shadow banking entities. They also identify the importance of securitisation activity in the Euro area which is supported by Brañanova (2012) in their study on shadow banking in Spain. In Brañanova (2012), securitisation is the major component of shadow banking in Spain.

Another attempt at delimiting and quantifying shadow banking is undertaken by Kocjan et al. (2012) from Deloitte. Their study identifies the components of the shadow banking system for the US and construct a shadow banking index. Components identified include money market mutual funds (MMMFs), ABCP conduits, ABS, Non-agency MBS, CDOs, Repos, securities lending and agency MBS. Quarterly data on outstanding assets of these entities is collected from Q4 2004 and an index is constructed using 2004 Q4 as the base year. In comparing their measure with other measures, they find great disparities in the size of shadow banking assets, with the FSB broad measure suggesting very high values whilst others (Kocjan et al., 2012, Pozsar et al., 2013, Pozsar and Singh, 2011) suggest lower amounts of shadow bank assets.

In Malaysia, the shadow banking system comprises other financial intermediaries, which specifically undertake the following activities: loan origination, purchase of debt securities, securitisation, credit guarantee or enhancement and credit rating or scoring activities (Farid, 2013). Their definition is in tandem with that of studies in other advanced countries including the US, the Euro and Japan where securitisations and credit enhancement are a major component of the shadow bank measure in these regions (Bakk-Simon et al., 2011, Pozsar et al., 2013, Pozsar and Singh, 2011, Konno et al., 2013).

### 2.2.6 Issues in Measuring Shadow Banking

By its nature, the shadow bank sector is opaque and efforts to quantify it have been met with considerable challenges even in advanced economies (Kocjan et al., 2012, Pozsar et al., 2013).

Emerging markets have not been spared by this challenge as they face more gruelling challenges when it comes to data availability. By 2016, 10 emerging countries participated in the FSB shadow bank monitoring exercise. However, the main distinction between shadow banking in US and Europe, and shadow banking in emerging countries remains in the types of institutions and activities considered. Whilst securitisation is the major shadow banking activity in advanced economies, emerging markets boast of large numbers of Finance companies (although diverse in operations), trust companies and different kinds of investment funds.

An underlying feature of shadow banking institutions in emerging markets is the substituting role played by non-bank financial intermediaries. Li (2014) and Acharya et al. (2013) argue that for China and India respectively, shadow banking involves direct credit extension by non-bank financial institutions. In China, the major participants in shadow banking are Trust companies and brokerage firms, whilst in India finance companies are the major issuers of credit outside the formal banking system. For South Africa, collective investments funds take the larger proportion of shadow bank assets. Such heterogeneity in composition of the shadow banking sector present obvious challenges for cross country comparisons and suggest different approaches to risk management and regulation. Table 2.2 presents a summary of studies that have attempted to measure shadow banking. The measurement components are summarily described and the case country is provided. However, the table is not exhaustive.

In measuring shadow banking, the present study adopts two measurement strategies and use relevant proxies to account for shadow banking in emerging economies. Firstly, the study employs data on OFIs from the FSB and the South African Reserve Bank. Other data used captures shadow banking liabilities in the spirit of Harutyunyan et al. (2015). The proxy used is that of foreign bank liabilities and the data is access from BIS.

Table 2.2. Summary of Shadow Banking Measures

| Author/ Institution | Description | Measure/Definition | Country/region |
|---|---|---|---|
| FSB<br>2012-2018 | Shadow Bank Monitoring Report + Data | Broad measure – OFIs<br>Narrow measure – Economic functions | Global |
| ECB<br>2016-2018 | EU Shadow Bank Monitor | Entity based measure – OFIs<br>Activity Based measure | Euro Region |
| Pozsar (2010) | Shadow Banking | Securitisation, ABCP, ABS, CDO, repo transactions | US |
| Godfrey and Golden (2012) | Measuring shadow Banking in Ireland | financial vehicle corporations (FVCs), money market funds (MMFs)<br>and investment funds (IFs) | Ireland |
| Bakk-Simon et al. (2011) | Shadow Banking in the Euro Area | All OFIs | EU |
| (Hsu et al., 2014) | Shadow Banking and Systemic risk in China | Banks, trusts, broker-dealer<br>pension, micro-loan<br>companies, guarantee companies, pawnshops, investment, financing<br>companies, brokers | China |
| Deloitte<br>(Kocjan et al., 2012) | The Deloitte Shadow Banking Index | MMFs, ABS, ABCB conduits, non-agency & agency MBS, CDOs, Repos, Securities lending | US |
| IMF<br>(Harutyunyan et al., 2015) | Shedding Light on Shadow Banking | MMFs, other OFIs and Banks | Global |

Source: Author's Compilation

## 2.3 A Schematic Model of a Financial Sector with Shadow Banking

The section adapts the framework suggested in Moreira and Savov (2014) and Harutyunyan et al. (2015). Harutyunyan et al. (2015) argue that a complete model of shadow banking should include non-traditional financial intermediation as practiced by both banks and other financial intermediaries. This definition contrasts the general view which ascribes shadow banking to non-bank financial intermediaries (other financial intermediaries) only. The present study borrows this wider definition of shadow banking to include non-traditional financial intermediation activities practiced by all financial institutions. The following diagram, Figure 2.2 with own alterations represents a financial sector with a parallel shadow banking sector as in Harutyunyan et al. (2015).

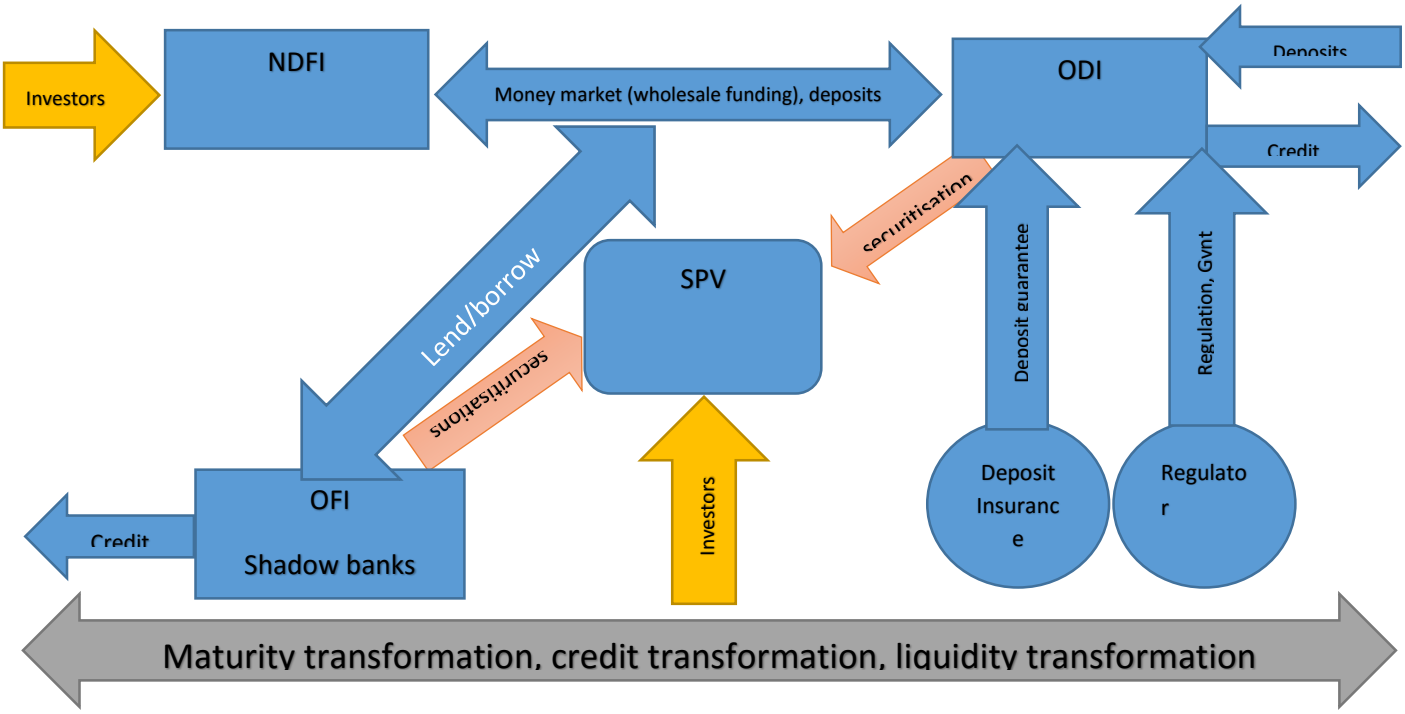


Figure 2.2: Schematic Model of Financial Sector with a Parallel Shadow Banking Sector
Source: Adapted from Harutyunyan et al. (2015)

From Figure 2.2 OFIs interact with both banks and other Non-Depository financial intermediaries through the wholesale funding market. This is in line with the notion that banks and insurance comapnies also raise finance in the repo market for instance (Pozsar and Singh, 2011). Formal bank institutions and OFIs both issue securitised financial assets through different forms of SPVs. Another characteristic shared by banks and OFIs in this illustration is credit extension. Following Li (2014) and Adrian and Ashcraft (2016), shadow banks replicate the functions of formal banks. The distinction however, is the lack of a public backstop. Thus, shadow banks extend credit without any deposits that back the credit, and in the absence of either a Deposit insurance scheme or central bank backstop.

**Interconnectedness with other Financial Entities**

The demise of a shadow bank is only of consequence to the whole economy or financial sector to the extent that the shadow bank is connected to other financial entities (FSB, 2013). The interconnectedness between shadow banks and formal banking institutions increase the probability that risks emanating from the shadow bank system will have an impact of the financial sector as a whole. The FSB (FSB, 2017) reports on the existence of both direct and indirect linkages between shadow banks and banks or other financial corporation. Linkages

between banks and shadow banks are bi-directional, with banks receiving financing from shadow banking and providing financing to shadow banking also. On the other hand, in some jurisdictions shadow banks are effective in supplying liquidity to banks during periods of monetary tightening (Choi and Choi, 2017). Thus, with assets and liabilities of the different institutions recorded on each other's balance sheet, vulnerabilities arising in the shadow banking sector could be transferred through balance sheet linkages to the main stream banking sector.

The major consequence arising from these balance sheet linkages can be insinuated from the losses that were experienced during the GFC where both formal banking institutions and shadow banks experienced great losses due to both liquidity risk and insolvency. The FSB (FSB, 2017) documents that amongst emerging economies Brazil, South Africa, Chile and China have the highest bank liabilities financed by OFIs. Thus, shadow banking sector vulnerabilities in these countries' can transfer to the whole banking system faster.

### 2.4 Growth and Development of Shadow Banking in Selected Emerging Economies

Development and growth of shadow banking has accelerated in emerging countries during the period after the GFC, surpassing even the growth of shadow banking in advance economies (FSB, 2015). Due to trade inter-connections amongst emerging countries and between these countries and global financial markets, it is noble to make an inquiry into the effect of the expansion of shadow banking on these group of countries.

Figure 2.3 shows the assets of financial intermediaries, including banks and non-bank financial intermediaries. Non-bank financial intermediaries are divided into pension funds, public financial institutions, insurance corporations and other financial institutions (OFIs). OFIs provide the broad measure of shadow banking according to the FSB definition. The graph shows that there has been upward trend in the assets of OFIs, even in periods where bank assets have declined. Clearly, it can also be shown that the GFC had a negative impact on the growth of the assets of all financial intermediaries, signifying the effect of the interconnectedness on financial market players.

A closer analysis of Figure 2.3 shows that the proportion of OFIs in total financial assets has rapidly increased during the period under consideration in comparison to both Insurance companies and Pension funds, whereas at the beginning of the century they were almost at the same level. The FSB (2016) reports accelerated growth in OFIs in emerging market economies with China experiencing about 46% growth whereas other emerging countries had growth rates above 10% between 2015 and 2016. During the same period major advanced economies experienced a decline in shadow banking activities.

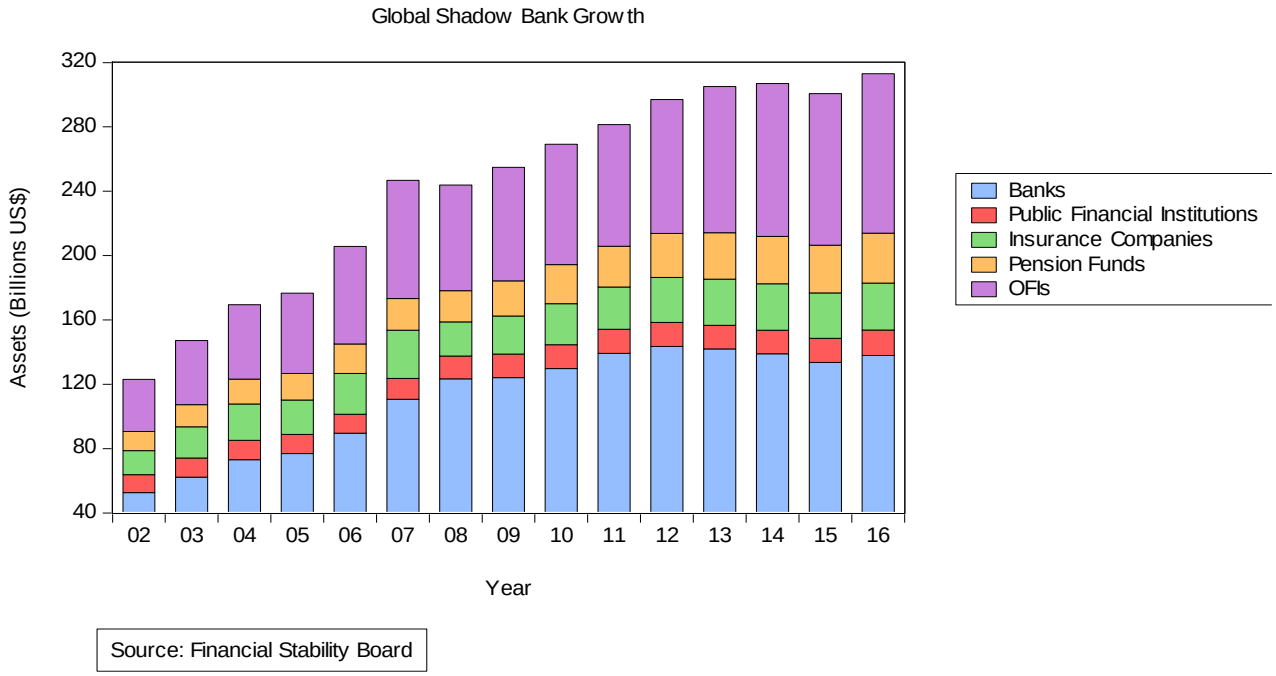


Figure 2.3: Global Growth of Shadow Banking versus Rest of Financial Sector

Recent reports continue to show stabilisation of the industry in advanced economies. The ECB (2018) reports on zero growth of the shadow banking sector during the year 2017 signifying stability of the shadow banking sector in advanced economies. Furthermore, the FSB (2017) notes a decrease in the proportion of OFI assets in the US, Japan and the UK. However, the FSB (2018) reports on increased shadow banking assets in emerging economies. Below is a description of shadow banking in selected emerging market economies.

### 2.4.1 Shadow Banking in China

Funke et al. (2015) documents that shadow banking rose out of the need to support interest rate liberalization in China and also as a result of regulatory arbitrage. In Li (2014), the shadow

banking sector involves direct credit extension by non-bank entities including state owned enterprises which lend money to small and medium enterprises (SMEs). Traditional shadow banking in China was meant to close the gaps left by the main stream banks. However, with time, bank motives seem to have changed in light of the lucrative profits offered by shadow banking. Other institutions involved in Chinese shadow banking sector include trust companies, brokerage firms and special purpose vehicles (Hsu et al., 2013).

It is noteworthy that China houses most of the largest banks in the world as measured by bank capitalization. Standard and Poor (Mehmood and Chaudhry, 2018), reports that four of the largest banks in the world are Chinese banks (Industrial and Commercial Bank of China Ltd, Agricultural Bank of China, China Construction bank and the Bank of China). With shadow banking at 82% of GDP and still growing in China, there is potential of bank spill overs and financial contagion in the event of a default by Chinese banks. However, whether these will affect China's trading partners is dependent on the inter-connectedness between the Chinese financial markets and those of its trading partners. Till date, the Bank of China has opened branches in India, South Africa and Brazil, strengthening financial ties amongst these economies.

### 2.4.2 Shadow Banking in Brazil

Girasa (2016) notes that Brazilian shadow banking system has expanded, threatening stability of the financial system. Compared to the period prior to the GFC, according to Girasa (2016), the level of shadow banking in Brazil could have worsened the stability of the financial system. However, in direct contrast to this view, Cozer (2015) finds that shadow banking is not a threat to stability in Brazil. Shadow banks in Brazil include hedge funds and special purpose vehicles. There is a close interconnectedness amongst financial institutions with 25 banks reigning as the most connected. Risk for contagion is therefore high in the case of default by a single bank.

### 2.4.3 Shadow Banking in South Africa

The SARB (2016) records that shadow banking has only grown modestly in South Africa in contrast to other emerging market economies. Using the FSB's narrow definition which excludes non-risk threatening activities of other financial intermediaries, shadow banking

assets grew from 24% of GDP to 27% of GDP between 2008 and 2015. There has been however a variation in the composition of shadow banking assets with multi-asset funds expanding, whilst money-market funds and fixed income funds have been on the decline. Shadow banking institutions include: hedge funds, money market funds, structured investment vehicles, exchange-traded funds, private equity funds, securitisations, Real-Estate Investment Trusts (REITs), trust companies and other asset-backed financing vehicles (Kemp, 2017). Finance companies and securitisations are to a larger extent not regulated, only being addressed through market regulation, thereby, posing threat to financial stability. Shadow banking has remained a regulatory concern in South Africa (SARB, 2016). Kemp (2017) provides a detailed analysis of shadow banking interconnectedness with the broad financial sector in South Africa. Her findings show that shadow banks are highly interconnected with the financial sector. These findings are supported by data from the FSB (2017) which shows that bank use of funding from OFIs is nearly 14% in South Africa which is third globally behind Luxemburg and Brazil.

### 2.4.4 Shadow Banking in India

Acharya et al. (2013) study the growth of non-bank financial institutions in India with a motive to understand the expansion of shadow banking in India. They find that non-bank financial institutions act as a link between banks and non-urban areas. India's non-bank financial institutions mainly offer loans and asset financing. Thus, bank lending reaches borrowers indirectly via the no-bank financial institutions. The argument for the existence of such non-bank institutions is the inability of banks to reach out to small and medium enterprises which are a large part of the Indian non-financial firms. NBFIs in India also actively provide housing financing and are highly interconnected with the banking sector (FSB, 2017). Furthermore, Sherpa (2013) finds that other players in the shadow banking sector includes, informal financial institutions such as gold loan companies, commodity trade financiers, chits funds and pawn brokers. Reasons given for increase in shadow banking in India include regulatory arbitrage and the need to cater for the unbanked and financially excluded. Thus, shadow banks in the form of microfinance companies play a major role in providing loans to small and medium enterprises, and the poor who do not have readily available collateral. Gold loan companies for example lend money on the back of collateral in the form of gold jewellery. In

contrast to the US system and other financial systems, in India, securitised debt instruments such as collateralised debt obligations and credit default swaps are not permitted.

Table 2.3: Analysis of Shadow Banking in different Emerging Economies (Summary)

| **Country** | **SB Institutions** | **SB Activities** | **SB Assets** |
|---|---|---|---|
| Brazil | hedge funds, special purpose vehicles | Wholesale funding, Direct lending | Loans, financial assets |
| China | Single money trusts, collective investment trusts, property trusts companies, brokerage firms, special purpose vehicles | Wholesale funding, Direct lending, asset management | Loans, various financial assets |
| India | Finance companies, Investment companies, micro-finance, gold loan companies, commodity trade financiers, chits funds, pawn brokers | Unsecured lending, asset financing | Loans |
| South Africa | hedge funds, money market funds, structured investment vehicles, exchange-traded funds, private equity funds, securitisations, Real-Estate Investment Trusts (REITs), trust companies, asset-backed financing vehicles, finance companies | Wholesale funding, direct lending (including unsecured lending), securitisation | Loans, various financial assets |

Source: Author Compilation

### 2.5 Functions of Shadow Banks

According to Pozsar et al. (2013), shadow banks undertake the traditional functions of banks, credit transformation, liquidity transformation and maturity transformation outside the formal banking system. In addition, shadow banks are also characterised by high use of leverage.

### 2.5.1 Credit Transformation

Traditional banking has always involved taking arbitrage positions whenever possible to gain from discrepancies in credit risk and yields of lenders and borrowers. Also called credit intermediation, transformation of credit allows an intermediary to fund high risk loans with low risk debt for instance. Adrian and Ashcraft (2016) and Pozsar et al. (2013) show that for credit intermediation to work, it is often enhanced by public or private enhancements. Enhancements are in form of credit guarantees and can be in the form of contingent lines of credit or credit default swaps.

Unlike deposit supported credit issued by banks, shadow banking credit intermediation is complex in that it relies on whole-sale funding sources, typically the repo market or money market. Furthermore, the ability of firms to securities debt also plays an important role in credit intermediation in the shadow banking sector. Complexities brought about by wholesale funding and securitisation make it more difficult for investors and regulators to rate the credit risk of issuers of shadow bank credit instruments. Similar to the period prior to the GFC when very risk assets were financed by less riskier tranches of investments, rating agencies tend to fail to correctly identify risk within the shadow banking sector (Acharya et al., 2013).

### 2.5.2 Maturity Transformation

In addition to commercial banks and investment banks, shadow banks also engage in maturity transformation which involves transformation of short term bank liabilities into long term assets (Drechsler et al., 2018, Segura and Suarez, 2017). For instance, banks receive demand deposits which are generally short term in nature or can raise funds in the interbank market to use in funding long term loans. Diamond and Dybvig (1983) suggest that banks engage in maturity transformation due to liquid preferences of investors and long term nature of investment projects. Banks are able to charge a term premium to capture profits from their long term assets.

In managing risk associated with maturity transformation however, understanding the shape of the yield curve is essential for any financial intermediary that undertakes maturity transformation. In addition to the term premium, maturity transformation can also vary depending on the bank's risk aversion and regulatory environment (Drechsler et al., 2018).

Banks are therefore prone to interest rate risk exposure which according to Entrop et al. (2015) affects a bank's assets through two main channels, roll-over risk and valuation risk. Roll-over risk captures the possibility of rolling-over a loan at a disadvantageous interest rate, whilst valuation risk is the impact of changes in the interest rate on the time value of money calculations.

Lack of regulatory limits, however, can lead to excessive maturity transformation by shadow banks as in the GFC which consequently has detrimental effects on the stability of the whole financial system. Both credit and liquidity risk could also be amplified in the case of shadow banks due to: (1) lack of a public backstop on the wholesale sourced funds, and (2) high risk taking meant to exploit profitable opportunities. Thus, whilst maturity mismatching for a commercial bank can still trigger a liquidity crisis if not monitored, a central bank backstop and regulatory requirements tend to reduce riskiness of commercial bank activities. Whilst others have argued that maturity transformation can enforce discipline in banking institutions (Bhattacharya and Thakor, 1993, Drechsler et al., 2018), the GFC has demonstrated the need to monitor the level of risk taking by economic agents.

### 2.5.3 Liquidity Transformation

Pozsar et al. (2013) define liquidity transformation as, 'the use of liquid instruments to fund illiquid assets'. Liquid securities can be issued to finance illiquid assets such as mortgage loans which are generally long term in nature. In their seminal paper, Diamond and Dybvig (1983) argue that banks are able to finance their illiquid assets with liabilities with liquid returns. They further point out that banks are prone to runs as a result of the illiquidity of their assets. During times of stability, agents can continue to deposit funds into the bank and the bank can issue loans. However, in crisis, agents can draw down their deposits resulting in a 'run' on the bank.

Shadow banks are also involved in liquidity transformation (Moreira and Savov, 2017, Chernenko and Sunderam, 2016). According to Chernenko and Sunderam (2016), shadow bank institutions such as investment funds can create open end funds that allow investors to buy the fund's shares or withdraw their investment at any time. This characteristic allows the funds to practice liquidity transformation as their liabilities are liquid. Illiquid assets can

therefore be invested in allowing the fund to earn a liquidity premium. In securitisations, new securities are issued to investors who provide a source of liquidity against illiquid underlying assets (Meddin, 2005).

Major risks arising from liquidity transformation include liquidity risk which can arise from lack of deposit insurance (Diamond and Dybvig, 1983), wholesale funding without guarantees and use of contingent financial instruments (Goodhart and Perotti, 2015). Banks' reliance on wholesale funding is also blamed as one of the causes of the 2007/2008 crisis. The extant literature on the origins of the 2007/2008 call the crisis a liquidity crisis. Nesvetailova (2014) argues that market watchers failed to keep in check the new complex securities that were being graded in the market. Whilst these assets were presumed to be liquid, the opaqueness of the shadow banking system ensured that investors could not price these securities correctly. This led to the disappearance of the market for these securities, hence a pronounced liquidity crisis which led to a systemic crisis, firstly in the US and also to other countries.

### 2.5.4 Leverage

In addition to replicating the core functions of commercial banks, shadow banks are characterised by extensive use of leverage. REITs for instance depends more on leverage. Higher levels of leverage usage can lead to a piling up of instability in the system which could crush the financial system at the slightest trigger. Thus, compared to commercial banks, shadow banks pose higher risk to the financial system (Malatesta et al., 2016). The fact that leverage is employed as a financing tool raises uncertainty and risk. Therefore, it is imperative for financial authorities to monitor the growth of leverage outside the formal banking system to reduce systemic risk.

Gennaioli et al. (2013) propose a model of securitisation which shows that it can increase leverage by providing risk-sharing opportunity to intermediaries who in turn are able to reduce inherent firm specific risks. Banks can use senior tranche of the investors' assets as collateral for acquiring more debt, thereby raise their level of leverage. Their conclusion is that entities that securitize have an incentive to increase leverage. Plantin (2014) also argues that regulation limits leverage in commercial banks. However, shadow banks have no

restriction on the amount of leverage resulting in huge amounts of leverage positions in the shadow banking sector.

### 2.6 Shadow Banking and Financial Stability

The major drawback associated with expansion of shadow banking activities is their capacity to originate and amplify risk (Kim, 2017, Adrian and Ashcraft, 2016). Shadow banks possess inherent risk attributes derived from the nature of their business. As a result of the assumption of bank-like functions, shadow banks face the same intrinsic risks that banks face. In addition to the common risks faced by banks, shadow banks also face unique risks. Luttrell et al. (2012) analyses the risk exposures of shadow banks compared to traditional banks. They argue that whilst in the traditional banking system there is only one intermediary using the 'originate to hold' paradigm, the shadow banking system involves several intermediaries. The later concept is known as 'originate to distribute'.

The participation of many intermediaries in the shadow banking credit extension framework has two explanations. Firstly, as a risk sharing tool, it can be important in reducing institutional specific risks. In bank securitisations for example, the use of an external financing vehicle can allow the bank to reduce balance sheet risk[3]. The second explanation is that the involvement of many enterprises and securitisation of assets increases the opacity of shadow banks which can undermine the ability of investors, regulators and even rating agencies to accurately determine the extent to which a shadow bank and/or its activities are risky. In particular, shadow bank credit intermediation involves a number of entities or layers of intermediation unlike commercial banking in which the lender directly extend credit to the borrower. Turner (2012) argues that in addition to a chain of intermediation, shadow banks use huge amounts of leverage.

The major point of reference in analysing risk associated with the shadow banking sector is the role it played during the financial crisis of 2008. The US had developed a highly sophisticated financial services sector with quite a huge non-bank financial sector compared to other regions. Thus, a wide range of financial activities were being conducted in financial

[3] Bank holding companies are now required to report consolidated financial report inclusive of their Special Purpose Entities.

market which replicated bank-like functions. One major activity that led to the build-up of vulnerabilities was securitisation. Securitisations involving non-investment grade loans or securities to issue new securities such as ABS increased moral hazard and encouraged high risk taking in US financial markets. Coupled with high credit ratings ascribed to these institutions by rating agencies, the industry grew exponentially. However, the nature of the shadow banking system makes it vulnerable to sudden withdrawals of funds from the system by major players in the market. When Lehman Brothers suffered insolvency, the liquidity shock spread quickly into the whole system as investors withdrew funds out of these structured financial assets markets.

Credit intermediation in the shadow banking sector just like credit intermediation in formal banking institutions, also involves maturity and liquidity transformation. Maturity mismatches are a common feature of banking activities as in most cases liabilities are short term whereas assets are long term. Banks therefore need other sources of finance to cover immediate payment requirements. At the same time, banks face liquidity challenges from time to time as available liquid assets may not cover liquidity needs of the bank. Two main sources of such financing are the central bank discount window and the interbank market. Thus, banks always have protection from failure as they can access funds from the central bank acting as the lender of last resort. Turning to shadow banks, it is clear that due to duplication of similar functions as banks, they also face similar risks as alluded to earlier. However, the absence of a central bank backstop raises the risk of failure in shadow banks.

Furthermore, shadow banks are subject to bank runs just as commercial banks are and do not have any insurance on investment money belonging to investors. In MMFs for example shares sold to clients are redeemable immediately at the request of the investor. Sudden withdrawal of invested funds by a sizable number of investors could force the firm to run out of liquid assets, further causing panic and hence resulting in failure of the entity. Gorton and Metrick (2012) also argues that the 2007/2008 crisis was a run on the repo market. The repurchase market is used by all financial intermediaries as a source of financing, including banks and shadow banks. Instruments such as commercial paper are issued to raise finance. In contrast to commercial banks, shadow banks depend almost entirely on these wholesale markets for

external finance. Thus, a negative shock in liquidity in these markets can have an enormous impact shadow banks resulting in increased financial markets fragility.

### 2.7 Concluding Remarks

The present chapter provides a review on the development of shadow banking, focusing on emerging market economies. The chapter presents the main shadow banking institutions, the interaction between shadow banks and other financial intermediaries and also the definition and measurement of shadow banking. In addition, this chapter is a foundation to understanding further theoretical issues underpinning this study which are reviewed in the next chapter.

# CHAPTER 3

## THEORETICAL LITERATURE REVIEW

This chapter provides a review of literature on major theoretical foundations underpinning this study. Firstly, in Section 1, shadow banking is placed within two theoretical foundations and implications for its growth are analysed. Shadow banking is positioned within the broader theory of financial innovation and studies on Non-Bank Financial Institution (NBFI). Theories on financial stability are discussed in Section 2 using the Financial Instability Hypothesis as the point of departure. Section 3 analyses the impact of shadow banking/financial innovation on economic performance. Particularly, the study reviews literature on economic growth, financial development and financial innovation. Section 4 relates shadow banking to monetary policy shocks and the monetary policy transmission mechanism. The literature on the impact of both monetary policy and bank liquidity on shadow banking is also reviewed. Shadow banking increases interconnectedness of financial entities through global balance sheet linkages and has an impact on stability of global financial markets. The study reviews literature on financial contagion across national borders in Section 5.

### 3.1 Traditional Theory of Financial Innovation

Earlier contributions to the financial innovation literature include Gurley and Shaw (1960) ,Ben-Horim and Silber (1977), Silber (1983), Silber (1983), (Tufano, 1989, Tufano, 2003) and Allen and Gale (1994). Gurley and Shaw (1960) attempts to explain the role of non-bank financial intermediaries in an economy. Their study is driven by the introduction of new financial assets, which NBFI were issuing. They established that the new securities had an impact on the money demand function and money supply. Securities issued by NBFI reduce money supply since they are substitutes to money and increase the interest rate elasticity of money demand. With their proposition, financial innovations are expected to impact equilibrium in the money market and affect the effectiveness of monetary policy. The importance of NBFI has since increased in financial markets with more than half of total financial assets belonging to this group by 2016 (FSB, 2018).

Tufano (2003) undertakes a review of the traditional literature on financial innovation and find a wide pool of related studies. These include general equilibrium modelling, innovation and regulation, legal policy and tax rules, role of regulation in driving financial innovation, studies offering explanations for existence of financial innovations and also empirical literature on innovation processes. Introduction of financial innovation in general equilibrium models is one of the oldest yet scathe area of research. Several studies have attempted to empirically model the impact of different financial innovations on the macro-economy starting with the contributions of Gurley and Shaw (1960) and Ben-Horim and Silber (1977). Recent notable contributions are attempts at assessing the impact of shadow banking and other NBFI on monetary policy effectiveness in a DSGE setting (Funke et al., 2015, Gerali et al., 2010, Verona et al., 2013, Wang and Zhao, 2016).

Another variant of the innovation literature argues for the role of imperfect financial markets in stimulating financial innovation. In this regard, innovation is seen as a response to high transaction costs, information asymmetries and other market imperfections (Cass and Citannaa, 2011, Tufano, 2003). The basic idea is that financial innovations improve efficient allocation of resources in markets. Ideally, attainment of pareto optimality is expected to improve with the introduction of an innovative financial product or process (Cass and Citannaa, 2011). This view is supported by a number of findings on the efficiency improving ability of new financial products (Hodrick, 2014). In this theory, reduction in transaction and information search costs is expected to improve the way deficit units and surplus units interact.

Tufano (2003) and Adrian and Ashcraft (2016) identify tax, capital and accounting regulation as drivers of financial innovation. Financial innovation is seen as a form of regulatory arbitrage; which financial intermediaries use to avoid regulation. Tight regulations imposed on financial institutions drive them to be innovative and introduce new processes or products that are outside the arm of the regulator (Silber, 1983, Alhusen, 2016). Regulation is seen as reducing the efficient functioning of markets, mainly in two ways. Firstly, regulation limits the activities and extent to which banks and other financial firms can make profit. By defining the scope of activities and outlawing certain actions, regulators can limit banks' profitability. Secondly, regulation can reduce retained profits of firms through fees and taxes.

Capital requirements such as those imposed by the Basel codes ensure that credit intermediators do not exceed certain thresholds when they issue loans. Basel 3 for instance propose the proportion of Tier 1 and Tier 2 capital that banks should hold. Holding more capital has potential to deny banks possible gains from economic activities. However, legislation has both an upper bound and a lower bound effect on financial innovation. The lower bound being the minimum legislative infrastructure for the thriving of financial innovation or the financial sector as a whole. The upper bound relates to the need for legislation to curb the extent to which market players can undertake highly risky investments. In Ngwu (2016), legislation should ensure that banks do not abuse the ability to use off balance sheet financing and misrepresent their capital thresholds. That is, there should be enough regulation to avoid too much risk taking by market agents. Capital adequacy thresholds enshrined in the Basel framework attempt to ensure stable banking systems by limiting the risk certain institutions can take (Balin, 2008). The development of securitisation is usually cited as one such innovation providing financial agents with a channel to increase lending activity beyond the prescribed capital thresholds. This is evidenced by a surge in off-balance sheet activities in financial markets during the period prior to the GFC.

Contrary to the idea that innovation improves efficiency is the view that recent innovations have created an opaque system with complex products. Alhusen (2016) argues that information asymmetries rise from the lack of knowledge of the processes and products by one party to the transaction. Producers of financial products tend to know their products better than investors and other stakeholders. The result is failure to effectively rate and price the risk of a given financial instrument. A case in point is the failure to rate ABS by credit rating agencies (CRA) in the period leading to the GFC (Harper, 2011). According to Harper (2011), CRAs contributed to the financial crisis by conniving with issuers of securitized products whose underlying were low rated products on how they could highly rate their asset-backed securities.

Tufano (2003) however argues that the presence of information asymmetries can be a driver of financial innovations. His argument reinforces the idea of using innovations to complete markets. Another reason for development of financial innovation given in Tufano (2003) is

the need to manage risk. Financial innovations are seen as instruments of managing increasing risks. This proposition identifies with the increased use of financial derivatives in financial markets (Semmler and Bernard, 2009, Instefjord, 2005). Derivative instruments do not only help financial institutions to share risk and lower on-balance sheet risk but also can effectively reduce systemic risk by contributing to stability of individual financial institutions. Thus, shadow banking activities can be expected to lower financial markets risk.

In addition to these classifications, there has been an increase in studies which explore different individual financial assets/processes during and after the GFC (Shin, 2009, Tang and Wang, 2015, Turner, 2011, Ucha, 2016). Main processes explored in these papers include securitisation and off-balance sheet financing. The popularity of securitisation has increased since the failure of securitised products during the GFC. Mortgage backed securities were at the centre of the fall of the crisis which triggered the whole world into a financial crisis.

Gubler (2011) identifies three main effects of financial innovation. The first being increasing complexity of financial instruments which obviously reduces the ability of agents to effectively rate and price the instruments. Secondly, he argues that financial institutions become more complex. Financial innovation makes risk assessment difficulty for outsiders as banks balance sheet items become more difficult to value. Lastly, Gubler (2011) asserts that innovations, although presenting earning opportunities for some market players have the potential to destabilize markets. He argues that new innovations replace old markets with new markets that are susceptible to herd behaviour and information constraints. Thus, instead of only benefiting the rest of the market, these instruments tend to negatively affect the economy as a whole.

### 3.1.1 Drivers of Financial Innovation

Theoretically, financial innovation including shadow banking is ascribed to evolution of the money supply, regulatory arbitrage, higher risk taking and the profit drive, and general agency problems that characterise financial markets (Tang and Wang, 2015). Thus, traditional banks and non-bank financial institutions (NBFI) participate in shadow banking activities as a substitute to formal banking activities due to the ability of shadow banks to generate more profit compared to traditional banks. Shadow banks can generate profit in two ways: (1)

engaging in the same activities as traditional banks but able to go beyond regulatory limits. (2) Shadow banks are generally unregulated, and are able to engage in other profit making activities or issue new financial instruments into the market which traditional banks may not be allowed to use.

There is general consensus on the role of regulatory arbitrage in spearheading shadow banking (Nesvetailova, 2014, Pozsar and Singh, 2011). Several definitions of shadow banking references to, 'activities and entities outside the regular banking system' (FSB, 2012, Kocjan et al., 2012, Wang and Zhao, 2016). The idea is that shadow banking or financial innovation in general arises when financial entities seek to earn more income unrestricted by existing regulation. Shadow banking therefore tends to reduce transaction costs and increase efficiency in financial intermediation. The idea is supported by evidence of banks moving from the 'originate to hold' model to the flexible 'originate to distribute model' used by shadow banks. Acceleration of securitisation activity and empirical evidence on the trade-off between shadow bank assets and traditional bank assets all testify to the existence of the regulatory arbitrage argument.

Defining shadow banks as unregulated entities is criticized by Nesvetailova (2014). According to Nesvetailova (2014) the regulatory arbitrage argument assumes a clear demarcation of financial activity between regulated and unregulated entities. This does not exist in practice, rather, empirical evidence portrays continued transformation of financial entities and introduction of new financial assets. This continuous evolution of financial instrument has also been witnessed even in times of stability. Harutyunyan et al. (2015) and Pozsar et al. (2013) also point to the inaccuracy of this assertion by suggesting partial regulation for certain entities.

Adrian and Ashcraft (2016) suggest that shadow banking is a result of the growth in the composition of the money supply. They argue that whilst money plays an important role through its medium of exchange, store of value and unit of account functions, different currency crisis over time have eroded the confidence in money. Financial innovations are therefore a response to the failure of money in its different forms to remain stable over time. They suggest that, financial innovations are part of the evolution of money which has seen

introduction of different forms of money from commodity money, silver coins, bank notes and bank deposits. According to this view, the occurrence of runs on bank deposits necessitated the introduction of securitised financial products meant to increase bank assets without endangering bank deposits. This theory concurs with the findings of Sunderam (2014) and liabilities classification by (Harutyunyan et al., 2015). Harutyunyan et al. (2015) view traditional banks as issuers of both shadow like liabilities termed non-core liabilities and core liabilities. As a corollary, Sunderam (2014) investigates the substitutability of shadow banking and high powered money and finds that shadow banking highly responds to money demand.

Awrey (2013) argues for supply-side reasons for the development of financial innovation. He recognizes the emphasis on demand-side explanations for financial innovations such as the need for efficient and user friendly financial instruments and products but further points out to the need to recognize supply drivers of innovations. Awrey (2013) identifies three main reasons why financial intermediaries innovate, covering both demand and supply reasons: (1) market demand, (2) regulatory arbitrage and (3) monopolistic profits. The third reason is purely from the supply side and can be used to further explain how financial firms pursue profitability in the presence of competition. Two strategies are suggested in pursuit of this strategy, namely differentiating firm products from other firms, which can be real or imaginary. The second strategy involves developing sophisticated processes and products to keep oneself unique. Both strategies are essential for creating the desired monopoly power and maximization of economic rents that can be extracted from the activities. As noted in Nesvetailova (2014), provision of complex financial instruments and processes characterises a number of leading financial firms prior to the GFC.

Empirical examination of the sources of shadow bank credit/activity are still scarce. Malatesta et al. (2016) use quarterly time series data for the Euro area covering 1999 to 2014. In their study, they investigate both the determinants of shadow banks and banks' credit. Their results show that shadow banking is positively related to real GDP growth, the weight of institutional investors and the short term interest rate. On the other hand, inflation rate impacts shadow banking negatively. However, formal bank credit is not found to have a statistically significant relationship with macroeconomic variables. Of particular interest is the finding that growth in shadow banking results in a reduction in credit extended by the

traditional banking system. The same finding is supported by Barbu et al. (2016) for the Euro region.

Similar to Malatesta et al. (2016), Barbu et al. (2016) investigate determinants of shadow banking for 16 EU countries. Whilst they used panel data techniques unlike time series used in Malatesta et al. (2016), both studies seek to establish the relationship between macroeconomic variables and shadow banking. Shadow banking portrays a negative relationship with GDP growth, short term interest rates, money supply and the ratio of investment funds' assets to GDP. Their study confirms the results established by Den Haan and Sterk (2011) who also find a negative association between shadow banking and GDP. A positive relationship is established between shadow banking and stock market index, and long term interest rates.

Alhusen (2016) undertakes an investigation to find the factors that drive shadow banking in emerging markets and developed countries. The study employs fixed effects panel regression method and identifies that growth in shadow banking in advanced countries is driven by the state of the traditional system. On the other hand, emerging market shadow banking is driven by low risk taking initiatives of institutional investors and high yield investments. The results of Alhusen (2016) are similar to Kim (2017) who also establishes that shadow banking growth is influenced positively by the growth and expansion of institutional investors. However, Kim (2017) provides a more robust analysis by considering both static fixed effects model and dynamic panel model.

Du et al. (2016) compare drivers of shadow banking growth in China and East Europe. They find that financial repression and credit market imperfections are major drivers of shadow bank credit. Specifically, an increase in re-lending activity by non-financial firms increases both financial assets and financial liabilities. Their arguments resonate with the traditional regulatory arbitrage hypothesis discussed in Tufano (2003) and (Nesvetailova, 2014). Financial repression reduces bank credit and lead to development of alternative sources of credit – shadow financial services. If financial repression promotes shadow banking, it implies a negative relationship between credit issued by regulated intermediaries and shadow bank activity. In essence, tight capital requirements imposed by banks by regulation such as Basel

III is expected to lead to proliferation of shadow banks and increase in shadow bank credit. The extent to which this is successful depends however on the substitutability of bank and shadow bank credit. In the extreme case where shadow banking and bank credit are perfectly substitutable, the economy is expected to constantly derive financial investment from the financial sector. However, the more pronounced case where the two are not perfect substitutes can reveal why shadow bank increase does not always increase economic performance. Taking from the discourse on bank versus market financing, traditional bank credit is effective in reinforcing discipline on borrowers resulting in sound corporate control which is a pre-requisite for development. On the other hand, the shadow banking sector operates mostly through the market system. Theory on incomplete markets suggests the prevalence of both adverse selection and moral hazard (Bernanke, 2007). Whilst moral hazard can still be a problem within the traditional banking system, the complexity and multi-intermediary system created by the shadow banking sector amplify moral hazard and promote higher risk taking to the detriment of the investor.

Duca (2016) also analyse how risk, capital regulation, information costs for traditional banks and bank reserve requirement on commercial banks affect shadow banking. The regression results show that the growth of shadow banking is negatively related to information costs. On the contrary, higher reserve and capital requirements are positively related to the growth in shadow banking activities. In addition, Duca (2016) finds that the introduction of new financial instruments and services also promote shadow banking activities. Moreover, regulations that impact banks negatively are found to promote shadow banking activities.

### 3.1.2 Shadow Banks as Non-Bank Financial Intermediaries (NBFI)

In this section, the study explores literature on non-bank financial institutions. Shadow banking is usually measured by delimiting non-bank financial intermediaries whose activities carry high risk and can potentially propagate systemic risk. Before 2007, shadow banks were treated within the group of NBFIs, which includes pension funds and insurance corporations as well as other financial auxiliaries. The FSB (2018) defines Other Financial Intermediaries (OFIs) as non-bank financial corporations which are not insurance companies or pension funds. According to the FSB (2016) for instance, the total assets of NBFIs were about $160 trillion. Of this amount, $99 trillion could be classified as constituting the OFIs sector. Further classification using the narrow measure of shadow banking shows that only $45 trillion worth of assets can be classified as shadow banking. Figure 3.1 below shows the

composition of the non-bank financial sector and the position of shadow banks as measured by its broad measure, OFIs and also as defined by the narrow measure.

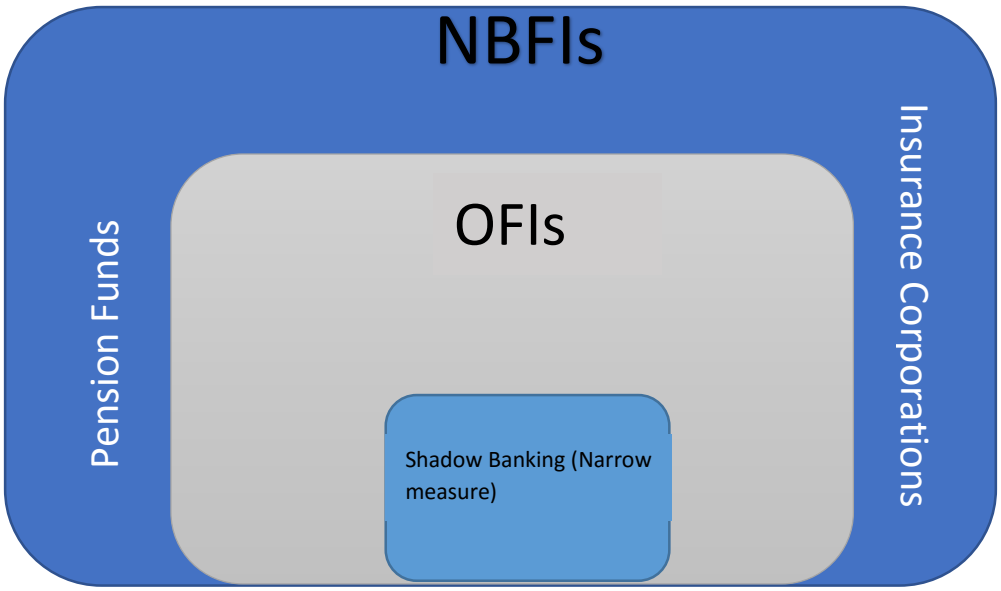


Figure 3.1. Non-bank Financial Intermediaries and Shadow Banking

The extant theory of financial intermediation assumes that banks have a unique role in the intermediation process. This role involves reducing search and transaction costs between lenders and borrowers and thereby increasing efficiency in financial markets (Diamond, 1984, Preece and Mullineaux, 1994). Formal banks are expected to have cost advantages in information gathering and credit collection compared to private individuals and other firms. Thus, the importance of NBFI in credit intermediation only became more apparent during the 1990 when more NBFIs became engaged in credit creation, a task that has been associated with formal banks alone. Liang and Reichert (2012) argue that studies that consider only banks in measuring financial development fail to explicitly cover the depth of present day financial markets. Suffice to state that NBFIs are an important component of the financial sector and can have significant effects on both performance and stability of the financial sector as a whole.

One way in which NBFI are important is their interconnectedness with the banking sector (FSB, 2017). Insurance companies, pension funds and other financial intermediaries are all connected to the mainstream banking system, either as providers of service, borrowers or lenders. Therefore, developments in this sector are closely connected with banks stability.

Véron (2013) discusses the importance of understanding financial market linkages, and argues for lack of complete understanding of the structure of financial markets. Whilst Véron (2013) acknowledges increase in studies that focus on financial markets after the GFC, lack of data for components of the sector such as the shadow banking sector constrain the analysis of financial markets.

In developing and emerging economies, NBFIs are an important source of finance for small and medium enterprises (Rateiwa and Aziakpono, 2017). Nassr and Wehinger (2014) suggest the use of securitisations, covered bonds and private placements to increase finance for SMEs. These methods could be useful in advanced economies with relatively advanced financial markets. However, in the case of underdeveloped financial markets such as those found in developing countries, leading sources of credit outside the banking sector include finance companies, trust companies and mutual investment vehicles. In South Africa for instance, borrowing requirements are high for most SMEs and they opt for credit from non-bank entities.

Most applications of the NBFIs literature are of empirical nature and seek to augment the finance-growth literature with variables that define NBFIs (Rateiwa and Aziakpono, 2017, Liang and Reichert, 2012, Okere et al., 2015). Rateiwa and Aziakpono (2017) employ time series methods and find strong evidence for long run relationship between NBFI and economic growth in South Africa and Egypt. Several other studies confirm this association (Okere et al., 2015, Vittas, 1997, Cheng and Degryse, 2010), which points to the general conclusion that NBFIs are an important part of the economy as a whole. In general, two explanations are provided for this result, firstly, the direct impact of NBFI on economic growth through their contribution to GDP (Rateiwa and Aziakpono, 2017). The second explanation is indirect impact through the influence of NBFIs on bank balance sheets (Nassr and Wehinger, 2014, Véron, 2013). Whilst the first impact could be obvious, the second channel also brings the role of NBFIs in propagating financial risks. Increased efficient allocation of resources could be achieved only if NBFIs enable banks to increase their credit allocations and drive the financial system towards stability. Thus, as witnessed during the financial crisis of 2007/8, instability triggered within the NBFIs sector has potential to destabilize formal banking

institutions, which in turn would contract their credit allocation resulting in an economy wide recession.

### 3.2 Theories of Financial Stability

This section reviews literature on financial instability. Specifically, two theories that relate to the present study are reviewed, namely the Debt deflation theory and the financial instability hypothesis. Furthermore, the section illustrates the role of shadow banking in propagating financial instability during the GFC. The discussion presented underscores the need to enhance regulatory measures aimed at cabbing risks from the shadow banking system.

#### 3.2.1 The Debt Deflation Theory

Irving Fisher's debt deflation theory has found resonance with recent development in financial markets (Von Peter, 2005, Shiller, 2013). Shiller (2013) uses the theory of financial crises as developed by Fisher (1933) to analyse the GFC. Two main issues are seen from Fisher (1933)'s work, first, is the accumulation of too much debt in the economy. Fisher (1933) hypothesize that expectation of future profits can lead firms to increase their leverage in order to invest. He blames the over borrowing on what he terms, 'easy money', that is cheap credit. This is followed by the second issue, price deflation which causes it to become more expensive to repay debt. Thus, the combination of very high debt levels and deflation is envisaged lead to failure to meet debt obligations by firms, hence, result in crisis.

The theory feeds well into the occurrences of 2007/2008 financial crisis in which accumulation of debt was at the core, albeit using newer and sophisticated financial instruments. There is contention however on the role of deflation during the GFC. Guttmann (2009) identified an accelerated drop in goods prices in the US in 2008 and a further decline in commodity prices between 2007/2008. Deflation characterizes a persistent depression and could be self-propagating. In addition, deflation can render monetary policy impotent. Shiller (2013) however argues that the decrease in prices experienced in 2009 did not represent a substantive deflation that could potentially confirm Fisher's theory. Whichever interpretation one can take from the GFC, the Debt Deflation Theory has become a strong component of the literature on financial stability and business cycles (Shiller, 2013, Minsky, 2016, Giraud and Pottier, 2016).

### 3.2.2 The Financial Instability Hypothesis: Hyman Minsky

Modern theory on financial stability can be traced back to Minsky[4] (1977)'s work on financial instability theory. Minsky (1977) disputed the Neoclassical interpretation of Keynes' general theory, arguing instead for an interpretation that centres around financial turmoil which he believed was a driving factor of the General Theory – the great depression. According to Minsky (1977), the General Theory has been interpreted wrongly to imply that investment decisions drive aggregate production in a capitalist society. However, Keynes had shown that the theory is centred around disequilibrium in financial markets. This view argues that disequilibrium in financial markets impacts financial agents' ability to price financial assets.

Minsky (1977) tracks back to the Keynesian capitalist market and identifies the different kinds of assets wealth individuals possess, including a wide array of financial assets. Furthermore, money is acknowledged as a facilitator for other asset purchases and also as an asset in itself. Financing from other assets is done through the banking system. Also, Keynes acknowledges the role of uncertainty and expectations in driving market fluctuations. The major source of fluctuations according to Minsky are financial markets. Thus, market economies become inherently unstable due to the fact that financial markets are unstable.

The theory is based on an economy with productive firms, households and government. All agents have access to financial markets where financial claims are traded. Profitability of productive firms determines their ability to repay debt and continue to access more financing. Minsky argues that the value of assets held by firms determines current investment and the ability to meet debt repayment requirements in future determines access to financing. Both asset valuation and ability to meet debt obligations depend on the business' gross profits, which in turn is determined by investment. Thus, the *Hyman-Minsky* economy depends on investment. Expectation of higher levels of investments drive debt financing since repayments can only be made when the expected investment returns are high enough to cover the debt.

At the centre of Hyman's arguments is the vulnerability of the economy which depends on the pace of investment. Economic agents' expectations about future investment and their

[4] The financial instability hypothesis

ability to determine the, “liability structure for the financing of positions in different types of capital assets” creates instability (Minsky (1977:24). He postulates that during periods of expansion, financial market participants tend to relax credit requirements for borrowers and firms increase leverage, becoming more profitable as envisaged by Modigliani and Miller (1961). This leads to a boom and consequently a bust. As a consequence, Minsky argues for a systematic approach to understanding financial crisis due to their recurrent nature. Financial instability is endogenous to capitalist markets. Business cycles are not a result of exogenous shocks but propagation of shocks from within the system. In line with the regulatory arbitrage view of financial innovations, Minsky also argues that interventions and regulations into the economy can negatively impact business cycles (Minsky, 1991).

Instability in the *Hyman-Minsky* economy is further aggravated by availability of financial innovations. In times of stability and growth, existing financial instruments tend to find multiplicity of uses and new financial instruments are introduced. This results in increased money-like instruments which drives up the prices of financial assets compared to price of goods. Hedgers and Speculators in financial markets also drive financial activities. However, speculators are vulnerable to interest rate and asset price risk, and can be easily affected by mismatches between cash payments and cash receipts. In addition, Mynsky (1977) points to the use of debt in debt repayment arrangement. Accumulation of higher levels of debt and inability to meet obligations discourage lenders who in turn withdraw in part the credit available to borrowers of funds. Thus, institutions that are dependent on credit will experience a reduction in investment. The result can be market wide disequilibrium leading to economic instability.

The recent GFC has been interpreted as a ‘Minsky moment’, illustrating the relevance of the instability hypothesis in explaining the event that took place in 2007 (McCulley, 2009). Two main traits of the GFC identify with the Minsky cycle as discussed in Palley (2009); that is, regulatory arbitrage and high risk taking. It is not surprising that the same elements describe the shadow banking sector, confirming the importance

63240 of Minsky’s contributions in this regard (Tang and Wang, 2015, Adrian and Ashcraft, 2016). Nevertheless, Minsky’s theory is without criticism. The main argument against interpreting the financial crisis in line with Minsky’ hypothesis relates to its implication on

leaving out the participation of the real economy from the crisis (Palley, 2009). Accordingly, other contributors have sort to explain the crisis fully considering the real determinants of the crisis (Foster and McChesney, 2010).

### 3.2.3 Role of Shadow Banking in Global Financial Crisis

Arguments against shadow banking stem from its role in exacerbating systemic risk (Hsu et al., 2013). Shadow banking played an amplifying role in the GFC leading to the recession of 2007/2008. Major risks associated with shadow banking include: liquidity risk[5], leverage risk and contagion. These risks arise from the four functions described earlier and contribute to the system wide risk. Liquidity risk of banks arises from their liquidity transformation role. Financial institutions involved in liquidity transformation may fail to repay short term liabilities when they are due because most of their assets are long term and illiquid. In US and Europe for instance, securitisation allows shadow banks to issue new tranched securities, which are generally liquid against an illiquid underlying asset such as mortgage loans.

#### Liquidity Risk

Traditional banks are usually protected by the central bank backstop facility or deposit insurance where it is available (Luttrell et al., 2012, Pozsar et al., 2013). The implication is that in the event of a threatening decrease in liquidity, it is possible for the bank to appeal to the lender of last resort. A deposit insurance scheme can also be important in providing a cushion against loss to the ultimate owners of the funds. The criticism levelled against both deposit insurance and recognition of systematically important banking institutions is their tendency to encourage higher risk taking due to moral hazard. The lack of a back stop facility and insurance for shadow banks makes them susceptible to 'runs'. This idea is supported by Gorton and Metrick (2012) and Copeland et al. (2014) who argue that the GFC was a run on the repurchase market (repo).

The repurchase market is a market for short term liquidity used by shadow banks and other financial institutions. Major participants in the repo market are NBFI, including pension funds, mutual funds and insurance companies. MMFs, Large non-financial firms and institutional

[5] Refers to the probability that an entity is unable to transform financial assets into cash to meet immediate liabilities.

investors undertake repo transactions (Gorton and Metrick, 2012). Copeland et al. (2014) show that there are two kinds or repo agreements, one in which there is bilateral exchange and another in which there is a tri-party transaction. In a bilateral agreement, Gorton and Metrick (2012) demonstrate that two parties are involved which agree to exchange cash with securities with the cash receiving party promising to buy back the securities at an agreed price. Usually the value of the assets exchanged is higher than the cash with the difference making up the, 'margin', which represents gains accruing to the lender. Thus, the exchanged securities act as collateral in the repo market and ABS were also used as such collateral (Copeland et al., 2014).

Several studies have established a decrease in ABS collateralized in the run-up to the GFC (Adrian et al., 2013, Copeland et al., 2014). Reduction in confidence in ABS precipitated withdrawal of funding from the repo market, coupled with 'fire sales' in ABS like assets, which exacerbated the crush. Thus, it can be concluded that the GFC was also a liquidity crisis which affected shadow banks initially but also spreads to traditional banks.

**Leverage Risk**

Leverage risk arises from high levels of leverage which puts stress on the financial system as a whole. High risk taking in banks during the GFC is blamed to a greater extent on the built up of excessive leverage (Bhagat s et al, 2015, Smith et al, 2017). High levels of leverage can encourage borrowers to take more risk in a bid to increase the spread between lending rates and borrowing rates. Furthermore, it increases the incidence of moral hazard in which borrowers take high risk knowing that the ultimate loss in the event of default is not bone by them. In both traditional banks and shadow banks, leverage plays an important role. For traditional banks however, the current Basel III leverage ratio has been effective in reducing risk taking among banks (Smith 2017). Lack of regulation in shadow banks makes the sector more prone to high risk taking considering high earnings usually required by shadow banks.

The nature of shadow banking activities result in the build-up of excessive leverage in the shadow banking system (Bruno and Shin, 2015, Pozsar et al., 2013). In its 2015 report, the FSB find that leverage is usually high for finance companies and other investment funds.

Participants in wholesale markets for instance use leverage in different forms to finance their transactions. Thus, shadow bank credit is mostly based on leverage.

The FSB (FSB, 2015) documents show that the link between shadow bank entities and formal banks make the financial sector as a whole prone to funding risks arising in the shadow sector. This form of contagion risk is more persistent where shadow banks are funded by the banking sector such as those in India. Hence, there is need to identify the extent to which shadow banking has affected the risk profiles of financial systems in different jurisdictions.

**Contagion through Interconnectedness in Financial Sector**

The FSB (FSB, 2017) documents show that the linkages between shadow bank entities and formal banks make the financial sector as a whole prone to funding risks arising in the shadow sector. This form of contagion risk is more persistent where shadow banks are funded by the banking sector such as those in India (Acharya et al., 2013) or where a parent-subsidiary relationship exists. High levels of leverage and the lack of a back stop for shadow bank assets make them more fragile and weakens the whole financial system given strong interbank transactions with traditional banks. Hence, the need to identify the extent to which shadow banking has affected the risk profiles of financial systems in different jurisdictions arises.

### 3.2.4 Positive Effects of Shadow Banking

The impact of shadow bank activities on the financial services sector cannot be limited to the propagation of risk. A close contrast to the risk propagation perception is the ability of banks and shadow banks to share risk as they adopt the originate to distribute model (Gennaioli et al., 2013). The idea that banks can de-risk their balance sheet has been at the centre of the financial innovation literature and literature on bank capital. Gennaioli et al. (2013) argue that bank capital is inherently risky and banks are driven to engage in interbank lending as a way of sharing risk. Banks can finance liabilities of other banking institutions in order to share risk.

Turning to shadow banking, the securitisation model enables risk-sharing to the extent that the players in the distribution channel understand the process and products involved. Securitisation involves the pooling together of financial assets (underlying), transferring them

to a special purpose vehicle (SPV) and issuing out new financial securities whose value derives from the underlying assets. The underlying could be a bond, stock, derivatives, bank loans or any other asset, the most popular being mortgages (see discussion on the role of securitisation in the global financial crisis). By removing assets (loans) from banks' balance sheets, securitisation allows banks to transfer risk to other economic agents, hence, increase capacity for credit supply. To the originator, the ability to originate and distribute financial liabilities to other entities enables the entity to off-load the risk on their balance sheets to institutional investors such as Hedge Funds, MMFs and Finance companies. The more players are involved in the distribution, the more the risk exposure to a single entity tend to be reduced.

### 3.3 Shadow Banking and Economic Performance

Whilst the debate on whether shadow banking stimulates economic performance or not remains largely unresolved, the general consensus is that there are economic benefits associated with shadow banking (FSB, 2013). Literature linking shadow banking to economic variables is still scarce. However, there is considerable literature on the impact of financial innovation on economic performance. This section evaluates the link between shadow banking and economic performance as contained in the literature on financial innovation. The next sub-section explores literature on financial innovation and economic growth. Following is literature relating financial innovation to firm performance. The last part of the section presents literature on effects of shadow banking on monetary policy effectiveness and cross border financial linkages.

#### 3.3.1 Financial Innovation and Economic growth

Literature on financial innovation and economic growth follows from the realization that financial development is a vital component of the economy (Levine, 1997). Earlier literature however shows divergent views on the direction of causality between financial development and economic growth (King and Levine, 1993; Boot, 2010). Hence, on the one hand, financial development is said to cause economic growth (Boot, 2010). This view emphasizes the role financial intermediaries play in allocating capital – specifically channelling capital to those sections of the economy that are productive. On the contrary, Lucas (1988) see financial development as responding to the level of economic prosperity, implying that financial

development follows economic growth. Proponents of this later view argue that financial systems facilitate transactions for the real economy. However, regardless of the two arguments, Levine (1997) and Boot (2010) point to the consensus that financial development including financial innovation is an important facilitator of economic growth.

#### 3.3.1.1 Neo-classical Growth Model

The seminal works of Solow (1956) and Swan (1956) provide the departure for modern economic growth theorists. The Solow-Swan (Neo-classical) model suggests an aggregated production function in which output growth is dependent on capital and labour as factor inputs, and an exogenous technological progress variable. Both the savings ratio and population growth are exogenous to the model. The model proposes that the higher the savings ratio and the lower the capital output ratio, the higher the growth rate. The neo-classical growth models relax the assumption of fixed proportion used in earlier models such as Harrod and Dommar model (Domar, 1946, Harrod, 1939). The model assumes; an economy in which a single good is produced using two inputs, capital ($K$) and labour ($L$). A production function that exhibits constant returns to scale and limited substitutability between labour and capital in production. Markets are assumed to be flexible to allow adjustments in the goods and factor markets.

The results of the Solow model contrast with Harrod-Domar model in that production is enhanced by an exogenous technology variable. Whilst the Harrod-Dommar model concludes that countries with more capital accumulation could achieve higher growth rates, in the Solow model capital accumulation does not contribute to growth. Harrod and Domar suggest that in a stead state, the economy should have the savings ratio equal to the product of population growth rate and capital to output ratio (Solow, 1988). Thus, by construct, since both Harrod and Domar's models assume constant returns to scale, a percentage increase in the savings rate would imply a percentage increase in capital to output ratio. Hence, countries with a higher savings rate were expected to grow faster.

The main results of the Solow model are that economic growth is mainly explained by the exogenous technological progress and that convergence can be attained if economies have

the same savings ratios. Convergence is driven by diminishing returns to capital with poor countries which have less capital growing faster as a result of higher marginal returns to capital. Variations in capital accumulation do not account for the differences in output. Thus, only growth in the effectiveness of labour (technical progress) can lead to a permanent growth in output per worker in the long run.

The production function takes the form;

$$Y = AF(K, L), \tag{3.1}$$

where $Y$ is the output and $A$ is technical progress. The Cob-Douglas function of the following form can be used;

$$Y = A_t K^{\alpha} L^{1-\alpha} \tag{3.2}$$

The function satisfies the following conditions; for all positive values of $K$ and $L$, the production function exhibits diminishing marginal returns with respect to both inputs. The production function also exhibits constant returns to scale and satisfies the *Inada* conditions; $\lim_{k\to\infty} f'(K) = 0$ and $\lim_{k\to 0} f'(K) = \infty$.

The main criticism of the Solow-Swan model stems its dependence on the unexplained, 'Solow residual' to account for growth disparities across time and between countries. Thus, several models have been introduced that treat technology as an endogenous variable. An earlier contribution in this direction was the 'Learning by doing theory' of Arrow (Mao, 2012). Arrow models endogenous technological progress and economic growth, noting that technological improvement is an ongoing process during production, often termed, 'learning-by-doing'. However, in Arrow's model, there is no conscious support of R & D projects since learning by doing is a passive phenomenon occurring during the production process. Therefore, other models have attempted to measure the sources of technology.

#### 3.3.1.2 Endogenous Growth Theories

During the 1980s, several models were proposed in which technology was endogenously determined (Romer, 2011). Several models of endogenous growth are presented in which technology is determined by investment decisions of firms. Technical progress occurs through ideas or designs and in Romer's 1986 model, these ideas are non-rival and partially

excludable. Use in one firm does not limit use by other firms. Partial excludability relates to the ability through patents and copyrights of producers to exercise monopoly power over their ideas for a given time. Thus, profit incentives drive firms and individuals to invest in the R&D sector. However, the initial model by Romer still assumed flexible markets in the spirit of neo-classical models.

In another study, Romer (1990) demonstrates that the term investment cannot be restricted to accumulation of physical capital and broadens it to cover research and development expenditure and human capital formation. To illustrate the effect of the endogeneity of technology, the production function (1) above becomes:

$$Y = F(K, L, A) \tag{3.3}$$

Thus, national output is a function of capital, labour and technology.

Romer (1990) develops a model based on the neo-Schumpeterian framework using three basic principles; the first being an economy driven by technology and secondly, endogenous technical progress. In this model and others (Howitt, 2010), endogenous theorists have argued for a monopolistic behaviour of firms and increasing returns to scale in contrast to neo-classical Walrasian general equilibrium models. The model diverts from the Solow model by introducing a knowledge producing sector (R & D) so that both capital and labour are divided between the two sectors: goods sector and R&D sector.

The production function for the goods producing sector is thus;

$$Y(t) = [(1 - \rho_k)K(t)]^{\alpha}[A(t)(1 - \rho_L)L(t)]^{1-\alpha}, \tag{3.4}$$

where $0 < \alpha < 1$

Thus, fraction $\rho_k$ of capital stock is used in production of R&D, whilst fraction $1 - \rho_k$ is used in the production of goods, and the same applies to labour.

Production in the R&D sector depends on the amount of capital and labour used in production of ideas, and also on the level of technology. The production function for production of knowledge can be specified as:

$$\dot{A(t)} = B[\rho_k K(t)]^{\beta}[\rho_L L(t)]^{\gamma} A(t)^{\theta} \tag{3.5}$$

$, where\ B > 0,\ \ \beta \geq 0,\ \ \gamma \geq 0$

The knowledge production function is assumed to have increasing returns to scale, implying that the stock of knowledge is an increasing function. $B$ is a shift parameter and $\theta$ determines the influence of existing technology on knowledge production.

Arguments against endogenous growth models stem from the characterization of ideas as public goods. The dissemination of knowledge is also expensive, such that not everyone can access new knowledge freely. Whilst both neo-classical and endogenous growth theories provide a foundation for growth accounting and cross country comparisons, empirically, it has become the norm to augment these baseline models with other widely acknowledged fundamental factors that impact economic growth (Bluhm and Szirmai, 2012).

North (1990) argues for the importance of institutional factors on impacting economic growth. Institutions are human devised constraints that govern interaction of economic agents. The relationship between institutions as well as economic growth and development is widely acknowledged in literature (Sobel and Coyne, 2011) and whereas political institutions are important, most studies have concluded that economic growth is directly related to economic rather than political institutions (Acemoglu and Robinson, 2008). Therefore, countries with favourable economic institutions such as property rights and good corporate governance are expected to grow faster.

The seminal work of North (1990) provides a definition for institutions; institutions are defined as, "the rules of the game in a society or more formally, humanly devised constraints that shape human interaction." Acemoglu and Robinson (2008) identify three features in North's definition which warrant mention, that is, institutions are humanly devised, rules and constraints as well. Institutions therefore are derived from societal decisions and human interaction through generations which can potentially differ from time to time and across countries and regions. As such, a central theme in institutional analysis is the variations in institutional factors across countries and regions.

Fedderke and Luiz (2008) however argues that heterogeneity of economies implies the need for country specific institutional analysis. Institutions differ from country to country and can affect policy implementation differently. The Washington Consensus, a list of policies that were expected to stimulate economic activity in many developing countries is an example of failure to give heed to differences in country specific institutional arrangements (Bluhm and Szirmai, 2012). Bluhm and Szirmai (2012) document that the Washington consensus was criticized for failure to allow for institutional diversity. In the end, seemingly sound policies

led to economic stagnancy in most South American economies and the collapse of the Russian economy. Fedderke and Luiz (2008) echo the same for South Africa where since 1994 the government has followed sound macroeconomic policies, but higher growth has not been achieved, instead growth has shrunk thereby implying that macroeconomic stability alone is not sufficient for sustainable economic growth. Thus, the debate on whether institutions are a requisite input into the growth formula has not been concluded.

### 3.3.2 Shadow Banking as Financial Development

An important aspect of augmented growth models focuses on the financial development and economic growth conundrum (Cooray, 2010, Abid et al., 2016, Wu et al., 2010). The broader version of finance-growth literature relates financial development in its broader sense to economic growth. The seminal work of King and Levine (1993) revived the debate on the impact of financial development on economic growth which has been a major area of research throughout the 1990s and the first years of the 21$^{st}$ century. In particular, they show that bank credit has a positive impact on economic growth. Their theoretical contribution is not new though, as it resonates with an already established theoretical literature on finance and growth which dates back to Schumpeter's 1911 paper (Schumpeter and Backhaus, 2003, Bazhal, 2016). Schumpeter argued that increased credit has a positive impact on economic activity if it could be matched to productive entrepreneurs. Other earlier contributors to this debate include McKinnon (1973) and Shaw (1973b). Shadow banking contributes to financial development as it expands the financial sector through new financial products and processes as indicated in Beck et al. (2010) who expand the World Bank Financial Development indicators to include non-bank financial intermediaries. On this backdrop, the study reviews below main theories on financial development and economic growth.

#### 3.3.2.1 McKinnon and Shaw Hypothesis

In their seminal work. McKinnon (1973) and Shaw (1973b) argue for financial liberalization and suggest deregulation of the financial system encourages savings, hence, increase economic growth. On the other hand, financial repression distorts prices of assets in financial markets, including the pricing of different currencies, increasing inefficiency and the cost of acquiring investment funds. Financial repression exists in different forms including, regulated lending, high reserve requirements, exchange rate controls, interest rate ceilings and

restrictive requirements to the market imposed against possible entrants. Their work has come to be known as the popular McKinnon and Shaw hypothesis and has attracted a lot of studies which test the validity of this hypothesis in different countries. Central to the original McKinnon and Shaw hypothesis is the role of low real interest rates which characterize financial repression. Thus, liberalization would imply deregulation of interest rates, hence, an upward movement in the real interest rate as determined by the market. The resulting effect is an increase in savings and in turn an upsurge in investment (Gemech, 2006).

Theoretical criticisms to the Mckinnon and Shaw hypothesis include its reliance on the savings-investment relationship: a proposition which does not always hold as investment decision and savings decisions are made by different economic agents. Further, the theory assumes homogeneous households with equal access to credit markets. Mankiw (1986) argues that in countries where some households have little or no access to credit markets, the elasticity of savings to the interest rate is low. Thus, savings may not increase as postulated by the theory. Gemech (2006) also argues that in countries with huge subsistence economic activity, consumers have less access to credit markets and their response to changes in the real interest rate are also negligible.

An argument closer to the shadow banking literature given in Eschenbach (2004) is proffered by Taylor (1983) who divides the money market into the formal banking sector and an unorganized money market. The banking sector is subjected to regulation and the minimum reserve requirement, whereas the unorganized financial sector is not. Thus, financial liberalization by raising the formal interest rates tends to move money from the unorganized banking sector to the formal banking sector. The need to retain money to meet the reserve requirement threshold results in reduced funds available for credit extension, hence, financial liberalization would result in reduced economic activities.

***Credit Market Imperfections***

Another strand of theory that rose as a response to the pro-liberalization literature in the early 1980s is the theory of credit market imperfections (Matsuyama et al., 2007). The theory postulates that credit markets are inherently flawed, and fail to allocate financial resources efficiently to productive sectors. According to Cecchetti and Kharroubi (2012) and Eschenbach

(2004), the theory is centred on the incidence of information asymmetries in financial markets, moral hazard, adverse selection and the principal-agent problem. Adverse selection can arise due to high real interest rates equilibrating the market which in turn attracts bad apples[6]. A related issue has to do with information asymmetry which can lead to high transaction costs and high costs of obtaining information. Kunieda and Shibata (2014) show that the quality of credit markets has a bearing on the market's influence on economic activity. Whilst stable and mature financial markets are generally believed to drive economic growth, most emerging markets and developing countries have less perfect financial markets.

***Credit Rationing***

Other criticisms against the McKinnon and Shaw hypothesis include the credit rationing theory. Credit rationing is necessitated by credit demand that is higher than credit supply. Credit rationing literature generally assumes that the supplier of credit has monopoly over credit and the demander is a price taker, implying that receivers of credit in a credit rationing regime cannot determine the interest rate at which such credit is extended. A seminal paper by Stiglitz and Weiss (1981) proposes a model in which increases in the nominal interest rate does not only increase return on savings but has a negative impact on loan portfolios. Higher nominal interest rates increase the probability of default of borrowers. Further, it also increases the incidents of moral hazard and adverse selection which in turn increases the overall risk exposure to the lender.

Jaffee and Stiglitz (1990) argue that credit rationing is effective when there are no alternative sources of credit. However, due to the fact that substitutes to bank credit are imperfect substitutes, credit rationing can still be used. Several forms of credit rationing are given in literature with the main form being pure credit rationing. Pure credit rationing occurs when individuals with the same characteristics are treated differently by the same lender. Another popular form is interest rate based rationing where borrowers interest is charged on the basis of the amount of money they would want to borrow (Eschenbach, 2004). A further consideration with an impact on rationing is the size of collateral one has. Borrowers with smaller quantities of collateral may fail to access credit though they have similar qualities with

[6] Borrowers with a very high default risk and high risk takers. They tend to decrease market efficiency and increase institutional and market fragility.

those who have larger stocks of collateral. Credit rationing has the effect of putting a constraint on credit which fundamentally distorts financial markets and reduce investment and consumption (Knoop, 2008).

Thus, contrary to the McKinnon and Shaw hypothesis, the presence of imperfect financial markets and heterogeneous institutions, financial agents and products result in complicated relationships between financial activities and real economic activities. Knoop (2008) argues that credit rationing impacts output negatively by reducing consumption and investment, amplifies the business cycle and has an asymmetric effect on the business cycle. Imposition of credit limits during a recession has an inhibitive effect on investment and growth and can further propagate the output decline. On the contrary, removal of credit constraints during the upswing tends to stimulate economic activity even further. The asymmetric effect between credit rationing and the business cycle also implies that borrowers become more susceptible to financial constraints when they reach their credit limit. Thus, they can no longer access further credit.

### 3.3.3 The Finance-Growth Nexus

The crux of the finance-growth conundrum is the disagreement on the direction of causality between economic growth and financial development (Jedidia et al., 2014, Durusu-Ciftci et al., 2017, Abid et al., 2016, Ductor and Grechyna, 2015, Laeven et al., 2015). Two theoretical explanations are forwarded for this finance–growth puzzle; the first theory centres on the ability of finance to boost growth through increasing funds available for investment (Knoop, 2008, Bazhal, 2016, McKinnon, 1973, Shaw, 1973b). Higher levels of investment in turn result in increased demand and output. Major channels through which financial development promotes growth include; the facilitation of transactions in the economy, enabling price discovery in financial markets, improving efficiency in resource allocation, promoting risk sharing and providing incentives for managerial control (Durusu-Ciftci et al., 2017, Knoop, 2008). Through these channels, countries with developed and relatively more liquid financial systems are expected to grow faster than countries in which entrepreneurs face financial constraints. The following illustration adapted from Levine (1997) shows the theoretical link between financial development and economic growth. Although the original diagram shows a uni-directional causal relationship from financial development to economic growth, it is

augmented to allow for a bi-directional relationship between the two in alliance with recent literature (Durusu-Ciftci et al., 2017, Laeven et al., 2015).

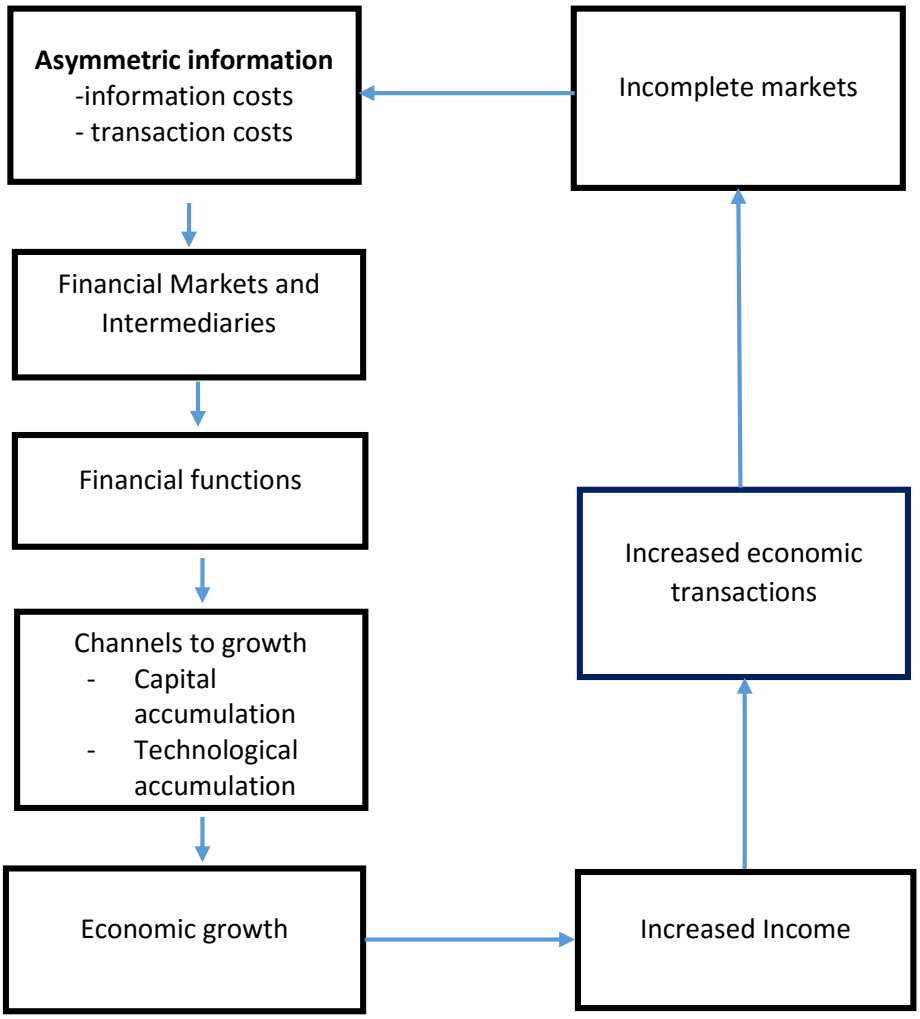


Figure 3.2 Financial Development and Economic Growth
Source: Levine (1997) and author's own adjustments

The second theory stems from the classical neutrality of money proposition. Lucas (1988) for example argues that financial development follows economic growth. Proponents of this view argue that financial systems facilitate transactions for the real economy. Multiplicity of financial transactions occur as the economy is growing, implying that there is a positive relationship between growth and financial development with the direction of causality flowing from economic growth to financial development.

A central argument against this view is raised from theories that recognize financial frictions that rise as a result of asymmetric information. Money can only be neutral if markets are

completely flexible and efficient. However, markets are seldom efficient, leading to situations where activities in financial markets impact the real economy. Two main branches of literature are leading in this respect – models of financial friction (Benanke, 1999) and models of credit rationing (Kiyotaki and More, 1995, Stiglitz and Weiss, 1981).

The preceding point towards lack of consensus on the direction of causality between the two variables. Both theoretical propositions above are supported by empirical evidence from various studies (Abid et al., 2016, Adeniyi et al., 2015, Jedidia et al., 2014, Narayan and Narayan, 2013). Whilst on the one hand others find that financial development positively influences growth (Boot and Marinč, 2010), other studies find a bi-directional relationship (Khan and Semlali, 2000). However, others do not find a clear relationship between the two (Narayan and Narayan, 2013), leaving the debate still open for further research. Recent studies have also sought to resolve the finance-growth conundrum (Jedidia et al., 2014, Durusu-Ciftci et al., 2017), but still fail to reach a conclusion about the relationship between the two variables.

**Financial Development and Endogenous Growth**

The emergence of endogenous growth theories in the 1980s led to research focusing on the role of financial intermediation in endogenous growth models during the 1990s (Andersen and Tarp, 2003). Most of the theoretical models produced sought to explain whether financial development could explain persistent increases in output. Financial intermediation continually allocates resources to productive sectors yielding impact both on output and also on individual consumers. Studies in this dimension offer explanations on how financial development through increased efficiency in intermediation result in high economic activity. One theory suggests that agents can hold both liquid and illiquid financial assets. Illiquid financial assets are important for driving economic growth due to their long term nature (Bencivenga and Smith, 1991). In addition, the models treat both financial development and growth as endogenous in the system allowing for the possibility of feedback effects between the two. Greenwood and Jovanovic (1990) suggest a model in which economic growth facilitates the expansion and growth of financial intermediation. This is because financial structure development entails costs that agents can only meet as their income grow. Therefore, for increased financial intermediation to occur, increased production and income

is required. On the other hand, their model envisages an increase in economic growth stemming from increased saving and investment.

Several other studies have linked the two variables in different models (Berthelemy and Varoudakis, 1996, Laeven et al., 2015, Mattesini, 1996, Roubini and Sala-i-Martin, 1992, Sunaga, 2017). A notable attempt is the financial development-technology economy where financial intermediaries supply funds to innovators who in turn drive the process of growth. Berthelemy and Varoudakis (1996) employ a learning and doing model in which increased growth generates efficiencies in the financial sector through learning and doing as a result of accumulations of Savings. In a recent study, Sunaga (2017) suggests a model in which it is costly for financial intermediaries to obtain information about entrepreneurs in the real economy. The probability that financial intermediaries meet a successful entrepreneur depends on its financial innovativeness; measured by the extent to which they have invested in improving their information on entrepreneurs. Their conclusion suggests the need for high financial innovation and accumulation of capital to drive growth. In another theoretical model, Laeven et al. (2015) formulates a model in which both financiers and non-financial entrepreneurs innovate. Particularly, financial firms innovate to improve their screening of borrowers. They conclude that economic growth can continue as long as financial intermediaries are able to innovate, driving innovation also in the real sector.

**Bank Based versus Market Based Financing**

Of importance to the finance-growth debate also is the question of bank based or market based finance that ensued during the 1980s and 1990s (Jedidia et al., 2014). Bank-based finance is sourced from banks in the form of credit extended to economic agents whilst markets such as stock exchanges and bond exchanges offer an alternative source of financing. Several studies have overcome this question by either using both indicators of financial development complementarily or computing an index that covers all the indicators (Khan and Semlali, 2000, Bittencourt, 2012). At the core however, there seems to be consensus that financial variables have an impact on economic growth (Adeniyi et al., 2015). The question of which of the two has a more bearing effect on growth depends on the structure of the financial sector of the economy. Economies with well-developed capital markets and smaller

banking sectors could expect capital markets to have a huge impact on economic performance compared to economies with smaller capital markets and large banking sectors.

Shadow banking possesses both characteristics of the formal banking system and market-based finance. Shadow banking credit intermediation has recently been at the core of market based financing in macro-finance analyses (Boot and Marinč, 2010). This has led to a newer strand of literature to which this work belongs, which attempts to analyse the impact of financial innovations on economic variables. This growing literature attempts to capture the impact of financial innovations in a broader sense on the economy (Bertay et al., 2017). This study intends to contribute to this literature by investigating the relationship between shadow banking and economic growth. Two arguments given in literature are tested, firstly the positive influence of shadow banking on economic growth, and secondly the negative influence of shadow banking on growth through worsening financial stability.

### 3.3.4 From Financial Development to Financial Innovation

Laeven et al. (2015) argue that it is financial innovation rather than broad financial development that has a bearing on economic performance. Their empirical findings are supported by several theoretical papers that model financial innovations, suggesting that financial innovation has more impact on economic growth than financial development (Lumpkin, 2010, Moreira and Savov, 2017, Michalopoulos et al., 2009, Mishra, 2008). Financial innovation determines financial structure, which has a strong impact on economic growth (Bara et al., 2016).

Bernanke (2007) argues for a positive impact of financial innovation on economic growth through its effect on allocation of capital. Given a world of imperfect markets and asymmetric information, shadow banking activities complete markets by allowing economic agents to hedge against risks inherent in financial markets. Increased access to capital can therefore be achieved. Other financial innovations such as asset securitisation can directly impact bank credit, thereby increasing capital available to firms. Bertay et al. (2017) however decompose the credit channel into consumer credit and corporate credit. Their findings suggest that securitisation; a form of shadow banking, of consumer loans does not impact economic

activities. There are limitations therefore to the impact of financial innovations on growth through its effect on capital allocation.

The negative impact of shadow banking on economic growth cannot be downplayed as evidenced by the GFC of 2008. Moreira and Savov (2014) use a macroeconomic model in which shadow banks issue securities that are liquid in normal times but become illiquid in crisis. In their model shadow, money such as securitized commercial paper increases in importance, increasing liquidity in normal times. The economy drifts towards shadow money and grows fast but uncertainty increases, hence, constitutes too much risk taking by economic agents, culminating in a crisis. As the crisis unfolds, shadow money becomes undesirable and investors seek to invest in safe assets whose demand increases and prices rise. The result being a crisis and slow economic recovery as capital is moved away from productive sectors.

Fewer studies have empirically tested the causes or effects of shadow banking on other financial and macroeconomic variables (Pozsar et al., 2013). Véron (2013) notes that the main challenge for empirical studies has been the unavailability of data and the neglect of macroeconomic implications of shadow banking. The main reasons being complexities associated with shadow banking market and also the differences in definitions of shadow banking across different countries. Nevertheless, other studies have employed different measures of shadow banking activities. The Financial Stability Board has designed a comprehensive measure of shadow banking, of which the data is available for the period 2010 to 2015. Other proxies used to measure shadow banking include the volume of securitized assets and the volume of non-core liabilities of financial firms (Harutyunyan et al., 2015).

Verona et al. (2013) and Funke et al. (2015) provide insight into the effect of shadow banking on the economy by employing a dynamic stochastic general equilibrium (DSGE) framework. Funke et al. (2015) use a DSGE model with binding constraints and analyse the effect of interest rate deregulation on monetary policy in the presence of shadow banking. Impulse response functions from their calibrated model show that commercial banks and shadow banks react differently to policy changes. For instance, when there is an interest rate shock (contractionary monetary policy), commercial banks contract whereas shadow banks grow. Their findings are consistent with literature on financial sector regulation that suggest a boom

in shadow banking whenever formal banking is tightly regulated (Adrian and Ashcraft, 2016, Huang, 2015). In another DSGE model, Landvoigt and Begenau (2016) develop a model with default able bank liabilities which replicate shadow bank liabilities. Their model shows that stricter regulation of commercial banks improves the safety of commercial banks but shadow banking increases as well. The present study extends this literature by developing a DSGE model for emerging markets with a shadow banking sector.

In a study based on China, Tang and Wang (2015) analyse the effects of shadow banking on return. Basing their hypotheses on the theories of financial innovation, diversification and portfolio theory they used wealth management products of Chinese banks as a proxy for shadow banking. Their results show that shadow banking increases risk adjusted return of banks as measured by the Sharpe ratio. This is consistent with literature on shadow banking, which argues that shadow banks are more profitable than formal banks (Adrian and Ashcraft, 2016).

Harutyunyan et al. (2015) measure shadow banking as non-traditional credit intermediation, and thus, use non-core liabilities of both banks and non-bank financial institutions for 26 countries. Their results show that non-core liabilities are more volatile than core liabilities, indicating that shadow banking activity increases financial sector instability. Their analysis involves the use of univariate characteristics of the data, including measures of central tendency and correlation analysis. They also employ graphical analysis to make comparisons between the US and EU GDP/non-core liabilities relationships. A similar descriptive study is used in Li (2014) who studied the growth of shadow banking in China. The study by Li (2014) finds that continued growth and rapid change in the structure of the shadow banking system is a threat to financial stability. Wealth management products and the growth of trust companies are the main proxies used for shadow banking in this study. These results confirm findings of similar study by Hahm et al. (2013) who use a credit risk model in which non-core liabilities are an indicator of the reduction in risk premiums. The model is estimated using the Panel Probit Technique (PPT). Hahm et al. (2013)'s results show that non-core liabilities have significant predictive power for credit crises.

The growth of non-bank financial institutions has also been used as a proxy for growth of shadow banks (Harutyunyan et al., 2015). Acharya et al. (2013) conducted a study based on India in which they investigated the determinants of the growth of non-bank financial institutions. Their study uses the random effects model. The results of their study show that non-bank financial intermediaries involved in credit extension had their credit ballooning in 2008, confirming the effect of the crisis. Unlike the shadow banking system in the US and Europe, banks lend to non-bank financial institutions as a substitute for direct bank lending to rural population. Thus, in India, NBFIs are able to reach non-urban areas that are inaccessible to formal banks.

### 3.4 Shadow Banking, Monetary Policy and Bank Liquidity

Leading theories of monetary policy build from the work of Friedman (1968,1982) and Taylor (1993, 2007). In spite of the differences in the choice of monetary policy instrument, the two provide a basis for analysis and execution of monetary policy. This section considers theoretical literature on monetary policy and reviews present monetary policy approaches.

#### 3.4.1 Monetary Policy Theory

Orthodox monetary policy theory can be traced back to Keynes' General Theory (Tily, 2012). There are however several interpretations to Keynes pointing to different directions. The interest rate is the main instrument of monetary policy in this framework and a change in money supply can be effected by changes in the interest rate. The theory of monetary policy is also closely intertwined with Business cycle theory due to use of policy stabilization approaches.

**Keynesian Theory of Monetary Policy**

Through several contributions including the 'General theory' and the 'Treaty on Monetary reform' Keynes (Keynes, 1937, Keynes, 1930), the strength of monetary policy in impacting economic activity at least in the short-run is shown. Whilst there are divergent interpretations on Keynes' work, the main stream interpretation proffered by Hicks (1983) and others (Boianovsky, 2004, Patinkin, 2013), maintain long-run money neutrality as in the classical theories. However, in the short-run, changes in money supply through mainly the interest rate have a bearing on both inflation and real economic activity. In the Keynesian

model, the interest rate is an equilibrating price between money demand (liquidity preference) and the supply of money. Thus, changing the interest rate would in turn change the money supply. For instance, monetary contraction that reduces access to liquidity would then decrease aggregate demand stabilizing the economy as a whole.

**Monetarist Theory of Monetary Policy**

The monetarist approach is espoused in theoretical contributions of Milton Friedman. Friedman (1967)'s seminal paper provides insight into the core issues to be considered in administering monetary policy. The work of Read together with Phelps (1968) argued for a distinct treatment of real and monetary variables. Du Plessis (2014) analyses three interpretations of Friedman's work. Firstly, one by Tobin (1995) who criticized the concept of monetary and inflationary surprises. The second interpretation derives from the work of Arrow et al. (2011) for the American Economic Association. According to Arrow et al. (2011), Friedman (1967) and Phelps (1968) who introduced the vertical long-run Phillips curve and the concept of the natural rate of unemployment which is the rate at which expected inflation is equal to current inflation rate. If inflation is inelastic with respect to unemployment in the long-run, it implies the trade-off between inflation and unemployment is only temporal. The third interpretation cited by Du Plessis (2014) is Friedman's interview in Snowdon and Vane (2005), which emphasized the possibility of using monetary policy to lower unemployment only in the short-run through monetary surprises. Thus, according to Friedman (1982) the main goal of monetary policy should be to maintain price stability.

The monetarist view also advances monetary control as the main instrument of monetary policy. The central bank according to Friedman can alter the money supply to effect any policy changes. In Friedman (1967)'s words, 'monetary authority should guide itself by magnitudes: it can control, not by ones it cannot control'. He suggests the exchange rate, rate of inflation and the money supply as candidates for policy instruments and surprisingly discredits the interest rate and the unemployment rate. As Nelson (2008) argues, this is in sharp contrast to Taylor's propositions on target variable, and considering the adoption of the interest rate as the main monetary policy tool in the past 40 years, one can conclude that Friedman did not succeed in this direction. Another important consideration for monetary policy from a monetarist view is a relatively slow response to avoid wide swings in policy changes.

Du Plessis (2014) argues that an overlooked contribution of Friedman lies in the relationship between monetary policy and financial instability. In explaining what monetary policy can do, Friedman (1967) notes that the first thing monetary policy does is to prevent money from being a source fragility. Monetary policy could thus be used as in the period after the GFC when unconventional monetary policy was a useful instrument in reducing further harmful consequences of a meltdown. Cerna (2012) acknowledges that Friedman provided insight into the ability of monetary policy to stabilize the economy.

Du Plessis (2014) Du Plessis also notes that Friedman and Schwartz (2008) describe in detail expected impact of monetary policy on both liquidity and the financial sector stability. According to this interpretation of the Great Depression and the banking crises that ensued, the reduction in the policy rate by the FED had caused an upsurge in withdrawals, depressing liquidity and resulting in bank panics. The consequence of failure to correctly apply monetary policy instruments could therefore be very high due to its connectedness with the rest of the financial sector.

Major criticism of Monetarism include those from Kaldor (1985) and (Tobin, 1995b, Tobin, 1995a). Kaldor (1985) identifies areas in which the monetarist view proved incorrect, especially drawing from failure in policy in both the US and UK during the 1980s. Central to his criticism was the notion that money supply cannot be the sole source of inflation and business cycles. Instead in contrast to Friedman's views, he argues that demand is not only driven by money supply but income derived from production. Thus, inflation according to this view cannot be a completely monetary phenomenon as alluded to by Friedman. These ideas support (Tobin, 1995a) who had already offered an explanation for inflation from the real side of the economy. According to Tobin (1995a), only the natural rate of unemployment is consistent with stable wage rate and prices. Increasing employment beyond the natural rate induces welfare loss in the form of inflation.

**Monetary Policy Rules**

To further debate on the conduct of monetary policy, it is important to review monetary policy rules. Two main authors dominate this literature: Friedman and Taylor. Before

presenting the generic rules suggested by these contributors, it is important to distinguish between monetary policy by rules and monetary policy by discretion. Conducting monetary policy through discretion involves decisions by the authorities from time to time on how to alter the policy stance. On the other hand, following a policy rule involves the use of a systematic decision process, usually stated in terms of a quantitative function. In both Friedman and Taylor's work, they demonstrate preference for monetary policy rules to discretionary monetary policy (Nelson, 2008). Friedman advocated for a monetary growth rule that could be used to target price stability. However, Friedman did not advocate for pursuance of full employment through monetary policy.

In several papers, Taylor (1993), (Taylor, 2007) argued for a deviation from Friedman's constant money growth rule policy. Three types of policy rules have been advocated for by Taylor, firstly: optimal control based policy rules, which he later discarded citing their complexity in line with Friedman's view that optimal control was sophisticated and even not compatible with the FED talent pool. Secondly, Taylor suggested simple policy rules which were monetary rules in which inflation was not explicitly specified in the model. The third type of rule is the conventional interest rate rule (Taylor, 1993).

**Contemporary Issues in Monetary Policy**

The 1990s and early 2000s saw a deliberate merge of the dominant schools of thought in the theory of business cycles. The New Keynesian economists with their sticky prices and wages, believing in the potency of monetary policy reached a consensus with new classical economists of the real business cycle theory. In the real business cycle theory, money has no influence on real variables both in the short and long run. According to (Galí, 2015), the New Neoclassical synthesis has emerged with new models that are micro-founded in the spirit of real business cycle theory but also possesses the sticky price traits of New Keynesian models. The new models have become the workhorse of business cycle analysis and are termed New Keynesian Dynamic Stochastic General Equilibrium Models (DSGE). However, earlier DSGE models did not account for financial sector activities in the models.

### 3.4.2 Monetary Policy and the Financial Sector

Verona et al. (2013)'s paper is the first to include a fully-fledged shadow banking system in a DSGE framework. Their paper builds from previous literature that builds models with financial frictions. Earlier works in this dimension include papers by Bernanke et al. (1999) and Kiyotaki and Moore (1997). Bernanke et al. (1999) use a model with a financial accellerator mechanism. Their model has financial intermediaries or producers of capital who leave or enter the market at random. Thus, financial intermediaries do not have enough time to build internal reserves against which to protect themselves from external financial shocks (Brázdik and Marsal, 2012). As usual, other economic participants include households, firms, and the governmant. Kiyotaki and Moore (1997) construct a model in which there are two types of consumers, impatient and patient. Impatient households borrow whilst patient households lend. Firms in their model differ with the collateral needed on borrowing. The land owned by firms can be used for production or as collateral when they want to borrow. The two studies therefore present two ways of including financial frictions in a DSGE framework: the financial accelerator and the collateral constraint.

Several studies have extended the basic framework of Bernanke et al. (1999) to include more specific aspects of the financial sector (Nachane, 2017, Funke et al., 2015). Christiano et al. (2010) build a model in which a financial accelerator mechanism allows firms to raise capital externally. However, their results do not show large variations between the model with the accelerator and one without it. Another attempt at extending Bernanke et al. (1999) 's framework is the study by Christensen and Dib (2008) in which two modifications are made. Firstly, monetary policy is represented by a different Taylor-type rule in which the nominal interest rate is adjusted in response to macroeconomic aggregates movements. The second change stems from the fact that debt contracts are written in nominal terms. Their model fits data better than the model without financial frictions.

### 3.4.3 Monetary Policy Transmission Mechanism

The theory on monetary policy transmission attempts to explain the various ways through which the effect of monetary policy changes can be transmitted into the economy. However, monetary policy transmission is often referred to as a 'black box' due to lack of specificity on which channel of monetary policy is dominant at a given time as different channels tend to

be operational at the same time (Mohanty, 2012). Mishkin (1996) documents the rise of monetary policy to prominence in the last decades of the 20th century as it became apparent that fiscal policy is difficult to implement due to challenges such as policy lags and inconsistencies. The increased use of monetary policy raises the need to understand the channels through which monetary policy affects the real economy. Literature distinguishes between traditional channels of monetary policy transmission, credit channels, asset price channels (Boivin et al., 2010a, Cecchetti et al., 2015) and other financial market channels (Peek and Rosengren, 2010, Xiang and Qianglong, 2014, Xiao, 2018). Mohanty (2012) however, provides a general classification in which he distinguishes between neo-classical transmission channels and non-neoclassical channels.

#### 3.4.3.1 Traditional Channels of Monetary Policy

Several studies document the channels of monetary policy transmission (Mishkin, 1996, Peek and Rosengren, 2010, Boivin et al., 2010a). Cecchetti et al. (2015) note that traditional channels of monetary policy transmission include the interest rate channel and the exchange rate channel. In the neo-classical framework contractionary monetary policy involves a hike in the interest rate, which in turn increases the cost of borrowing and reduces consumption and investment, dampening output growth. Real variables are assumed to respond to changes in the real rate of interest (Boivin et al., 2010b). in the short term, changes in the price level could be insignificant and changes in the nominal interest rate are directly correlated with the real interest rate. Thus, economic agents respond to changes in the real interest rate instead of the nominal interest rate.

The exchange rate channel of monetary policy transmission focuses on the responsiveness of exchange rates to changes in the interest rate. A reduction in the interest rate for example lowers the value of domestic assets compared to foreign assets and causes the exchange rate to depreciate (Mohanty, 2012). The result could be increased economic activity as a result of cheaper tradeable goods compared to foreign counterparts. On the contrary, an increase in the policy rate can therefore reduce aggregate demand and lower the price level (Boivin et al., 2010a, Cecchetti, 1995).

The relationship between the interest rate and asset prices present another channel through which monetary policy can impact the real economy. Using the discount models, it can be shown that the price of a stock or bond is negatively related to the interest rate (Cecchetti et al., 2015, Mishkin, 1996). An increase in the interest rate decreases the stock price as such holders of equities lose wealth and consequently become worse off. Lower policy rates however, increase the wealth of economic agents, thereby impacting their ability to purchase more goods and services. Both consumption and investment can increase.

Boivin et al. (2010a) argue for the importance of expectations in monetary policy transmission. The notion that expectations often become self-fulfilling is widely accepted in main stream macroeconomics. It is at the centre of monetary policy strategies such as inflation targeting regimes. Central banks thrive to build a credible reputation in order to be able to influence business and consumer expectations. Notably, both consumer and business confidence can improve during an expansionary monetary policy as agents expect high future growth (Cecchetti et al., 2015). Conversely, raising the policy rate may lower confidence, prompt agents to cut on their spending and ultimately result in a decrease in aggregate demand.

#### 3.4.3.2 The Bank Lending and Balance Sheet Channels of Monetary Policy

The importance of credit channels of monetary policy transmission have dominated literature in the past two decades (Karim and Azman-Saini, 2013, Auel and de Mendonça, 2011). Ampenberger et al. (2013) argue for the importance of banks in providing capital in countries or regions where capital markets are small. In most developing countries, banks are a vital component of the monetary policy transmission mechanism since capital markets are smaller and inaccessible to the bulk of small and medium enterprises found in these countries. The central bank can influence the credit issued by banks through open market operations, changes in the policy rate or changes in the reserve required ratio. Unlike the interest rate channel, the bank lending channel work through the impact of monetary policy changes on credit supply (Brooks, 2007). In addition, credit supply can also be influenced through regulation (Duca, 2016). For instance, the higher capital adequacy requirements of Basel II may have had a negative effect on overall bank lending.

Peek and Rosengren (2010) use an ideal world with three assets, money, government bonds and bank loans, to describe the conditions under which the bank lending channel can hold. In such a world, prices should be sticky, making money not neutral in the short run. Further, open market operations must affect the credit issued by banks, and lastly bonds and loans must not be perfect substitutes, at least for certain borrowers. Others, Perera et al. (2014) argue that a bank lending channel exists to the extent that banks depend on reservable deposits for credit extension. Thus, banks that depend only on central bank supplied reserves are more susceptible to policy shifts. In addition, Apergis et al. (2012) show that highly liquid and capitalized banks are less influenced by monetary policy, weakening the bank lending channel where such banks are dominant.

The effectiveness of open market operations implies that when the central bank for instance sells securities to decrease bank reserves, banks should lower credit supplied to firms and consumers. However, this depends on whether banks have access to non-reservable liabilities, which can replace the lost reservable liabilities (Apergis et al., 2012). Non-reservable liabilities are sources of reserves other than central bank supplied reserved. Thus, financial innovation such as securitisation present an opportunity for such diversion. Further, the higher the substitutability between reservable and non-reservable liabilities, the more likely bank lending will be insensitive to monetary policy changes.

It is noteworthy however that in empirical studies, it may be difficult to separate the bank lending channel from the balance sheet channel. Aysun and Hepp (2011) find that lack of loan data raises the problem of determining whether changes in credit are due to bank liquidity (bank lending) or due to changes in borrowers' balance sheets. Available evidence, however, documents a negative relationship between financial innovation and monetary policy effectiveness through the bank lending channel. Financial innovation tends to provide an alternative source of liquidity for banks which substitutes bank deposits in times on monetary policy contraction.

On the empirical front, a number of studies have investigated the bank lending channel of monetary policy (Ludi and Ground, 2006, Ashcraft, 2006, Altunbas et al., 2009, Ben Salah and Fedhila, 2014, Simpasa et al., 2014). Within literature, two broad categories can be identified,

studies that investigate the existence of the bank lending channel (Ashcraft, 2006, Brooks, 2007, Juks, 2004, Kishan and Opiela, 2000, Ludi and Ground, 2006, Simpasa et al., 2014) and those that analyse the effects of other bank specific variables on the bank lending channel (Altunbas et al., 2009, Ben Salah and Fedhila, 2014, Gambacorta and Marques-Ibanez, 2011, Maddaloni and Peydró, 2011). Another observable feature of these empirical studies is the increasing use of disaggregated data, specifically bank specific data (Aban, 2013, Lopreite, 2012).

Ludi and Ground (2006) investigate the existence of the bank lending channel in South Africa using aggregate data. Their study employs a structural vector error correction model and find no evidence for the existence of a bank lending channel. Their findings contradict previous studies (Kashyap and Stein, 1995, Juks, 2004, Farinha and Marques, 2002), which demonstrate the presence of a bank lending channel for the US, Estonia and Portugal, respectively. Their results may however be consistent with the view that well capitalized and liquid banks are less sensitive to monetary policy changes, considering that South African banking system is dominated by four main large banks (Aban, 2013).

#### 3.4.3.3 Financial Market Channels of Monetary Policy

The GFC of 2007/2008 raised a number of questions on the effectiveness of monetary policy transmission under worsening financial conditions. Three new channels have been suggested in literature recently: the risk taking channel, the bank capital channel and the shadow banking channel of monetary policy.

**Risk-taking Channel of Monetary Policy**

Borio and Zhu (2012) suggest a new channel of monetary policy in which capital regulation in a low interest rate environment induces economic agents to take more risk. They define the risk taking channel as: “the impact of changes in policy rates on either risk perceptions or risk-tolerance and hence on the degree of risk in the portfolios, on the pricing of assets, and on the price and non-price terms of the extension of funding” (Borio and Zhu, 2012:242). Changes in monetary policy have implications for increases or decreases in riskiness of assets portfolios. Several explanations are provided on the link between monetary policy and risk taking (López et al., 2011, Gambacorta, 2009, Borio and Zhu, 2012).

The first explanation is, 'search for yields'. Low interest rates drive financial market participants to search for high risk, high yield assets. Agents may be unwilling to accept low interest rates for various reasons including, 'money illusion' and other institutional requirements such as regulation or high nominal return requirements by providers of finance (Gambacorta, 2009). Secondly, changes in the interest rate impacts on valuation models and risk metrics. A decrease in the rate of interest for example has a favourable impact on risk measures. This can encourage economic agents to take more risks with the perception that the riskiness of their portfolios has decreased. On the other hand, asset valuation responds positively to a decrease in the discount rate and lowering the interest rate increases asset value and has an incremental effect on individuals' net-worth. According to Borio and Zhu (2012), available models of risk assessment, which tie increased wealth to increased ability to bear risk imply agents can take more risk as a result of such changes in interest. The third explanation for changes in risk perceptions or risk appetite is the conduct of the central bank itself. Borio and Zhu (2012) argue that the degree to which the central bank is committed to future changes in monetary policy, coupled with the level of transparency in the conduct of monetary policy are important in influencing risk taking behaviour of financial market participants. Bruno and Shin (2013) also find a risk taking channel across national borders. Lower interest rates in advanced economies drive banks to engage in risky cross border credit intermediation. Their model uses balance sheets of domestic, regional and international banks, and they find that low interest rates tend to increase capital outflows. In another specific study, López et al. (2012) show that the risk taking channel is present in consumer loans in Colombia. Specifically, after a decrease in the policy rates, banks are found to be more reluctant to extend credit to clients with bad credit record.

**The Bank Capital Channel of Monetary Policy**

Van den Heuvel (2006) argues for the existence of a different channel of monetary policy, which impacts bank lending outside the common but falls outside the conventional bank lending channel. Regulatory capital as required by central banks or International agreements such as the Basel codes can provide a channel through which policy changes impact bank credit. Levieuge (2009) reviews literature linking bank lending to bank balance sheet conditions. They argue that bank equity has a significant effect on bank credit. Specifically,

factors like supervision ratings and the level of bank capitalization influence the cost of credit extended by banks. As found in Hubbard et al. (2002), cost of credit is higher from banks with low levels of capital or banks which are rated low by the supervisor. Stated more succinctly, the bank capital channel is operationalized as follows: an increase in regulatory capital reduces the available liquid liabilities to lend. Thus, in the event of a monetary policy shock, credit from undercapitalized banks is more elastic to changes in the monetary stance compared to well capitalized banks.

**Shadow Bank Channel of Monetary Policy**

The shadow banking channel of monetary policy is identified in a number of studies (Verona et al., 2013, Wang and Zhao, 2016). Xiao (2018) is however the first to point out the existence of the shadow banking channel. The channel offers an explanation for increased shadow banking during periods of monetary contraction. An interest rate hike result in reduced liquidity available for banks to conduct their business. Instead of reducing bank lending, banks tend to switch to other sources of finance which substitute central bank money. One such source is the wholesale market which eventually allows the interaction between banks and non-bank financial intermediaries. When banks have a financial deficit, they can borrow from the wholesale market and when they have surplus, they can lend to NBFIs in wholesale markets. Thus, a trade-off exists between formal banks' liquidity and growth of shadow banks in which they expand as formal banks contract.

A number of reasons are forwarded in literature for this relationship. Firstly, a decrease in the interest rate can drive commercial banks into shadow banking activities in search of high yields. Tang and Wang (2015) find that returns in the shadow banking sector are high compared to the formal banking sector. The profit incentive can therefore drive formal banking entities into shadow banking activities in search of higher returns. Secondly, regulatory arbitrage allows banks to use shadow banking as a substitute for regulated liabilities. Increases in capital regulation drive financial market players into the shadow banking sector where they are lightly or not regulated at all. Thus, tight monetary policy increases activities in the shadow banking sector (Wang and Zhao, 2016, Xiang and Qianglong, 2014).

In brief, whilst there is an insurmountable amount of research on monetary policy transmission, no single transmission mechanism can be able to completely explain the transmission of monetary policy. Policy makers are therefore expected to understand the context in which they craft policies and possible impact of monetary and financial variables on monetary policy transmission. This study extends the literature on monetary policy transmission by investigating the linkages between shadow banking, monetary policy, liquidity and risk taking.

### 3.5 Cross Border Financial Linkages in Shadow Banking

Shadow banks pose threat to financial stability through their connectedness with the formal banking sector. In addition to credit exposure, linkages between the formal banking and shadow banks can also rise due to fixed income securities, participation in the repo market and investments in money market. The more connected shadow banks are with the formal banking system, the more likely it is that default in the shadow banking system will affect the formal banking system and increase systemic risk. In India for example shadow banks are financed by formal banks (Acharya et al., 2013). Depending on the share of credit extended to shadow banks compared to total credit of the banking sector, shadow banks failure could result in failure of formal banking institutions. In addition, the participation of banks in the wholesale funding markets also increases the interconnectedness between formal banks and shadow banks.

In addition to enhancing local financial networks, shadow banking tends to promote regional and cross boarder financial interconnectedness (FSB, 2017). In Pozsar et al. (2013) external shadow banking is operational at the global level, creating a chain of interconnected bank balance sheets. Through these balance sheet networks, shocks from other countries could be transmitted across their boarders (Lane and McQuade, 2014). This interconnectedness creates a channel for risk transfer from one jurisdiction to another posing a threat to financial stability (Mitchener and Richardson, 2013). Although there have been efforts to capture cross boarder financial flows, lack of data specific to shadow banking has limited research in this area, with many studies focusing on foreign domestic investment (FDI), portfolio investment and corporate debt flows. However, both banks and non-financial corporates use alternative sources of debt financing, and thus, source funds from shadow banks. This bank funding

through international leverage could cause distortions within the local banking systems if regulation is weak. The third way in which shadow banking linkages can be identified is via bank holding companies. Most commercial banks participate in the shadow banking industry through subsidiaries of their bank holding companies. Thus, systematic risk can be transmitted either way: from the banking sector or from the shadow banking sector due to such balance sheet linkages (FSB, 2016). The FSB FSB (2017) however reports that data on global shadow banking interconnectedness is still scarce, with participating jurisdictions only having started to submit such data in 2017. Therefore, there remains a lot to be done in analysing the extent to which these linkages can propagate financial risk from one jurisdiction to another.

The study considers four central theories of global financial markets, cross border capital flow theory, the theory of bank runs, the theory of financial frictions and theories of financial contagion. The analyses of this study aim at testing whether the hypothesis proposed by these theories explain the presence of a parallel banking market in emerging countries.

### 3.5.1 Cross Border Capital Flows

Increased financial globalization has led to the rise in cross border banking and direct lending between financial institutions in different countries (Buch et al., 2010). The baseline theory used to analyse cross border capital flows is the push and pull analysis (Cerutti et al., 2015a, Fratzscher, 2012). Push factors are domestic conditions that drive capital out of the country, whilst pull factors attract capital flows into the country. Several studies apply this framework and establish a number of factors that determine the direction of flow of capital between countries (Fratzscher, 2012, Cerutti et al., 2015a). Figuet et al. (2015) categorize push factors as those drivers of capital flows in the country of the lender or originator. These factors are external to the borrower and are exogenously determined. Thus, push factors are exogenous to emerging markets. However, pull factors refer to the borrower country's conditions that attracts capital inflows and are generally associated with economic development in the recipient country. The seminal work of Calvo et al. (1993) and several other studies (Ahmed et al., 2017, Cerutti et al., 2015a, Herrmann and Mihaljek, 2013) show that economic growth, the level of the interest rate and other macroeconomic indicators are important capital flow pull factors.

Earlier studies on capital flows concentrated on foreign direct investment and portfolio investments. At the turn of the century, there was a shift of focus towards bank lending. However, studies in this area were constrained by lack of data (Figuet et al., 2015). Such studies increased in the aftermath of the financial crisis with a renewed attempt at understanding both the benefits and risks associated with increased cross border bank lending (Allen, 2011, Avdjiev et al., 2012, Bautista et al., 2008, Brunnermeier et al., 2012, Bruno and Shin, 2015, Degryse et al., 2010). The increase in the number of studies focused on cross border bank lending shows the importance attached to cross border financial shocks.

The current study seeks to extend on this literature by considering cross border financial linkages through the shadow banking sector. The FSB (FSB, 2017) shows that there are very strong global financial linkages in the shadow banking sector. Shadow banking as demonstrated by contagion across national borders experienced during the GFC provides a channel for extension of credit, and an alternative source of liquidity to the recipient country financial sector. Cerutti et al. (2014) argue that financial innovation in the form of shadow banking increases cross border volatility and has potential to contribute to financial sector fragility.

### 3.5.2 The Theory of Bank Runs

Sequel to the seminal work of Diamond and Dybvig (1983), several papers have discussed the occurrence of bank runs in financial markets. A bank run implies a speedily withdrawal of funds from a bank by depositors as a result of a rise in the risk profile of a financial institution. Starr and Yilmaz (2007) contrast the two main sources of bank runs identified in the literature, self-fulfilling bank runs and information asymmetry. Self-fulfilling bank-runs are suggested by Diamond and Dybvig (1983) and relate to the compounding nature of expectations in leading to a certain action in this case depositors' withdrawal of funds. However, the two sources of bank runs are not mutually exclusive. Starr and Yilmaz (2007) argue that both self-fulfilling and informational runs were at play in Turkey during the 2001 bank runs. Informational bank runs are a result of asymmetric information amongst depositors concerning bank fundamentals. Some studies have shown that banks with weaker fundamentals have experienced runs (Starr and Yilmaz, 2007).

Although bank runs apply directly to deposit taking institutions, non-deposit taking financial institutions could experience far more reaching consequences in the event of investors withdrawing their funds from the system (Gorton and Metrick, 2012). Bank runs have been a prominent feature of most financial crisis (Iyer and Puria, 2012, Starr and Yilmaz, 2007). The GFC with no exception was also partly a result of a run on the repo market, a wholesale market for funding shadow banking activities (Gorton and Metrick, 2012). The main argument for prevalence of runs is lack of deposit insurance. Although several countries have adopted deposit insurance policy since the Great Depression, shadow financing is largely uninsured. Gorton and Metrick (2012) finds that uninsured depositors are more likely to withdraw their funds from any financial system given an impending failure of a bank. Thus, lack of any form of insurance, backstop or government guarantee make shadow banking highly prone to bank runs, and thus, weakening the financial system as a whole. The growth of the shadow banking system is therefore expected to increase financial instability according to the theory of bank runs. The present study tests this hypothesis by empirically testing the relationship between financial stability and shadow banking in emerging countries.

### 3.5.3 Theories of Financial Frictions

New Classical DSGE macro-economic models of the 1980s assume money neutrality, a proposition which undermine the role played by monetary and financial variables in modern economies (Galí, 2015). Following Bernanke and Gertler (1989) and Bernanke et al. (1999), Brázdik and Marsal (2012), it is arguable that financial crisis have shown that financial shocks are a central element of the macro economy. Starting with Bernanke and Gertler (1989), several studies have been conducted that demonstrate the role of financial frictions in business cycles. Financial frictions can only be incorporated in a DSGE model by using New Keynesian price rigidities. Two most popular rigidities used are found in Bernanke et al. (1999) and Kiyotaki and Moore (1997). In Bernanke et al. (1999), the authors suggest a financial accelerator mechanism which is able to magnify a small change in financial markets or in the real economy into a huge change in the economy. The intuition behind the financial accelerator is that firms depend on external finance, whilst at the same time their access to external finance depends on their net worth. Thus, a small decrease in external finance for instance will lead to a decrease in firms' investment, reducing their net worth and leading to

a further lower credit rating by financiers who in turn increase their finance premium, further decreasing investment. The cycle can therefore lead to a very huge overall decrease in both financial and real economic activity (Brázdik and Marsal, 2012). Further extensions of this model are found in Verona et al. (2013) and Christensen and Dib (2008).

Alternatively Kiyotaki and Moore (1997) propose a mechanism in which the limit to financing is driven by the collateral assets owned by the firm. In their model, firms hold fully secured debt contracts. Small and temporary diversions from normal productivity are shown to have a huge impact on output. Extensions of this model have added nominal contracts and demand for real estate to the baseline asset collateral constraint model (Iacoviello and Neri, 2010, Christiano et al., 2010). The models used here underscore the linkages between the financial sector and the real sector. Whilst the study does not employ directly any of these models, they provide a theoretical background to the analyses, thereby, linking shadow banking to real economic factors.

### 3.5.4 Theories of Financial Contagion

Financial contagion occurs when distress in one financial entity is transmitted to other financial systems. For instance, if a bank goes bankrupt or is under financial distress it will fail to pay its creditors, transferring the distress to its creditors as well as investors. Ozkan and Unsal (2012) illustrate that creditors and investors respond to a bank failure by selling their financial claims which coupled with depositor or investor herding behaviour results in a bank run. Due to interconnectedness of financial markets, failure of one bank can then be easily transferred to the other institutions that hold financial claims in the distressed institution. The process can be repeated across the whole banking network ultimately resulting in financial crisis. Dungey and Gajurel (2015) argue that bank failure transmitted from other jurisdictions is detrimental to domestic financial stability. Although financial contagion can be slow and subtle during normal times, it is more aggressive and reinforcing during a crisis. The main reasons for contagion in financial markets include information asymmetries and imperfect markets, as well as the role of currency (Allen and Gale, 2000).

Bruno and Shin (2015) suggest a model of global credit intermediation in which local banks extend credit drawn from funding from abroad. In their model, a regional/local bank is

connected to the global market through its interlinkage with a global bank. Their basic model show that global banks raise funds in the wholesale market and in turn supply these funds to local banks in another wholesale market or as cross border loans. Bruno and Shin (2015) model credit risk using an augmented Vasicek (2002) model. In their model, the global bank bears risk arising from probability that the local bank will default. On the other hand, the local bank also faces risk which is a combination of regional-specific risk and global risk. Thus, both banks face risk exposures arising from both jurisdictions. Whilst they do not distinguish between independent bank linkages and subsidiary-parent linkages, they are able to show that increase in bank leverage across borders has the potential to increase financial sector vulnerability in different countries. Their model is consistent with several studies that measure and categorize cross border credit as shadow banking (Errico et al., 2014, Harutyunyan et al., 2015).

Mitchener and Richardson (2013) find that financial crises are exacerbated by the presence of shadow banking. The existence of shadow banks creates a wider off-balance sheet network in addition to balance sheet linkages of banks through which financial distress can be transmitted to other institutions. In Dungey and Gajurel (2015), three channels of bank contagion can be identified: systematic, idiosyncratic and volatility contagion. Systematic contagion arises from structural changes in Global financial markets which have effect on functionality or structure of domestic financial markets. Idiosyncratic contagion is related to distress transmitted from specific financial institutions which affect other financial institutions whether locally or globally. On the other hand, volatility contagion is a result of variations in market volatility which may rise due to changes in other economic fundamentals. The present study seeks to validate or refute the claim that shadow banking increases financial contagion by empirically testing this proposition on the interbank linkages among emerging economies. The study uses global vector auto regression (GVAR) technique to identify financial shocks rising from cross boarder financial linkages and growth in shadow banking sector.

### 3.6 Concluding Remarks

The Chapter provided a review of theoretical literature underpinning the empirical work covered in this study. Firstly, theoretical literature on financial innovation is covered to

provide a basis for the analysis of shadow banking as a form of financial innovation. The chapter also review literature on economic growth theories, with emphasis of the neo-classical model which forms the base for empirical work in Chapter 4. Section 3 covers literature on monetary policy transmission, liquidity and shadow banking and provides foundational exploration for empirical work in Chapter 6. In section 4, the study reviews literature related to cross border capital flows and financial shocks which also relates to empirical work covered in Chapter 5. All in all, the review covers contemporary views on the impact of shadow banking on economic growth, financial risk and monetary policy.

# CHAPTER 4

# AN EMPIRICAL ANALYSIS OF THE IMPACT OF SHADOW BANKING ON ECONOMIC GROWTH IN EMERGING ECONOMIES

This Chapter provides an empirical analysis of the impact of shadow banking on economic growth in emerging countries. The Chapter is aimed at meeting objective 1 of the study. The chapter is structured in four main sections, with Section 1 focusing on background and justification for the research. Section 2 reviews empirical literature on financial innovation and economic growth and section 3 focuses on description of the methodology used and estimation techniques adopted in the study. In section 4 and 5, estimation results are presented and discussed, while section 6 summarizes the Chapter.

## 4.1 Background

The importance of shadow banking activities to the broader macro economy cannot be understated considering its role in the recent financial crisis (Hsu et al., 2013). Whilst several studies have criticized shadow banking activities as encouraging high risk taking and thereby increasing financial risk, there is no documented literature on the impact of shadow banking on overall performance of the economy. Available literature generally assumes two channels through which shadow banking impacts economic performance; firstly, it negatively affects the economy through propagating systemic risk, which can result in crisis such as the 2007/2008 Global Financial Crisis (GFC). The second channel is its ability to increase credit which can encourage economic activity through increased access to capital by productive units within the economy (Bernanke, 2007). The study analyses the relationship between shadow banking activities and economic growth in emerging countries using the panel ARDL approach and a panel of ten emerging economies. To the best of the researcher's knowledge this is the first work that seeks to directly relate shadow banking to economic activity.

Increased financial innovation in modern economies has seen a surge in financial activities outside the traditional banking system, generally referred to as shadow banking[7]. Shadow banking is primarily associated with institutions that are not regulated by the monetary

[7] The FSB defines shadow banking as, "credit intermediation involving entities and activities (fully or partly) outside of the regular banking system".

authorities, although recent developments have seen commercial banks and other regulated financial institutions extending credit through the shadow banking system (Harutyunyan et al., 2015). The term shadow banking as coined by McCulley (2009) refers to financial conduct outside the normal banking system. However, shadow banking is neither new nor static, but a continuously evolving sector. Its nature derives from the two main drivers of shadow banking, regulatory arbitrage and the profit incentive (Tang and Wang, 2015). Regulatory arbitrage because economic agents always seek to maximize self-interest and tend to find efficient ways of exchange if regulation prohibits free flow of goods or capital in markets. The profit incentive as suggested in Tang and Wang (2015) implies that financial institutions including commercial banks prefer shadow banking activities to traditional banking because it is highly profitable. The risk-return trade-off however limits the extent to which these profits can be pursued.

Whilst increased activity in the shadow banking sector prior to GFC occurred mainly in the United States (US) and other developed countries, emerging economies have recently had an upsurge in shadow banking activities. The Financial Stability Board (FSB, 2016) reports that emerging economy countries were leading in shadow banking growth between 2010 and 2016, with China having a spiralling shadow banking sector. Figure 4.1 below shows the growth of shadow banking in selected emerging countries over the past 15 years.

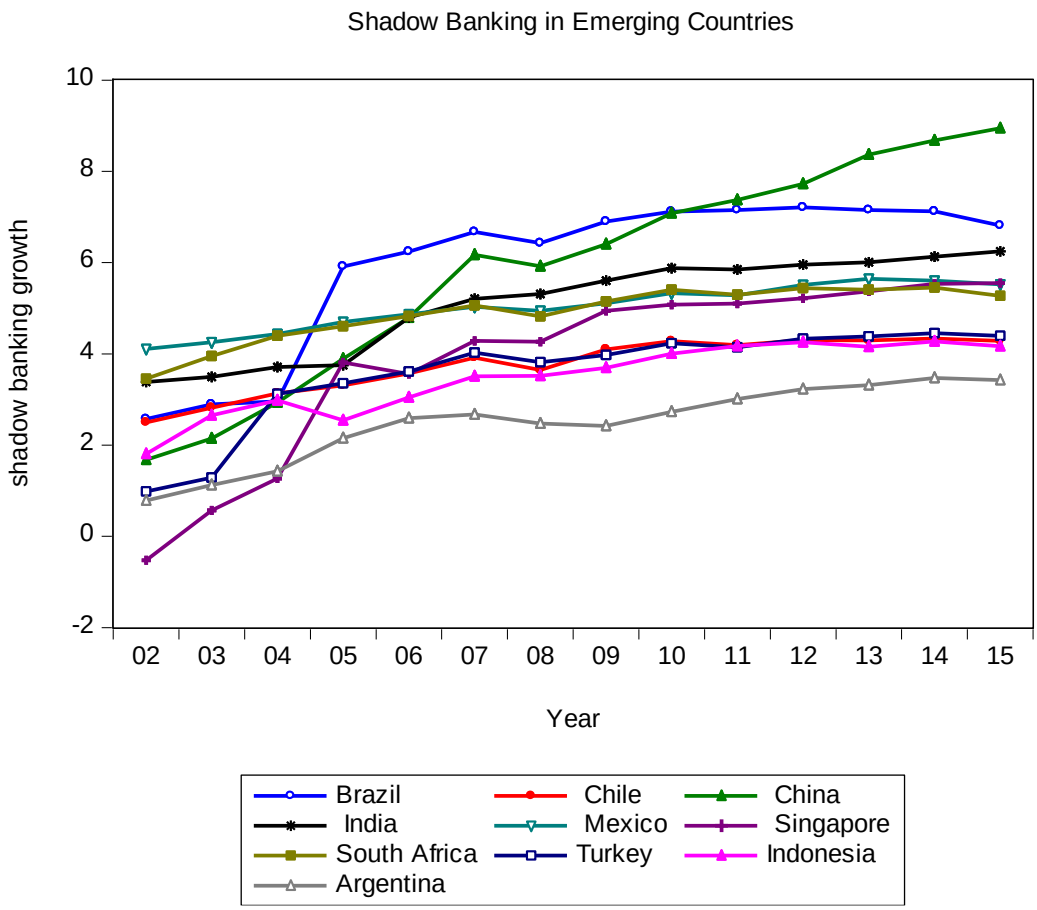


Figure 4.1 Shadow Bank Growth in Emerging Economies
Source: FSB (2016)

Figure 4.1 shows that the three highest growth rates in shadow banking are found among BRICS member countries, Brazil, China and India. Although South Africa does not have a very high rate of shadow banking growth, it is still relatively high compared to other non-BRICS members. The Financial Stability Board (FSB) reports that growth in shadow banking in emerging market economies has outpaced growth in GDP and is higher than that in developed countries (FSB, 2017). In addition, in most countries shadow banking has outgrown its prior crisis levels, raising fears of a return to 2008.

Several studies have narrated the existence of a shadow banking sector in emerging countries, illustrating its growth both in the pre-crisis period and in the post crisis era (Cozer, 2015, Li, 2014, Mehrling, 2012). Although such narratives offer a strong case against the growth of and possible risks created by shadow financial activities, they do little however in revealing the underlying macro-economic linkages of shadow banking (Bengtsson, 2016, Tang and Wang, 2015). This Chapter contributes to literature on shadow banking in at least two distinct ways;

the first being to investigate the relationship between shadow banking and economic growth. In doing so, it addresses a gap identified in Claessens et al. (2012), in which they bemoan lack of studies that analyses the overall economic value of shadow banking. The second contribution stems from the use of granger causality tests to investigate the channels through which shadow banking impacts economic growth and inter-connectedness between shadow banking and formal banks. The ARDL approach to cointegration (Pooled Mean Group) is adopted to estimate a 10 country panel data regression model and present an argument for increased shadow financial activities to enhance and sustain economic growth. The closest papers to the analysis of this study are papers on financial innovation and economic growth (Bertay et al., 2017, Laeven et al., 2015).

### 4.2 Literature Review

Literature on the impact of shadow banking on economic performance is still in its infancy (Adrian and Ashcraft, 2016). Two reasons have discouraged such analyses in the past, firstly the opacity of the shadow banking activities, which makes it prohibitive for regulators and research institutions to gather data on such activities. The second reason stems from the first one and points to the general lack of data on shadow banking activities across countries (Pozsar et al., 2013). Several studies have however, provided explanation for the proliferation of financial innovations and their effects on financial development and economic activities (Allen and Gale, 1995, Laeven et al., 2015, Merton, 1992, Silber, 1975, Tufano, 2003). The current study follows this literature and positions shadow banking within the pool of literature on financial innovation. The ensuing discussion provides empirical literature on financial innovation and economic growth.

Based on the notion that financial development is important for growth, several studies have undertaken to establish the relationship between financial innovation and economic performance. Bertay et al. (2017) however, notes that empirical literature on financial innovation is relatively scarce. In addition, it is also difficult to generalise findings in this area as a result of differences in regulatory frameworks, industry structures, banking traditions and countries' level of development. The subsequent discussion presents selected empirical studies on financial innovation, noting however that financial innovation has been considered at different levels, either product, process or system innovations.

Earlier attempts at estimating the impact of financial innovation include papers by Ben-Horim and Silber (1977), (Silber, 1983). In both studies, a constraint induced model is applied. Financial innovation is found to increase welfare through allowing agents to circumvent regulation and improving their risk bearing capacity. Other earlier studies investigate the determinants of financial innovation (Nachane and Ghosh, 2002, Lerner, 2002). Nachane and Ghosh (2002) use a pooled OLS model to estimate the determinants of off balance sheet activities of banks and find that size, capital and liquidity of financial institutions are important determinants. Lerner (2002) reports that the level of patenting in banks is positively related to bank size and linkages to research institutions. The lack of empirical studies in the 1990s can also be noted, signalling a huge gap in empirical analysis of financial innovation and economic performance.

Laeven et al. (2015) use both a pure cross country analysis and the first differenced Generalized Method of Moments (GMM) to assess the impact of both financial innovation and financial development on economic growth. Their findings show that financial innovation is associated with economic growth, more than financial development. These findings concur with Beck et al. (2016) who also find that financial innovation results in economic growth. Beck et al. (2016) use panel GMM also but use expenditure on Research and development (R&D) as a proxy for financial innovation whilst Laeven et al. (2015) use growth in bank credit to private sector.

Other studies (Bertay et al., 2017, Keys et al., 2010) use specific products as measures for innovation in the form securitised assets and derivatives. Bertay et al. (2017) employ a fixed effects panel model in which growth in national income is determined by broad measures of financial development, securitisation and other control variables. Their findings suggest a negative association between securitisation and economic growth. Keys et al. (2010) effects of securitisation on incentives of financial intermediaries to screen borrowers is tested. Securitisation is found to have a worsening effect on screening incentives of financial intermediaries. Maddaloni and Peydró (2011) also find that securitisation reduces the effectiveness of monetary policy, possibly increasing vulnerability of the macro-economy.

A second strand of empirical literature related to this work analyses the impact of non-bank financial intermediaries (NBFIs) on economic growth (Cheng and Degryse, 2010, Liang and Reichert, 2012, Okere et al., 2015, Rateiwa and Aziakpono, 2017, Vittas, 1997). Haque et al. (2009) investigates the impact of NBFIs on economic growth in Malaysia. Their study employs the autoregressive distributed lag method (ARDL) and bounds test procedure to test for long run relationship. Their findings suggest a cointergrating relationship between NBFI and per capita income growth. Rateiwa and Aziakpono (2017) confirm the existence of a long run relationship between NBFIs and economic growth using time series analysis for South Africa, Egypt and Nigeria. Their study employs Johansen cointegration technique and they report on long-run estimates and Granger causality tests. NBFIs are found to positively influence economic growth with causality running from NBFIs to economic growth.

Liang and Reichert (2012) analyse longitudinal data for emerging and advanced economies and find that NBFIs have a negative and statistically significant influence on economic growth. Whilst these findings are contrary to a number of studies (Cheng and Degryse, 2010, Okere et al., 2015), the authors suggest worsening of financial market stability that accompanies expansion of NBFIs in the face of scant regulation as a possible reason for such a relationship. This lack of consensus invites further studies and use of granular data on specific NBFIs variables to establish their contribution to economic performance. However, Liang and Reichert (2012)'s result could also have been affected by the measures of financial development employed in their study.

Other empirical studies on shadow banking concentrates on explaining the drivers of shadow banking. Duca (2016) for instance, analyses how capital regulation and other factors influence the growth of shadow banking both in the short and long term . Their study employ vector error correction models and find that shadow banking is negatively related to information costs in the long run and positively associated with both absolute burden of bank reserve requirement and relative burden of capital requirements. Kim (2017) uses a dynamic panel model and data for the G-20 countries to analyse drivers of shadow banking. The study finds that growth of formal bank assets is positively related to growth of shadow banks. Pension funds and insurance providers also influence growth of shadow banking positively.

Due to lack of data on shadow banking on emerging countries, no specific empirical paper has attempted to investigate the effect of shadow banking on economic variables. Thus, this study fills this gap and revisits the finance-growth nexus in the presence of market credit intermediation (shadow banking). The results presented here give a departure for further analysis on the benefits of shadow banking.

### 4.2.1 Theoretical Model

The present study uses an augmented version of the Solow growth model in the spirit of Durusu-Ciftci et al. (2017) and Wu et al. (2010). Assume a Cobb-Douglas production function that is labour augmenting;

$$Y_t = [\![F(K]\!]_t, L_t) = K^{\varphi}([\![AL)]\!]^{1-\varphi}, \tag{4.1}$$

where $Y_t$, $K_t$ and $L_t$ represents output, capital and labour respectively. A is the technology variable or total factor productivity. Assuming that both labour and capital are exogenous to this model, the law of motion of capital can be represented compactly as follows;

$$K_{t+1} = K_t - \delta K_t + I_t, \tag{4.2}$$

$$K_{t+1} - K_t = I_t - \delta K_t$$

Assuming a closed economy, households use their income following the equation:

$$Y_t = C_t + I_t, \tag{4.3}$$

And $I_t = S_{t-1}$

Then,

$$\dot{k} = s\frac{Y_t}{A_t L_t} - \delta k \tag{4.4}$$

$$\dot{k} = sf(k) - (\delta + n + g)k \tag{4.5}$$

Where $\dot{k}$ represents the growth rate of capital per unit of effective labour. $\delta$ Is the rate of depreciation and $n$ is the population growth rate. $g$ represents the growth in knowledge.

The study suggests a theory of finance in which firms obtain finance from two sources; regulated financial institutions (regulated finance) and unregulated financial institutions (unregulated finance). Unregulated finance (URF) is relatively cheaper than regulated finance (RF). This proposition is supported by Tang and Wang (2015) who argue that shadow banking: a form of unregulated financing offers higher returns than RF. Thus, whilst URF is cheaper for borrowers, it still offers a higher return for lenders and investors. Therefore, regulatory arbitrage entices financial market agents with this higher returns, overcoming the downside of regulation in increased prices due to fees, higher transaction costs and credit limits imposed by capital requirements.

In addition, it can be noted that the trade-off between regulated and unregulated financing. According to Singh and Pozsar (2011) a decrease in bank regulated financing in a normal situation, can lead to an increase in unregulated financing. Following Durusu-Ciftci et al. (2017) and Wu et al. (2010), the following constant elasticity of substitution (CES) function for investment is proposed:

$$I_t = [\sigma {RF_t}^{\rho} + (1-\sigma){URF^{\rho}}_t]^{\frac{1}{\rho}} \tag{4.6}$$

Where RF and URF represents regulated finance and unregulated finance respectively.

The fundamental equation of growth becomes:

$$K_{t+1} - K_t = [\sigma {RF_t}^{\rho} + (1-\sigma){URF^{\rho}}_t]^{\frac{1}{\rho}} - \delta K_t \tag{4.7}$$

Multiply the first term on the right-hand side by $Y_t$ and obtain;

$$K_{t+1} - K_t = [\sigma {RF_t}^{\rho} + (1-\sigma){URF^{\rho}}_t]^{\frac{1}{\rho}} . \frac{Y_t}{Y_t} - \delta K_t, \tag{4.8}$$

Let $\frac{RF_t}{Y_t} = rf$, and $\frac{URF_t}{Y_t} = urf$. Capital per effective worker can be found as follows:

$$k_{t+1} = (1-\delta)k_t + \frac{\left[\sigma {rf_t}^{\rho} + (1-\sigma){urf^{\rho}}_t\right]^{\frac{1}{\rho}} . {k_t}^{\varphi}}{(1+g)(1+n)}, \tag{4.9}$$

$$(1+g)(1+n)k_{t+1} = (1-\delta)k_t + \left[\sigma {rf_t}^{\rho} + (1-\sigma) urf_t^{\rho}\right]^{\frac{1}{\rho}} . {k_t}^{\varphi}, \tag{4.10}$$

At the stead state output per effective labour becomes:

$$\tilde{k} = \frac{\left[\sigma r f_t^{\rho} + (1-\sigma) u r f_t^{\rho}\right]^{\frac{1}{\rho}\frac{1}{1-\varphi}}}{n + g + ng + \delta}, \tag{4.11}$$

And from $y = k^{\varphi}$ we have

$$\tilde{y} = \frac{\left[\sigma r f_t^{\rho} + (1-\sigma) u r f_t^{\rho}\right]^{\frac{1}{\rho}\frac{\varphi}{1-\varphi}}}{n + g + ng + \delta}, \tag{4.12}$$

Where $\tilde{k}$ and $\tilde{y}$ are stead state equations for capital per effective labour and output per effective labour respectively.

Multiplying the right hand-side by $A_t$ gives the per capita stead state of output.

$$y_t = A_t \left( \frac{\left[\sigma r f_t^{\rho} + (1-\sigma) u r f_t^{\rho}\right]^{\frac{1}{\rho}\frac{\varphi}{1-\varphi}}}{n + g + ng + \delta} \right), \tag{4.13}$$

Equation (4.13) describes our estimated model. Using log-linear transformation, we get;

$$log y_t = log A_t + \frac{1}{\rho} \log\left[\sigma r f_t^{\rho} + (1-\sigma) u r f_t^{\rho}\right] - \frac{\varphi}{1-\varphi} log(n + g + ng + \delta), \tag{4.14}$$

g Taylor series expansion, the right hand side can be expanded as follows:

$$log y_t = log A_t + \sigma \log r f_t + (1-\sigma) log u r f_t - \frac{1}{2}\sigma(1-\sigma)(log r f_t - log u r f_t)^2 - \frac{\varphi}{1-\varphi} log(n + g + ng + \delta) + \mu \tag{4.15}$$

Or

$$log y_t = \beta_0 + \beta_1 log\, r f_t + \beta_2 log u r f_t - \beta_3 (log r f_t - log u r f_t)^2 - \beta_4 log(n + g + ng + \delta) + \mu,$$

where $\beta_0 = log A_t,\ \beta_1 = \sigma,\ \beta_2 = (1-\sigma), \beta_3 = \frac{1}{2}\sigma(1-\sigma)$ and $\beta_4 = \frac{\varphi}{1-\varphi}$ are coefficients in a regression model. Equation (4.15) captures the importance of both regulated funding and unregulated funding on economic growth. According to Wu et al. (2010) both sources of funding should not be ignored in studies that model the impact of financial development and innovation on other economic variables. Equation (4.15) is estimated using annual data for 10 emerging market economies that participate in the FSB shadow bank monitoring exercise.

### 4.3 Methodology

The study seeks to estimate the relationship between economic growth and shadow banking using a panel of ten (10) emerging economy countries[8]. Our sample has both a cross sectional and time series constraint due to lack of data on shadow banking. Annual data from the World Bank, World Development Indicators are used. Data on other financial institutions (OFI) assets from the FSB is used as a proxy for shadow banking. In addition, transformations of variables into logarithms is done to enable interpretation of coefficients as elasticities and also reduce the impact of outliers in the data.

#### 4.3.1 Panel Unit Root Tests

Several unit roots tests are documented in literature (Baltag, 2008). These are generally divided into first, second and third generation unit root tests. First generation panel unit root tests include Im et al. (2003), Harris and Tzavalis (1999), Levin et al. (2002), Breitung (2001) and also a residual-based LM test by Hadri (2000). Second generation unit root tests include Bai and Ng (2004), Moon and Perron (2004) and Choi (2001). Some researchers have grouped newer tests into third generation group, which includes Pesaran (2007) and Pesaran et al. (2009).

The study adopts Im, Pessaran and Shin test (2003) (IPS) test as the baseline unit root test. For robustness purposes, the researcher also uses the unit root test by Pesaran (2007). The IPS test uses an average of individual Augmented Dickey Fuller (ADF) tests, allowing for heterogeneity of the coefficient of $y_{it-1}$ in the regression below.

$$y_{i,t} = \rho_i y_{i,t-1} + \sum_{j=1}^{p} \varphi_{ij} \Delta y_{i,t-j} + z_{i,t}, \qquad (4.23)$$

where $y_{i,t}$ is the variable considered for unit root testing. $z_{i,t}$ is the vector of deterministic variables, including any fixed effects and p refers to the number of lags in the model, and $\gamma$ is the vector of coefficients. The null hypothesis for this test is that each series contains a unit root. Baltag (2008) shows that the alternative hypothesis allows for some series to have a unit root.

$H_0$: $\rho_i$ = 0 for all $i$

[8] Argentina, Brazil, Chile, China, India, Indonesia, Mexico, Turkey, Singapore and South Africa

$H_{1:}\ \rho_i < 0$ for $i$ = 1,2....$N_1$ and $\rho_i$ = 0 for $i$= $N_1$+1,.....,N

**Pesaran (2007) Unit Root Test**

Pesaran (2007) proposes a unit root test that accounts for cross sectional dependence in heterogeneous panels. The unit root is computed by augmenting the ADF regression with averages of lagged series at levels, and also first differences of the series. Critical values for the test are provided in (Pesaran, 2007).

### 4.3.2 Panel Cointegration Test

Panel cointegration tests due to Pedroni (1999) and Kao (1999) are commonly applied. Pedron's cointegration test accounts for heterogeneity using specific parameters that vary across individual countries. The following equation is regressed to find residuals:

$$y_{i,t} = a'_i + \delta_i t + \beta_{1i} x_{1i,t} + \beta_{2i,t} x_{2i,t} + \cdots \ldots . + \beta_{Mi} x_{Mi} + \epsilon_{i,t}, \qquad (4.27)$$

for $t$ = 1.....T; $i$ = 1...N; $M$ = 1.....M

In equation 6, N refers to the number of cross sections in the panel, T is the length of the period under study (time dimension) and M is the number of regression variables. Slope coefficients are given by β, whilst $a'_i$is an intercept. The term $\delta_i t$ is a deterministic time trend. In Pedron's model test statistics assume that co integrating relationships are heterogeneous between individual members. The model uses seven test statistics in which the null hypothesis of no cointegration is tested against different alternative hypotheses. For the first four test statistics, the null is: $H_0$: $\beta_i$ = 1; and the alternative hypothesis is: $H_1$: $\beta_i = \beta < 1$. The last three statistics are based on group mean panel cointegration (between) and have the alternative hypothesis: $H_1 = \beta_i < 1$. An alternative to Pedroni's test is suggested by Westerlund and Edgerton (2007) which is more suitable for data that includes structural breaks. However, it is not applicable to our model because due to the small sample characteristic. For robustness purposes, (Kao, 1999)'s test is also applied. Gutierrez (2003) finds that Kao (1999)' cointegration test has more power in smaller samples than does Pedroni's test.

### 4.3.3 Test for Cross Sectional Dependence

Cross correlations between residuals in different panels often exists in panel data modelling (Pesaran, 2004b). Several panel data techniques however assume cross sectional independence, leading to inefficient and biased estimation results in the presence of cross

sectional dependence. Pessaran's cross sectional dependence (CD) tests is widely applicable in panels of different sizes (Pessaran, 2004). The test is robust to small samples and the presence of structural breaks in the data. The CD test statistic is as follow:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right), \tag{4.28}$$

Where $\hat{\rho}_{ij}$ are the pairwise correlation coefficients derived from residuals from individual – specific OLS regressions. $N$ are the number of cross-sections and $T$ is the sample or time period.

### 4.3.4 Panel Granger Causality Test

Although the estimation techniques used above show the relationships among the dependent and independent variables, they do not show the direction of causality (Bildirici and Kayıkçı, 2013). The study undertakes granger causality tests to define the direction of causality between economic growth and shadow banking in emerging countries. The study applies Dumitrescu and Hurlin (2012) Granger non-causality approach which allows for heterogeneity in the causal relationships across panels and also in the regressions used. It has an advantage over the traditional granger causality tests which tests for causality between two variables everywhere in the panel. The null hypothesis in the Dumitrescu and Hurlin (2012) test is that, variable x for example does not granger cause variable y. On the other hand, the alternative hypothesis is that x granger causes y in at least one panel.

### 4.3.1 Panel Data Estimation Techniques

Panel or longitudinal data possesses both a cross-sectional dimension and a time dimension (Hsiao, 2014). The use of panel data analysis allows the researcher to reap several advantages of panel data analysis over both time series and cross sectional analyses. Baltagi (2008) provides an outline of the advantages of panel data analysis. Firstly, in using panel data more observations are allowed increasing the degrees of freedom and providing more information and variability. In addition, panel data analysis does not assume homogeneity across panels and allows for dynamics of adjustment due to the time component as opposed to cross sectional studies. The standard asymptotic distributions in panel unit root tests make them more reliable than time series unit root tests with non-standard distributions.

However, whilst the analysis of panel data has advanced analysis of large amounts of cross-sectional data, it has its own problems. Major issues that arise in panel data analysis include characterizing heterogeneity in panels, accounting for feedback effects in variables (endogeneity) and also describing the dynamic relationships. The presence of unobserved individual panel and time specific fixed effects may lead to parameter heterogeneity in the specified model which should be addressed to avoid inconsistency in estimated parameters. The baseline pooled OLS regression shown below provides a departure in understanding why carefulness is warranted in dealing with panel data:

$$y_{it} = \alpha + \sum_{k=1}^{k} \beta_k \, x_{kit} + \mu_{it}, \qquad (4.17)$$

where $i = 1 \ldots \ldots . N$ and $t = 1 \ldots \ldots . T$. Assuming that there are no country specific unobserved effects, equation (4.17) can be estimated by pooled OLS. However, in most instances due to heterogeneity in cross sections, unobserved individual specific effects exist, implying that the error term;

$$\mu_{it} = \eta_i + \vartheta_{it},$$

Where $\eta_i$ denotes the unobserved country specific effects and $\vartheta_{it}$ is the error term which is assumed to be identically and independently distributed (*i.i.d*) Ignoring such effects result in biased and inefficient estimates.

#### 4.3.1.1 Fixed and Random Effects Methods

Two most common methods of estimation used that incorporate unobserved time-invariant effects are fixed effects and random effects models. In both models $\eta_i$ are unobservable time-invariant effects.

**The Fixed Effects Technique**

In a one-way error component model, $\mu_{it} = \eta_i + \vartheta_{it}$. The fixed effects model assumes $\eta_i$ are fixed parameters to be estimated and $\vartheta_{it}$ is the error term. Firstly, the fixed effects model assumes strict exogeneity of $x_i$ conditional on $\eta_i$. To estimate the fixed effects parameter $\beta$,

the model uses the *within transformation.* Within transformation in this case is accomplished by averaging equation (22) above, in which case the following equation is obtained:

$$\bar{y}_i = \alpha + \bar{x}_i\beta + \eta_i + \bar{\mu}_i, \tag{4.18}$$

where $\bar{y}_i = T^{-1}\sum_{t=1}^{T} y_{it}$, $\bar{x}_i = T^{-1}\sum_{t=1}^{T} x_{it}$, and $\bar{\mu}_i = T^{-1}\sum_{t=1}^{T} \mu_{it}$. Further, the transformed equation is found by subtracting equation $(4.18)$ from equation $(4.17)$ and can be represented as follow:

$$y_{it} - \bar{y}_i = \theta + (x_{it} - \bar{x}_i)\boldsymbol{\beta} + (\mu_{it} - \bar{\mu}_i), \tag{4.19}$$

Where $\boldsymbol{\beta}$ is the fixed effects estimator, which is consistent and efficient. It is simply an OLS estimator of the within transformed equation. Let $y_{it} - \bar{y}_i = \dot{\mathrm{y}}_{it}$ and $x_{it} - \bar{x}_i = \dot{\mathrm{X}}_{it}$, the following expression shows the fixed effects estimator.

$$\hat{\beta}_{FE} = \left(\sum_{i=1}^{N}\sum_{t=1}^{T} \dot{\mathrm{X}}'_{it}\,\dot{\mathrm{X}}_{it}\right)^{-1}\left(\sum_{i=1}^{N}\sum_{t=1}^{T} \dot{\mathrm{X}}'_{it}\,\dot{\mathrm{y}}_{it}\right)^{-1}, \tag{4.20}$$

**Random Effects Technique**

The random effects model impose strict exogeneity assumptions on the relationship between $\eta_i$ and $x_{it}$. The unobserved effects are not correlated explanatory variables defined in the model for all time periods. To estimate the $\beta_s$, the random effects approach treats $\eta_i$ as part of the error term and uses generalized least squares technique to estimate the model. In addition, the random effects model is more suitable when drawing cross section randomly from a large population, whereas the fixed effects model is more suitable where focus and inference is restricted to N specific firms. The random effects model can be expressed as follow:

$$y_{it} = \alpha + x'_{it}\beta + z'_t\gamma + \upsilon_{it}, \tag{4.21}$$

Where $\upsilon_{it} = \eta_i + \mu_{it}$. The random effects model assumes that $\mathrm{E}(\mu_{it}|x_i, \eta_i) = 0$ and $\mathrm{E}(\eta_i|x_i,) = \mathrm{E}(\eta_i) = 0$. The first assumption is important for feasible generalized least squares used by random effects to be feasible since for GLS to be consistent, there should be strict exogeneity between the $x_i$ and the error term. The random effects estimator is expressed as follow:

$$\hat{\beta}_{RE} = \left(\sum_{i=1}^{N} \mathrm{X}_i' \widehat{\Omega}^{-1} \mathrm{X}_i\right)^{-1} \left(\sum_{i=1}^{\mathrm{N}} \mathrm{X}_i' \widehat{\Omega}^{-1} y_i\right), \quad (4.22)$$

Where $\widehat{\Omega}$ is the variance matrix. The random effects estimator is a consistent estimator in the class of consistent estimators such as the pooled OLS.

**Hausman Test for Comparing Fixed and Random Effects Techniques**

Hausman (1978) proposes a method that is based on the difference between fixed effects and random effects estimates. In practice, failure to reject the null hypothesis is interpreted as indicating that the random effects model is the suitable model, whilst a rejection of the null hypothesis indicates that the fixed effects model is the suitable modelling technique. The approach tests for lack of correlation between the unobserved effect and the explanatory variables (Baltagi, 2008).

**4.3.1.3 Dynamic Panel Data Techniques**

Following recent studies (Apergis et al., 2007, Durusu-Ciftci et al., 2017), the study considers dynamic panel cointegration models which are able to explain macroeconomic relationships more fully, avoiding spurious regression and accounting for endogenous relationships within the model. A simple representation of a dynamic panel model is shown below:

$$Y_{it} = \delta y_{i,t-1} + X'_{it}\beta + \mu_{it}, \quad (4.24)$$

*where* $i$ = 1,2……..N  t = 1,2……T

$\delta$ is a scalar, $X'_{it}$ is a 1×K vector and $\beta$ is a K×1 row matrix. The presence of lagged depended variables such as $y_{i,t-1}$ accounts for dynamic relationships in the model.

**Mean Group Estimators**

The study adopts Pesaran et al. (1999)'s Pooled mean group technique to check the robustness of and complement the results of this study from the OLS and random effects models. Pesaran and Smith (1995) suggest two step based mean group estimator (MG), in which the first step is to estimate N-based OLS regression coefficients. In the second step, these coefficients are averaged to find the panel coefficients. The MG estimates are inefficient

in small country samples and individual country estimates are unreliable when T is small compared to the PMG estimators. The Pooled Mean Group (PMG) estimator of Pessaran (1999) extends the MG to include an intermediate estimator that assumes slope homogeneity across countries in the long-run whilst maintaining short-run parameter heterogeneity. An advantage of assuming the same long-run coefficients is an improvement in efficiency of the estimators. Wu et al., (2007) however, argues that assuming homogeneous coefficients for all cross sections can result in inconsistent results if the restrictions are not valid. In addition, both the MG and PMG estimators assume cross sectional independence. The PMG (ARDL) error correction model is expressed as follow:

$$\Delta Y_{i,t} = \theta_i\left(Y_{i,t-1} - c - \beta X_{i,t-1}\right) + \sum_{k=1}^{\rho-1} \alpha_{i,k}\, \Delta Y_{i,t-k} + \sum_{j=1}^{\rho-1} \omega_{i,k}\, \Delta X_{i,t-j} + \varepsilon_{i,t}, \qquad (4.26)$$

where $Y$ is GDP per capita, $\theta$ is the coefficient of the error correction term ( the speed of adjustment to equilibrium) and $X_i$ are the different variables influencing the growth rate of GDP. $\alpha_i$ and $\omega_i$ are short-run coefficients.

The choice of model adopted in this study is not only driven by the small sample nature of the data at hand but by the characteristics of emerging market economies which resemble similar properties in economic progress. It can therefore be expected that their long-run macroeconomic characteristics are the same; whereas short-run dynamics can be allowed to differ.

**4.4 Empirical Model and Results Discussion**

Equation (4.15) is restated here for convenience;

$$logy_t = \beta_0 + \beta_1 log\, rf_t + \beta_2 logurf_t - \beta_3 (logrf_t - logurf_t)^2 - \beta_4 (n + g + ng + \delta) + \mu$$

Output growth is measured by $y_t$, which is specifically growth in real GDP. $rf_t$ measures bank credit to the private sector and $urf_t$ represents shadow bank credit. Variable X ($(logrf_t - logurf_t)^2$) is an interaction term between bank credit and shadow banking. The last variable in the equation, ($\log(n + g + ng + \delta)$) is termed Z. Z is expected to have a negative impact on output growth and X to have a positive impact on growth in the absence of a trade-off between bank credit and shadow banking. To capture other sources of finance,

noting that most emerging markets have vibrant capital markets, stock market capitalization variable is added as a control variable in the model (SMKT). The final estimated equation is as follows:

$$logy_{it} = \beta_0 + \beta_1 log\, CRED_{it} + \beta_2 logLSBS_{it} - \beta_3 X_{it} - \beta_4 Z_{it} + logSMKT_{it} + \mu_{it}, \quad (4.29)$$

where $\mu_{it}$ is an error term assumed to be independently and identically distributed (iid). The variables are as described in Table 4.1.

### 4.4.1 Data and Variables

Data used is obtained from World bank, World Development Indicators, individual central banks and the FSB. A panel of ten emerging economies is used with a sample period of 15 years (2002-2017). The data is in yearly frequency since data on shadow banking from the FSB is in yearly frequency. Preliminary data transformations done include calculations of $X_{it}$ and $Z_{it}$ using available data on shadow banking and credit. Absolute amounts are also transformed into logarithms for credit and shadow banking to fit into the log-linear equation, (18). Table 4.1 below summarises the variables used and sources of data.

Table 4.1. Summary Description of Model Variables and Data Sources

| **Variable** | **Description** | **A priori sign** | **Source** |
|---|---|---|---|
| $ly$ | Log of Real GDP per capita (US$) | | WDI, Central Bank |
| LSBS | Shadow banking measure/log of assets of OFIs | +ve or -ve | FSB, IMF |
| LSMKT | Log of Stock market capitalization | +ve | WDI, Central bank |
| LCRED | Bank credit to private sector (% of GDP) | +ve | WDI |
| Xi | $(logrf_t - logurf_t)^2)$ | -ve or +ve | WDI +FSB |
| Zi | $(\log(n + g + ng + \delta))$ | -ve | WDI + own computations |

***GDP growth (y)***

The dependent variable in the model GDP growth is measured by the log of per capita GDP in US dollar terms. Following established theories (Durusu-Ciftci et al., 2017), the study analyses the relationship between the economic growth rate and its various determinants including a measure of financial innovation in the form of shadow banking.

***Shadow Banking (sbs)***

Shadow banking is primarily measured using its broad measure, the total assets of all OFIs in a country. This measure was computed by the Financial Stability Board for 20 participating countries. However, the data is only available from 2002 and puts a restriction on the time dimension of the model. Although it is fairly a broader measure, it can be argued that most shadow banking activities are undertaken by OFIs (FSB, 2016) and their growth is a good proxy for shadow banking activities. The relationship between shadow banking and economic growth from theory is bi-directional, depending largely on the ability of financial authorities to use macro-prudential tools. On the one hand, shadow banking is expected to boost economic growth through increased credit (Beck et al., 2016) but on the other hand, it could stifle growth through an increase in systemic risk (Adrian and Ashcraft, 2016).

***Credit***

The variable credit measures financial development and is measured by the ratio of bank credit to the private sector to GDP. An increase in credit is expected to support business investment, hence, contribute to economic growth positively. Although others scholars (Laeven et al., 2015) have argued that it is not the broad measure of financial development that matters but financial innovation, other studies have argued for a positive association between bank credit and economic growth (Durusu-Ciftci et al., 2017). Still, other studies have found a negative relationship between bank credit and economic growth (Narayan and Narayan, 2013).

***Stock market Capitalisation***

Stock market capitalization measures financial development albeit from the capital market dimension. The relationship between stock market development and economic growth is expected to be positive as firms raise equity finance for investment purposes. Previous studies

that have found a positive association between stock market capitalisation and economic growth include Durusu-Ciftci et al. (2017) and Jedidia et al. (2014). Capital markets pool resources from savers and allow investors to finance their investment projects and the development of efficient capital markets which has been at the core of financial development studies (Naceur and Ghazouani, 2007).

### 4.4.2 Descriptive Statistics and Correlation Matrix

Table 4.2 below presents the univariate characteristics of each variable included in the model. From Table 4.2, it is important to note that some variables are normally distributed and others are not. A summary measure of normality to be observed is the Jarque-Bera test. The measure of skewness and Kurtosis also confirm the distribution. For instance, inflation with a Kurtosis near 3 portrays a normal distribution and a skewness that is near zero. Non-normality is reflected in variables with large skewness value and a Kurtosis that is widely different from 3. Since all variables are either in percentages or logarithms, the problem of heteroscedasticity is minimised. Agung (2011) notes that policy analysis and decision making can be enhanced through paying attention to the uni-variate characteristics of the data. Measures of central tendency such as mean, median and mode are also displayed in the table for each variable.

Table 4.2. Descriptive Statistics

| | LCRED | LSBS | LSMKT | Xi | LY | Zi |
|---|---|---|---|---|---|---|
| Mean | 47.02385 | 4.398564 | 27.22782 | 1.118343 | 5.035134 | 1.338786 |
| Median | 46.63828 | 4.282965 | 27.37509 | 0.729000 | 5.114603 | 1.305000 |
| Maximum | 66.77641 | 8.944516 | 28.06641 | 9.516000 | 15.24038 | 5.500000 |
| Minimum | 27.68566 | -0.527633 | 25.56557 | 0.008000 | -10.89448 | -1.460000 |
| Std. Dev. | 14.28684 | 1.672944 | 0.722745 | 1.471138 | 3.860459 | 0.645932 |
| Skewness | 0.040334 | 0.010486 | -0.827580 | 3.396755 | -0.680592 | 2.351613 |
| Kurtosis | 1.469652 | 3.311246 | 2.763450 | 16.72180 | 4.975374 | 19.71284 |
| Jarque-Bera | 13.69942 | 0.567663 | 16.30713 | 1367.564 | 33.57040 | 1758.396 |
| Probability | 0.001060 | 0.752893 | 0.000288 | 0.000000 | 0.000000 | 0.000000 |
| Sum | 6583.340 | 615.7990 | 3811.895 | 156.5680 | 704.9188 | 187.4300 |
| Sum Sq. Dev. | 28371.83 | 389.0250 | 72.60814 | 300.8303 | 2071.537 | 57.99469 |

LCRED is the logarithm of total bank credit to private sector. LSBS is the logarithm of total assets of OFIs. LSMKT is the logarithm of total market capitalisation. LY is the logarithm of real GDP per capita. X and Z are calculated as shown in Table 1.

### Correlation Matrix

Individual correlations are shown in Table 4.3. The importance of such an analysis is to check if the problem of multi-collinearity will not arise in the estimated model. Maddala and Lahiri

(2009) suggest a correlation greater than 0.8 to be a concern for the presence of multi-collinearity. In our case, no cross correlation is higher than 0.8 and all variables can be retained in the model.

Table 4.3. Correlation Matrix

| Correlation | LCRED | LSBS | LSMKT | Xi | LY | Zi |
|---|---|---|---|---|---|---|
| CRED | 1.000000 | | | | | |
| LSBS | 0.592532 | 1.000000 | | | | |
| LSMKT | 0.617114 | 0.561004 | 1.000000 | | | |
| X | -0.445635 | -0.509448 | -0.520463 | 1.000000 | | |
| Y | -0.158221 | 0.025510 | 0.075428 | 0.290294 | 1.000000 | |
| Z | -0.027900 | -0.045692 | 0.072674 | -0.258505 | -0.067396 | 1.000000 |

### 4.4.3 Results of Panel Unit Root Tests

Panel unit root tests are conducted, presented and summarised below in table 4.4 Specifically, the study employs IPS (2003) test and one new generation test in the form of (Pesaran, 2007) test. The null hypothesis in both tests is that all panels are non-stationary. As shown in Table 4.4. the variables portray mixed levels of integration $\mathrm{I}(0)$ and $\mathrm{I}(1)$. Although our variables have mixed orders of integration, it is possible for us to test for cointegration, which is done in the next section.

Table 4.4. Unit Root Tests

| Variable | IPS (2003) | Level of Integration | Pesaran (2007) | Level of Integration | Conclusion |
|---|---|---|---|---|---|
| $ly$ | -1.595 | I(1) | -2.661*** | I(0) | Mixed |
| $lsmkt$ | -2.484** | I(0) | -3.537*** | I(0) | I(0) |
| $lsbs$ | -2.632*** | I(0) | -1.801** | I(0) | I(0) |
| $Xi$ | -1.957 | I(1) | -3.218*** | I(0) | Mixed |
| $Zi$ | -2.940*** | I(0) | -2.136*** | I(0) | I(0) |
| $cred$ | -1.701 | I(1) | -0.664 | I(1) | I(1) |

***, ** and * refers to significant at 1%, 5% and 10% respectively.

### 4.4.4 Results of Panel Cointegration Test

Pedroni (1999) and Kao (1999)'s tests for cointegration are reported. The null hypothesis in both tests is that series are not cointegrated. Pedroni (1999) provides critical values for the reported two categories of tests. The within dimension group of statistics are computed by averaging the time series statistics across the panela. The second group which is the between dimension, averaging is not done directly on the computed individual statistics but is done in pieces on the denominator and the numerator terms separately. Pedroni's cointegration test results are shown in Table 4.5 (See **Appendix A** for full results).

Table 4.5. Panel Cointegration Test (Pedroni)

| | Within Dimension | | | | Between Dimension | | |
|---|---|---|---|---|---|---|---|
| | *v-stat* | *Rho-stat* | *pp-stat* | *ADF-stat* | *Rho-stat* | *pp-stat* | *ADF-stat* |
| *Statistic* | -3.93 | 3.27 | -24.33*** | -5.50*** | 4.92 | -22.88*** | -4.72*** |

*, **, *** represents significance at 10%, 5% and 1% respectively. Thus 4 tests out of seven reject the null hypothesis of no cointegration. Both intercept and trend are included in running the test. Note that only I(1) variable are used in the sample for cointegration test.

Kao (1999) proposes an ADF type unit root test. The tests are based on residuals from a fixed effect model. The results from Kao (1999)'s test also rejects the null hypothesis of no cointegration at 1% level of significance as shown in Table 4.6 below.

Table 4.6 Panel Cointegration (Kao, 1999)

Series: Z LY X LSM LSBS CRED

| **Test** | **t-statistic** | **Prob** |
|---|---|---|
| ADF | -59834 | 0.0000 |

The presence of a cointegrating relationship amongst the variables in the model suggests the use of a panel cointegrating technique to estimate the long-run relationship between the

dependent and independent variables. The selected estimation technique is the PMG technique for its flexibility with variables of different levels of integration[9].

### 4.4.5 Results of Pesaran (2004) Cross Sectional Dependence Test

Pesaran (2004)'s cross sectional dependence test, which test the null hypothesis of cross sectional independence is used to test for cross sectional dependence. The test for CD is done using the residual approach based on the Dynamic Common Correlated Effects (DCCE) mean group estimator of Pesaran (2005). The model is estimated using the DCCE first and the test for CD is conducted using the residuals from the estimated model. The results of the CD-test are shown in Table 4.7.

Table 4.7. Cross-Sectional Dependence Test Results

$H_o$: Cross sectional independence

| Method of Computation | CD-test stat | P-value |
|---|---|---|
| DCCE Estimator | -0.75 | 0.4556 |

DCCE – Dynamic common correlated effects estimator. CD test part of the estimated results from using the estimator.

As shown in Table 4.7, the null hypothesis of cross sectional independence cannot be rejected. Thus, the PMG technique which assumes cross sectional independence can be estimated. Specifically, the following dynamic model is estimated which allows us to report both long-run and short-run estimates in the PMG model.

### 4.5.1 Estimation Results – Panel OLS and Random Effects (Static Model)

Having a small sample data, both in terms of number of cross sectional unit, N and time dimension, T, our regression is estimated using static panel data methods first to check robustness of the results to a change in the estimation technique. By so doing, stationarity issues are initially ignored given that our time dimension is only 15 years. Stationarity is addressed in the main estimation which employs the Pooled mean group technique. The results of the pooled OLS and random effects estimation methods are presented in Table 4.8 below.

[9] The ARDL method allows for use of a mixture of I (0) and I (1) variables.

Table 4.8. Estimation Results: Static Models

| **Dependent variable:** *ly* | | |
|---|---|---|
| **Independent Variable** | ***Coefficients*** | |
| | **POLS** | **RE** |
| Xi | 1.258408*** | 1.197601*** |
| | [4.8491] | [4.9496] |
| Zi | 0.183617 | 0.146923 |
| | [0.3797] | [0.3298] |
| LSBS | 0.577488** | 0.590659** |
| | [2.4022] | [205845] |
| CRED | -0.089245*** | -0.091312*** |
| | [-3.1419] | [-3.5373] |
| LSM | 2.062892*** | 2.008969*** |
| | [3.6540] | [3.9246] |
| C | -51.12955*** | -49.50494*** |
| | [-3.4649] | [-3.6994] |

*, **, *** represent 10%, 5% and 1% level of significance respectively. Numbers in parenthesis are t-statistics.

### 4.5.2 Hausman Test

The Hausman test is performed to decide which model to use between fixed effects and random effects methods. From Table 4.9, the null hypothesis cannot be rejected implying that the random effects method is the suitable method for estimating the model. We therefore proceed with our analysis using the random effects model.

Table 4.9. Hausman Specification Test

| **Correlated Random Effects - Hausman Test** | | | |
|---|---|---|---|
| Equation: EQ02 | | | |
| Test cross-section random effects | | | |
| Test Summary | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob. |
| Cross-section random | 0.000000 | 5 | 1.0000 |

* Cross-section test variance is invalid. Hausman statistic set to zero.

The results in Table 4.8 show that there is a positive relationship between shadow banking and economic growth in emerging countries. In both estimations, shadow banking has a positive and significant impact on output growth. The finding supports theory that posits for increased economic activity as a result of increased financing through shadow banking activities. A surprising finding however is that bank credit has a negative impact on output growth. The impact of bank credit on output growth has been a subject of many studies. Several studies have established a positive relationship between the two variables (Durusu-Ciftci et al., 2017, Jedidia et al., 2014). The result however, confirms findings by Narayan and Narayan (2013) and Chang et al. (2010) who also established a negative relationship between bank credit and economic growth. According to Narayan and Narayan (2013), the differences in these findings can be explained by the different sizes of sample used and also the typical countries considered for the sample.

Stock market capitalisation also shows a positive association with growth in both models. This result is not surprising as previous studies have also found the same (Durusu-Ciftci et al., 2017, Wu et al., 2010, Levine and Zervos, 1996, Cooray, 2010). Although the short-run homogeneous coefficients are not statistically significant, the coefficient for stock market development maintains the same sign. According to Cooray (2010), stock markets can influence growth through at least three channels. Firstly, they provide investors with an option to diversify their portfolios, thereby reducing risk and increasing return from investment. The second channel is that it provides firms with a way to raise more capital, which can contribute to investment. Finally, stock markets can increase financial markets liquidity and reduce overall liquidity risk for investors.

### 4.5.3 Estimation Results – Pooled Mean Group (Dynamic model)

Panel regression results from the estimated model are shown below. Due to the presence of mixed orders of integration in the variables, the analysis uses the pooled mean group model (PMG). However the PMG methods assumes cross sectional independence and Bakas et al. (2017) suggest that we should test for and ascertain cross sectional independence before making the choice of an estimation method. The test for cross sectional dependence in Table

4.7 confirms the presence of cross sectional independence. The estimated model for the ten emerging economies is as follows:

$$\Delta ly_{it} = \alpha_{i1}\Delta ly_{i,t-1} + \alpha_{i2}\Delta lsbs_{it} + \alpha_{i3}\Delta X_{it} + \alpha_{i4}\Delta Z_{it} + \alpha_{i5}\Delta lsmkt_{it} + \alpha_{i6}\Delta credit_{it} + \vartheta_i\left(ly_{i,t-1} - \beta_1 lsbs_{i,t-1} - \beta_2 X_{i,t-1} - \beta_3 Z_{t-1} - \beta_4 lsmkt_{i,t-1} - \beta_5 credit_{i,t-1}\right) + \omega_{i,t}, \quad (4.30)$$

where $\alpha_{i1}$ is the coefficient of the error correction term, should be negative and statistically significant for short-run dynamics to explain the movement towards the long-run equilibrium. The coefficients $\alpha_{i2}$ to $\alpha_{i8}$ represent short –run elasticities. The PMG technique also provides individual country estimates for the short-run dynamics. The $\beta s$ are the long-run elasticities which are the same for all the countries.

Table 4.10. Estimated Coefficients
Dependent variable: ly

| ***Pooled Mean Group*** | |
|---|---|
| ***Variable*** | **Long-run** |
| Xi | 0.605874*** [3.167620] |
| Zi | -2.218399*** [-4.019441] |
| LSBS | 0.729098*** [2.697207] |
| CRED | -0.185823*** [-6.914315] |
| LSMKT | 0.354725*** [4.996731] |
| C | |
| | ***Short-run*** |
| COINTEQ01 | -0.808274*** [-4.461230] |
| D(Xi) | 8.250308 [1.111227] |
| D(Zi) | -17.78210 [-1.110527] |
| D(LSMKT) | -1.725344* [0.0547] |

***, **, * represents 1%, 5% and 10% significant level respectively. Numbers in parenthesis are t-statistics.

Table 4.10 shows that shadow banking has a positive relationship with economic growth in emerging countries. A 1 percentage change in shadow banking results in a 0.72 percentage change in GDP per capita. This result confirms literature by Laeven et al. (2015) and Bertay et al. (2017) who also find a positive association between financial innovation and economic performance. Although using a different measure of innovation, the results show that financial innovation in the form of shadow banking has a more pronounced effect on economic activity compared to the wider measures of financial development such as stock market development or credit growth. Our results dispute the negative label assigned to shadow banking in many studies (Beck et al., 2016, Laeven, 2014), and reveals that shadow banking is important as a source of finance for growth. The same argument is raised in Laeven et al. (2015) who suggest that financial innovation drives economic performance through efficient allocation of resources and risk sharing ability.

Stock market capitalisation also show a positive association with growth in both models. This result is not surprising as previous studies have also found the same (Durusu-Ciftci et al., 2017, Wu et al., 2010, Levine and Zervos, 1996, Cooray, 2010). Although our short-run homogeneous coefficients are not statistically significant, the coefficient for stock market development maintains the same sign. According to Cooray (2010), stock markets can influence growth through at least three channels. Firstly, they provide investors with an option to diversify their portfolios thereby reducing risk and increasing return from investment. The second channel is that it provides firms with a way to raise more capital which can contribute to investment. Finally, stock markets can increase financial markets liquidity and reduce overall liquidity risk for investors.
In addition, the coefficient of the ECT takes a negative sign as expected showing that short-run dynamics are relevant in explaining the long-run relationships. About 80% of deviation from equilibrium in the previous year is restored in the current year.

All other variables take expected signs except credit growth which exhibits a negative influence on GDP in the long-run. Thus, in the presence of shadow bank credit, credit from the banking sector does not influence GDP growth positively as in other studies (Durusu-Ciftci et al., 2017). The results however confirm the findings of Narayan and Narayan (2013) and Chang et al. (2010) who find a negative association between economic growth and domestic

bank credit. Without making generalisations, it is of particular interest to state that banking institutions in emerging countries do not have the same effect on economic growth with banking institutions in developed countries.

Following Narayan and Narayan (2013), tight regulation and relatively concentrated financial markets could be reasons why bank development negatively influence economic growth in emerging countries. Again, the results show that studies which find a positive relationship between the two variables (Durusu-Ciftci et al., 2017), reflect the stronger positive effect of credit growth on GDP growth in developed countries. In addition, the results can be explained using the Herwartz and Walle (2014) proposition. Herwartz and Walle (2014) argue that very high levels of openness tend to limit the growth increasing ability of financial development. For instance, if credit is used to import finished goods instead of fixed capital formation, GDP can be negatively affected.

According to Herwartz and Walle (2014), both current account and capital account openness lead to a positive effect of financial development on economic growth but to a certain threshold. Our results could therefore be explaining the negative impact of higher levels of openness in emerging countries.

### 4.5.4 Results of Ganger Causality Tests

Whilst our regression estimates provide an understanding on the nature of relationship between the variables in the model, they do not however show us the direction of causality. An attempt to resolve the finance-growth nexus is done by analysing the direction of causality in our model using granger causality tests. Table 4.11 provides results of selected granger causality tests.

Table 4.11: Pairwise Granger Causality Tests (Dumitrescu & Hurlin, 2012)

| Statistic | ly-lsbs | Lsbs-ly | ly-lsmkt | Lsmkt-ly | ly-cred | Cred-ly |
|---|---|---|---|---|---|---|
| W-Stat | 1.2405 | 6.8996*** | 0.7627 | 13.891*** | 1.3497 | 4.8212* |
| Z-bar Stat | -1.1958 | 3.5495 *** | -1.5062 | 8.2004*** | -1.1198 | 2.0622* |

***, **, * represents 1%, 5% and 10% significant level respectively. The null hypotheses states that the variable on the left hand-side does not granger cause the variable on the right-hang side.

The results in Table 4.11 extends the previous discussion on the finance-growth nexus. Clearly, there is a uni-directional relationship between shadow banking and economic growth from shadow banking to economic growth. Shadow banking granger causes economic growth. On the contrary, economic growth does not granger cause shadow banking. This finding further supports the argument in Laeven et al. (2015) that both technological innovation and economic growth stop whenever financiers stop to be innovative. Financial innovation is therefore critical for economic growth.

The study also finds a uni-directional relationship between stock market development and economic growth. In essence, stock market development granger causes economic growth and economic growth does not granger cause stock market development. Since our estimated results from Table 4.10 show a positive association between the two variables, an increase in stock market development results in an improvement in economic growth. The findings confirm earlier theories of finance and growth by Lucas (1988) and McKinnon (1973). However, there is no evidence that economic development encourages stock market development.

Our evidence points to a uni-directional causal relationship flowing from credit to economic growth. Increases in credit tend to constrain growth in emerging countries. This finding may point to the fact that entrepreneurs in these countries are not constrained by lack of funds but lack of innovative ideas (Laeven et al., 2015). The limit to growth imposed by availability of credit could also be explained by using the credit decomposition channel (Bertay et al., 2017). If credit growth is driven by consumption, higher levels of consumer debt and lower levels of investment can be expected. High consumer debt tends to decrease economic performance through the balance sheet effect also. This is where higher debt levels erode away individuals' net worth and affect their savings behaviour negatively. If so, we expect lower levels of investment and lower GDP in the presence of higher credit. Firms on the other side could suffer from higher debt levels if their net worth decrease and their credit ratings are downgraded. Investment will also decrease and economic growth will eventually decline. Ductor and Grechyna (2015) also argue that the financial sector competes with other economic sectors for inputs, implying that a huge financial sector may harm other industries and negatively influence production.

### 4.6 Concluding Remarks

This Chapter analyses the relationship between economic growth and shadow banking. Shadow banking is used as a measure of financial innovation and the results show that there is a positive relationship between shadow banking and economic growth using a panel of 10 emerging economies. Further, the test for causality between shadow banking and economic growth using Dumitrescu and Hurlin (2012) granger non-causality test. The findings show a uni-directional relationship flowing from shadow banking to economic growth. This finding supports the argument that financial innovation is vital for economic growth.

In addition, the study contributes to the debate on financial development and economic growth by providing evidence on the relationship between stock market development and bank credit, and economic growth. Our results show that stock market development is positively related to economic growth. However, granger causality tests establish a uni-directional relationship between stock market and economic growth. This finding resonates with findings from earlier studies (Narayan and Narayan, 2013, Cooray, 2010, Levine and Zervos, 1996) and point to the size and stability of capital markets in emerging markets. Stock markets in these countries are relatively large and more liquid than in developing countries which could explain why our result differs from Jedidia et al. (2014).

Bank credit is found to be negatively related to economic growth. This finding is in line with previous studies (Narayan and Narayan, 2013, Cooray, 2010). The relationship is largely uni-directional from credit to economic growth although feedback effects are also identified. However, this finding extends the finance-growth conundrum and disputes the general perception that bank credit increases economic growth through its impact on investment (Chen et al., 2013, Ductor and Grechyna, 2015, Durusu-Ciftci et al., 2017, Beck et al., 2014). In analysing the effect of credit, other factors need to be taken into account such as: tight regulation, structure of banking industry, effect of trade openness and whether credit is used for consumption versus investment purposes.

To sum up, the study's findings points to a regulatory environment that promotes shadow banking activities, for benefits of shadow banking to be effected into the economy.

Furthermore, it is also imperative to find a balance between economic growth and financial development in the spirit of Ductor and Grechyna (2015) to minimise harmful effects of accelerated financial development coupled with slow economic growth. In addition, macro-prudential policy should be flexible to allow incorporation of new financial processes and products into existing regulatory frameworks. Our findings emphasize the role of financial innovation in enhancing economic performance given a stable regulatory environment. Therefore, regular review of macro-prudential policy is suggested to carter for new financial activities and also to allow for development of new financing techniques.

Our results have important implications for further empirical work, especially considering the heterogeneity of shadow banking activities. The empirics of shadow banking remains a largely under-studied area and use of more granular country specific data is argued for in further studies.

# CHAPTER 5

## SHADOW BANKING, CROSS BOARDER SHOCKS AND FINANCIAL STABILITY IN EMERGING ECONOMIES: A GLOBAL VAR ANALYSIS

The present Chapter analyses the transmission of financial instability through the shadow banking channel to emerging market countries. Shadow banking has been at the centre of the global financial crisis (GFC) for its role in originating and propagating financial risk (Adrian and Ashcraft, 2016). This Chapter addresses objective 2 of the study and analyses transmission of shadow bank shocks across jurisdictions and their impact on financial stability. Section 1 is of an introductory nature providing background information, identifying the gap and giving justification of the study. In Section 2, available empirical literature is reviewed focusing on financial shock transmission and cross border financial linkages. Section 3 present the theoretical model adopted in the study and the methodology used in the study is provided in Section 4 including the steps to be taken in the analysis of data. Sections 5 and 6 present the results and provide a discussion of the results. In Section 7, the study provides results from an alternative measure of shadow banking as a robustness check of the main results. The Chapter ends with a concluding remark in section 8.

### 5.1 Background

Financial globalization has thrived in recent decades on the back of both technological infrastructure and product financial innovations, driving global finance into one village. This has culminated into an increase in credit intermediation across national borders. Some studies have argued that cross border credit intermediation depends on shadow banking activities and processes, increasing exposure of global financial markets to developments in the shadow banking sector (Bruno and Shin, 2013). More so, cross border credit can be classified under the non-core category of bank liabilities which are considered part of the shadow banking liabilities of a bank (Harutyunyan et al., 2015). Several studies have however shown that due to over dependence on leverage, shadow banking activities and institutions are vulnerable and could trigger instability in financial markets and the fragility could be transferred to counterparts in different jurisdictions (Adrian and Ashcraft, 2016, Meeks et al., 2017, Moreira and Savov, 2017). Instability initiated in one jurisdiction could easily be transferred to other jurisdictions through balance sheet linkages as witnessed during the

Global financial crisis (GFC). This chapter investigates the possible impacts of contagion risk transferred through cross border bank linkages which according to Degryse et al., (2010) depends to a greater extent on the development of the shadow banking system (Degryse et al., 2010).

In the recent decade, central banks woke up to the fact that monetary policy alone cannot guarantee financial stability rather reverted to traditional theories of financial stability, putting more emphasis on macro prudential policy (McCulley, 2009, Minsky, 2016). The source of the instability experienced in 2007/2008 has been identified particularly to fall within the shadow banking system which is a complex and opaque sub-system of the financial sector involving new financial instruments and activities that are generally unregulated. Wheeler and Governor (2015) and Turner (2014) argue that due to further consolidations on bank balance sheets introduced through Basel 2 and 3, there has been an upsurge in market based funding across borders in the aftermath of the financial crisis. This points out to increased financial linkages and foreign assets and liabilities in banking systems.

Research has shown that foreign liabilities of banks tend to be persistent and reinforcing during bubbles, growing faster than domestic liabilities during periods of credit expansion (Albertazzi and Bottero, 2014). On the downside, these liabilities are fragile, possessing high probability of withdrawals in the event of a decrease in confidence which can possibly trigger a financial crisis in the borrower's country. On this backdrop however, recent developments in the shadow banking sector has seen a surge in shadow banking activities in emerging economies (FSB, 2017), particularly in the BRICS countries. Shadow banking has been growing at a faster rate in emerging markets compared to advanced economies since the GFC. There is no evidence however on the effect of this expansion on other countries. The present study attempts to fill this gap by providing empirical evidence on the impact that growth in shadow banking has on the financial systems of emerging market economies. Our second contribution is derived from the use of a Global VAR analysis to simulate cross border effects of shocks to shadow bank liabilities.

## 5.2 Literature Review

Major theoretical underpinnings of this work include the McKinnon-Shaw financial liberalization hypothesis (McKinnon, 1973, Shaw, 1973a) and Minsky (1977)'s financial instability hypothesis. If the Mckinnon and Shaw hypothesis is correct, an increase in cross border credit through shadow banking should encourage economic growth in countries with unrestricted capital flows. The financial instability hypothesis postulates that banks are inherently unstable due to presence of imperfect markets and financial innovations. Asymmetric information in imperfect markets give rise to moral hazard and adverse selection in markets. The incidence of moral hazard and adverse selection become more pronounced in cross border banking where familiarity with counterparties or their operating environment is limited. Increased financial activities across borders therefore are expected to worsen the stability of financial systems. The ensuing discussion briefly reviews empirical literature related to this work.

The present Chapter also relates to two strands of empirical literature. Firstly, our work seeks to extend literature on financial contagion. Literature on financial contagion includes papers investigating financial contagion between financial sector and the real economy in a single country (Baur, 2012) as well as financial contagion across national borders (Galesi and Sgherri, 2013). The traditional approach has been to use growth in equity prices as the main variable to measure financial contagion across the sectors or countries. Thus, several studies have used either stock market prices or stock market returns (Baur, 2012, Bautista et al., 2008). A number of papers however have used cross border exposures focusing on a single country (Degryse and Nguyen, 2007, McGuire and Tarashev, 2007).

Recently, several papers have focused on the transmission of financial shocks across national borders, either between banks themselves or between banks and their corporate customers (Popov and Udell, 2012, Dekle and Lee, 2015, Degryse et al., 2010, Albertazzi and Bottero, 2014, Hassan et al., 2017, Cerutti et al., 2015b, Figuet et al., 2015, Lane, 2015, Lysandrou and Nesvetailova, 2015). Whilst these studies illustrate the importance of cross border financial linkages, they do not however provide insight into the role of the shadow banking sector, either in propagating financial shocks or causing financial fragility. The focus here is on empirical literature covering cross border financial shock transmission.

Baur (2012) empirically tests financial contagion within the same jurisdiction as well as financial contagion across national borders for 25 countries. Their study focuses on three channels through which contagion can be transmitted. They include: contagion among different countries' financial sectors, contagion between financial sector and the real economy across countries, as well as within country contagion between the financial sector and the real sector. His findings confirm the findings of Dungey et al, (2010) who demonstrate the presence of financial contagion between the financial sector and the real sector. Further, (Baur, 2012) establishes contagion through different sectoral channels and finds that all sectors in the economy were affected by the GFC.

In the context of the GVAR model, a number of studies have used the stock market index data to simulate financial shock transmissions across national borders (Galesi and Sgherri, 2013, Hassan et al., 2017, Lane, 2015, Wheeler and Governor, 2015, Filardo and Siklos, 2018). Galesi and Sgherri (2013) add credit to the private sector in their model to further account for financial linkages but their findings show little significant of credit in international shock transmissions. They conclude that stock prices are the main channel of contagion in international markets. The same result is supported in Hassan et al. (2017) who also employ stock market index in the context of a Global VAR to simulate international financial shock transmissions. Filardo and Siklos (2018) find that changes in bank lending standards in one jurisdiction have an impact on credit extension in other countries.

The second strand of empirical studies related to this work investigates the drivers of cross border bank credit on various economic and financial variables (Cerutti et al., 2015b, Popov and Udell, 2012, Degryse et al., 2010). Cerutti et al. (2015b) investigate the composition of cross border loans by distinguishing between syndicated and non-syndicated loans. Their findings show that syndicated loan exposures take the greater proportion of cross border loans. Drivers of cross border loans are found to include capital account openness, size and level of economic development. Shirota (2015) also investigates the determinants of cross border credit flows by using three volatility factors in a Bayesian dynamic latent factor model. They find that a Global common factor contributes more to cross border credit flows. Meanwhile at country level, their findings are mixed.

### 5.3 Theoretical Model

The theoretical model used in this study is adapted from Bruno and Shin (2015). They propose a global banking structure in which there are two types of banks: a global bank and a regional bank. Their model does not distinguish between regional banks which are subsidiaries of foreign global banks and other local banks. In so doing, they show that all banks have the potential to access funds from the global banking markets. According to Bruno and Shin (2015), global banks raise funds in the wholesale markets and lend these funds to local/regional banks. The funds end up in the hands of local borrowers and as assets on the books of local banks. Two points can be observed from their framework; firstly, the main source of cross border funds are wholesale markets which can be classified as shadow bank markets (Adrian and Ashcraft, 2016). The second idea which is also not clearly spelt in their theory is suggested by Harutyunyan et al. (2015) who classified foreign bank liabilities as shadow banking liabilities. Thus, we propose a model in which banks hold shadow bank liabilities emanating from their cross border activities. Two characteristics of these liabilities can be identified also; firstly, shadow bank liabilities increase during a bubble. They are however susceptible to sudden withdrawals during periods of instability as shown by Moreira and Savov (2017). Thus, depending on the type of assets supported by these liabilities, a global shock in shadow banking liabilities could trigger financial instability in other countries. The model can be displayed as in the following diagram in which SL represents shadow bank liabilities:

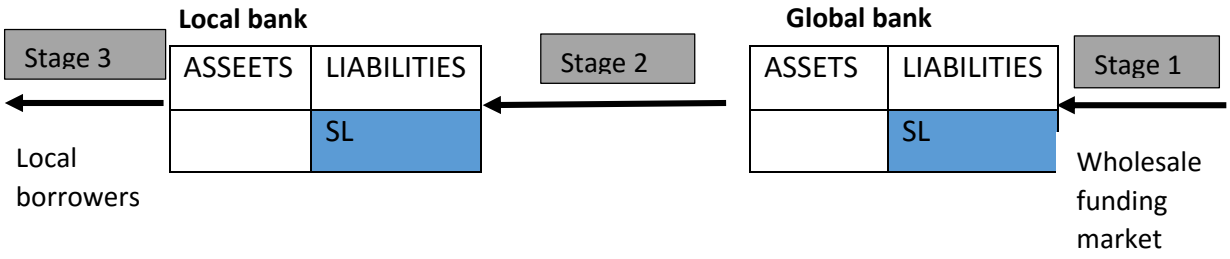


Figure 5.1: Stages in Cross Border Shadow Financing
Source: Bruno and Shin (2015)

Figure 5.1 shows the flow of funds across borders. In stage 1, global banks raise finance from the wholesale markets. They in turn lend to local banks in stage 2. Local banks can be either a subsidiary of the global bank or another bank seeking liquidity from international markets.

In stage 3, local banks who are holders of shadow bank liabilities, lend to local borrowers. Instability could be triggered in either country, the country of residents of the global bank or the country of residents of the local bank. A negative shock to the shadow bank sector in the global bank's country of residents will lead to withdrawal of shadow bank liabilities as investors seek safe assets. In turn, banks will reduce or withdraw cross border funding. In the end, local banks will experience an immediate shock and may experience fragility. Instability in the financial sector in which the local bank operates cause it to demand more shadow bank liabilities and could also increase fragility of the global financial markets.

### 5.4 Methodology

A number of methodologies have been used in literature for analysis of cross border shock transmission and contagion (Gropp et al., 2009, Degryse et al., 2010, Bruno and Shin, 2013, Galesi and Sgherri, 2013). Gropp et al. (2009) employ a multinomial logistic model whilst Degryse et al. (2010) use the probit model to investigate contagion due to cross border exposures. Dynamic panel data techniques are employed in (Bruno and Shin, 2013). In addition, both augmented vector autoregressive models (VARX) and panel vector autoregressive models (PVARs) are also suitable for analysis of international shock transmission (Canova and Ciccarelli, 2013). Several recent studies have however employed the Global vector autoregressive model (GVAR) of Pesaran et al. (2004). The GVAR model allows the researcher to study financial spill-overs and feedback effects between countries within the same model by combining country specific VARX models into a global framework. In Figure 5.2, the study shows a schematic diagram with steps involved in running a GVAR model. As shown in the diagram, results of impact elasticities, generalized impulse response functions and generalized forecast error variance decompositions are reported.

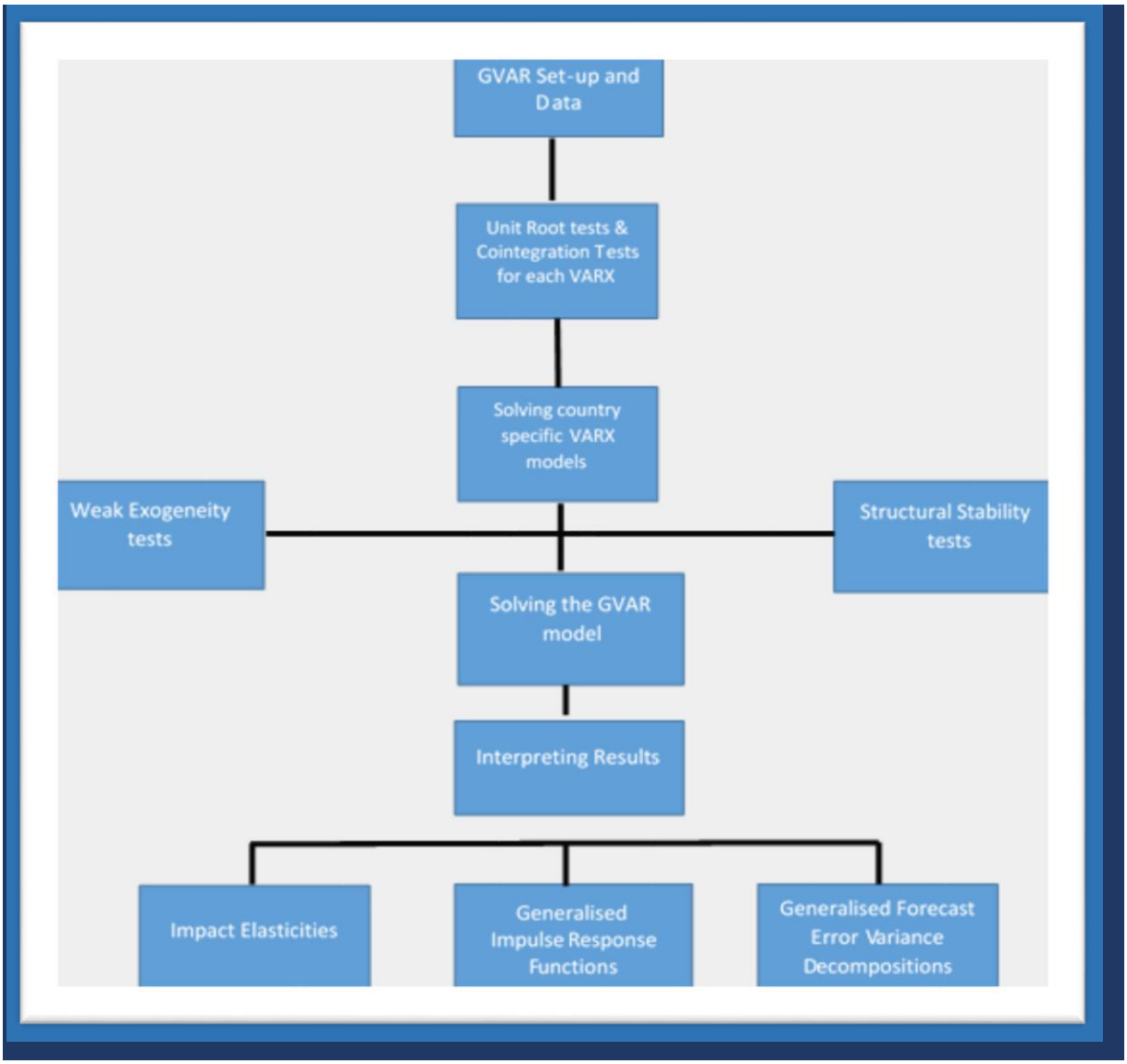

Figure 5.2. Global VAR Model Estimation Steps

### 5.4.1 Global Vector Auto-regression

The study adapts Pesaran et al. (2004)'s Global Vector Autoregressive model (GVAR). The GVAR framework, first proposed by Pesaran et al. (2004) and extended by Dees et al. (2007) is arguably very useful in modelling high dimensional data. Their global model composes of 33 countries and can accommodate up to eight (8) domestic and foreign variables respectively. The model accounts for foreign variables in each country model by using weights from cross country trade flows. Several other kinds of weights have been used in literature including financial weights, geographic distance and industry sectoral input-output tables (Galesi and Sgherri, 2013). GVAR modelling has an advantage over both basic VAR and panel VAR, because it allows for simulation of different kinds of shocks and transmission

mechanisms in a global framework, albeit without falling into the trap of dimensionality challenges (Çakır and Kabundi, 2013).

As illustrated in Pesaran et al. (2004), three channels can be identified through which GVAR can be used to analyse interactions between economies; firstly contemporaneous effects between domestic and foreign variables, $Y_{it}$ and $Y_{it}^{*}$. The second channel refers to the impact of common global factors on country specific variables, and lastly, cross country covariance can be used to measure the dependence of shocks in one country to shocks in another country. Further, Chudik and Pesaran (2016) argue that the GVAR framework is able to overcome the curse of dimensionality, whilst at the same time preserving theoretical foundations of the model. The technique makes use of augmented VAR model (VARX) using global variables as exogenous variables in the individual country models. The estimation procedure follows a two-step approach in which in the first stage, country specific VARX models are simulated. The second step involves estimation of the global VARX model by staking the estimated individual country VARX models.

#### 5.4.1.1 Augmented Vector Auto-regressive Model (VARX)

A VARX is simply a VAR augmented with exogenous variables. Consider a group of countries $N$, where $i = 0,1,2, \dots \dots \dots N$ and $t = 1,2, \dots \dots \dots \dots . T$. Following Galesi and Sgherri (2013) and Chudik and Pesaran (2016) in the first step of the GVAR analysis, each country model (VARX) can be specified as follow:

$$Y_{it} = \alpha_{i0} + \theta_{i1} + \phi_i Y_{i,t-1} + \varphi_{i0} Y_{it}^{*} + \varphi_{i1} Y_{i,t-1}^{*} + \mu_{it}, \qquad (5.1)$$

Where $Y_{it}$ and $Y_{it}^{*}$ are vectors of country specific domestic and foreign variables respectively. $Y_{it} = (y, zscore, eq, ep,\ r,\ sliab)$ and $Y_{it}^{*} = (y^{*},\ zscore^{*}, eq^{*},\ ep^{*},\ r^{*},\ sliab^{*})$.
The variables are explained fully below. $\alpha_{i0}$ and $\theta_{i1}$ are $(k \times 1)$ vectors of intercepts and time trend respectively and $\phi_i$ is a $k \times k$ matrix of coefficients for the lagged values of $Y_{it}$.

Foreign variables are computed using trade weights derived from trade flows and Purchasing power parity adjusted GDP. Foreign output $y^{*}$ for instance is a weighted average of the output from the rest of the world (specifically countries included in the model) as below.

$$y_{it}^{*} = \sum_{m=0}^{N} w_{im}^{y} y_{mt}\,, \tag{5.2}$$

The weights, $w_{im}^{y}$ are computed for each country and can be based on trade flows, financial flows or geographic proximity (Smith and Galesi, 2014).

#### 5.4.1.2 Solving the GVAR Model

The model is solved by assuming that all variables are endogenous to the system. The GVAR technique deals with the curse of dimensionality by using the estimated country specific VARX models in solving the GVAR model. Following Pesaran et al. (2004), the GVAR model can be constructed by grouping domestic and foreign variable in a vector $z_{it}$. Let,

$$\mathrm{Z}_{it} = \begin{pmatrix} Y_{it} \\ Y_{it}^{*} \end{pmatrix}, \tag{5.3}$$

Then each country model in equation (5.1) above can be written as:

$$\mathrm{A}_i \mathrm{Z}_{it} = a_{i0} + a_{i1t} + \mathrm{B}_i \mathrm{Z}_{i,t-1} + \omega_{it}, \tag{5.4}$$

Where $\mathrm{A}_i = (I_{ki}, -\varphi_{i0})$ and $\mathrm{B}_i = (\phi_i, \varphi_{i1})$. Note that the dimensions of $\mathrm{A}_i$ and $\mathrm{B}_i$ are $k_i \times (k_i + k_i^{*})$ and rank of $\mathrm{A}_i$ is $rank\ \mathrm{A}_i = k_i$.

The next step is to formulate a global vector comprising all country specific variables. Let,

$$\mathrm{X}_t = \begin{pmatrix} Y_{0t} \\ Y_{1t} \\ \vdots \\ Y_{Nt} \end{pmatrix}, \tag{5.5}$$

Where $\mathrm{X}_t$ is a $k \times 1$ vector and $k$ represents the number of endogenous variables in the model. Following the preceding, a link matrix $W_i$ can be used to rewrite country specific variables in terms of $\mathrm{X}_t$ as follows;

$$\mathrm{Z}_{it} = W_i \mathrm{X}_t, \tag{5.6}$$

where $i = 0,1,2 \ldots \ldots N$,

$W_i$ is a $(k_i + k_i^*) \times k$ matrix of fixed constants constructed from country specific weights. Substituting $W_i \mathrm{X}_t$ for $\mathrm{Z}_{it}$ in (5.4) above, it becomes:

$$\mathrm{A}_i W_i \mathrm{X}_t = a_{i0} + a_{i1t} + \mathrm{B}_i \mathrm{W}_{i,} \mathrm{X}_{t-1} + \omega_{it}, \tag{5.7}$$

where $\mathrm{A}_i W_i$ and $\mathrm{B}_i \mathrm{W}_i$ are $(k_i \times k)$ dimension matrices. To construct the GVAR model, the individual country models in (5.7) can be stacked up to form;

$$G\mathrm{X}_t = a_0 + a_1 t + \mathrm{H}\mathrm{X}_{t-1} + \omega_t, \tag{5.8}$$

where,

$$G = \begin{pmatrix} \mathrm{A}_0 W_0 \\ A_1 W_1 \\ \vdots \\ A_N W_N \end{pmatrix}, \qquad \mathrm{H} = \begin{pmatrix} \mathrm{B}_0 W_0 \\ \mathrm{B}_1 W_1 \\ \vdots \\ \mathrm{B}_N W_N \end{pmatrix},$$

$$a_0 = \begin{pmatrix} a_{10} \\ a_{20} \\ \vdots \\ a_{N0} \end{pmatrix}, \qquad a_1 = \begin{pmatrix} a_{11} \\ a_{21} \\ \vdots \\ a_{N1} \end{pmatrix}, \qquad \omega_t = \begin{pmatrix} \omega_{1t} \\ \omega_{2t} \\ \vdots \\ \omega_{Nt} \end{pmatrix}.$$

$G$ is a $k \times k$ matrix considered to be of full rank and non-singular. The reduced form of the GVAR model can be expressed as follows:

$$\mathrm{X}_t = G^{-1} a_0 + G^{-1} a_{1t} + G^{-1} \mathrm{H}\mathrm{X}_{t-1} + G^{-1} \omega_t, \tag{5.9}$$

The model can be solved and dynamic properties of the model can be analysed using Impulse response function and Generalized Forecast Error Variance Decomposition. In addition, the study will also analyse the contemporaneous effects of foreign variables on domestic variables in order to establish the channels through which financial instability can be transferred from one jurisdiction to another.

### 5.4.2 Data Collection and Data Sources

The study uses quarterly data as used in Dees et al. (2007) and further updated by Smith and Galesi (2014) in the GVAR toolbox. Specifically, the study uses the 2016 Vintage Data which is available from 2018. Two variables are added to the model to account for financial contagion, the Bank Z-score and foreign shadow liabilities (*sl*). This secondary data was

collected from Bank scope and Bank for International Settlements (BIS), and also from the Financial Stability Board (FSB). Data from these sources are preferred due to the rigorous methods used in computation of the data by such national and international institutions. In addition, due to limitations in data availability on the introduced variables, the sample period is restricted to 1996Q1 to 2015Q1.

### 5.4.3 Variable Description

***Shadow Financial Liabilities***

The study adopts foreign liabilities of banks as a measure of shadow bank deposits. According to Harutyunyan et al. (2015), these liabilities constitute non-core liabilities of a banking entity and fall into the definition of shadow banking. Whilst foreign liabilities are only part of the measures used to construct shadow banking indexes by different authors (FSB, 2017, Harutyunyan et al., 2015), they provide the most expansive data compared to other components. Data is extracted from BIS locational statistics Table 7a[10]. Due to unavailability of data on more granular measures of shadow banking, the study employed data on external deposits of all reporting banks visa vis all sectors. The cut-off date of 1996Q1 is selected due to two reasons: firstly, to minimize any data gaps in the individual country series and the second is the length of other time series used in the model such as data on bank z-scores. To provide robustness checks to the model, another estimation is conducted using data on Other Financial intermediaries from the FSB in a second model and we report only impact elasticities from this second model.

***Real GDP***

Real GDP can fit either in the push or pull factors within the theory of capital flows in our model. Foreign GDP acts as a push factor by stimulating lenders and investors in credit originating countries to extend credit to borrowers in credit receiving jurisdictions. As an indicator of economic activity, robust economic performance can encourage lenders to

[10] We recognise that employing data on external positions (liabilities) could have added value to the data used in the study. However, there are many gaps in the data in Table 8a of the BIS's Locational banking statistics. Thus our measure leaves out components of the shadow banking system such as money market instruments and different kinds of pooled funds. These are however incorporated in the alternative measure from the FSB covering assets of OFIs. This data is used in the robustness test model.

increase credit across national borders for two main reasons: firstly, to diversify their portfolios and secondly, to utilize extra capacity that is usually created as business booms. On the other hand, GDP is a stylized pull factor, effective in attracting investment. High growth countries for instance are associated with high return on investment (Figuet et al., 2015).

***Bank Z-score***

The study uses the aggregate country level bank Z-score as a measure of financial stability for all countries in the sample. The data used originates from Bank scope but is published by the World Bank. The data averages Z-score data for participating banks in each country and is calculated using the following formula: $Z_{score} = \frac{\mu_{roa}+CAR}{\sigma_{roa}}$, where $\mu_{roa}$ is the mean return on equity. $CAR$ is the ratio of equity capital to total assets and $\sigma_{roa}$ is the standard deviation of the return on assets (roa). The Z-score measures the probability of default of banks in a country.

***Short term interest rate***

The interest rate is traditionally treated as a pull variable in international capital flows (Figuet et al., 2015). High interest rates in emerging market economies specifically draw capital to move from developed countries to these destinations. This line of reasoning defines the interest rate as a return on investment. Given that the same rate can be considered as borrowing cost, firms in emerging economies can be forced to opt for other sources of credit if their interest rates are higher. Thus, shadow bank credit, including cross border credit can be used as a substitute for domestic credit where domestic interest rates are very high compared to foreign interest rates.

***S & P Index***

Following Figuet et al. (2015), the S&P 500 index is used to represent the general global financial conditions. A higher index shows strong market sentiments and can act as a driver for high credit demand by firms. In turn, cross border credit is expected to increase. Therefore, more shadow banking activity is expected when global financial markets are in a boom increasing foreign bank liabilities in emerging economies. The index is used as a global variable in the model.

***Oil Prices***

The framework incorporates oil prices into the model as well as accounts for supply side shocks to the economic and financial systems. Most of the countries included in the panel are net importers of oil and a shock in oil prices is expected to increase demand for credit. However, at the same time, increased costs of production can dampen the ability to make regular loan repayments which can also increase financial institutions' distress. The relationship between oil prices and financial stability is therefore ambiguous, depending on other economic fundamentals such as the extent to which government oil subsidies are available.

## 5.5 Empirical Results

This section presents results from the GVAR model. Before the main results from the analysis can be presented, several procedural steps are worthy highlighting for the reader to have complete information on the steps taken in running the model. Firstly, the study uses the GVAR toolbox 2.0 developed by Smith and Galesi (2014). The model covers 33 countries which can be reduced to 26 after grouping the Euro area region. Our analysis focuses on 15 emerging market economies in the sample. The sample also includes the US, the EURO, UK and Japan which represents major global financial markets. Table 5.1 below shows all the countries represented in the GVAR.

Table 5.1. Countries and Region included in the GVAR Model

| **Emerging markets** | | **Europe (Euro)** | **Major Financial markets** |
|---|---|---|---|
| Argentina | Peru | Austria | Japan |
| Brazil | Singapore | Belgium | USA |
| Chile | Thailand | Finland | UK |
| China | India | France | |
| Indonesia | South Africa | Germany | |
| Malaysia | Saudi Arabia | Italy | |
| Mexico | Turkey | Netherlands | |
| Philippines | | Spain | |

The study focuses on the emerging market group of countries, including Singapore. The Euro Area enters the model as a region where as the US, UK and Japan enter as individual countries. These countries are retained in the model because they are the main financial centres and also by construct have the highest proportion of shadow bank activities.

The study adopts in-built country specific fixed weights to construct foreign variables. These weights are based on trade flows data between the different countries. The data for trade flows is provided for by Smith and Galesi (2014) to cover the period up to 2016Q4. Further aggregation weights for countries and regions are constructed using GDP (PPP, current international $) data.

### 5.5.1 Pre-Estimation Tests

Pre-estimation tests computed incudes, unit root tests and cointegration tests. The model computes both Augmented Dickey Fuller test (ADF) and the weighted symmetric ADF type tests of Park and Fuller (1995) (WS) statistics. Results of the unit root tests are presented in Table B1 and B2 in ***Appendix B***. The results show that most variables in majority of the countries are stationary after the first difference although in some cases, higher orders of integration can be identified. The presence of unit roots in our variables necessitates testing for cointegration.

Cointegration is performed for each country specific VARX model and each model is estimated as an augmented vector error correction model (VECMX). The cointegration rank is found by using Johansen (1992)'s reduced rank procedure which reports results from both the Max eigenvalue and the Trace statistic. Table B4 in ***Appendix B*** presents results from these cointegration tests providing the number of cointegrating vectors for each country model.

### 5.5.2 Structural Stability Tests

Hassan et al. (2017) argue for the importance of GVAR stability tests and identify three criteria that can be used to check for model stability as given in Smith and Galesi (2014). Firstly, eigenvalues must lie on or within the unit circle. From our results, 71 moduli lie on the circle and 250 moduli lie inside the unit circle. No moduli lie outside the unit circle. The second criteria to check for stability is that persistent profiles (PP) should converge to zero within the first 40 periods. The Bootstrap median estimates PP are shown in Figure 5.3 below and show that all PPs converge to zero within the 40-period horizon. In addition, the reported Generalized Impulse response functions tend to stabilize within the 40 period horizon which can also confirm the stability of the GVAR model.

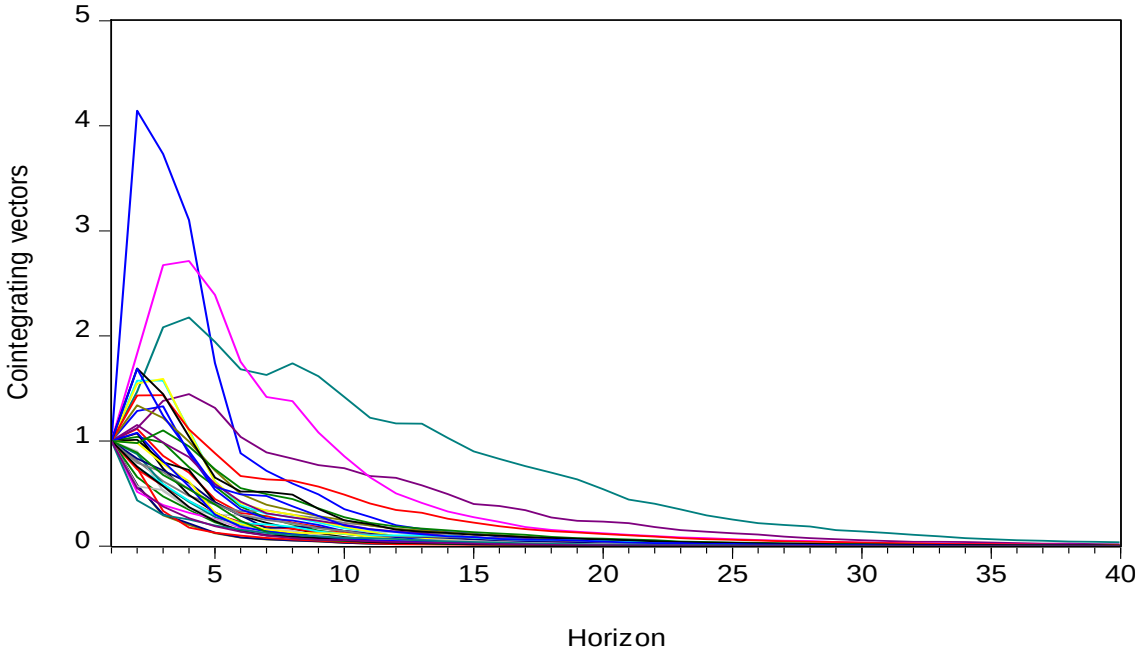


Figure 5.3. Persistence Profile of the Effect of System-wide shocks to the Cointegrating Relations of the GVAR Model
Source: Estimation

### 5.5.3 Testing for Weak Exogeneity

According to Chudik and Pesaran (2016) and Smith and Galesi (2014), the weak exogeneity test is the basic assumption underlying the estimation of the individual country VARX* models. The weak exogeneity assumption refers to the absence of any feedback effects between domestic variables $(Y_{it})$ and their foreign counterparts $(Y_{it}^{*})$. However, feedback effects of the variables' lagged values which cannot be ruled out, implying that $Y_{it}^{*}$s are long-run reinforcing for $Y_{it}$ (Smith and Galesi, 2014). The method used to test for weak exogeneity in the GVAR model follows from the work of Johansen (1992) and Harbo et al. (1998). Specifically, it requires the estimation of the following equation:

$$\Delta Y_{it,\iota}^{*} = \theta_{i\iota} + \sum_{j=1}^{r_i} \nu_{ij,\iota} \, ECM_{I,t-1}^{j} + \phi_{i,\iota}\Delta Y_{i,t-1} + \varphi_i \Delta Y_{i,t-1}^{*} + \epsilon_{it,\iota}, \qquad (5.10)$$

In equation (5.10), $ECM_{I,t-1}^{j}$ captures the estimated error correction terms for each cointegration vector $r_i$ for each country, $i$. The Weak Exogeneity test is an F-test for the joint hypothesis that $\nu_{ij,\iota} = 0$, where $j = 1,2 \ldots\ldots\ldots r_i$. in our model, the lag length is selected by AIC information criterion. Results of the Weak exogeneity test are provided in Table 5.2. At the 5% level of significance, only 5 variables from a total of 151 country variables rejects the

null hypothesis of weak exogeneity. It can therefore be concluded that foreign variables in the model are weakly exogenous.

Table 5.2. F-statistic for Testing the Weak Exogeneity of Country specific Variables and Global Variables

Test for Weak Exogeneity at the 5% Significance Level

| Country | F test | Fcrit_0.05 | Y* | Sl* | Eq* | Ep* | R* | Zs* | poil | sp |
|---|---|---|---|---|---|---|---|---|---|---|
| ARG | F(2,44) | 3.21 | 1.84 | 2.42 | 0.09 | | 2.51 | 0.83 | 0.39 | 0.06 |
| BRAZIL | F(2,59) | 3.15 | 0.88 | 1.68 | 3.05 | | 1.23 | 0.14 | 0.66 | 3.24* |
| CHINA | F(2,59) | 3.15 | 1.06 | 0.04 | 2.94 | | 0.23 | 0.11 | 0.29 | 1.14 |
| CHILE | F(2,58) | 3.16 | 0.02 | 1.39 | 0.08 | | 0.21 | 2.57 | 0.25 | 0.70 |
| EURO | F(1,59) | 4.00 | 0.20 | 14.82 | 0.02 | | 0.67 | 0.02 | 1.26 | 0.43 |
| INDIA | F(2,58) | 3.16 | 0.55 | 1.12 | 0.77 | | 0.01 | 0.09 | 0.11 | 0.94 |
| INDOS | F(3,58) | 2.76 | 0.59 | 1.76 | 0.33 | | 1.02 | 1.40 | 2.32 | 0.34 |
| JAPAN | F(2,58) | 3.16 | 2.64 | 1.12 | 1.99 | | 0.81 | 0.34 | 0.14 | 1.32 |
| MAL | F(2,44) | 3.21 | 0.35 | 5.17* | 1.34 | | 0.55 | 4.40 | 0.46 | 1.49 |
| MEX | F(2,59) | 3.15 | 5.10* | 3.61* | 1.53 | | 0.60 | 0.74 | 0.17 | 1.40 |
| PERU | F(2,59) | 3.15 | 1.20 | 1.20 | 2.37 | | 1.22 | 2.00 | 0.15 | 1.69 |
| PHL | F(3,57) | 2.77 | 1.46 | 1.12 | 1.64 | | 0.61 | 0.19 | 0.55 | 0.65 |
| SA | F(2,58) | 3.16 | 0.09 | 2.47 | 0.19 | | 1.85 | 0.80 | 0.08 | 0.03 |
| SAUDI | F(1,61) | 4.00 | 1.05 | 0.07 | 0.17 | | 0.26 | 0.31 | 0.21 | 0.35 |
| SING | F(1,59) | 4.00 | 0.74 | 0.72 | 0.01 | | 2.55 | 2.39 | 0.31 | 0.18 |
| THAI | F(2,51) | 3.18 | 0.12 | 2.11 | 0.40 | | 0.19 | 2.19 | 0.79 | 0.77 |
| TURK | F(1,60) | 4.00 | 4.26* | 0.05 | 0.13 | | 1.06 | 1.38 | 0.17 | 0.93 |
| UK | F(2,58) | 3.16 | 0.03 | 1.03 | 1.42 | | 0.27 | 0.35 | 0.19 | 0.98 |
| USA | F(2,59) | 3.15 | 0.91 | 3.06 | | 0.60 | | 2.07 | 0.27 | 1.17 |

Where * denotes significant at the 5% level.

Source: Estimation

### 5.5.4 Impact Elasticities

Impact elasticities capture the contemporaneous effects of foreign variables on their domestic counterparts. They are especially important in that they allow for analysis of interlinkages of variables across different countries and are suitable for describing cross border economic and financial linkages. The reported results show impact elasticities and their t-values. The higher the elasticity, the greater the extent of linkages, assuming that it is statistically significant.

Table B3 in ***Appendix B*** reports on the contemporaneous effects of foreign variables on their domestic counterparts. With the exception of Saudi Arabia and Singapore, shadow financial liabilities' impact elasticities are not statistically significant. However, for most countries, impact elasticities of the bank Z-score are significant. These results may indicate the effect of different bank market structures and regulatory environments on cross border bank capital flows. On the other hand, significant Bank Z-scores imply the possibility of transference of fragility across national borders. Countries such as India, Indonesia, Malaysia, Mexico, Peru, Philippines show positive elasticities demonstrating strong linkages with the global banking industry.

Our third financial variable in the model, the short term interest rate shows positive and highly significant impact elasticities for the majority of the countries in the Global VAR. For instance, India, Indonesia and South Africa show positive impact elasticities. this may indicate again the importance of accounting for cross border financial interlinkages amongst emerging market economies. Positive interest rate impact elasticities can also suggest global competition to attract investment. Higher interest rates in global financial markets drive domestic interest rates upwards.

A fourth financial variable in the model, real equity prices growth also shows strong interlinkages among emerging economy countries and the global economy. The elasticities are all positive and highly significant with a number of elasticities lying above unit indicating an overreaction to changes in global equity markets. The result is in line with previous studies (Galesi and Sgherri, 2013, Hassan et al., 2017). Lastly, the result also show macroeconomic linkages as demonstrated by elasticities of output growth $y$. Increased trade and integration of economies could account for this interconnectedness.

To check robustness of these results, a second GVAR model is estimated using shadow banking data from the FSB. The data is available on an annual basis, so transformation to quarterly frequency is done in Eviews to get a data set ranging from 2002Q1 to 2016Q4. Impact elasticities for this model are reported in Section 5.7. Results from this model suggest strong cross country financial linkages through the shadow banking system. Impact elasticities

for shadow banking are all statistically significant in the robustness model in various countries except for Indonesia and Philippines. The results of these elasticities give a glimpse of *a priori* expectations from the GIRF and FEVD that are presented in the next section.

### 5.6 Dynamic Analysis

This section presents results from the dynamic analysis of the Global VAR model. Generalized Impulse Response functions (GIRF) are used following Koop et al. (1996). GIRFs capture the historical correlations among the variables and is invariant to the ordering of the variables and the countries in the model. They are therefore suitable for large scale macroeconomic models (Çakır and Kabundi, 2013). Galesi and Sgherri (2013) however argue that GIRFs cannot provide information on causal relationships among variables since they are not orthogonalised. This is in contrast to the traditional Orthogonalised Impulse Responses (OIR) of Sims (1980) where *a priori* relationships among variables are used in variable ordering. Nevertheless, GIRFs are better suitable for analysing large multi country models as those found in a GVAR framework. Specifically, GIRFs provide information on how shocks are transmitted across international borders.

In addition, the study reports on Generalized Forecast Error Variance Decomposition (GFEVD). Also, it is worth mentioning that application of standard orthogonalised FEVD is not possible in a GVAR set up. In a GVAR model in which the shock simulations are invariant to the ordering of the variables, the approach is to consider the proportion of the variance of forecast errors explained by non-orthogonalised shocks. This involves allocating the innovation in a given variable among the different country specific variables or regions. Thus, each relative contribution reveals the importance of innovation in a given country/region to the rest of the variables or countries in the model.

#### 5.6.1 Generalised Impulse Response Functions

Results from shocks to two variables of interest in our model are presented in this sub-section. To meet the objectives of the paper, a negative shock in shadow financial liabilities at the global level is simulated. This allows us to analyse the response of different variables in different countries to a shock in shadow banking. External liabilities are believed to be more vulnerable to sudden withdrawals by nature and therefore can trigger financial instability in

the deposit holding country (Adrian and Ashcraft, 2016). Secondly, we simulate a negative shock in Bank Z-score to analyse contagion effects passed through bank balance sheets. Interestingly, the results below show strong financial interlinkages amongst emerging market economies and also between emerging market economies and the major world financial centres. Table 5.3 gives a summary of the shock simulated in the study and response variables considered in each case together with an *a priori* response based on literature.

Table 5.3. Summary of Simulated Shocks

| **Shock** | **Description** | **Response variable** | **Economic Implication** |
|---|---|---|---|
| 1 | 1 standard error negative Global shock to shadow banking (*sl)* | z-score (*zs*) | Shadow bank liabilities susceptible to sudden withdrawals resulting in increased bank instability (Ghosh et al., 2012, Grung Moe, 2015). |
| 2 | 1 standard error negative Global shock to the Bank Z-score (*zs*) | Output (*y)* | Worsening financial conditions have a negative impact on the real economy through reductions in output (Baur, 2012). |
| 3 | 1 standard error negative shock to China Z-score | z-score (*zs*) | China has grown to become a regional financial giant and worsening financial conditions of Chinese Banks can be transferred to other emerging countries (Degryse et al., 2010). |
| 4 | 1 standard error global negative shock in bank Z-score | shadow banking (*sl*) | Worsening financial conditions should lead to contraction of the shadow banking sector due to 'flight to safety' (Moreira and Savov, 2017). |

#### 5.6.1.1 Response of $zs$ to 1 Standard Error Negative Global Shock to $sl$

Figure 5.4 shows results from simulating a one standard error negative shock in shadow financial liabilities $(sl)$. It presents the effect of a decrease in shadow banking liabilities on a country's financial stability $(zs)$. Whilst the impact may not be statistically significant in some countries, the graphs for such countries are still retained and can still be used to at least infer the general direction of the responses (Galesi and Sgherri, 2013). There is a negative response to a decrease in shadow banking in several countries in the panel including Argentina, Brazil, Malaysia, Turkey, Thailand and Singapore. A 1% negative standard error shock in shadow financial liabilities at the global level worsens financial conditions in these countries. However, the effects are not persistent and are shown to be corrected after at most 12 quarters.

On the other hand, a negative shock to global shadow banking results in improvement in financial stability conditions of some countries including Chile, India, Indonesia, Mexico and South Africa. A fall in shadow banking globally leads to improvement in financial stability conditions in these countries. In a number of cases however, the shock is significant only during the first 8 quarters indicating cyclical behaviour of credit markets. Argentina, Thailand and Singapore portray this behaviour. This evidence could generally indicate the robustness of domestic financial systems in the absence of external financial linkages.

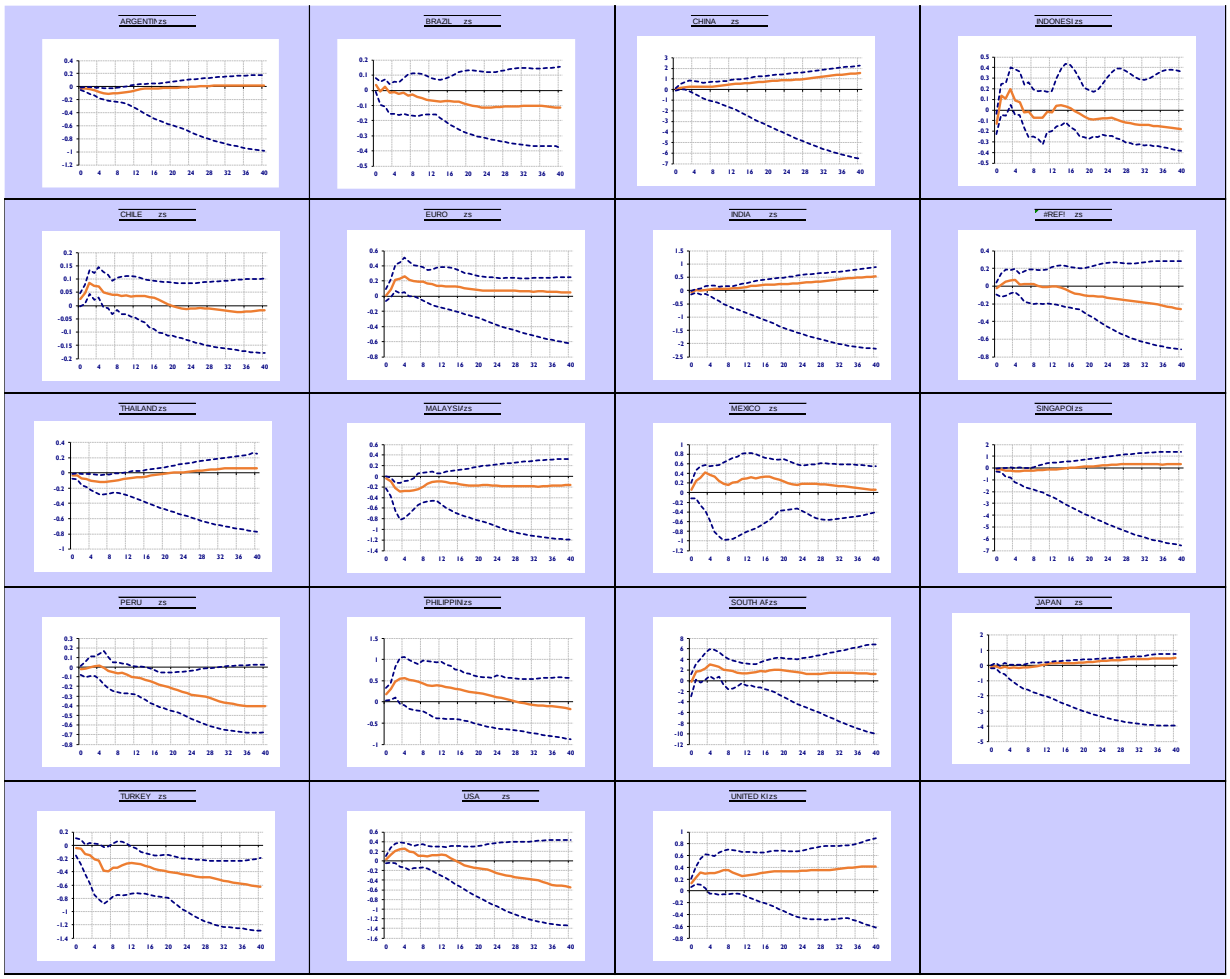


Figure 5.4. Response of zs to 1 Standard Error Negative Global shock to sl

### 5.6.1.2 Response of $y$ to 1 Standard Error Negative Global Shock to the Bank Z-score ($zs$)

A shock in the measure of financial stability tests for contagion across national borders through bank balance sheets to the real economy. From Figure 5.5 below, a 1% standard error negative shock in the global Bank Z-score measure result in the worsening of individual countries' economic conditions as measured by the country's specific GDP $(y)$. This result confirms the presence of financial contagion channel via bank balance sheets, a finding that is supported by several previous studies (Popov and Udell, 2012, Meeks et al., 2017). South Africa, Brazil and Peru for instance have significant results and show a negative response to the shock. Other countries show a negative response though the results are not statistically significant. Financial instability is therefore a threat to economic growth in both the short run and the long run as most responses are persistent.

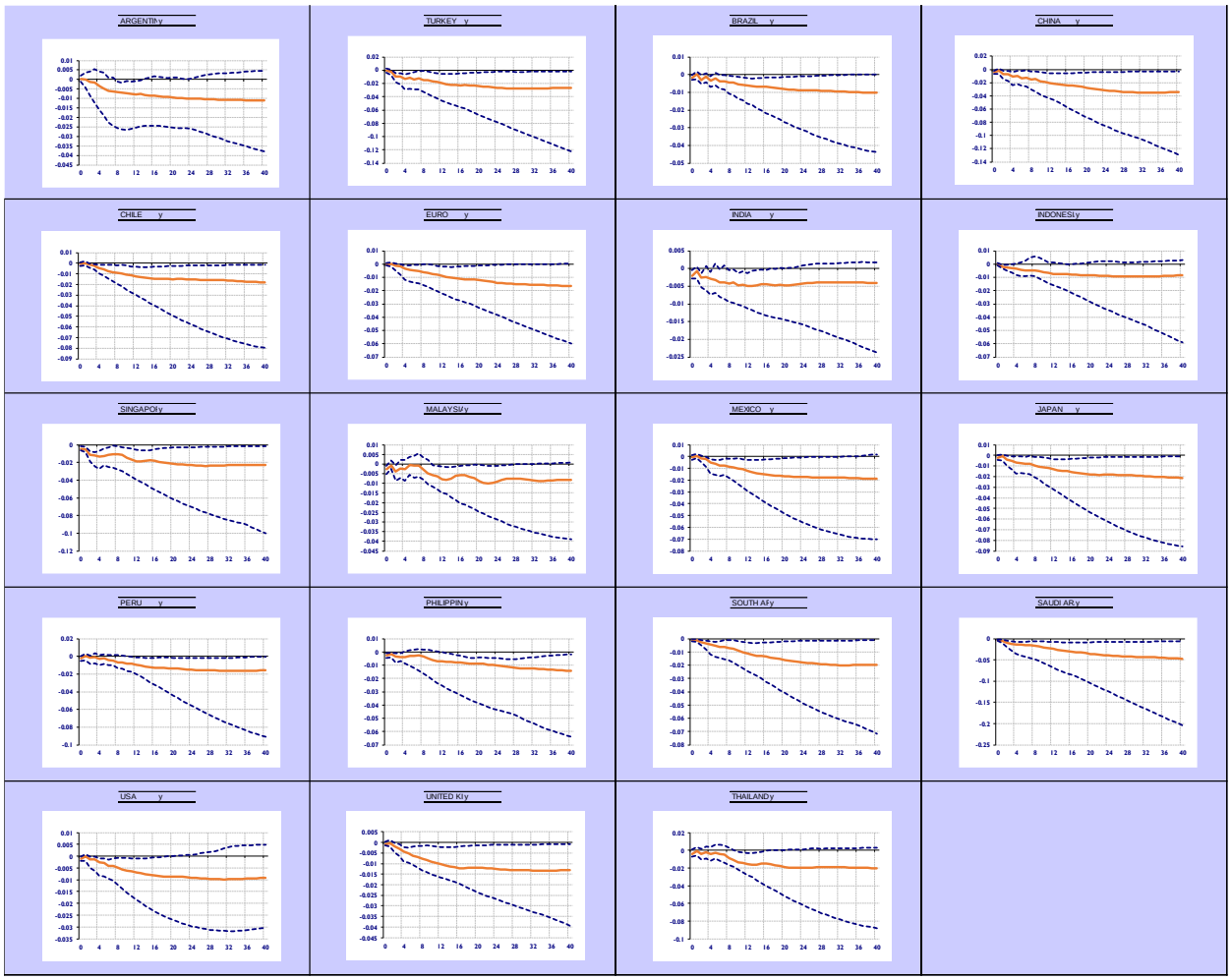


Figure 5.5. Response of y to 1 Standard Error Negative Global Shock to the Bank Z-score (zs)

### 5.6.1.3 Response of zs to 1 Standard Error Negative Shock to China Z-score

The increased importance of China in South to South trade implore an analysis of the effects of financial developments in China on other emerging economies. The study simulates a negative shock in bank Z-score (zs) of China. Figure 5.6 shows that a 1% standard error shock in China's Z-score index results in a decrease in financial stability conditions of other emerging economies. In Chile, Indonesia, Mexico and Saudi Arabia, the effects last for about 8 quarters, whereas in Turkey it only lasts for 4 quarters. The effect is persistent in India, confirming closer financial linkages between the two counties. An exception to the direction of the impact is found in Malaysia where the impact of a negative shock to China's Z-score index on Malaysia's index is positive. This implies that as financial conditions worsen in China, Malaysia's financial institutions become more resilient. This finding supports the report by the IMF (2013) which concluded that Malaysia has less reliance on cross border bank funding and a robust bank regulatory system. Thus, they managed to wither away the financial crisis. Impulse response

functions for other countries including Argentina, Brazil and South Africa are not statistically significant. Also, strong central bank institutions and robust regulatory environments explain the lack of contagion between these countries and China.

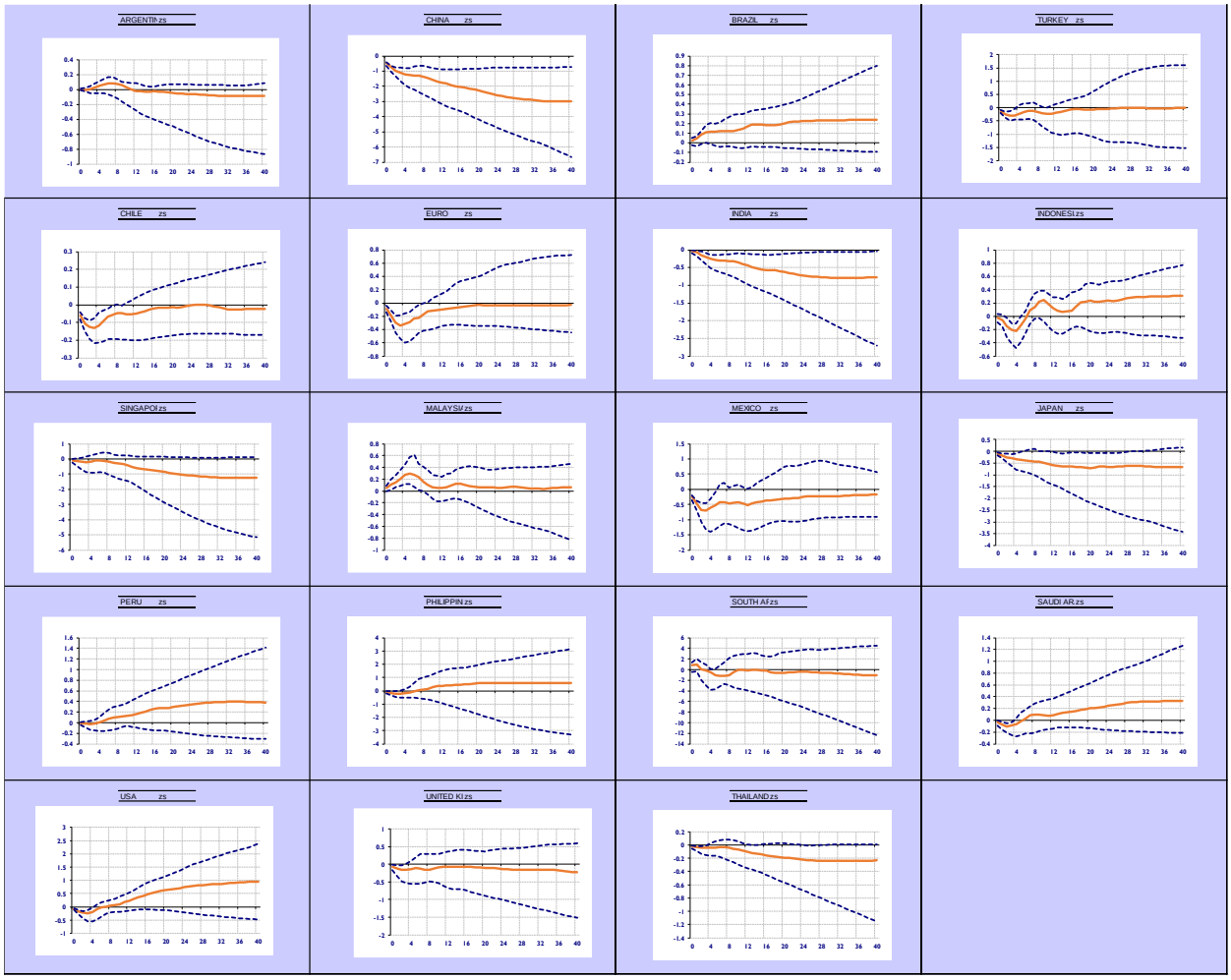


Figure 5.6. Response to 1 Standard Error Negative Global Shock to China Z-score

### 5.6.1.4 Response of $sl$ to 1% Standard Error Global Negative Shock in Bank Z-score

Responses of shadow banking to shocks from the Z-score are presented in Figure 5.7. Countries in the sample show persistent decrease in shadow banking liabilities as a result of a negative shock to global financial stability. The effect is significant but short lived for Brazil. For another group of countries, the impact is only significant in the medium to long term. These countries include Chile, South Africa and Turkey. Thailand and Malaysia show a persistent statistically significant response both in the short and long run. The results provide important insight into the responsiveness of shadow banking to global financial conditions. A

decrease in global financial stability conditions results in banks reducing their levels of external deposits and other positions.

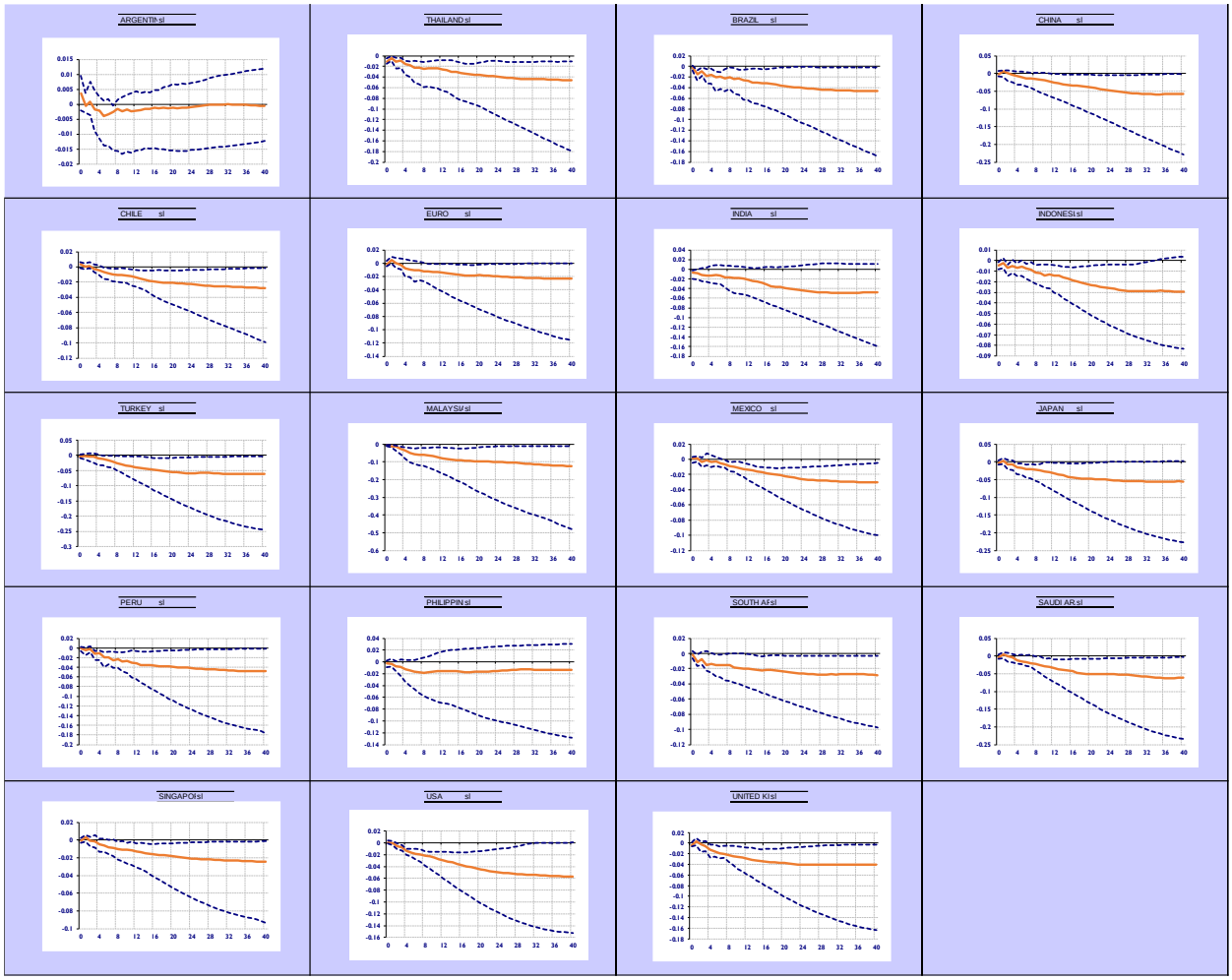


Figure 5.7. Response of $sl$ to 1% Standard Error Global Negative Shock in Bank Z-score

From 5.7 above, two explanations are therefore warranted from our findings to explain the relationship between financial stability and shadow banking. Firstly, that shadow banking increases fragility of financial institutions and lead to deterioration of financial conditions in a country. This is due to the nature of shadow banking liabilities which are more sensitive to development in both domestic and international markets. The finding supports the notion of sudden withdrawal potential that these liabilities possess (Gravelle et al., 2013, Adrian and Ashcraft, 2016). Regulators should therefore take this into account when crafting regulations that govern the flow of such liabilities both within and into the country. The second finding supports the first one as it shows that there is a two-way relationship between shadow banking and financial stability. A decrease in financial stability at the global level lead holders

of shadow bank assets/liabilities to withdraw their investments and seek safe havens elsewhere. This may further exacerbate financial conditions as banks may find it uneasy to raise more finance and raises the need for an external intervention into the banking sector/market.

### 5.6.2 Generalized Forecast Error Variance Decompositions

In this section, the study examines how the different shocks in section 5.1 are explained by variation in the different country variables. From Table B5 in ***Appendix B***, it is evident that on impact, the variation in shadow bank liabilities at the global level is driven by shadow banking in China and the US. China shadow banking explains about 38.5% of the forecast error variance on impact. Other emerging countries that contribute significantly to variations in global shadow banking in the short run through their shadow bank liabilities are Thailand, Saudi Arabia, Indonesia and India. In addition, other variables contribute relatively less to the variation in $sl$ in the short term. Both GDP and the Bank Z-score do not show significant contributions to variation in global shadow banking. Except in selected countries like Japan, the contributions of these variables to the forecast error variance of shadow banking is small in the short run and increases with time.

## 5.7 Robustness Model Results: Using OFI Data from the Financial Stability Board

This section is used to validate and improve on impact elasticities derived from the main model. In this Section, data on foreign shadow liabilities is replaced with data on Other Financial Intermediaries (OFIs). The data refers to the broad measure of shadow banking as compiled by the FSB. Table 5.4 shows the contemporaneous effects of foreign variables on their domestic counterparts. From the table, most of the coefficients of shadow banking are statistically significant. This confirms the presence of cross border financial linkages through the shadow banking sector. In this second model, interlinkages of financial markets through the interest rate channel can also be observed. Most elasticities of the short term interest rate are statistically significant. The results therefore show the presence of competition to attract investors especially amongst emerging economies where the coefficients of the interest rate are large compared to developed countries included in the model. Lastly, whilst the impact elasticities of the bank Z-score are not significant for some countries, they are still significant for a number of emerging market countries included in the model. In brief, these

findings confirm the presence of strong financial linkages among emerging counties themselves and also between emerging markets and the global economy.

Table 5.4. Contemporaneous Effects of Foreign Variables on their Domestic Counterparts

| *country* | *Y* | *sl* | *R* | *Zs* |
|---|---|---|---|---|
| ARGENTINA | -0.36 | 0.66 | 4.38 | 0.12 |
| | [-1.43] | [4.45] | [3.35] | [1.38] |
| BRAZIL | 0.92 | 1.87 | -0.21 | 1.03 |
| | [3.76] | [2.73] | [-0.63] | [1.62] |
| CHINA | 1.13 | 3.38 | 0.44 | -0.71 |
| | [2.37] | [4.69] | [2.40] | [-4.82] |
| CHILE | 0.97 | 0.58 | 0.27 | 0.39 |
| | [2.71] | [9.75] | [0.71] | [0.77] |
| EURO | 0.60 | 0.40 | 0.56 | 0.21 |
| | [5.36] | [3.05] | [4.94] | [0.85] |
| INDIA | 1.10 | 0.64 | 2.33 | 0.11 |
| | [3.82] | [2.00] | [4.35] | [0.50] |
| INDONESIA | -0.06 | 0.31 | 0.85 | 0.11 |
| | [-0.71] | [1.26] | [1.75] | [3.70] |
| JAPAN | 1.03 | 0.27 | 0.09 | 0.10 |
| | [2.95] | [6.50] | [3.52] | [0.15] |
| MEXICO | 0.45 | 0.87 | 0.60 | 0.23 |
| | [1.53] | [12.11] | [1.67] | [1.36] |
| PERU | 0.31 | 0.15 | -0.02 | 0.38 |
| | [1.37] | [1.61] | [-0.10] | [2.88] |
| PHILIPPINES | 0.42 | 0.06 | 0.60 | -0.21 |
| | [2.15] | [0.92] | [1.12] | [-2.48] |
| SOUTH AFRICA | 0.44 | 0.86 | 0.92 | 0.63 |
| | [4.36] | [5.58] | [3.17] | [2.67] |
| SAUDI ARABIA | 0.43 | 0.89 | | 0.41 |
| | [2.19] | [1.98] | | [1.95] |
| SINGAPORE | 2.41 | 2.94 | -0.01 | -8.01 |
| | [5.30] | [4.23] | [-0.06] | [-1.55] |
| THAILAND | -0.05 | 0.16 | 0.52 | -0.16 |
| | [-0.07] | [1.97] | [2.07] | [-1.94] |
| TURKEY | 2.66 | 1.93 | 3.11 | 1.17 |
| | [3.33] | [2.75] | [4.51] | [3.57] |
| UNITED KINGDOM | 0.95 | 0.78 | 1.00 | 0.19 |
| | [7.15] | [7.16] | [5.17] | [1.24] |
| USA | 0.22 | 0.33 | | 0.64 |
| | [2.09] | [9.11] | | [1.22] |

Numbers in parenthesis are t-values.

Source: Estimation

## 5.8 Concluding Remarks

Financial innovation has been at the forefront of financial globalization with shadow banking becoming a major source of funding for both private corporates and public enterprises. This Chapter analyses the extent to which cross border financial linkages through the shadow banking sector provides a channel for transmission of financial risk, hence, increase financial fragility in trade partners' financial markets. Our investigation specifically focused on 15

emerging market economies, the US, Euro and Japan to account for the major financial centres outside of the emerging market countries. The findings are mixed with a number of countries showing that decrease in global shadow banking liabilities result in worsening of financial conditions. A few others show that a decrease in shadow bank liabilities improves the country's financial conditions.

Using both impact elasticities and generalized impulse response functions, the study also analyses the extent to which financial contagion can be transferred from global financial markets to emerging markets. The results show evidence of financial contagion through the channel of shadow banks. An increase in shadow banking increases cross border financial intermediation leading to stronger balance sheet interconnectedness, and, increase exposure to risk from foreign financial system (Popov and Udell, 2012). Furthermore, the study investigates the presence of a risk channel transmission from China to other emerging market countries. The findings suggest the importance of China among emerging market economies. A negative shock in financial conditions as measured by the bank Z-score results in a deterioration of financial conditions in all emerging market economies except for Malaysia, South Africa and Brazil.

The Chapter provides interesting implications for regulatory policy. Firstly, the vulnerable nature of shadow bank liabilities implies the need for careful regulation of the types of liabilities that formal banking institutions are allowed to hold. Some countries may need to close the regulatory gap revealed by the differences in responses between countries. In countries with robust financial regulations and bank supervision, the extent to which contagion can be transferred is reduced. Regulator could reduce the impact of globally induced financial instability (exogenous to the domestic economy) by taking a pro-active stance in protecting ad ensuring maintenance of sound financial practices in the domestic markets. Targeted regulation is required to reduce the impact of shadow banking activities on both domestic and external financial stability conditions.

# CHAPTER 6

# SHADOW BANKING, BANK LIQUIDITY AND MONETARY POLICY SHOCKS IN EMERGING COUNTRIES: A PANEL VAR ANALYSIS

This Chapter presents an analysis of the relationships between monetary policy, shadow banking and bank liquidity in emerging market economies. The presence of market finance has important implications for monetary policy transmission, whilst on the other hand, changes in bank liquidity has an influence on the growth of the shadow banking sector. This Chapter addresses objective 3 of the study. Section 1 provides the background and justification of the study. In Section 2, the study reviews empirical literature on monetary policy and shadow banking. The methodology used in the study is explained in Section 3. Section 4 presents and discusses results, and Section 5 presents results from an alternative annual data-set. The study concludes in Section 5 by summarizing the main findings.

## 6.1 Background and Justification

The shadow banking sector gained popularity during the Global Financial crisis of 2007/2008 albeit for its negative role in propagating systemic risk (Adrian and Ashcraft, 2016). Research on the economic benefits and costs of this sector have however been limited by its opaque nature, hence, lack of data that accompanies such opacity. Whilst there is no debate on the existence of this sector and the role played by shadow banks, it is not clear as yet how its growth impacts monetary policy transmission. However, with the continued growth of shadow banking assets in both advanced and emerging economies, it is ideal to analyse the possible impact of shadow banking on monetary policy transmission to proffer suggestions on how to improve monetary policy frameworks in different countries.

Contributions made in this direction range from studies that analyse the relationship between price stability and financial stability (Smets, 2014, Hellwig, 2015), papers on effectiveness of monetary policy in the presence of shadow bank activities (Ge, 2011, Verona et al., 2013) and studies that directly analyse the relationship between shadow banking and monetary policy (Chen et al., 2017, Nelson et al., 2018). A relatively new concept that promises to provide explanation on the response of shadow banking to monetary policy decisions is the risk taking

channel of monetary policy (Borio and Zhu, 2012). A monetary policy shock is deemed to impact financial agents' risk taking in at least two ways. Firstly, Gambacorta (2009) argues that a negative shock in the interest rate induces agents to substitute low interest government bonds with high risk, high return assets. Secondly, changes in the interest rate impact asset valuation and several risk metrics. For example, a decrease in the nominal interest rate reduces volatility estimates, hence, impacts risk metrics favourably. Market participants may therefore take more risk thinking that their portfolio risk has decreased.

The linkages between monetary policy and the non-bank financial sector complicates the assumed dichotomy between price stability and financial stability. Smets (2014) shows that the decision on how to relate monetary policy and financial stability depends on the effectiveness of macro-prudential policy, the significance of the risk taking channel of monetary policy and the extent of financial dominance[11]. Monetary policy is linked to non-bank financial sector through two channels, the interest rate and liquidity. Firstly, changes in the nominal interest rate are argued to influence financial market participants' risk taking, resulting in what has been termed the risk taking channel of monetary policy (Gambacorta, 2009). The second link is provided by the substitutability between bank liquidity and wholesale market liquidity, such that in times of monetary contraction, non-bank financial firms provide liquid liabilities to the banking sector (Aftab and Varotto, 2017). Whilst this is contrary to Adrian and Shin (2009)'s observation that liquidity is only of a global nature, it is intuitive that banks source for liquid assets from wholesale markets during periods of monetary contraction, thereby maintaining their operations and limiting the effect of monetary policy.

Models of shadow banking show increased risk taking in the shadow banking sector, increasing financial sector fragility and slowing down of business cycle recovery in the aftermath of a recession (Moreira and Savov, 2017, Adrian and Ashcraft, 2016). Thus, the existence of a shadow banking sector should reinforce the risk taking channel of monetary policy and impact negatively on efforts to stimulate or stabilise economic activity through monetary policy. This intuition is supported by studies which investigates the impact of

[11] It refers to, "the risk that financial stability considerations undermine the credibility of the central bank's price stability mandate" Smets (2014).

shadow banking on monetary policy effectiveness (Verona et al., 2013, Xiang and Qianglong, 2014). The implication for instance is that shadow banking is contra cyclical to the credit cycle, expanding when formal banks contract and dwindling as formal banks expand.

Other studies look at the impact of monetary policy on shadow banks. Contractionary monetary policy for instance is viewed as a ramp for increased shadow banking activities (Nelson et al., 2018). Thus, reduction in central bank liquid liabilities of banks leads to increased shadow banking activities. Additionally, the explanation for this relationship is increased risk taking and substitutability of market finance and bank deposits. The relationship between monetary policy and shadow banking is therefore ambiguous, and its analysis requires a framework that can capture endogeneity. The present study attempts to analyse the response of each variable to a shock in another variable in a panel VAR framework in which all variables are treated as endogenous to the system. Two closely related works to ours are Nelson et al. (2018) and Chen et al. (2017) who relate shadow banking to monetary policy in the US and China respectively. The study extends this literature by considering a panel of emerging market economies within a panel VAR framework. In addition, it considers the dynamics between shadow banking and bank liquidity.

### 6.2 Literature Review

Monetary policy transmission in the traditional Keynesian model is largely regarded to pass through the interest rate (Knoop, 2008). Recent literature has however shown the importance of the financial sector in the transmission mechanism. Theoretically, the study is positioned within the body of literature that links monetary policy to financial sector disturbances (Smets, 2014, Knoop, 2008). Standard models of monetary policy such as the New Keynesian Dynamic Stochastic General Equilibrium (DSGE) Models do not account for financial sector linkages (Galí, 2015). Linkages between the monetary sector and the real sector are assumed to occur directly through the impact of the interest rate on investment and consumption. On the other side, the models allow for financial regulation through macro-prudential policy (Smets, 2014). Theories of financial frictions have been used to explain the relationship between monetary policy and the financial sector within the DSGE framework (Bernanke et al., 1999). However, whilst these succinctly show the balance sheet channels of monetary policy transmission, they do little in explaining instability originating from the financial sector.

To complement this deficiency, several studies have attempted to augment these models with a banking sector (Gertler and Karadi, 2011, Mazelis, 2014, Simpasa et al., 2014). More so others have further included a shadow banking sector in their analyses (Verona et al., 2013, Xiang and Qianglong, 2014).

Theoretical contributions of both Minsky (1977) and Friedman (1968), (Friedman, 1982) provides the departure for this study. Du Plessis (2014) argues that Friedman's view on the role of monetary policy in achieving financial stability stemmed from his studies on the Great Depression in which he blamed the Federal Reserve (FED) for the bank crises between 1930 and 1933. Further, Friedman believed if monetary policy had been conducted correctly in 1966/7, the US economy would have remained stable (Friedman 1968). Thus, in Friedman (1968)'s view, monetary policy conduct has an effect on financial sector stability. The Financial instability hypothesis of Minsky (1977) also argues that financial stability is at the core of Keynes' monetary exposition. Another earlier paper by Gurley and Shaw (1960) also postulate that financial innovations are a result of tight monetary policy and the presence of non-bank financial intermediaries reduces monetary policy potency.

The preceding theoretical propositions are supported by recent works which focus on the linkages between monetary policy and the financial sector through both the risk taking channel of monetary policy and the non-bank financial sector (Nelson et al., 2018, Chen et al., 2017, Borio and Zhu, 2012). The present study extends on this literature by providing empirical evidence on the impact of monetary policy on shadow banking in emerging market economies. In the ensuing discussion, the study reviews empirical literature on monetary policy, bank liquidity and shadow banking, including the role of other non-bank financial intermediaries.

Xiao (2018) documents the existence of a shadow banking channel of monetary policy for the US. Their study is based on two assumptions, the first being that shadow banks offer inferior services and the other being depositors with different yield sensitivity. Using a structural model of bank competition, they show that about 35% of reduction in bank deposits during monetary contraction is off-set by an increase in shadow bank deposits. Shadow banks offer high interest rates; therefore, depositors switch from formal banks to shadow banks seeking

high yields. Haisen and Yazdifar (2015) undertake a similar study for China using SVAR model and OLS regression. Their results show that increased shadow banking has the effect of increasing money supply and the price level. They support (Xiao, 2018)'s findings that monetary policy becomes less potent in the presence of shadow banking.

Nelson et al. (2018) also use the Bayesian VAR approach and simulates the impact of monetary policy on both assets of commercial banks and assets of shadow banks. They argue for a pro-cyclical response of commercial bank assets to a shock in monetary policy and a contra cyclical response of shadow bank asset growth to the same shock. In addition, their study builds a DSGE model with shadow banks, which is able to explain the theoretical findings from the Bayesian VAR. Their results are further buttressed by Chen et al. (2017) who investigate the relationship between shadow banking and monetary policy in China. The study employs both descriptive analysis and panel VAR model. Their results show that monetary policy contraction lowers bank loans but increase high risk non-loan assets. Evidence from both analyses show that contractionary monetary policy has a positive impact on shadow banking.

Mazelis (2014) uses a DSGE model and show that monetary policy contraction decreases bank loans whilst at the same time it increases shadow bank loans. In their model, the presence of shadow banks dampen the power of monetary policy as represented by a Tailor rule. Mazelis (2014) also finds that the presence of shadow banks increase the response of other variables to a shock in monetary policy. Paligorova and Santos (2017) investigate the risk taking channel of monetary policy for the US using corporate loan pricing policies. Their study show that monetary policy stance has an effect on loan spreads, distinguishing between high risk and low risk banks. High risk banks respond to monetary tightening by increasing their yield spreads. During periods of monetary easing, high risk banks reduce spreads, limiting the full impact of monetary policy changes.

Aftab and Varotto (2017) use MMFs to investigate the relationship between liquidity regulations and shadow banking. They find that new regulations have increased the resilient of MMFs. In a related study, Loutskina (2011) investigates the impact of bank securitisations on the ability of banks to sustain lending. Their study constructs a new index of bank loan

liquidity and employ regression analysis to analyse liquidity of US banks. Their findings show that securitisation increases the lending ability of banks. In fact, liquid assets provided through securitisation act as substitutes to bank deposits. Further, securitisations are found to increase bank liquidity and limit the effectiveness of monetary policy.

On the other hand, the relationship between monetary policy and bank regulation has been investigated by (De Moraes et al., 2016). Their study analyses the response of banks to monetary policy changes by focusing on capital requirements and the risk taking channel. They conclude that banks react to monetary policy by changing the amount of loan provisions and their capital adequacy ratio. Their study challenges conventional treatment of micro-prudential regulation, macro-prudential regulation and monetary policy where these policies are treated separately. They point to an integrated approach which is capable of ensuring that the conduct on macroeconomic policy does not influence prudential oversight negatively. De Moraes et al. (2016) show that monetary policy has an effect on micro-prudential supervision, a mixture of macroeconomic policy and the microeconomic side.

Bruno and Shin (2015) document evidence of the bank risk taking channel of monetary policy across borders for the US. The study employs a recursive VAR in which implied volatility, the real interest rate, leverage and the real effective exchange rate are used as endogenous variables. According to Bruno and Shin (2015), banks are an important component of the transmission mechanism and their cross border operations are elastic to changes in the policy stance. The finding is important as it confirms evidence on the susceptibility of shadow bank liabilities to sudden withdrawals (Moreira and Savov, 2017). Cross border liabilities of banks are an alternative liquidity source to bank deposits and are vulnerable to both changes in economic conditions on the source country and destination country. They are therefore, more vulnerable to sudden withdrawals in the face of economic or financial instability, increasing the instability in the process. In another study, De Nicolò et al. (2010) employ simple OLS procedure and scatter diagrams to demonstrate a negative association between the ratio of risk weighted assets of banks to capital and the US policy rate. Thy establish a negative association between the two variables signifying the existence of the risk taking channel of monetary policy in the US.

### 6.3 Empirical Model and Variable Description

In this study, the researcher focuses on investigating the relationship between monetary policy, bank liquidity and shadow banking using a panel of 15 emerging economy countries. Panel data framework is preferred due to its robustness over both time series and cross sectional analyses. The study follows previous studies on monetary policy shocks which employ the vector autoregressive model (VAR) (Sims, 1980, Nelson et al., 2018). However, due to the panel nature of the data, the study estimates a panel vector autoregressive model (PVAR).

Following Kilian (2011) based on the identification scheme used reports on granger causality, impulse response function and forecast error variance decompositions are made. As argued in literature (Kilian, 2011, Stock and Watson, 2001), these analyses are more informative than estimated coefficients in a VAR. Granger causality is a useful tool in identifying the existence of a causal relationship between a variable and lagged values of another. Impulse response functions reveal the impact of structural innovations on the variables in the model. Forecast error decomposition gives the percentage of forecast error attributable to a shock in a given variable.

#### 6.3.1 Panel Vector Auto-regressive Method

In panel VARs, all variables are also assumed to be endogenous as in the time series VARs. However, endogeneity of the regressors is addressed using GMM-like instruments making the technique robust to the presence of endogeneity and overcoming the Nickell (1981) bias. Thus, all variables are interdependent and shock transmissions can be identified. Hence, Canova and Ciccarelli (2013) show that given a VAR of the following form;

$$y_t = A_0(t) + A(l)y_{1t-1} + \mu_t, \qquad (6.1)$$

in which $y$ is a vector of endogenous variables and $A(l)$ is a polynomial in the lag operator and $\mu_t$ are identically and independently distributed error terms. $A_0(t)$ could represent all the deterministic components of the data.

To transform the VAR into a panel VAR framework, a cross sectional dimension is added to the above representation. The following is a panel VAR representation:

$$y_{it} = A_{oi}(t) + A_i(l)Y_{t-1} + \mu_{it}, \qquad (6.2)$$

where, $i = 1, \ldots\ldots, N$ and $t = 1 \ldots\ldots, T$

$y_{it}$ is the vector of endogenous variable in each unit (e.g. in a country) and $Y_t$ is therefore a stacked version of $y_{it}$ and $\mu_{it}$ is a vector of random disturbances assumed to be white noise.

According to Canova and Ciccarelli (2013), there are three distinguishing features of equation (6.2); firstly, it portrays dynamic interdependency which is the fact that lags of all endogenous variables enter the model for each unit. The second characteristic is that of static interdependence which is explained by correlation amongst the different units'$\mu_{it}$. The third characteristic is cross sectional heterogeneity – the slope, the intercept and variance of shocks $\mu_{it}$ are different for each unit.

### 6.3.2 Variables and Data

The study uses quarterly data from the year 1998Q2 to 2016Q4. The sample period is constrained by the unavailability of banking data in some jurisdictions beyond 1996. The following model shall be estimated for the 15 countries following Love and Zicchino (2006).

$$y_{it} = A_{oi}(t) + A_i(l)Y_{t-1} + \mu_{it}, \qquad (6.3)$$

where $y_{it}$is a vector of the 6 variables in Table 6.1. $A_i$ is a matrix of parameters and $\varepsilon_t$ are white noise innovations. The variables used in the analysis are summarised in Table 6.1 and further explained in detail in the discussion that follow.

Table 6.1. Summary of Variables used in the Model and Data Sources

| Variable | Description | Data Source |
|---|---|---|
| $Infl$ | Inflation is the logarithm of the CPI index for each country. | Central banks/IMF |
| $sbs$ | shadow banking/non-core liabilities. Two data sets are used, logarithm of assets of OFIs. Logarithm of external liabilities of banks from BIS. | BIS/FSB |
| $gdpn$ | Nominal GDP. Logarithm of nominal GDP. | IMF Data |
| $reer$ | Reer Effective Exchange rate | IMF/Smith and Galesi (2014) |
| $liquid$ | Liquidity measure – M1 | IMF/ |
| $pr$ | Central Bank policy rate | BIS |

**Central Bank Policy rate**

The central bank policy rate is the main instrument of monetary policy in the model. Thus, it provides information about the monetary policy stance of the central bank. In standard economic theory, a positive shock in the policy rate is expected to reduce money supply, thereby decreasing bank liquidity and in turn decreasing output. The data for the policy rate is collected from the BIS Central bank policy rates database. The data is available for all the countries in the sample.

**Inflation**

The CPI index data is collected from IMF and is log transformed to enable analysis of the rate of inflation. Price stability is the aim of monetary policy in most jurisdictions (Nelson, 2008). A positive shock in the policy rate is expected to result in a decrease in the rate of inflation as money supply decreases. However, in other empirical studies, inflation has responded positively to a hike in the interest rate, resulting in what is termed the price puzzle (Castelnuovo and Surico, 2010). Therefore, the analysis will also validate of refute the existence of the prize puzzle in emerging economies.

**Bank Liquidity**

Bank liquidity is measured using M1 and M2 for countries where M1 data is not available. It measures liquidity provision by banks which is backed by the central bank. The analysis of bank liquidity has changed in the recent past as most studies have attempted to account for market based and credit based source of liquidity in addition to deposits and central bank money. In this study, we consider bank liquidity at the basic level, which include bank deposits only to allow for interaction between bank liquidity and shadow banking which provides some of the market based liquidity.

**Shadow Banking**

Shadow banking is mainly constructed using data from the FSB[12] on assets of other financial intermediaries and data on foreign liabilities from the BIS for four countries that do not participate in the FSB Shadow Bank Monitoring programme. The data is transformation logarithms and measured as growth in shadow bank assets. Other studies have established a positive relationship between the interest rate and shadow banking implying that shadow banking increases as bank liquidity decreases (Barbu et al., 2016, Altunbas et al., 2009). Their studies do not however take into account the bi-directional effect that can exist between the two variables.

**Output**

Output is measured using the log nominal GDP. The data is collected from the World Bank. In standard models of monetary policy, deviations of output from equilibrium output impact monetary policy decisions (Taylor, 1993, Taylor, 2000). Thus, expansionary monetary policy is expected to increase output whereas contractionary monetary policy decreases output.

The real effective rate in US $ terms is used for all countries. The data used is extracted from the IMF. Monetary policy in both the domestic economy and in foreign economies can potentially move exchange rates. Contractionary monetary policy for example raises the

[12] For the main model we use data on foreign liabilities of banks as a proxy for shadow bank liabilities. Where it is not available, we use data from the FSB. The FSB data is provided in yearly frequency. Following Smith and Galesi (2014), we transform the data into a quarterly data set in Eviews using the Linear conversion method. The results obtained are robust to the change in the method of transformation. To confirm robustness of the results obtained using the transformed data, we provide an alternative robustness model estimated using annual non-transformed data. These results confirm our findings in the main model and are given in section 6.5.

interest rate and dampen asset prices in the domestic economy. Capital flows will increase and the domestic currency will appreciate. An appreciation of the domestic currency is expected in response to an increase in the policy rate.

**Country Sample used in the Study**

Table 6.2 below provides a list of the countries included in the sample. The study includes Singapore amongst 14 emerging economies due to its proximity to emerging countries in Asia.

Table 6.2. Country Sample for the PVAR Model

| | | |
|---|---|---|
| Argentina | Malaysia | Thailand |
| Brazil | Mexico | India |
| Chile | Philippines | South Africa |
| China | Peru | Saudi Arabia |
| Indonesia | Singapore | Turkey |

**6.4 Results Discussion**

This section provides a concise description of the estimation results from the panel VAR model. Due to the presence of cross sectional dependency in the sample, the study employs Pesaran's PESCADF (2007) unit root test to test for stationarity of each variable. Two advantages of this unit root test are that it accounts for cross sectional dependence and it can also be used in unbalanced panels. Thus, the following procedure is followed to obtain the results: Preliminary univariate analysis of data, cross sectional dependence test, unit root tests and then estimation of panel VAR. The study reports on panel VAR granger causality tests, Impulse Response Functions (IRFs) and Forecast Error Variance Decompositions (FEVD).

**6.4.1 Descriptive Statistics**

Table 6.3 shows summary statistics for all the 15 countries in the sample. It is noteworthy to mention that variables used in the estimation are logarithms in the cases of inflation (logarithm of the cpi index), gdpn (logarithm of nominal GDP in US$ terms), reer (logarithm of the country specific reer), shadow banking (logarithm of OFI assets of bank foreign liabilities) and liquidity (liquid) is the logarithm of M1 or M2 depending on available country data. This transformation is important for basically two reasons: firstly, to avoid outliers in

the data and secondly to minimize the possibility of heteroskedastic errors from the estimation. From Table 6.3, all data presented show consistence in terms of low standard deviations and shorter ranges. The number of observations for both sbs and liquid show that the panel is unbalanced as it is less than the maximum number expected per variable from all the countries.

Table 6.3. Descriptive Statistics of the Variables

| Variable | Observations | Mean | Std.Dev | Min | Max |
|---|---|---|---|---|---|
| Sbs | 1.097 | 10.68576 | 0.6669625 | 8.7717 | 12.98063 |
| Liquid | 1.104 | 551.5009 | 318.8401 | 1 | 1103 |
| Infl | 1.125 | 1.811522 | 0.495537 | -0.0105076 | 2.209343 |
| Gdpn | 1.125 | 4.940878 | 0.3239192 | 4.415491 | 6.264406 |
| Pr | 1.125 | 0.069643 | 0.0860626 | 0 | 2.000267 |
| Reer | 1.125 | 1.793163 | 0.3476365 | 05895266 | 2.82597 |

### 6.4.2 Correlation Matrix

Table 6.4 below shows individual correlations for all variables used in the model. As expected, there is a very high correlation coefficient for liquidity and inflation. All other correlations are below 0.5 reducing the extent to which our modelling could suffer multi-collinearity.

Table 6.4. Correlation Matrix

Sample: 1998Q2 2015Q1

| Correlation | REER | SBS | PR | LIQUID | GDPN | INFL |
|---|---|---|---|---|---|---|
| REER | 1.000000 | | | | | |
| SBS | -0.044901 | 1.000000 | | | | |
| PR | -0.152604 | 0.036007 | 1.000000 | | | |
| LIQUID | -0.236705 | 0.238839 | 0.237018 | 1.000000 | | |
| GDPN | -0.022537 | 0.471653 | -0.164176 | 0.177695 | 1.000000 | |
| INFL | 0.179980 | 0.045384 | -0.323402 | -0.846239 | 0.222644 | 1.000000 |

### 6.4.3 Cross Sectional Dependence Test Results

According to Sarafidis and Wansbeek (2012), cross sectional dependence refers to the presence of correlation across panels. Most panel data estimation methods assume cross sectional independence and the presence of cross sectional dependence can influence the estimated results (Comunale, 2017). Sarafidis and Wansbeek (2012) argue that cross sectional dependence can result in biased and inconsistent results. In addition, traditional panel unit root tests assume cross sectional independence, however, in many macro panels including the present, there is rich economic information suggesting influence across panels in cross country panels (Pesaran, 2007, Sarafidis and Wansbeek, 2012). The study applies Pesaran

(2004b)'s individual cross sectional dependence test and the results are presented in Table 6.5.

Table 6.5. Pesaran's Cross Sectional Dependence Test

| Varable | CD-test stat | P-value |
|---|---|---|
| Dpr | 9.50 | 0.000 |
| Dsbs | 22.16 | 0.000 |
| Dgdpn | 24.20 | 0.000 |
| Dliquid | 17.36 | 0.000 |
| Dreer | 42.58 | 0.000 |
| Dinfl | 7.68 | 0.000 |

Table 6.5 shows that for all variables, the null hypothesis of cross sectional independence can be rejected. Thus, all variable exhibit cross sectional dependence. In the next section, the study employs a panel unit root test that accounts for cross sectional dependence in the spirit of Pesaran (2007).

### 6.4.4 Panel Unit Root Tests Results

The study adopts Pesaran (2007) panel unit root test. The tests account for cross sectional dependence by augmenting the Augmented Dickey Fuller (ADF) regressions with panel averages of lagged values and first differences of the series. The null hypothesis in the test is that the series have a unit root against an alternative hypothesis of no unit root. As shown in Table 6.6, the null hypothesis of a unit root process in the series cannot be rejected for all series at levels. However, all differenced series show evidence of stationarity, specifically all series are integrated of order one (I (1)).

Table 6.6. Panel Unit Root Tests for Model Variables

| Variable | Test Statistic | | |
|---|---|---|---|
| | Levels | 1st Diff | Conclusion |
| REER | **-1.117** | **-6.275*** ** | **I(1)** |
| SBS | **0.819** | **-7.161*** ** | **I(1)** |
| $PR^T$ | **-0.173** | **-8.825*** ** | **I(1)** |
| $LIQUID^T$ | **-0.796** | **-3.201*** ** | **I(1)** |
| GDPN | **3.542** | **-6.412*** ** | **I(1)** |
| INFL | **-1.056** | **-6.544*** ** | **I(1)** |

$^T$ refers to inclusion of a time trend. *, **, *** refers to 10%, 5% and 1% significance level respectively.

### 6.4.5 PVAR Estimation Results

This section reports results from the panel VAR estimates. Due to the presence of unit roots in our main data set, the PVAR is estimated in differences. It is noteworthy that using data at levels does not show any non-negligible difference in the simulated IRFs. The estimation method follows Love and Zicchino (2006) and Abrigo and Love (2016). The method accounts for country specific individual unobservable characteristics using fixed effects. However, in order to overcome the Nickell (1981) bias where the lags of the dependent variable are correlated with the error term, Helmert transformation is used. Helmert procedure removes fixed effects using forward mean differencing, preserving orthogonality between the transformed variables and lagged variables and helps to reduce serial correlation (Hove et al., 2015). The model is estimated using the method of Generalized Methods of Moment (GMM). This section presents results for Granger causality, Impulse response functions and FEVD. Lag selection is done following Abrigo and Love (2016) and a PVAR of lag order 2 is selected. Results of the lag selection criterion are shown in Table 6.7 below. The study follows the lag order as selected by the MAIC selection criterion suggested by Andrews and Lu (2001).

Table 6.7. PVAR lag Order Selection Criteria

| Lag | CD | J-sta | J-pvalue | MBIC | MAIC | MQIC |
|---|---|---|---|---|---|---|
| 1 | 0.95 | 91.73 | 0.092 | -422.88 | -58.26 | -197.15 |
| 2 | 0.85 | 37.89 | 0.895 | -305.19 | -62.10 | -154.70 |
| 3 | -24.42 | 16.29 | 0.905 | -155.24 | -33.70 | -79.99 |

In addition, model stability is checked using the AR roots table and graph. Figure 6.1 shows the AR roots graph for the estimated model. It indicates that the model is stable as all roots are inside the circle. Furthermore, the study tests the model for over identifying restrictions using Hansen's J-statistic. The coefficient of the J-statistic is found to be 88.88 ($p = 0.086$) which is not significant at the 5% level of significance. GMM instruments are therefore valid.

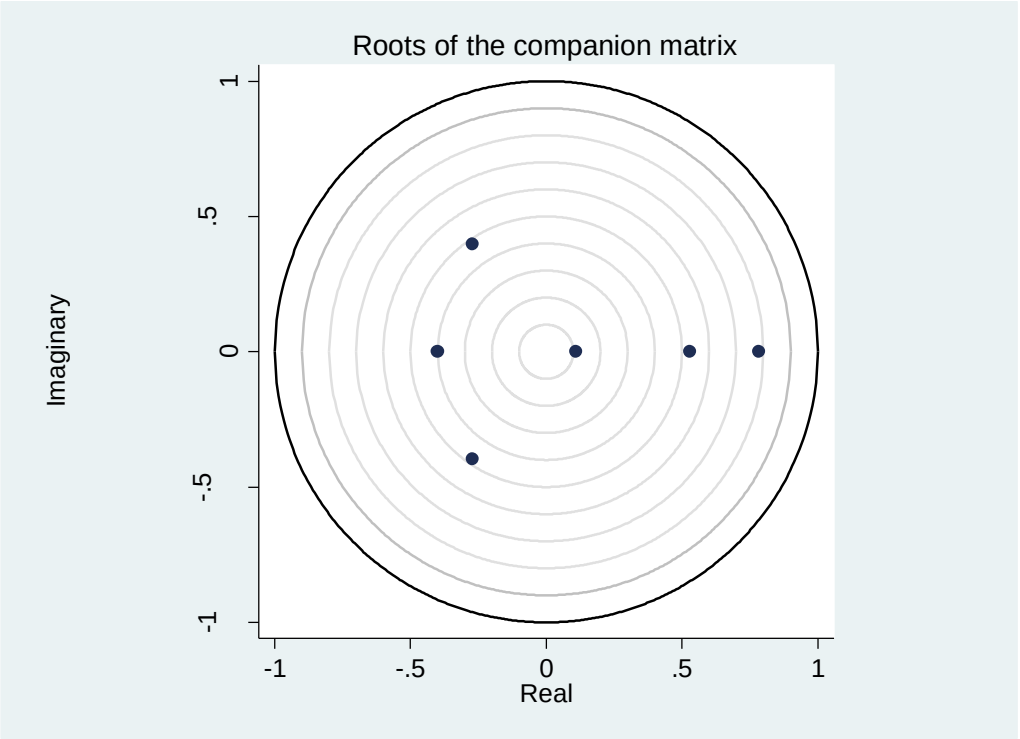


Figure 6.1. AR Roots Graph for testing PVAR Model Stability

#### 6.4.5.1 Granger Causality Tests

Panel granger causality tests were undertaken after estimating the panel VAR model and the results are presented in Table 6.8. The null hypothesis is that the excluded variable (*left hand variable*) does not granger cause the equation variable (*right hand variable*). Thus, the alternative hypothesis is that the excluded variable granger causes the equation variable.

Table 6.8. Panel VAR Granger Causality Test

| | Hypothesis | Chi2 stat | P-value |
|---|---|---|---|
| 1 | $dinfl$ does not granger cause $dsbs$ | 111.99*** | 0.000 |
| 2 | $dgdpn$ does not granger cause $dsbs$ | 22.60*** | 0.000 |
| 3 | $dreer$ does not granger cause $dsbs$ | 0.76 | 0.381 |
| 4 | $dpr$ does not granger cause $dsbs$ | 5.18** | 0.023 |
| 5 | $dliquid$ does not granger cause $dsbs$ | 230.44*** | 0.000 |
| 6 | $dinfl$ does not granger cause $dpr$ | 208.13*** | 0.000 |
| 7 | $dgdpn$ does not granger cause $dpr$ | 90.54*** | 0.000 |
| 8 | $dreer$ does not granger cause $dpr$ | 4.41** | 0.036 |
| 9 | $dsbs$ does not granger cause $dpr$ | 0.14 | 0.712 |
| 10 | $dliquid$ does not granger cause $dpr$ | 1.53 | 0.216 |
| 11 | $dinfl$ does not granger cause $dliquid$ | 51.08*** | 0.000 |
| 12 | $dgdpn$ does not granger cause $dliquid$ | 77.99*** | 0.000 |
| 13 | $dreer$ does not granger cause $dliquid$ | 0.48 | 0.484 |
| 14 | $dsbs$ does not granger cause $dliquid$ | 8.13*** | 0.004 |
| 15 | $dpr$ does not granger cause $dliquid$ | 0.024 | 0.878 |

*, ** and *** represents 10%, 5% and 1% significance respectively.

The granger causality tests in table 6.8 show that lagged values of inflation, GDP, policy rate and bank liquidity all have effects on shadow banking. Of interest is the uni-directional relationship between shadow banking and the policy rate flowing from the policy rate. The implication would be that monetary policy stance impact shadow bank activity. This proposition has been suggested in Borio and Zhu (2012) on the risk taking channel of monetary policy where changes in the monetary policy stance have a bearing on financial market agents' risk taking. This is also supported by our findings in section 6.4.5.2 on impulse response functions below.

It is also important to mention the uni-directional relationship between shadow banking and macro-economic variables, inflation and GDP. Shadow banking responds to the broader macroeconomic environment. This finding is in tandem with empirical studies that investigate the macroeconomic determinants of shadow banking (Barbu et al., 2016). In addition, the

study establishes a bi-directional relationship between shadow banking and bank liquidity. Thus, lagged values of our shadow bank measure have influence on bank liquidity, whilst at the same time dynamic influences of liquidity have a bearing of shadow banking.

#### 6.4.5.2 Impulse Response Functions

Granger causality tests conducted in section 6.4.5.1 above cannot account for the nature of the relationships amongst the variables in the model. Thus, it is not clear whether the relationship between the two variables is positive or negative. The study further investigates the relationships amongst the variables using impulse response functions (IRFs) and forecast error variance decompositions (FEVD).

Cholesky decomposition is used for identification in both IRFs and FEVD. Follow Dajcman (2016) and Dajcman and Tica (2017), the following order of variables is used: *MACROECONOMIC variables*, *MONETARY variables* and *BANK* SPECIFIC variables. The ordering assumes that macroeconomic variables are the most exogenous and in turn influence monetary variables which also influence financial or bank specific variables. According to Dajcman and Tica (2017), it is important to identify all monetary policy channels in order to develop optimal monetary policy. They argue that unidentified channels can dampen the monetary policy impulses, reducing the intended impact of a policy shift.

This section reports the cumulative impulse response functions from the estimated PVAR model. Three shocks are simulated, a monetary policy shock, a shock to shadow banking and a shock to bank liquidity. These are discussed separately below.

***Impulse responses to a 1 standard deviation shock to Shadow banking***

Figure 6.2 shows the response of other variables to a shock in shadow banking. A positive shock in shadow banking results in an increase in bank liquidity as measured by the money supply. This could imply shadow banking has a complementary effect on the liquidity of banks with increased participation of shadow banks in financial activities increasing bank deposits. On the other hand, banks could also be taking advantage of wholesale markets to raise finance from the shadow banking system which substitutes bank deposits in credit creation, hence, they are able to extend credit whilst at the same time increasing their stock of liquid liabilities. Viewed from either side, shadow banking complementary effect on bank liquidity

implies banks do not entirely depend on central bank money and deposit creation for funding. The finding supports evidence in Loutskina (2011) who demonstrates that securitisation increases bank liquidity and reduce the sensitivity of bank credit creation to changes in bank deposits.

The response of the policy rate to a shock in shadow banking portrays mean reversion around the zero x-axis. Thus, initially there is an increase in the policy rate in response to a shock in shadow banking. The mean reverting shape indicates there is over-correction of the changes in the policy rate. A shock to shadow banking also results in depreciation of the domestic currency. The depreciation of the domestic currency as a result of a shock in shadow banking could be indicative of the cross border nature of shadow banking activities. Thus, shadow banking activities could be associated with increase capital outflows, leading to a depreciation of the currency.

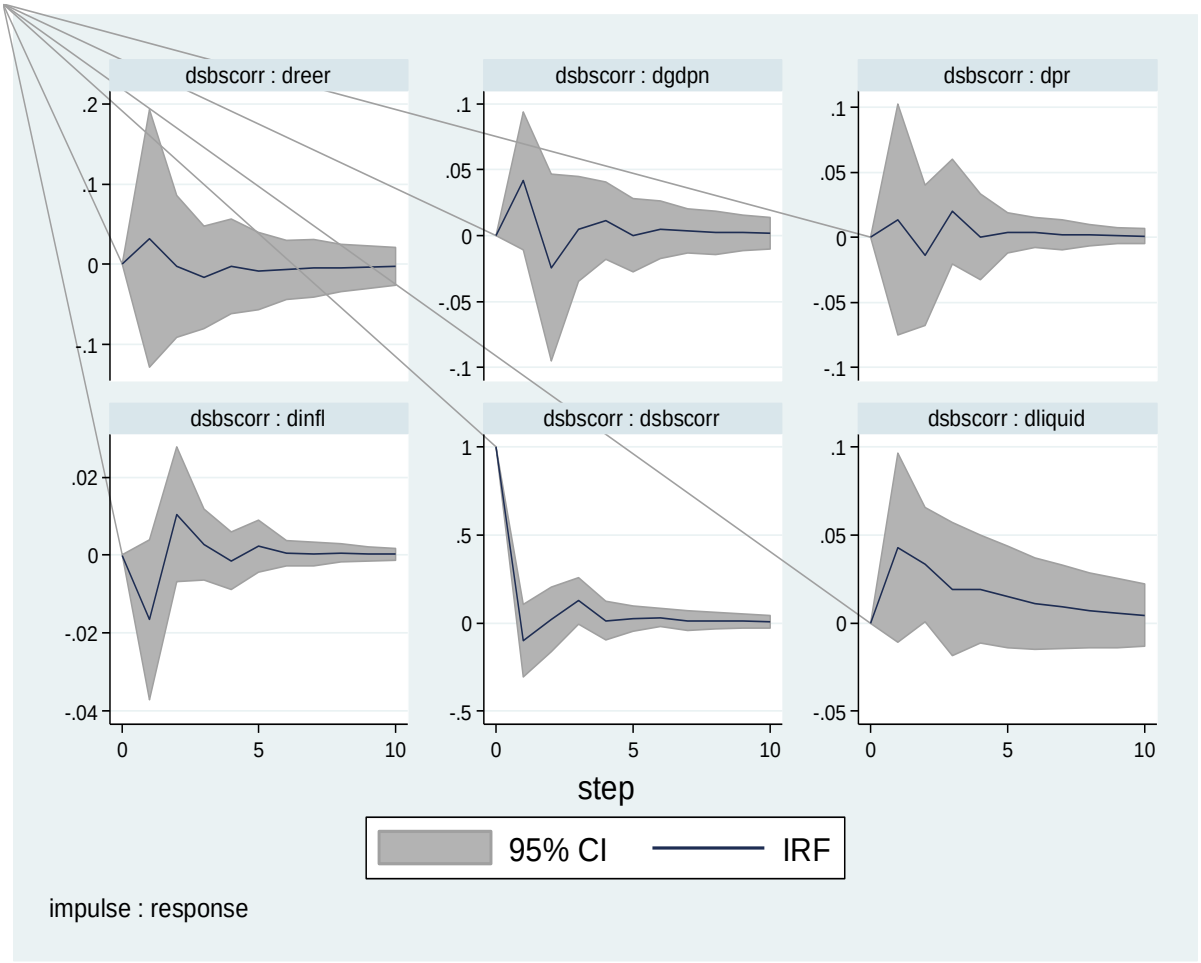


Figure 6.2. Impulse Responses to a 1 Standard Deviation Shock in Shadow Banking

Impact of shadow bank shocks on both inflation and GDP is very small as shown in the graph which may be interpreted as not significant. The direction of the shocks however may give an important insight into the relationships amongst these variables. For instance, a shock in shadow banking activity induces a decrease in the rate of inflation in emerging economies. This finding may indicate the reduction in consumption as funds are transferred from consumers into financial markets for investment purposes as shadow banks grow. A shock in shadow banking also induces an increase in GDP, a finding in tandem with the Granger causality tests above which established a uni-directional relationship between GDP and shadow banking flowing from shadow banking. This is in line with literature on financial innovation and economic growth which suggests that financial innovation increases economic growth (Bara et al., 2016, Beck et al., 2016, Laeven et al., 2015).

***Impulse responses to a 1 standard deviation shock to the monetary policy rate***

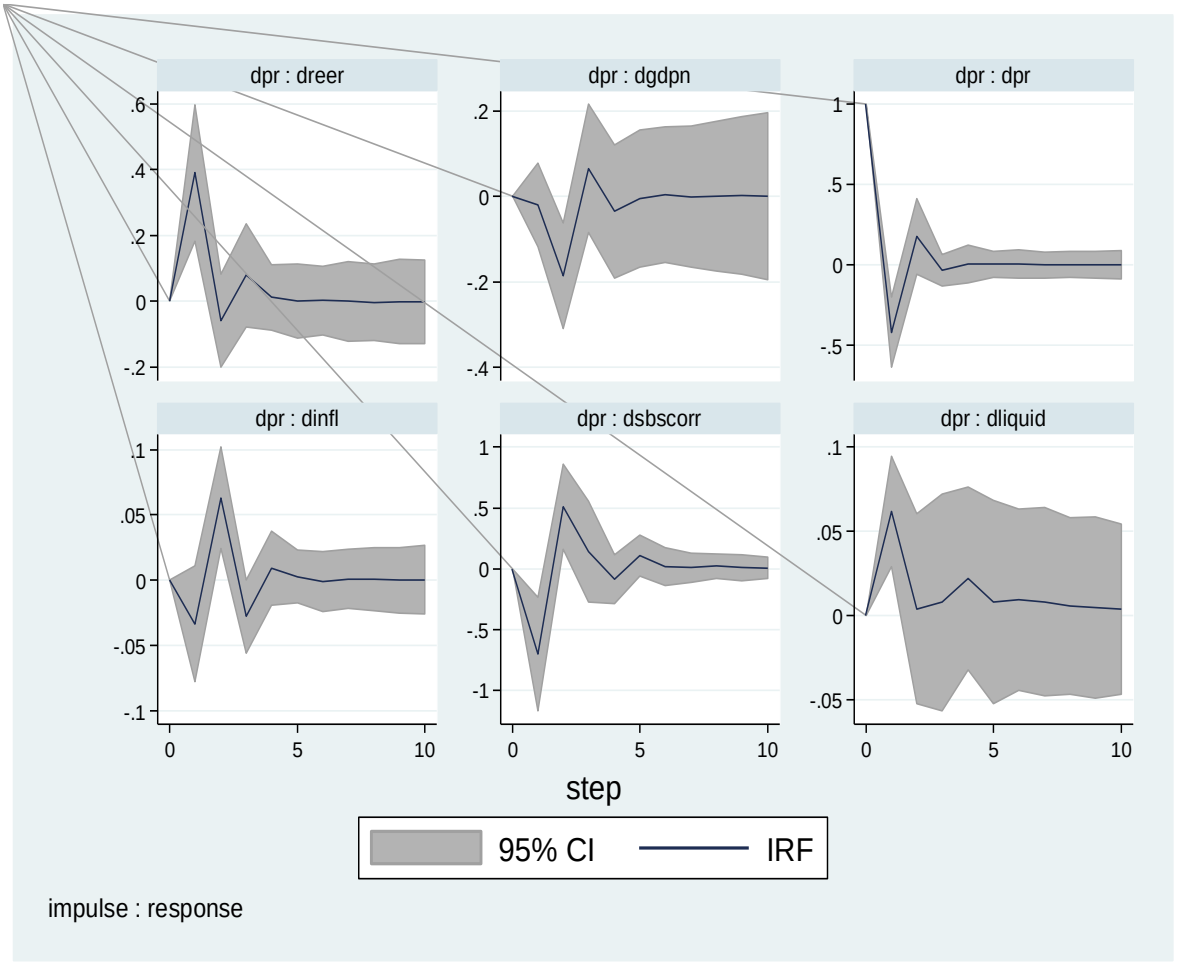


Figure 6.3. Response to a 1 Standard Deviation Innovation in the Policy Rate

Figure 6.3 shows results of the response to a shock in the policy rate. A contractionary monetary policy shock induces a decrease in shadow banking. However, the decline is short lived. The finding is first of all contrary to other studies such as Nelson et al. (2018) and Funke et al. (2015) whose findings suggest an increase in shadow banking as a result of a positive monetary policy shock. The implication could be that higher interest rates increase confidence in the main stream banking sectors and financial resources are transferred from the shadow banking sector to the formal banking sector as investors seek safe investments. Secondly, shadow banking liabilities are not substitutes for bank liquid liabilities but they complement each other. This second explanation is supported by the finding that bank liquidity increases with a shock to shadow banking and the work of Loutskina (2011). Thus, in the case of a positive shock to the policy rate, bank liquidity is expected to decrease. Therefore, there is a complementary effect between bank liquidity and shadow banking in contrast to Nelson et al. (2018)'s findings that suggests a contractionary monetary policy leads to an increase in shadow bank asset growth for the US. Therefore, the impact of monetary policy on shadow banking is different in developed versus emerging or developing countries.

Our results are plausible considering that the relationship between monetary policy and shadow banking could point to a strong presence of the risk taking channel of monetary policy through the shadow banking sector. According to Gambacorta (2009), the existence of the risk taking channel implies a decrease in the policy rate will induce financial agents to undertake higher risk activities with the belief that risk has decreased. By extension, an increase in the policy rate implies risk metrics will indicate higher risk, inducing financial market participants to reduce engagement in risky activities, including shadow banking activities. Furthermore, the result is important in revealing the importance of the shadow banking sector in monetary policy transmission. The complementarity between bank liquidity and shadow banking growth indicates the increased sensitiveness to monetary policy changes effected by shadow banks in emerging markets. Monetary policy could be more effective in emerging market economies due to the presence of shadow banks in these countries.

A shock in the monetary policy rate induces an immediate increase in bank liabilities contrary to theoretical expectations. The increase is however short-lived and followed by a deep decrease. Thus, in the presence of shadow banking, money supply does not respond to the

policy rate immediately except with a lag. Also, it can be shown that the policy rate impact shadow banks negatively first before bank liquidity begins to dwindle. Our explanation for this finding points to banks participation in shadow banking and sudden withdrawal of shadow banking liabilities in the event of a monetary policy shock. Banks respond to a monetary policy shock by reducing shadow banking asset holdings converting them to accessible liabilities on their balance sheets.

A contractionary monetary policy shock however, decreases both inflation and GDP growth as expected. In theory, tight monetary policy is used against an overheated economy, reducing both the price level and output (Klaeffling, 2003). The results therefore confirm the overall potency of monetary policy in emerging economies. This finding is supported by previous empirical works on monetary policy (Gambacorta et al., 2014).

***Impulse responses to a 1 standard deviation shock to bank liquidity (m1)***

In this section, the study analyses response to a shock in bank liquidity. In Figure 6.4, a positive shock in bank liquidity results in an increase in shadow bank assets growth. Again, this confirms the complementarity between bank liquidity and shadow banking in emerging market economies. This can be explained by the role commercial banks play in shadow banking activities of emerging market economies. Two explanations can be proffered: firstly, commercial banks have a parent/subsidiary relationship with shadow banks. A decrease in funding in the parent company would also negatively affect the subsidiary. The second explanation could be the importance of formal banking institutions as financiers of shadow banking activity in emerging markets. In line with the study of Acharya et al. (2013), shadow banking in emerging market economies derives its funding from commercial banks. Intuitively, a reduction of commercial bank funding will therefore have a negative effect on shadow bank growth and *vice-versa*.

A shock in bank liquidity also induces the monetary authorities to raise the policy rate as indicated in the second panel of Figure 6.4. However, the effect is small and almost insignificant. A positive shock in liquidity is however shown to be important in driving economic growth during the first and second quarters, only to dissipate sharply after the second quarter. The finding is important as it confirms the short-run potency of monetary

policy in driving real activity. Again a positive shock to money supply, driven by lower interest rates could be accompanied by an outward capital flow. The capital outflow results in depreciation of the domestic currency as shown by the increase in the real effective exchange rate below. The effect of a shock in bank liquidity on inflation is relatively insignificant.

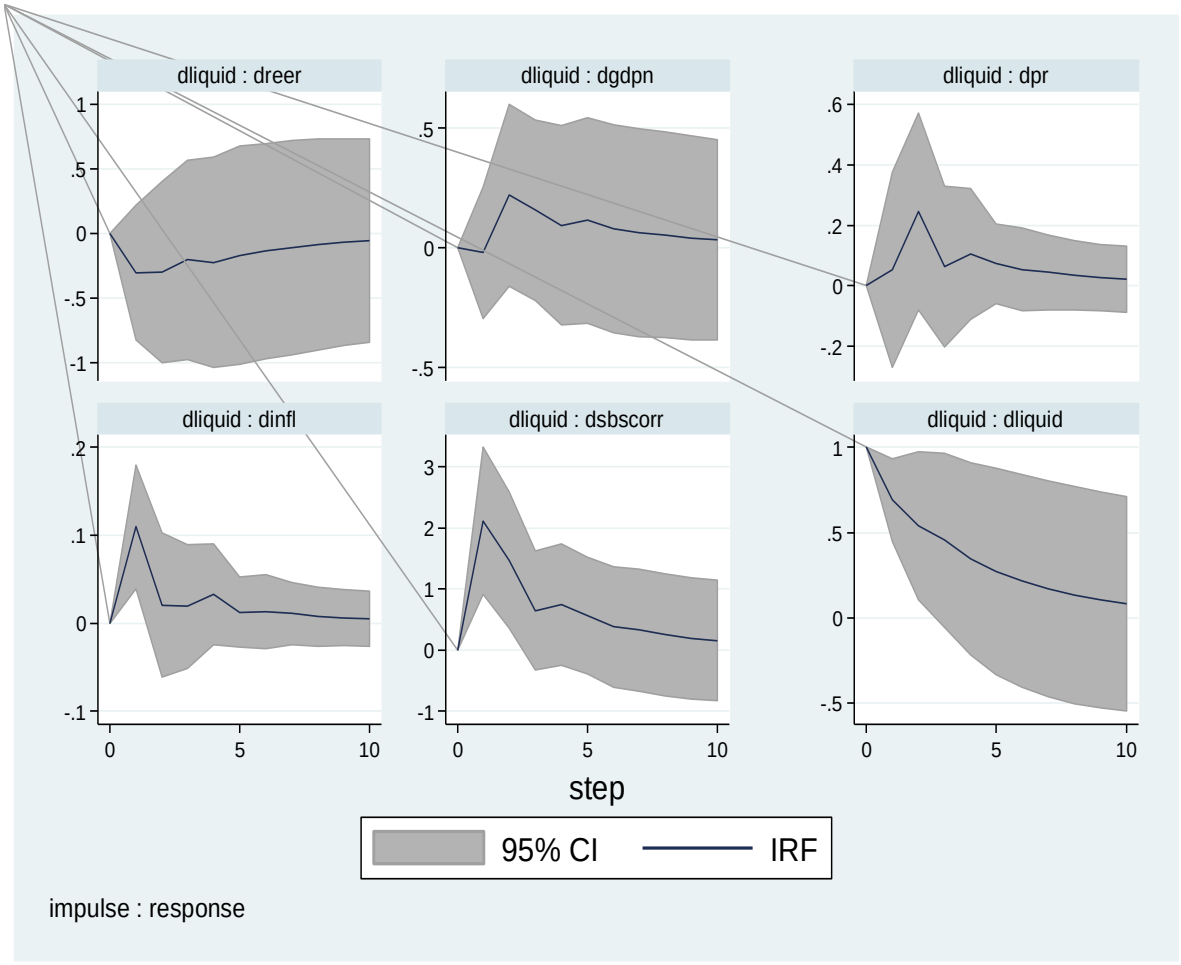


Figure 6.4. Response to a 1 Standard Deviation Innovation in Bank Liquidity

#### 6.4.5.3 Forecast Error Variance Decompositions (FEVD)

This section presents results on FEVD. The results are displayed in Table 6.9 below. Response variables as selected are the policy rate, shadow banking and bank liquidity. The main result from the study is that in both the short-term and the long-term, variability in these variables is driven by the variables themselves. The rate of inflation and GDP have a significant influence on the policy rate however, with approximately 1.5% variation being explained by GDP in the short-run. Inflation rate explains about 9.4% of the variability in the policy rate. The other variables do not explain a significant portion of the variability in the policy rate. Variability in shadow baking is also to a greater extent explained by itself. Notable contributions however,

are drawn from GDP, inflation and the policy rate. For instance, after 10 periods (10 quarters), GDP contributes about 3.3% of the variation in SBS, INFL contributes about 2% and the policy rate contributes about 1.9% to variation in shadow banking. The last variable of interest is bank liquidity. Variation in bank liquidity is also mostly explained by itself. Variability in both inflation and GDP is explained by the variation in the policy rate and the exchange rate (REER). Lastly, variability in the exchange rate is also explained by changes in GDP, inflation and the policy rate. For instance, about 4.2% of the variation in REER in the 10th period is explained by the policy rate. GDP and Inflation explain approximately 11.8% and 3.1% of the variation in the REER respectively.

Table 6.9. Forecast Error Variance Decompositions[13]

| Response variable | Impulse variable | | | | | |
|---|---|---|---|---|---|---|
| | $\Delta dpr$ | $\Delta gdpn$ | $\Delta liquid$ | $\Delta infl$ | $\Delta reer$ | $\Delta sbscorr$ |
| $\Delta dpr$ | 0.88 | 0.015 | 0.0005 | 0.094 | 0.0007 | 0.0001 |
| $\Delta sbscorr$ | 0.019 | 0.033 | 0.001 | 0.021 | 0.012 | 0.92 |
| $\Delta liquid$ | 0.0004 | 0.004 | 0.99 | 0.0003 | 0.0013 | 0.0002 |
| $\Delta gdpn$ | 0.15 | 0.94 | 0.008 | 0.005 | 0.02 | 0.000008 |
| $\Delta infl$ | 0.042 | 0.008 | 0.0002 | 0.93 | 0.01 | 0.0002 |
| $\Delta reer$ | 0.042 | 0.12 | 0.007 | 0.031 | 0.79 | 0.003 |

*The results presented are for period 10 or 10 quarters, which can be used to indicate short run responses. The variances do not change significantly with longer time periods. Δ represents first difference.

### 6.5 Robustness Model – Alternative Shadow Banking Measure (Annual Data)

This section presents results from using an alternative annual data set covering 2002-2016. In this analysis, data on shadow banking from the FSB is used for countries that participate in the FSB Shadow Bank Monitoring exercise. Again the variables are found to be integrated of order one $I(1)$. Therefore, the analysis is carried out in differences and the identification is as described before. The results presented in Figure 6.5 and 6.6 below do not deviate much from the results above. Only impulse response functions for two shocks are presented: (1) a positive shock in the policy rate and (2) a positive shock in shadow banking. Further, we also present FEVD for the estimated PVAR. The rest of the analysis and appropriate tests are

[13] Full results are provided in Appendix C.

provided in ***Appendix C*** which includes model stability test, lag selection criteria and unit root tests.

A shock in the policy rate induces a decline in shadow banking activity in the first period. however, this is reversed from the second period, resulting in an increase in shadow banking. Bank liquidity responds to a hike in the policy rate by a decline as expected. Thus, in the short run, monetary policy is potent for the sample under study. These findings are in line with our main results reported above and both theoretical and empirical literature (Kim et al., 2013, Adrian and Shin, 2009). There is indeed a linkage between the financial sector and monetary policy, confirming literature that suggest increased caution in monetary policy implementation. Monetary policy authorities in emerging economies need to take into account the size and role of the non-bank financial sector when conducting monetary policy analyses.

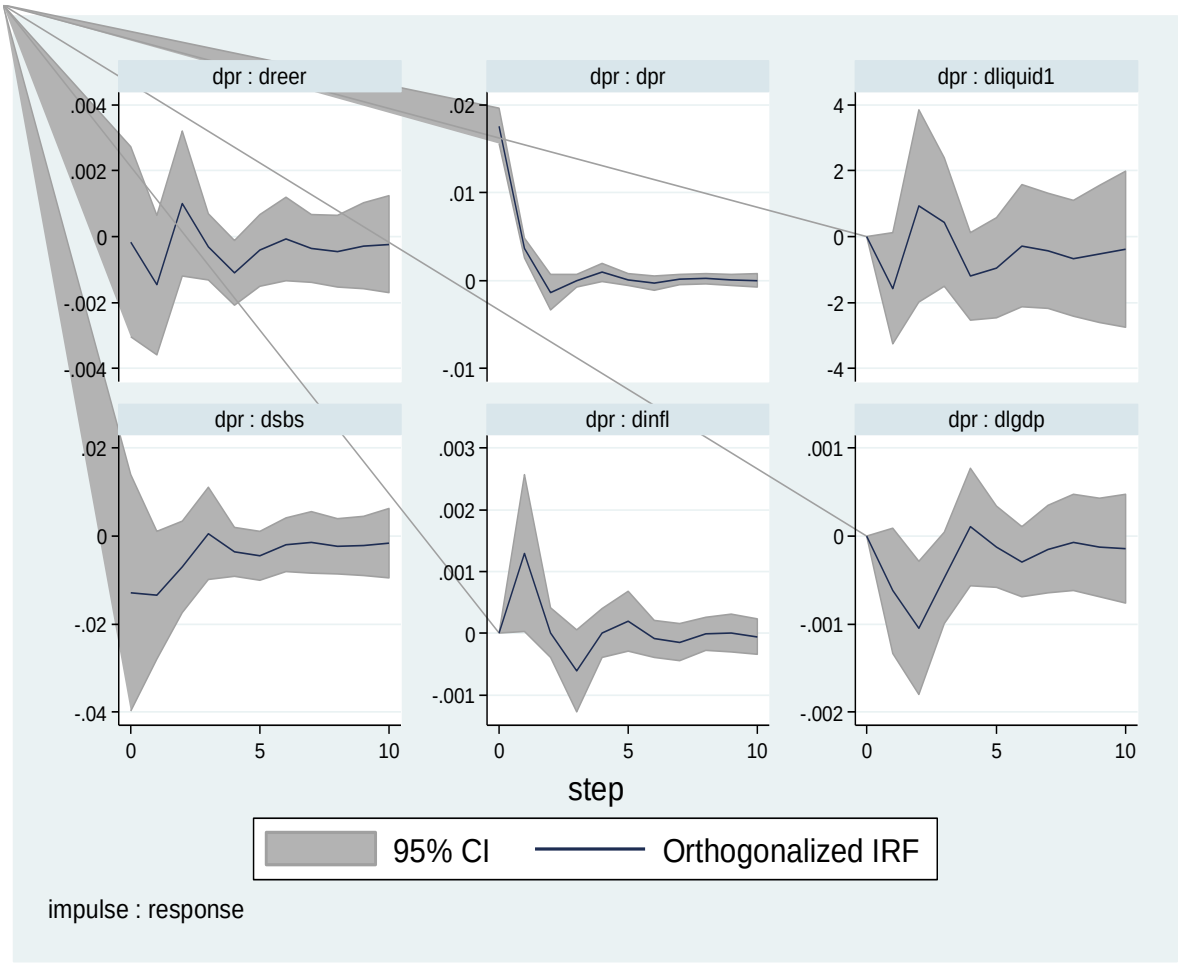


Figure 6.5. Response to a 1 Standard Deviation Innovation in Policy Rate – Model 2

A positive shock in shadow banking results in an increase in bank liquidity. The result implies that an increase in shadow bank assets increases bank liquidity. The linkages could be due to balance sheet linkages where banks are able to raise funds from shadow banks in form of liabilities or more directly through increased deposits on bank balance sheets from shadow banks. The impact of a shock in $sbs$ on the policy rate again portrays mean reversion around the zero x-axis. However, the initial response shows that monetary authorities hike the rate in response to a rise in shadow banking assets which could be interpreted to imply that authorities are willing to dampen market activities by raising rates. $GDP$ response to a shock in $sbs$ as expected showing that the financial services sector has an influence on variables in the short term. By construct, the linkages between the shadow banking sector and the real economy could point to the presence of a contagion channel confirming the decreases in output in major economies during the financial crisis.

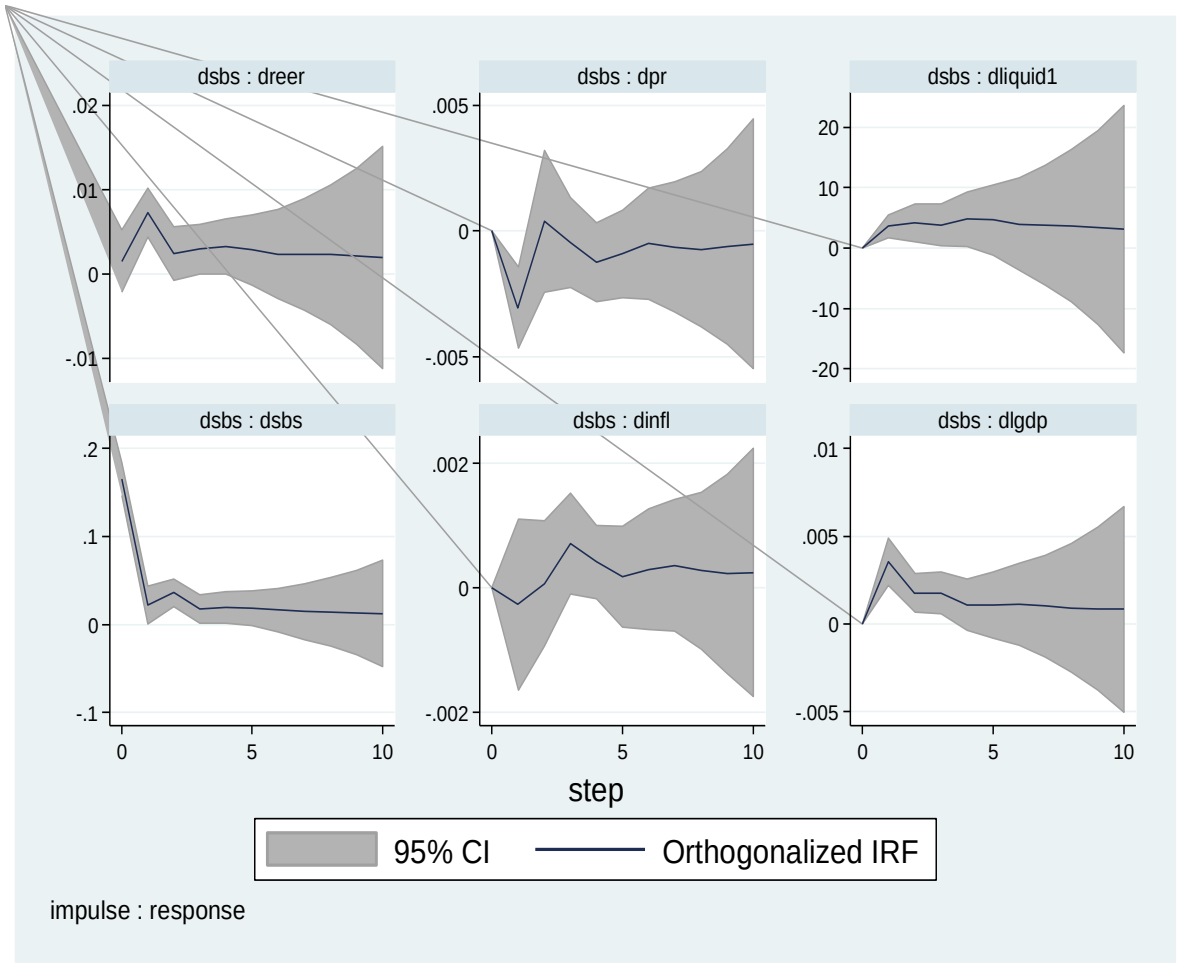


Figure 6.6. Response to a 1 Standard Deviation Innovation in Shadow Banking – model 2

Forecast error Variance decompositions are provided in Table C9 in the Appendix. The results show that the variability in the policy rate is mostly explained by the interest rate itself and the rate of inflation. The FEVD for $sbs$ show that the variability in shadow banking is explained by its own error terms, GDP and bank liquidity. Thus, shadow banking responds more to economic activity and also to variations in bank liquidity. The inflation rate and GDP also explain much of the variation in bank liquidity. The influence of sbs errors on the variation in pr and liquidity are low as reported in the main results although it is shown to increase over time.

### 6.6 Concluding Remarks

The present Chapter was aimed at understanding the linkages amongst shadow banking, bank liquidity and monetary policy in emerging countries. The results indicate a weak response of monetary policy to developments in the shadow banking sector. Using Granger causality tests, impulse response functions and FEVD, the study shows that monetary policy does not respond to a shock in shadow banking. On the contrary, the findings provide compelling evidence that shadow banking responds to changes in the monetary policy stance. These results point to the existence of a shadow banking channel of monetary policy as proffered by (Xiao, 2018). Increases in the policy rate result in an immediate decrease in shadow banking activity which is reversed in the 2$^{nd}$ period. We concluded that firstly, changes in the policy rates have a significant impact on shadow banking. Secondly, policy rate changes have a negative impact on shadow banking in emerging economies.

The response of bank liquidity to shocks in the policy rate is as expected from literature, with a hike in the policy rate dampening bank liquidity. The results indicate the potency of monetary policy in emerging economies. In addition, a shock to bank liquidity results in an increase in shadow banking. The economic significance of this finding is that strong linkages should exist between shadow banks and commercial banks for these results to be valid. Ideally, commercial banks in emerging economies are actively involved in shadow banking activities or possess strong linkages with the shadow banking sector. On the other hand, a shock in shadow banking is found to increase bank liquidity. Activities in the shadow banking sector result in increased liquidity of commercial banks. The result shows that banks are able

to raise more liquid liabilities from the shadow banking sector during periods of accelerated growth in the shadow banking sector.

The above findings have strong implications for policy analysis. They show that monetary policy has an influence on the financial sector and by extension on financial stability through its effect on shadow banking. Analysis and conduct of monetary policy that does not account for its influence on financial variables may lead to a less optimum policy stance being taken. Furthermore, central banks should consider the linkages between the shadow banking sector and commercial banks' liquidity to craft effective micro and macro prudential measures.

# CHAPTER 7

# SHADOW BANKING, RISK TAKING AND MONETARY POLICY IN EMERGING COUNTRIES: A PANEL COINTEGRATION APPROACH

This study investigates the nexus between shadow banking, risk taking and monetary policy in emerging countries. Recent studies have pointed out to the effect of shadow banking on the monetary policy transmission mechanism (Verona et al., 2013, Wang and Zhao, 2016, Xiao, 2018). The Chapter addresses objective 4 of the study. The rest of the Chapter is arranged as follows. Section 1 presents the background and justification for the study. Specifically, it illustrates the linkages between monetary policy and the financial sector. Section 2 provides empirical literature on the impact of monetary policy on shadow banking. Section 3 develops a theoretical framework for the determination of shadow banking using a loan demand and loan supply equilibrium framework. Section 4 discusses the methodology used in the analysis. The results of the analysis are reported in section 5. Section 6 provides some concluding remarks and proffer some policy recommendations.

## 7.1 Background

Smets (2014) argues that the degree of importance attached to financial sector developments is critical to the conduct of monetary policy and can determine whether monetary policy is effective or not. The burgeoning of literature focused on the relationship between the financial sector and the monetary sector in the aftermath of the GFC suggest the presence of additional channels of monetary policy through the financial sector (Gambacorta, 2009, Xiao, 2018). Indeed, financial dominance cannot be denied with the experience of the GFC. However, empirical support for these propositions is largely derived from advanced economies with little or no evidence from emerging economies and developing countries. This Chapter uses cross country data to investigate the role of shadow bank growth in the monetary policy transmission mechanism with a special focus on the role of bank risk.

Shadow banking played an important role in the demise of the financial services sector in 2007/2008. However, whilst other forms of shadow banking have been curbed, on aggregate, shadow banking activities have continued to increase even after the GFC (FSB, 2017). The FSB

(FSB, 2017) reports that shadow banking has increased to its pre-crises levels in the US and has also increased at a faster pace in emerging countries compared to advanced economies. Several observations have been made relating to the period after the GFC. Firstly, prudential regulation has become more stringent with the operationalisation of Basel III regulations in most countries. Basel III increases the capital thresholds for banks, introduced leverage requirements and increased risk coverage by incorporating both on and off-balance sheet exposures in analysis of bank risk. This has lead researchers to investigate what has become known as the bank capital channel of monetary policy (VanHoose, 2008, Borio and Zhu, 2012). Low capitalised banks are found to be mostly affected by changes in monetary policy rates, whilst banks with robust balance sheets have a moderating effect on the transmission.

In addition, the preceding growing interest has risen in analysing the role of non-bank financial institutions (NBFI) and the possible effects of risk perceptions in the transmission mechanism. Several studies have attempted to include the NBFI or shadow banks in modelling the business cycles (Bundesbank, 2014, Chen et al., 2017, Funke et al., 2015, Nelson et al., 2018). For instance, Funke et al. (2015) develop a model in which they analyse the interaction between monetary policy, commercial banking and shadow banking. Such studies depart from the pre-crisis consensus which advocates for separation of monetary policy and financial stability functions. They point to the presence of interlinkages between the monetary sector and financial sector which effectively imply that the financial sector conditions influence the effectiveness of monetary policy. In fact, Verona et al. (2013) argue that developments in the shadow banking sector should be incorporated in monetary policy decision making. Also, several studies have also pointed to the presence of a risk taking channel of monetary policy in which risk perceptions of economic agents can have an impact on the effectiveness of monetary policy (Borio and Zhu, 2012, Gambacorta, 2009). Reductions in interest rates for example could lead to an increase in risk taking as financial agents revise their risk perceptions downwards.

What is apparent from the original view on risk taking is that it impacts both banks and NBFI (Borio and Zhu, 2012). However, studies on bank risk taking fail to provide a link between bank risk taking and shadow banking, concentrating instead on bank risk taking as a separate channel without accounting for the role played by other sections of the financial sector

(Ashraf, 2017, Ashraf et al., 2016, De Nicolò et al., 2010, Gambacorta, 2009). The study argues that risk taking by commercial banks is directly linked to the non-bank financial sector. In essence, banks self-regulate to maintain acceptable risk levels by participating in financial markets, including their participation in the wholesale market. During times of low risk, banks increase participation in shadow banking activities, whereas, in times of high risk they withdraw funds from these market segments. By construct, the pass through effect of monetary policy to the financial sector will also depend on the risk perception of banks with high risk banks allowing for more effectiveness in transmission of monetary policy. Thus, as a secondary contribution, our paper is focused on defining the role of shadow banks within the risk taking channel of monetary policy.

The Chapter is mainly aimed at analysing the effect of monetary policy on shadow banking in emerging market economies within a single equation framework. The study adopts a loan demand and loan supply framework to develop a theoretical model in which shadow banking is determined by Gross Domestic Product (GDP), inflation and the policy rate. Our analysis is closely related to Barbu et al. (2016)'s study which focuses on analysing the determinants of shadow banking in the Euro. This study departs from their analysis by focusing on the interaction between shadow banking, monetary policy and bank risk. The study contributes to literature in two ways: firstly, it considers a panel of emerging economies which have seen a surge in shadow bank growth in the past two decades. The study analyses the impact of monetary policy on the growth of shadow banking in emerging economies. The second contribution comes from analysing the linkages between shadow banking and bank risk taking within the monetary policy transmission.

### 7.2 Literature Review

The growth of shadow banking both before and in the aftermath of the GFC has been of great concern to policy makers, with a number of papers committed to understanding of the nature of shadow banking. Literature on shadow banking has concentrated mainly on advanced economies and to a lesser extent emerging markets (Acharya et al., 2013, Adrian and Ashcraft, 2016). In addition, the measurement of shadow banking has also attracted attention. At the global/aggregated level, the Financial Stability Board (FSB) shadow bank monitoring programme provides a leading role in the monitoring and understanding of the nature and

growth of shadow banking. Other institutions that have contributed to this drive include the International monetary fund (IMF), the Bank for International Settlement (BIS) and the European Central Bank (ECB). At country levels, central banks have been at the fore front of the drive to quantify and classify shadow banks.

In theory, shadow banking is driven by a number of factors. Adrian and Ashcraft (2016) proffer three main reasons for shadow banking growth. Firstly, shadow banking is a form of regulatory arbitrage. This view contends that shadow banking activities are a response to stringent regulatory measures in the formal banking channel. Regulation can come in the form of micro-prudential requirements, monetary policy or macro-prudential policy. For instance, increased capital requirements of Basel III could have led to the up surge in shadow bank activity after the GFC. In other studies, tight monetary policy has been found to be a positive drive of shadow banking (Chen et al., 2017, Funke et al., 2015, Nelson et al., 2018). In both Sunderam (2014) and Adrian and Ashcraft (2016), shadow banking also arises due to innovations in money supply: where the need for money like instruments increases participation of financial agents in the use of new financial products and processes. According to Sunderam (2014), shadow banking acts as a substitute for bank deposits, a proposition which is also tested in this paper. The third reason for growth of shadow banking are problems relating to incomplete markets in financial markets. Asymmetric information in financial markets is described in Du et al. (2016) who notes that credit market imperfections and financial repression contribute to growth of shadow banking.

Empirical studies on shadow banking are still scarce, so also, literature on the determinants of shadow banking. This section reviews literature related to determination of aggregate shadow banking and literature on the determinants of individual shadow banking instruments or processes. Barbu et al. (2016) provides the first study that investigates the macroeconomic determinants of shadow banking. Their study analyses determinants of shadow banking for the Euro area using data on monetary funds as a proxy for shadow banking in a sample of 15 European countries. Their study establishes a negative relationship amongst economic growth, short term interest rates, money supply and shadow banking. As a corollary, contractionary monetary policy which increases the short term rates leads to a decrease in

shadow banking activity. Stock market developments and long term interest rates are found to be positively related to shadow banking.

Sunderam (2014) develops a model of money creation in which both bank deposits and shadow banking responds to money demand. His study suggests that both shadow bank liabilities and bank deposits respond to changes in money demand. This suggests that shadow banking is driven by the demand for money like claims. The implication of his results is that banks engage in shadow banking activities either to substitute or complement their deposits. The finding is supported by various studies which point to the importance of bank liquidity in driving shadow bank activities (Agostino and Mazzuca, 2011, Nachane and Ghosh, 2002). Shadow bank liabilities are therefore important in driving bank credit and have potential to stabilise banks' balance sheets in the event of increased bank withdrawals under a tight monetary policy stance.

Several studies investigate the determinants of securitisation activity (Farruggio and Uhde, 2015, Cardone-Riportella et al., 2010). Cardone-Riportella et al. (2010) use bank specific characteristics to investigate the drives of shadow banking in Spain. Their study employs both logistic regression and descriptive statistics to analyse the impact of different variables on securitisation. They do not establish the existence of the regulatory arbitrage hypothesis, rather they find that securitisation is driven by the search for liquidity and the profit incentive. Their findings are supported by Tang and Wang (2015) who find that shadow banks were more profitable than formal banks in China, concluding that banks engage in shadow banking activities to increase their earnings. Farruggio and Uhde (2015) investigate the determinants of securitisation for the Euro region. They use data from 1997 to 2010 for a sample of 75 banks divided into securitizing and non-securitising banks. They find market factors, bank specific factors and macroeconomic factors to influence securitisation decisions. Specifically, economic growth and high competition among banks are found to drive securitisation. Other factors include bank size, bank capitalisation, regulatory and institutional environment.

Panetta and Pozzolo (2018) use a sample covering 1991 to 2007 for bank from over a 100 countries. They employed the method of proportional hazard regression and find that banks securitise as a result of tight regulation, low operating expenditure and as a hedge against

both liquidity and credit risks. Their findings validate the mainstream belief that regulatory arbitrage is the main driver of shadow banking activities. In a related study, Nachane and Ghosh (2002) analyse the determinants of off-balance activities of banks and find that bank size and liquidity are important factors impacting the decision whether to securitise or not in India. Specifically, they argue that well capitalised and highly liquid banks have no incentive to engage in off-balance sheet activities. Bank size negatively influence securitisation decisions. Liquidity and tax incentives both have a negative influence on securitisation, showing that banks could be risk averse as they increase their pool of liquid liabilities.

In another study, Agostino and Mazzuca (2011) investigate the determinants of securitisation for Italian banks using data between 1996 and 2009. They employed panel data techniques in the form of pooled and random probit model. Their study finds that bank leverage, size and stock exchange listing positively impact the bank's willingness to securitise. Bank liquidity has a negative and significant effect on securitisation. Furthermore, they distinguish between non-performing securitisations and RMBS securitisations. They find that RMBS securitisations are driven by capital arbitrage and the need for funding. Non-performing securitisations are driven by the need for funding but not capital arbitrage. These findings point to the fact that Italian banks may have securitised to clean up their balance sheets, a reason that drove off-balance sheet activity prior to the GFC.

In another study, Duca (2014) analyses the drivers of shadow banking in both the short run and in the long run. He uses credit creation by money market funds as a proxy for shadow banking. His study uses single equation time series regression and finds that information costs and bank capital regulation have significant effects on the growth of shadow banking in the long run. An interesting finding from this study is that short run reductions in shadow banking followed increases in bank liquidity and increased risk in financial markets. Duca (2014) argues for vulnerability and pro-cyclical behaviour of shadow bank liabilities which have serious consequences for financial and macroeconomic stability.

The study also relates to empirical papers which link shadow banking to monetary policy. Shadow banking is found to reduce the effectiveness of monetary policy (Xiang and Qianglong, 2014, Xiao, 2018). Xiao (2018) documents a positive relationship between the fed

funds rate and growth in shadow bank assets for the US. Their study uses disaggregated data for five shadow bank entities including, broker dealers, finance companies, funding corporations, ABCP issuers, captive and other financial institutions. They argue that a positive shock on the monetary policy rate induces an increase in shadow bank deposit creation. Nelson et al. (2018) use an autoregressive model with time varying parameters to show that a contractionary monetary policy increases shadow banking growth but reduces growth of commercial bank assets.

### 7.3 Theoretical Model

The theoretical model developed here follows the work of Stein (1998), Ehrmann et al. (2001) and Abdul Karim et al. (2011). Stein (1998) develops a model in which banks pay a premium to access market finance in the event of a monetary policy shock. He provides a foundation for investigation of the bank lending channel of monetary policy by both Ehrmann et al. (2001) and Abdul Karim et al. (2011) for the Euro area and Malaysia respectively.

Assume the following identity for a bank balance sheet:

$$A_t = \mathcal{L}_t + K_t \tag{7.1}$$

Where $A_t$ are bank assets, $\mathcal{L}_t$ are bank liabilities and $K_t$ represents bank capital. In practice, bank assets comprise cash, loan portfolio, short term and long term securities and also property and equipment. However, the highest proportion of bank assets comprises loans $(L_i)$ and securities $(S_i)$. Following Abdul Karim et al. (2011), the simplified identity can be restated as follows;

$$L_i + S_i = D_i + K_i + SB_i \tag{7.2}$$

Where$D_i$ are deposits and $K_i$ is the bank's capital. $SB_i$ captures shadow bank liabilities which include financing from all other non-core bank activities. Unlike in Abdul Karim et al. (2011) where other sources of finance refer only to unsecured money market funding, the study recognises the importance of the wider wholesale markets, including the repo market which has been thriving in emerging countries like South Africa. In our model, shadow bank liabilities $SB_i$ can be substituted for bank deposits, $D_i$. In the event of a contractionary monetary policy shock, banks increase their use of market finance, resulting in increased $SB_i$.

In addition, shadow banking impact the left hand side of equation (2) through securities holdings. Thus, our model allows for securities holdings by banks to include both long term bonds and money market instruments and other short-term assets. The later represents banks' financing of shadow banks who are the issuers of such assets. $S_i$ can therefore be decomposed as follows:

$$S_i = S_L + S_s$$

Where $S_L$ represents long term securities. $S_s$ is the short term component of banks securities holdings and is linearly related to the bank short term lending rate, $r_l$. Thus, $S_s = \varphi r_l$ where $\varphi < 0$. Thus, in the short term an increase in the bank lending rate encourages bank loan supply at the same time reducing funds available for short-term shadow bank asset holdings. The equation above can be expressed as follows

$$S_i = S_0 - \varphi r_l \tag{7.3}$$

Where $S_0$ is a constant term accounting for long term and other securities. The level of bank deposits is also a decreasing function of the policy rate,

$$D_i = -\alpha r_p \tag{7.4}$$

Where $\alpha\ is\ negative\ for\ all\ i$. As in Abdul Karim et al. (2011), Capital is a function of loans:

$$K_i = kL_i \tag{7.5}$$

Bank loan demand is determined by output $y$, the price level $p$ and the interest on loans $r_l$ as in the following equation,

$$L_i^d = \beta_i y + \beta_2 p - \beta_3 r_l \tag{7.6}$$

The supply of bank loans is can be derived by combining equation (2) to (5) above and solving for $L_i$. Simple manipulation will result in the following:

$$L_i^s = D_i + K_i + SB_i - S_i \tag{7.7}$$

$$L_i^s = D_i + kL_i^s + SB_i - (\theta_0 - \theta_1 r_l)$$

$$L_i^s(1-k) = D_i + SB_i + \theta_1 r_l - \theta_0$$

$$L_i^s = \frac{D_i}{(1-k)} + \frac{SB_i}{(1-k)} + \frac{\theta_1 r_l}{(1-k)} - \frac{\theta_0}{(1-k)} \tag{7.8}$$

Let $\rho_i = \frac{1}{(1-k)}$ be the coefficient of $D_i$, $\gamma_i = \frac{1}{(1-k)}$ be the coefficient of $SB_i$ and $\frac{\theta_0}{(1-k)}$ be he coefficient of $r_l$, we can rewrite equation (8) above as:

$$L_i^S = \rho_i D_i + \gamma_i SB_i + \phi_i r_l - \phi_0 \tag{7.9}$$

Ehrmann et al. (2001) show that the effect of $D_i$ on loan supply can be decomposed into two factors, one that is independent of bank characteristics and another factor that is dependent on bank level characteristics such as capitalization, liquidity and size.

Let $x_i$ represent bank specific characteristics. In our model, a higher value for $x$ implies low risk for bank $i$. Banks with low risk have more access to market finance compared to high risk banks, thus, should have loan supply that is relatively inelastic to changes in the policy rate.

If $\rho_i$ is the coefficient of $D_i$, it can be decomposed into two parts, firstly $\rho_o$ which describes the influence of deposits on loan supply that is independent of bank characteristics and $\rho_1$ which describes the influence of deposits on loan supply that is dependent on individual bank characteristics as follows:

$$\rho_i = \rho_o - \rho_1 x_i$$

Equation (9) above becomes:

$$L_i^S = (\rho_o - \rho_1 x_i) D_i + \gamma_i SB_i + \phi_i r_l - \phi_0 \tag{7.10}$$

Equilibrating loan demand (equation 6) and loan supply (10), and substituting $D_i$ with $-\alpha r_p$, shadow banking is determined by output, inflation, the policy rate and bank lending as follows[14]:

$$SB_t = \psi_0 + \psi_1 y_t + \psi_2 p_t + \psi_3 r_{l_t} - \psi_4 r_{p_t} + \psi_5 x_i r_{p_t} + \omega_t \tag{7.11}$$

Where $\psi_0$ is a constant and parameters $\psi_1 - \psi_5$ account for the impact of each variable on shadow banking. The $\omega_t$ is an error term accounting for entity specific reasons for participation in shadow bank activities.

Equation $(7.11)$ shows that shadow banking is determined by output, the price level, the prevailing loan interest rates, bank liquidity and the monetary policy stance. Noteworthy is the positive relationship expected between monetary policy and shadow banking, where tight monetary policy increases shadow banking activity. The variable $x_i r_{p_t}$ is an interaction term capturing bank risk effects on monetary policy and shadow banking. Thus, the model predicts a decrease in shadow banking when with a contractionary monetary policy. However, the less risky, the bank, the lower the impact of monetary policy on shadow banking.

[14] Complete Mathematical derivation is available on request. The model is however simple to follow.

The impact of bank liquidity/deposits on shadow banking depends not only on the quantity of deposits but also on the extent to which a bank's deposit is influenced by its risk ratings. The higher the value of $x_i$, the smaller the effect of bank deposits on shadow banking. Two explanations for this proposition are suggested, firstly, that low risk well capitalized banks' shadow banking activities are less sensitive to monetary policy changes. Secondly, financial fragility increases the sensitivity of the financial sector to monetary policy changes. This proposition also suggests that the impact of monetary policy or bank liquidity on the financial sector is not symmetric, it should be low during normal times and high during times of instability.

### 7.4 Methodology

The methodology followed in this Chapter follows the literature on non-stationary panels (Baltagi, 2008). Ignoring the non-stationarity of panel data could lead to spurious regression, hence, unusable results. The present study employs data from 15 emerging economy countries for the period 2002 to 2017. The data is of annual frequency, implying 16 time-series observations for each variable per country. The total observations are therefore, 240. The data structure requires analysis that can explore both its cross sectional and its time series characteristics, thus, panel data methodologies are required.

#### 7.4.1 Panel Unit Root Tests

Panel unit root tests are important in determining the order of integration of the variables in a panel framework. Baltagi (2008) provides an outline of first generation and second generation panel unit root tests. This study adopts two main unit roots tests from Im et al. (2003) (IPS) and Pesaran (2007). IPS (2003) suggests a unit root tests that averages individual ADF type test statistics when the error term is serially correlated but with different correlation properties across units. The null hypothesis of this test ii that each panel has a unit root. The IPS t-bar statistic can be shown as follows:

$$\bar{t} = \frac{1}{N}\sum_{i=1}^{N} t_{\rho_i} \tag{7.15}$$

In equation $(7.15)$ above $t_{\rho_i}$ is the individual t-statistic for each panel. Critical values are provided by IPS (2003) for ADF regressions with no intercept and trend, intercept only regressions and also for regressions with intercept and trend.

Pesaran (2007) suggests a unit root test that is robust to the presence of cross sectional dependence. They propose a test in which the Dickey Fuller (DF) or Augmented Dickey Fuller (ADF) regressions are augmented using cross sectional averaged lags of levels and first differenced individual series. Thus, the unit root tests are based on cross-sectional augmented ADF statistics (CADF). Pesaran proposes two test statistics for the test, z-bar and t-bar. The null hypothesis tested is that series are integrated of order one $I(1)$. The test statistics are provided in (Pesaran, 2007) and the test is implemented in Stata using Stata command *multipurt.*

The sample properties of the test are analysed and the test are found to have satisfactory size and power in small samples. In addition, the test is more suitable for panel structures in which the number of cross sections, N is approximately equal to the time dimension, T. Hence, the test is more applicable to our data, which is a small sample and N is approximately equal to T.

### 7.4.2 Panel Cointegration

Panel cointegration tests are applied to ensure that variables are cointegrated before carrying out regression estimations. The most popular cointegration tests are Kao (1999) cointegration test and Pedroni (2004)'s test. Due to the short time series dimension of our data, the study employs Kao (1999)'s cointegration test which is more suitable for shorter macro panels. Kao proposes DF and ADF tests for unit roots for the residuals in a panel regression as follows:

$$y_{it} = x'_{it} + z'_{it}\theta + \epsilon_{it} \tag{7.16}$$

Where the variables $y_{it}$ and $x_{it}$ are integrated of order one and not cointegrated. If $z_{it}$ represents unobservable fixed effects,, the DF-type tests can be run on fixed effects residuals:

$$\hat{\epsilon} = \rho\hat{\epsilon}_{i,t-1} + \vartheta_{it} \tag{7.17}$$

Thus, setting $H_o: \rho = 1$, one can test the null hypothesis of no cointegration. Baltagi (2008) shows that the asymptotic distributions of the ADF test statistic converges to the standard normal distribution.

### 7.4.3 Non-Stationary Estimators in Panel Data

Pooled OLS estimates for cointegrated variables are biased due to the presence of endogeneity and serial correlation. To mitigate this short coming, the study employs non-stationary panel methods for parameter estimation in the form of the panel Fully Modified OLS and panel Dynamic OLS methods.

**Panel FMOLS**

The panel FMOLS of Pedroni (2000) as well as Philips and Moon (1999) follow from the time series version FMOLS estimator of Philips and Hansen (1990). The estimator corrects for bias and endogeneity in the OLS estimator using non-parametric methods.

$$\hat{\beta}_{FM} = \left[\sum_{i=1}^{N}\sum_{t=1}^{T}(x_{it} - \bar{x}_i)(x_{it} - \bar{x}_i)'\right]^{-1} \times \left[\sum_{i=1}^{N}\sum_{t=1}^{T}(x_{it} - \bar{x}_i)\hat{y}_{it}^{+} - T\hat{\Delta}_{\varepsilon u}^{+}\right] \tag{7.12}$$

Where $\hat{y}_{it}^{+}$ is the endogeneity correction term and $\hat{\Delta}_{\varepsilon u}^{+}$ is the serial correlation correction term.

**Panel DOLS**

The panel DOLS method of Kao and Chiang (2000) follows from the time series DOLS methodology of Saikkonen (1991) which adds lags and leads of differenced independent variables to correct for bias and endogeneity. Consider the following representation for the panel DOLS estimation;

$$y_{it} = \alpha_i + x_{it}\beta + \sum_{j=-\theta}^{\theta_2}\delta_j \Delta x_{ij} + \mu_i + \varepsilon_{it} \tag{7.13}$$

Where $\delta_j$ is the parameter for the leads and lags of the differenced explanatory variables. The DOLS estimator $\hat{\beta}_D$ can be estimated by running the above regression. As illustrated in Bangake and Eggoh (2011) below is the coefficient of the DOLS estimator.

$$\hat{\beta}_D = \sum_{i=1}^{N}\left(\sum_{t=1}^{T} Z_{it}Z_{it}^{"}\right)^{-1}\left(\sum_{t=1}^{T} Z_{it}\hat{y}_{it}^{+}\right) \tag{7.14}$$

Where $Z_{it}$ is a $2(\mathrm{q}+1)\ \times 1$ vector of regressors including lags and leads of first differences of the regressors.

Kao and Chiang (2000) show that the limiting distribution of the DOLS estimator is the same as the FMOLS estimator. However, through Monte Carlo simulation, they find that the DOLS estimate is superior to both the OLS and FMOLS estimates in terms of bias correction. In addition, they also show that bias in both the FMOLS and the DOLS estimators is reduced as the panel time series dimension grows compared to short T panels. Kao and Chiang also find that the cross sectional dimension has an effect on the biases of all the three estimators in small panels between 1 and 20 cross sections, suggesting that bigger samples could assist in reducing estimation bias.

### 7.4.4 Empirical Model

The model estimated here derives from the theoretical model in section 7.3 above. However, the basic model is augmented with other variables from theory and the estimation employs bank credit data instead of the lending rate. Reinstated below is the basic model of shadow bank determination:

$$SBS_{it} = \psi_0 + \psi_1 lgdp_{it} + \psi_2 infl_{it} - \psi_3 bcred_{it} - \psi_4 pr_{pit} + \psi_5 x_{it} pr_{pit} + \omega_{it} \qquad (7.18)$$

Where $SB_{it}$ is shadow banking, $lgdp_{it}$ is output,$infl_{it}$ is the price level, $bcred_{it}$ is the bank credit and $pr_{pit}$ is the policy rate of the central bank. $\omega_t$ is an error term assumed to be independently and identically distributed (iid). The $\psi_1 - \psi_5$ are parameters to be estimated. For the purpose of this study, two basic models are estimated, firstly bank lending rate is replaced with bank credit and the effect of the policy rate on shadow banking is analysed when controlling for bank credit. In the second model, the study also controls for bank liquidity and stock market prices. In both estimations, the findings show that the policy rate has a negative influence on shadow banking. Furthermore, to control for the effect of bank risk, an interaction term between the policy rate and the bank zscore ($prrisk = x_{it} pr_{pit}$) is used.

### 7.4.5 Data and Variable Description

Data is obtained from various sources including the Financial Stability Board, the Bank for International Settlement, the World Bank data portal and IMF International financial statistics. Data used is of annual frequency covering the period 2002 to 2017. The period sample is constrained by availability of shadow banking data from the FSB which only starts in 2002. Preliminary data transformations in the form of log linear transformations are done for data that is not in percentages in its original form. The study uses a sample of 14 emerging economy countries plus Singapore, which the MSCI classifies as an advanced economy. The same sample is used in previous Chapters and includes countries tabulated in Table 7.1 below.

Table 7.1. List of Countries included in the Sample

| | | | | |
|---|---|---|---|---|
| Argentina | China | Mexico | Saudi Arabia | Singapore |
| Brazil | Indonesia | Philippines | Turkey | Thailand |
| Chile | Malaysia | South Africa | Peru | India |

Equation $(7.18)$ shows that shadow banking determined by output, inflation rate, the policy rate, deposit rate, bank risk and also the level of bank credit. In Table 7.2, a concise description of all variables used in the model and their economic implications is provided.

Table 7.2. Summarised Description of Variables used in Estimating the Model

| **Variable** | **Symbol** | **Description** | ***A priori* sign** |
|---|---|---|---|
| Shadow banking growth | sbs | Log of shadow bank assets | |
| Output | lgdp | Log of real GDP | Positive |
| Inflation | Infl | Log of CPI index | Positive |
| Policy rate | Pr | Central bank policy rate | Positive |
| Exchange rate | Reer | Real effective exchange rate | Negative |
| Bank liquidity | liquidity | Bank liquidity proxy is M1 | Negative |
| Stock markets | Ep | Log of Equity price index for each country | Positive |
| Bank credit | Bcred | Bank credit as a percentage of GDP | Negative |

### 7.5 Results Discussion

This section presents the results of the estimated model. For robustness purposes, the study reports estimates from a number of estimation techniques including OLS pooled regression, random effects method, fully modified OLS and the Dynamic OLS methods. Of interest is the persistence in the signs of the coefficients throughout all the estimated models. However, before the models were estimated, preliminary data transformations and unit root tests are conducted to avoid reporting spurious regression results. Thus, descriptive statistics for each variable, stationarity tests and cointegration tests are reported first before carrying out the regressions. We take logarithms of observations collected in amounts and indexes such as real GDP and the CPI index to remove heteroscedasticity from the data and also avoid outliers. All variables therefore enter the model either as percentages or logarithms and coefficients can be interpreted as elasticities.

#### 7.5.1 Descriptive Statistics

Descriptive statistics are provided in Table 7.3 below.

Table 7.3. Descriptive Statistics of Variables

| | LZSCORE | PR | BCRED | LIQUID | LGDP | INFL | SBS | REER | EP |
|---|---|---|---|---|---|---|---|---|---|
| Observations | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 | 240 |
| Mean | 2.4757 | 0.064458 | 0.584623 | 0.755743 | 11.72219 | 1.976989 | 10.75735 | 1.977388 | 1.879463 |
| Median | 2.6181 | 0.052800 | 0.489375 | 0.682540 | 11.61929 | 1.988753 | 10.56853 | 1.983032 | 1.927905 |
| Maximum | 3.6898 | 0.440833 | 1.568093 | 2.084584 | 12.97796 | 2.197073 | 12.98063 | 2.117535 | 2.749910 |
| Minimum | 1.1537 | 0.000137 | 0.104169 | 0.234937 | 10.95922 | 1.663666 | 8.771751 | 1.742901 | 0.877676 |
| Std. Dev. | 0.5405 | 0.062054 | 0.374864 | 0.412875 | 0.440320 | 0.094933 | 0.697096 | 0.053967 | 0.289955 |
| Skewness | -0.3627 | 3.097254 | 0.601379 | 0.900053 | 0.741855 | -0.405453 | 0.506744 | -0.713924 | -0.716589 |
| Kurtosis | 2.3157 | 15.84100 | 2.112321 | 3.180650 | 3.021110 | 3.173835 | 3.489434 | 5.270703 | 4.256571 |
| Jarque-Bera | 9.2830 | 1897.123 | 20.85627 | 30.54815 | 20.55053 | 6.419346 | 11.82255 | 67.15187 | 33.90771 |
| Probability | 0.0096 | 0.000000 | 0.000030 | 0.000000 | 0.000034 | 0.040370 | 0.002709 | 0.000000 | 0.000000 |
| Sum | 554.55 | 14.43856 | 130.9556 | 169.2865 | 2625.770 | 442.8455 | 2409.647 | 442.9348 | 420.9997 |
| Sum Sq. Dev. | 65.14974 | 0.858701 | 31.33659 | 38.01385 | 43.23560 | 2.009732 | 108.3653 | 0.649481 | 18.74851 |

Table 7.3 detail the statistical characteristics of the data on an individual series bases which is imperative for understanding regression results (Agung, 2011) . Of importance is the distribution of the variables as shown by the range and their standard deviations. Shorter ranges in the series should indicate the absents of extreme values in the data. Extreme values or outliers can raise problems such as heteroscedasticity and could also influence the outcome of the regression. In addition, note that the variables resemble non-normality as reported by the significant Jarque-Bera test statistics (JB).

### 7.5.2 Correlation Matrix

Table 7.4 presents the correlation matrix together with the associated t-statistics for each correlation coefficient. Correlation coefficients are important for avoidance of multi-collinearity in regression models. A correlation coefficient of 0.8 or above could signify the presence of multi-collinearity (Maddala and Lahiri, 2009). As shown below, no variables resemble very high correlation between themselves. All variables can therefore be included in running the different regression models. In addition, one can infer expected signs of regression coefficients from the correlations between the dependent variable and the independent variables. For instance, sbs and GDP have a positive correlation, implying that the variables move in the same direction. However, since correlation does not imply causation nor give the direction of the effect, it is proper to conduct regression analysis in which a cause and effect analysis can be done.

Table 7.4. Correlation Matrix

| Correlation<br>t-Statistic | ZSCORE | SBS | REER | PR | LGDP | INFL | BCRED1C |
|---|---|---|---|---|---|---|---|
| ZSCORE | 1.000000<br>----- | | | | | | |
| SBS | 0.280639<br>(4.1659) | 1.000000<br>----- | | | | | |
| REER | 0.107830<br>(1.5453) | 0.111877<br>(1.6040) | 1.000000<br>----- | | | | |
| PR | -0.171449<br>(-2.4794) | -0.060009<br>(-0.8565) | -0.372073<br>(-5.7112) | 1.000000<br>----- | | | |
| LGDP | 0.143627<br>(2.0678) | 0.648296<br>(12.131) | -0.057313<br>(-0.8179) | 0.264873<br>(3.9136) | 1.000000<br>----- | | |
| INFL | 0.097392<br>(1.3942) | 0.506339<br>(8.3659) | 0.169220<br>(2.4462) | -0.348683<br>(-5.3006) | 0.166871<br>(2.4113) | 1.000000<br>----- | |
| BCRED1C | 0.259968<br>(3.8358) | 0.278413<br>(4.1300) | 0.101234<br>(1.4498) | -0.373502<br>(-5.7367) | 0.081103<br>(1.1593) | 0.304939<br>(4.5619) | 1.000000<br>----- |

### 7.5.3 Panel Unit Root Tests

Various unit root tests were undertaken to ascertain the level of integration in the variables. Our findings point to mixed results from the different unit roots tests as pointed out in (Baltagi, 2008). However, the general conclusion derived points to the presence of $\mathrm{I}(1)$ level of integration for all the variables. In Table 7.5, results from two tests conducted are presented, IPS (2003)'s unit root test and Pesaran (2007) unit root test.

Table 7.5. IPS (2004) and Pesaran (2007) Panel Unit Root Tests Results

| **Variable** | **IPS (2003) unit root test** | | **Pesaran (2007) unit root test** | | **Conclusion** |
|---|---|---|---|---|---|
| | Test stat | p-value | Zt-bar stat | P-value | |
| $lgdp$ | 2.196 | 0.986 | 5.181 | 1.000 | Non-stationary |
| $infl$ | 0.231 | 0.591 | -1.136 | 0.128 | Non-stationary |
| $reer$ | -0.181 | 0.427 | -0.404 | 0.343 | Non-stationary |
| $pr$ | -1.325* | 0.092 | -0.849 | 0.198 | Non-stationary |
| $sbs$ | -0.372 | 0.355 | 1.151 | 0.875 | Non-stationary |
| $bcred$ | -0.607 | 0.271 | 0.926 | 0.823 | Non-stationary |
| $zscore$ | -0.718 | 0.236 | -2.162** | 0.015 | Non-stationary |
| $liquid1$ | 0.513 | 0.696 | 2.212 | 0.987 | Non-stationary |
| $\Delta lgdp$ | -1.541* | 0.061 | -2.199** | 0.014 | Stationary |
| $\Delta infl$ | -2.335*** | 0.009 | -3.455*** | 0.000 | Stationary |
| $\Delta reer$ | -4.159*** | 0.000 | -2.498*** | 0.000 | Stationary |
| $\Delta pr$ | -2.926*** | 0.001 | -2.873*** | 0.002 | Stationary |
| $\Delta sbs$ | -3.854*** | 0.000 | -6.812*** | 0.006 | Stationary |
| $\Delta bcred$ | -1.719** | 0.042 | -2.751*** | 0.003 | stationary |
| $\Delta zscore$ | -5.001*** | 0.000 | -6.174*** | 0.000 | Stationary |
| $\Delta liquid1$ | -1.831** | 0.033 | -2.309*** | 0.010 | Stationary |

***, ** and * represents 1%, 5% and 10% level of significance respectively. The IPS test includes a trend and intercept whereas Pesaran' s (2007) test includes a trend.

### 7.5.4 Panel Cointegration Test

Table 7.6 presents results for panel cointegration test. Due to the small sample nature of the panel, the study considered Kao (1999)'s residual based cointegration test. The null hypothesis of the test is that there is no cointegration against the alternative hypothesis that at least one panel is cointegrated. From the table, it is evident that the ADF statistic is significant at 1% level, implying the null hypothesis of no cointegration is rejected and the conclusion is that the series are cointegrated. The presence of cointegration implies that a long-run relationship exists amongst the variables. Bispham (2005) indicates that using OLS regressions on non-stationary cointegrated series will result in spurious regression. To avoid this pitfall, firstly the pooled OLS and random effects models are estimated using differenced series. In the main estimations, cointegration estimation methods are used which provide long-run parameters for the regression equation.

Table 7.6. Kao Residual based Cointegration Test

Null Hypothesis: No cointegration

| | t-Statistic | Prob. |
|---|---|---|
| ADF | -2.766150 | 0.0028 |

### 7.5.5 Estimation Results

In this section, estimation results from panel regressions are presented. Due to the presence of unit roots in our sample, the pooled Ordinary Least Squares (OLS) and random effects (RE) models are estimated in differences to avoid spurious regression. Spurious regression in panel data can occur when data is non-stationary. In addition, tests for heteroscedasticity and serial correlation and cross-sectional dependence were conducted. The results of the basic random effects and fixed effects models show that heteroscedasticity is present. The study used the modified Wald test for group wise heteroscedasticity. The final model controls for heteroscedasticity and serial correlation by using clustered and robust standard errors. Cross sectional dependence test due to Pesaran (2004a) is used to test for cross sectional dependence and the results show that there is no cross sectional dependence in the model. The results are presented in Table 7.7 below.

Table 7.7. Pesaran' s Cross Sectional Dependence Test

| Pesaran' s cross sectional dependence Test<br>Null Hypothesis: residuals are correlated | | |
|---|---|---|
| | t-Statistic | Prob. |
| CSD | -1.401 | 0.1612 |

The regression results are presented in Table 7.8 and 7.9 below. In Table 7.8, the OLS and random effects results from differenced data are presented. In each case, the first regression shows the impact of the central bank policy rate and other variables on shadow banking growth. The second regression contains an interaction term between the policy rate $pr$ and bank risk as measured by the bank zscore ($lzscore$). We interpret the differenced estimation results to indicate short-run effects of each explanatory variable on shadow banking.

Table 7.8. Estimation Results – Static Model: Short-run Coefficients

Dependent variable: $\Delta sbs$

| *Independent variables* | *Coefficients* | | | |
|---|---|---|---|---|
| | Pooled OLS | Pooled OLS | Random Effects | Random Effects |
| | (1) | (2) | (1) | (2) |
| $\Delta lgdp$ | 2.91*** | 2.81*** | 2.82*** | 2.74*** |
| | [3.46] | [3.17] | [3.17] | [3.03] |
| $\Delta infl$ | -1.10 | -1.41* | -1.43* | -1.62** |
| | [-1.48] | [-1.84] | [-1.81] | [-2.04] |
| $\Delta reer$ | 0.93** | 1.03** | 0.99** | 1.09** |
| | [2.14] | [2.29] | [2.30] | [2.40] |
| $\Delta pr$ | -0.67** | -1.89*** | -0.63** | -1.88*** |
| | [-2.03] | [-3.17] | [-1.95] | [-3.17] |
| $\Delta prrisk$ | | 0.18** | | 0.19** |
| | | [2.43] | | [2.47] |
| $\Delta bcred$ | -0.00034 | -0.0002 | -0.0003 | -0.0003 |
| | [-1.19] | [-1.00] | [-1.33] | [-1.08] |

Note: ***, **, * represents significant at 1%, 5% and 10% levels respectively. Robust and clustered standard errors are used in the random effects estimation to remove heteroscedasticity and serial correlation. Thus the values in parenthesis t-stats for OLS regression and z-stats for random effects model. Δ refers to the first difference of the variable.

The results shown above show that shadow bank growth is determined by GDP, inflation, the real exchange rate, the central bank policy rate and an interaction term between the policy rate and bank risk. Specifically, there is a positive relationship between shadow banking and GDP and the real exchange rate. Our variable of interest, the policy rate affects shadow bank negatively. In essence, a contractionary monetary policy stance results in reduced shadow

banking activity. However, interacting the policy rate with bank risk shows that the higher the risk in the banking system, the higher the impact of monetary policy on the shadow banking sector.

Due to the presence of cointegration as pointed out by Kao's cointegration test, the study employs panel cointegration techniques to estimate long run coefficients. The results for both panel Dynamic Ordinary Least Squares and panel Fully Modifies Ordinary least squares are presented in Table 7.9. Our results are distinguished by the decision to control for either bank credit or bank liquidity. The second regression in each case includes an interaction term between the policy rate and the bank zscore, a measure of bank risk. Other control variables are used to improve the estimated models.

Table 7.9. Estimation Results – Cointegrated Techniques: Long-run Coefficients

| | Dependent variable: $sbs$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| *Independent variables* | *Coefficients* | | | | | | | |
| | PFMOLS (1) | PFMOLS (2) | PFMOLS (3) | PFMOLS (4) | PDOLS (5) | PDOLS (6) | PDOLS (7) | PDOLS (8) |
| $lgdp$ | 0.85*** | 0.74*** | 0.79*** | 0.71*** | 0.72*** | 0.68 | 0.73 | 0.81 |
| | (8.21) | (6.76) | (50.79) | (39.10) | (12.9) | (0.59) | (0.75) | (0.70) |
| $infl$ | 1.50*** | 1.75*** | 1.63*** | 1.79*** | 1.28*** | 6.62*** | 5.48*** | 4.93*** |
| | (3.29) | (3.83;) | (24.19) | (3.73) | (4.56) | (4.77) | (4.24) | (3.81) |
| $reer$ | -1.22*** | -0.87 | -1.06*** | -0.70*** | | 0.48 | | |
| | (-2.06) | (-1.48) | (-12.19) | (-7.24) | | (0.35) | | |
| $pr$ | -1.12 | -3.00*** | -0.37** | -2.76*** | -2.17*** | -3.84** | -6.04*** | -6.02*** |
| | (-1.03) | (-2.16) | (--2.41) | (-12.04) | (-3.53) | (-2.20) | (-3.73) | (-3.57) |
| $pr * risk$ | | 0.26 | | 0.26*** | | 0.44* | 0.49** | 0.38* |
| | | (2.23) | | (13.81) | | (1.87) | (2.38 | (1.72) |
| $bcred$ | 0.41*** | 0.41*** | | | | | 0.001 | |
| | (3.17) | (3.27) | | | | | (1.33) | |
| $lzscore$ | 0.17*** | | 0.02*** | | | | | |
| | (2.08) | | (13.31) | | | | | |
| $ep$ | | | | | | -0.92*** | -1.10*** | -1.03*** |
| | | | | | | (-2.97) | (-3.77) | (-3.39) |
| $liquidity$ | | | 0.002*** | 0.003*** | | | | 0.001 |
| | | | (15.24) | (15.94) | | | | (0.68) |

***, ** and * represent 1%, 5% and 10% significance level respectively. The lags and leads (nlag/nleads) for the DOLS method are set at (1/1) for models (5) and (6), and (3/1) for the models (7) and (8) respectively. The PFMOLS uses the pooled estimator for all models. Results are robust to using the weighted estimator, which uses cross section specific long run covariances to reweight the data before carrying out the estimations.

The results in Table 7.8 and 7.9 show that there is a negative and significant relationship between the central bank policy rate $(pr)$ and shadow bank growth $(sbs)$ . Thus, both in the short-run and long-run, the policy rate has a negative effect on shadow banking. Specifically, model 3 in Table 7.9 shows that a 1% increase in the policy rate results in a 0.37% decrease in shadow banking. The sign is persistent in all the estimated models although it is not significant in model (1) of Table 7.9. The conclusion derived from this result is that monetary contraction through an increase in the policy rate is negatively related to shadow banking. Shadow banking in emerging economies decreases with a contraction in money supply derived from an interest rate hike. These results contradict findings from previous studies which argue for an increase in shadow bank activity after monetary contraction (Nelson et al., 2018, Xiang and Qianglong, 2014). Our results show that contractionary monetary policy reduces shadow bank growth. This may imply very close interconnectedness between shadow banking and commercial banks in emerging economies compared to advanced economies. Therefore, the impact of monetary policy on shadow banking in emerging countries is different from the experiences in developed countries.

The results also provide insight into the relationship amongst monetary policy, bank risk and shadow banking. Firstly, bank risk is controlled for using the logarithm of the bank zscore index for each country in our FMOLS regression. Bank zscore is found to be positively associated with shadow banking, implying that an improvement in bank risk results in increased shadow banking activity. This can be interpreted to confirm the proposition by Borio and Zhu (2012) who suggested that reduced risk perceptions by banks encouraged them to take higher risk. In relating interest rates to risk taking by financial agents, Borio and Zhu (2012) argue that lower interest rates may signal low risk exposure and make banks to increase their risk appetite, consequently increasing their participation in high risk activities. In line with this proposition, our results suggest that banks and other financial agents increase participation in high risk shadow banking activities when bank risk is perceived to be low.

Further, an interaction term between the policy rate and the bank z-score is used to analyse the effect of changes in bank risk on the impact of monetary policy on shadow banking. Our results in both Table 7.8 and 7.9 show persistent positive sign on the interaction term. An increase in the bank zscore which shows improvement in bank risk in a given country, results

in a decrease in the negative impact of the $pr$ on $sbs$. The impact of monetary policy on shadow banking becomes less pronounced when bank risk is low. Our results support the proposition of Xiao (2018) who suggests that monetary policy effects work more effectively through high risk entities. Thus, high risk banks pass-through more policy rate changes to the shadow banking sector compared to low risk commercial banks. By construct, we also argue that the effects of monetary policy on the financial sector is low during periods of financial stability. Thus, several studies relating monetary policy to financial stability during the GFC could have been biased as a result of increased instability during the GFC which increased the impact of monetary policy on financial sector variables.

Our main result agrees with our findings in Chapter 6 in which we find that bank liquidity and shadow banking in emerging countries are complements. Table 7.9 shows that an increase in liquidity (money supply) results in an increase in shadow banking in the short-run. thus ideally, a negative shock in the policy rate which raises bank liquidity results in more shadow banking activities. The results dispute the proposition by Sunderam (2014) that shadow banking is a substitute for bank deposits. We re-instate here our strong inclination towards the intuition that banks in emerging market economies are more connected to shadow banking activities and are the drivers of shadow bank activities compared to their advanced economies counterparts. Thus, in times of monetary expansion, bank channel more funds to the shadow banking system.

Another interesting result as shown in Table 7.8 relates to the negative sign on the coefficient of $\Delta bcred$. The implication is that in the short term there is a trade-off between shadow banking and bank credit, results that support findings in Chapter 4 of this thesis. It is intuitive that banks in emerging market economies face the decision of whether to channel resources to their normal credit creation business or re-direct resources towards shadow banking activities. Further, the finding supports Mazelis (2014) and Xiao (2018) who also find that shadow bank credit moves in opposite direction to bank credit. In the long-term however, $bcred$ shows a positive association with $sbs$. This may show that in general, the growth in bank assets over time is positively associated with the growth in shadow banking activities. In other words, the larger the banking system, the larger the shadow bank sector.

Other variables take expected signs with both inflation and GDP having significant and positive coefficients in the long-run. whilst inflation shows a negative association with $sbs$ in the short-run, the results are not strongly significant, demonstrating a weak short-run relationship between the two. In the long-run, the size of the economy as measured by GDP significantly influences the growth of shadow banking. This relationship could be driven by both demand for loan or supply side factors such as the search for higher returns by investors leading to increased supply of funds to shadow banks. Equity prices also have a negative impact on shadow banking in the long term, showing that higher returns in alternative markets reduce finances that are channelled through the shadow banking system. This may also confirm the proposition that unregulated finance in the form of shadow banking is negatively related to regulated finance whether it be from formal banking institution or regulated market exchanges.

In addition, bank risk $(zscore)$ is shown to have positive sign in Table 7.9. As shown already, an increase in the zscore indicates lowering of bank risk. Therefore, an improvement in bank risk tends to increase shadow banking. The result is an important contribution to the burgeoning literature on bank risk taking. Given that shadow bank activities are highly risky (Pozsar et al., 2013), the lowering of risk could result in downward revision of risk perceptions, and increased uptake of high risk activities in the shadow banking sector. Borio and Zhu (2012) show that low interest rate can potentially impact risk perceptions and lead to high risk taking by financial market participants. Our finding suggests banks engage in high risk taking activities through participation in shadow banking activities. Furthermore, as noted above, riskiness has an effect on the shadow banking channel of monetary policy suggested by Xiao (2018).

### 7.6 Concluding Remarks

This Chapter presented an empirical analysis of the impact of monetary policy on shadow banking in emerging economies. Controlling for bank credit, liquidity, risk and macroeconomic factors, the study establishes a negative impact of monetary policy on shadow banking. Specifically, monetary policy contraction decreases shadow bank growth suggesting the dominance of banks in shadow banking activities of emerging countries. Contrary to previous findings for the US and China which suggested that monetary policy contraction encourages

shadow banking, this study suggests that effective bank regulation and monitoring of risk is important in the drive to contain shadow banking activities.

The study also investigates the influence of bank risk on the monetary policy effects to shadow banking. The study finds improvement in bank stability to be important in limiting the negative impact of monetary policy on shadow banking. This results add more light on bank risk taking, suggesting that banks engage in higher risk transactions through shadow banking activities. Thus, the shadow banking sector is an important component of the bank risk taking channel of monetary policy.

In addition, the study reveals the short term behaviour of the trade-off between bank credit and shadow banking. Thus, the proposition for a negative relationship between the two variables only holds in the short term. In the long term, bank credit increases together with shadow banking. The implication could be the need to develop both short-run and long-run policy towards curbing shadow banking as larger banking systems will end to have larger shadow banking systems as well.

Our results have other important implications for regulation, pointing firstly to the need to consider risk factors in analysing monetary policy effectiveness. Pass-through strength of monetary policy rates through the non-bank financial sector and the banking sector is affected by the resilience of the financial sector. The impacts of monetary changes are most felt in countries with a relatively unstable financial sector, leaving room for investigation of the role of other channels of monetary policy such as the exchange rate and the traditional interest rate channel.

# CHAPTER 8

# SHADOW FINANCIAL SERVICES AND FIRM PERFORMANCE IN SOUTH AFRICA

The last two decades have seen an upsurge in shadow banking activities in both advanced and emerging economies. Shadow banks have therefore become an important part of financial markets due to their credit creation and capital allocation roles. This study investigates the impact of shadow banking activities on firm profitability in South Africa. The Chapter proceeds as follows: Section 1 provides the background to the study and spells out the problem statement. In Section 2, the study highlights the growth of shadow banking in South Africa. Section 3 provides empirical literature on the determinants of firm profitability and Section 4 illustrates theoretically linkages between shadow banking and firm profitability. Measures of firm profitability are also reviewed in Section 5. Sections 6 and 7 provide the methodology used in the study and estimation results respectively. Concluding remarks are given in Section 8.

## 8.1 Background

The main argument for proliferation and growth of shadow financial services is the idea that financial innovation promotes economic activity by enabling economic agents to ameliorate financial market imperfections (Henderson and Pearson, 2011, FSB, 2013). Any kind of financial innovation should therefore improve efficiency and effectiveness of financial markets. Shadow banking[15] literature has shown that capital can be sourced at a lower cost and efficiently from shadow banks (Tang and Wang, 2015). By construct, firms should find capital from shadow banking markets relatively cheaper compared to sourcing capital from main stream capital markets and banks. Theoretically, this provides an alternative capital source to the two most reviewed in literature, mainly bank based and market based capital (Boot and Marinč, 2010). Following this argument, one is persuaded to conclude that firm's profitability increases with an up-surge in shadow banking activity (Lu et al., 2015). This proposition is tested in this Chapter for South Africa using a unique data set on growth of Other Financial Intermediaries (OFI). Our choice of variable is necessitated by lack of data on

[15] Shadow Banking is defined following the FSB definition as, "credit intermediation involving entities and activities (fully or partly) outside of the regular banking system".

the more relevant function based narrow measure of shadow banking that is constructed by the Financial Stability Board (FSB).

The spirit of this Chapter is to provide empirical evidence on the impact of an increase in shadow banking on the real economy. Whilst several studies have investigated the relationship between firm profitability/performance and broad measures of financial development, no evidence is available that link shadow banking to firm performance. Studies by Lu et al., (2014) and Acharya et al. (2013) argue that shadow banks have the propensity to finance non-financial firms thereby enhancing the profitability of such firms. On the contrary, Pozsar and Singh (2011) establish that shadow banking is only an activity between shadow banks and traditional banks for the United States of America (US). We submit therefore that differences in structure of financial markets and regulatory environment are important determinants of the effect that shadow banking has on the economy. It is on this backdrop that this study analyses the impact of shadow banking on firm profitability in South Africa.

Studies closer to ours investigate the impact of macroeconomic factors on firm performance (Francis, 2013, Hirsch et al., 2014, Kandir, 2008, McNamara and Duncan, 1995). Issah and Antwi (2017) and Zeitun et al. (2007) analyse the impact of macro-economic variables on firm profitability and find GDP, the interest rate, inflation, money supply and bank credit to have significant influence on performance of firms as measured by return on assets (ROA). Our contribution is twofold, firstly, the study analyses the impact shadow banking has on firm profitability. Furthermore, aggregate data on firm profitability at industry level in South Africa is used and the study is able to reveal whether shadow banking benefits non-financial firms or banks only. The study is important in that it provides novel findings on the relationship between shadow banking and various measures of firm profitability.

### 8.2 Shadow Banking Activities in South Africa

Shadow banking as a term only became popular after McCulley (2009)'s paper in which he referred to financial activities done outside the normal banking sector. Several other studies have explored the growth and characteristics of shadow banking activities with more literature focusing on advanced economies (Pozsar and Singh, 2011, Pozsar et al., 2013, Meeks et al., 2017, Xiang and Qianglong, 2014). Recent studies have however centred on

emerging markets as there has been a surge in shadow banking activities in these markets in the aftermath of the Global Financial Crisis (GFC). The Financial Stability Board (FSB) reports that shadow banking grew by an average 10% between 2016 and 2017 compared to an increase averaging 6% in advanced economies (FSB, 2017). In South Africa specifically, shadow banking assets grew by R4.5 billion during the same period. Figure 8.1 below shows that there has been a gradual increase in shadow banking assets from the year 2002. From Figure 8.1, it is observable that during the crisis, there was a drop in shadow banking activities, but after the crisis, there is an upward trend again.

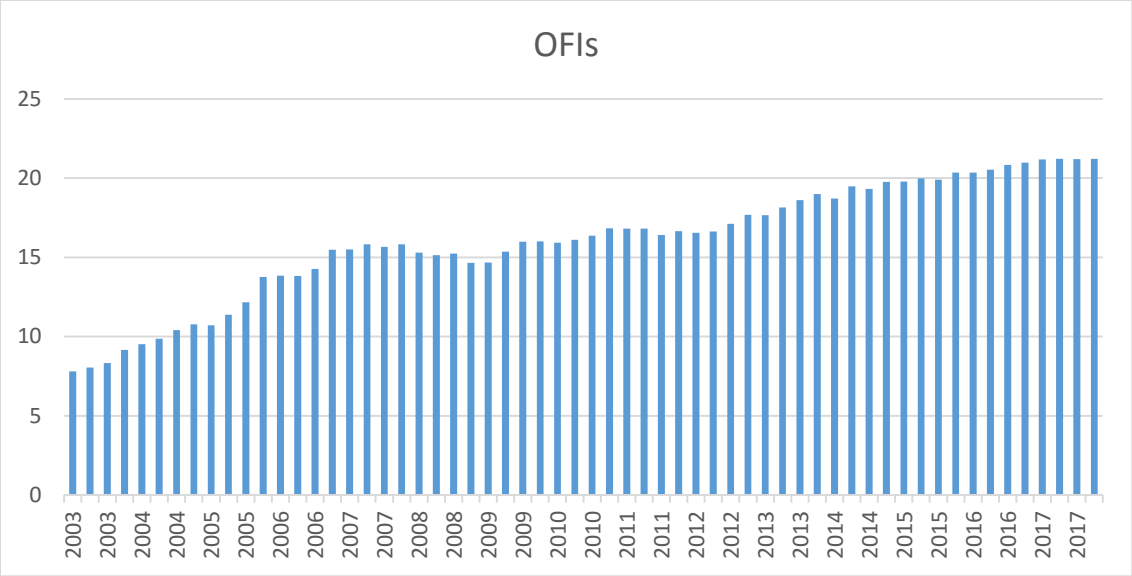


Figure 8.1. Growth of Assets of Other Financial Intermediaries
Source: South African Reserve Bank

Of importance is the comparative increase in assets of shadow banks compared to formal banks. Prior to 2003, banks' share of assets have always been higher and growing compared to other financial institutions. Available data however shows that from 2003 the proportion of bank assets to total assets of the financial services sector has gradually dropped. Contrary to this is a gradual increase in proportion of shadow banks assets. Is there a trade-off between shadow banking and formal banking or it is only a coincidence? Theoretically, a trade-off should exist between shadow banking and formal banking as formal banks transfer assets from their balance sheets to shadow financial vehicles (Meeks et al., 2017). Two explanations support this trade-off, firstly, when there is shortage in funding, innovative financial agents introduce new ways of providing finance, usually outside mainstream banking activities (Adrian and Ashcraft, 2016). This could be a result of regulatory arbitrage or new technology.

The second explanation hinges on profit incentive where formal banks are driven to engage in shadow banking activities in expectation of higher earnings (Tang and Wang, 2015). Formal banking institutions may direct more of their assets toward shadow banking activities with the expectation of earning higher profits whilst concurrently reducing assets for main-stream banking activities. Figure 8.2 below illustrates the growth of shadow banking assets compared to other assets in South African financial sector. One can clearly see from the diagram that as the proportion of assets held by traditional banks decreases, there is an increase in assets owned by shadow banks.

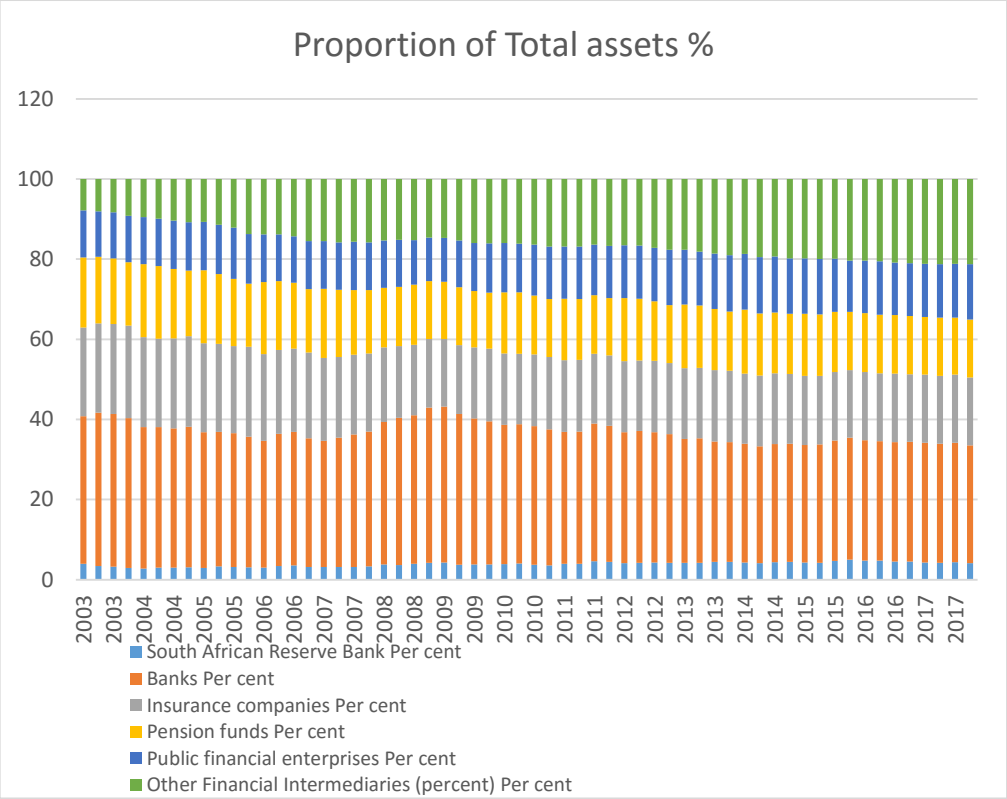


Figure 8.2. Proportion of OFIs to Total Assets of the Financial Sector
Source: South African Reserve Bank

Furthermore, the pool of activities classified as shadow banking is wide and heterogeneous across countries owing to differences in the regulatory environment (FSB, 2017). Pozsar et al. (2013) undertake a comprehensive analysis of activities and firms classified under shadow banking in the US. They compared shadow banking to commercial banks of the early 1900s which operated without a public backstop and argued for possible benefits that can be derived from shadow banking. Shadow banking activities include: asset securitisation, credit from non-bank firms, wholesale funding, enhanced credit intermediation and direct lending

from finance companies (Pozsar et al., 2013, Acharya et al., 2013). In addition, shadow banking institutions can also be identified including finance companies, money market funds (MMFs), hedge funds, other investment funds, real estate investment trusts and real estate funds (hereafter REITS), central counterparties, money lenders, structured finance vehicles, trust companies, as well as captive financial institutions and broker-dealers (FSB, 2017). The FSB report (FSB, 2017) shows that in South Africa, major shadow banking activities consists of securitisations, money market funding, vehicle financing and multi asset funds amongst others. These are illustrated by importance in Figure 8.3 below.

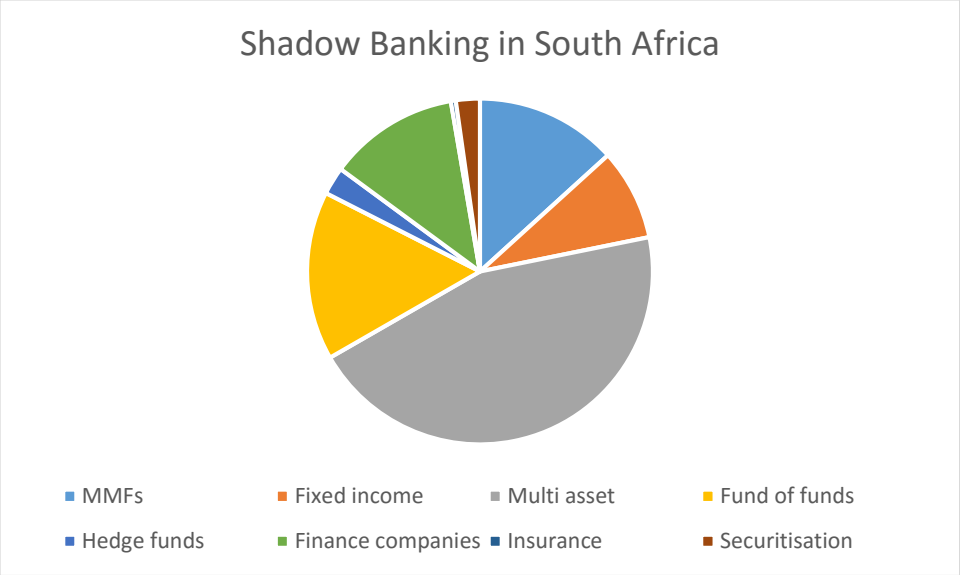


Figure 8.3. Composition of Shadow Banking in South Africa
Source: South African Reserve Bank

Shadow banks also undertake the three main functions of banks namely: maturity, liquidity and credit transformation albeit without the use of any government backstop or deposit insurance (Pozsar et al., 2013). In addition, shadow banks employ high levels of leverage. There is no homogeneity however, in the extent to which a particular type of a shadow bank can undertake these functions. Under its economic function 1 category for instance, the FSB (2016) reports that credit intermediation is high for fixed income funds, MMFs and Mortgages. Liquidity transformation is also high for fixed income and MMFs whilst leverage is low for these categories. Thus, different types of risks could be associated with each type of shadow bank.

Literature offers several arguments for the growth of shadow banking with regulatory arbitrage being the main explanation (Barbu et al., 2016, Pozsar et al., 2013, Pozsar and Singh, 2011). Limits to growth imposed by regulation often drive market participants to find ways of expanding income that by-pass regulations. Tang and Wang (2015) also suggest a profit motive. The profit incentive as suggested in Tang and Wang (2015) implies that financial institutions including commercial banks prefer shadow banking activities to traditional banking because it is highly profitable. Due to lack of regulation, shadow banking markets are deemed more efficient and allow capital to be availed to investors at low cost, however at high risk (Pozsar et al., 2013). Other reasons for the growth of shadow banking includes: worsening liquidity conditions, increased risk appetite and flight to safe assets (Barbu et al., 2016). Considering the reasons behind growth of shadow banking, several authors have argued that benefits of shadow banking may surpass the risk associated with its growth (Claessens et al., 2012, Adrian and Ashcraft, 2016). Thus, the growth of shadow banking activities and assets should have a positive impact on both financial firm's profit and profitability of non-financial firms.

### 8.3 Determinants of Firm Profitability

In this section, the study reviews literature on the determinants of firm performance and link it to shadow banking. The basic premise of this relationship is that shadow banking increases credit available to firms, both in the financial sector and to non-financial sectors (Adrian and Ashcraft, 2016, FSB, 2017). This claim can only be robust if two central theories of finance hold the pecking order theory and Modigliani Miller capital structure proposition. The pecking order theorem suggests that firms prefer debt to equity. Thus, in the absence of internally generated funds, there is an incentive to increase debt and shadow bank credit provides a cheaper source of debt. Modigliani and Miller proposition argues that in the presence of taxes and other constraints capital structure does have an impact on firm performance. Increased access to debt through shadow banks should positively impact firm profitability.

Three sets of factors are used to account for changes in firm profitability, firm specific factors, industry factors and macroeconomic factors (Issah and Antwi, 2017, Hirsch et al., 2014). Stylised macroeconomic determinants of firm profitability include money supply growth, inflation rate, interest rate, saving and investments as well as exchange rate changes

(Broadstock et al., 2011, Issah and Antwi, 2017, Zeitun et al., 2007). Issah and Antwi (2017), McNamara and Duncan (1995) and Broadstock et al. (2011) derive macroeconomic factors using Principal Component Analysis (PCA) from a range of macroeconomic variables covering business cycle indicators, monetary variables, financial factors and supply factors. All three studies find that the derived macroeconomic factors have statistical significance in determining firm profitability when employed in regression models.

Other studies use specific macroeconomic variables to explain the variation in firm profitability. Zeitun et al. (2007) use several macroeconomic aggregates for a panel sample of 167 firms. Macroeconomic variables used include the nominal interest rate, changes in money supply, the production manufacturing index, inflation, exports and availability of credit. Their results show that unexpected changes in the interest rate have a significant negative effect on profitability. Production manufacturing index and Islamic credit have a positive and significant effect on firm profitability. Inflation, money supply and other commercial bank credit do not have a significant effect on profitability.

Asma'Rashidah Idris et al. (2011) investigate the determinants of banks' profitability in the case of Malaysia. Their study uses return on assets as a measure of profitability and bank specific variables as regressors. They employed a panel (GLS) technique and find that only bank size has a statistically significant influence on bank profitability. Other variables considered are liquidity, capital adequacy, credit risk and expenses management. Ali et al. (2011) and Panayiotis et al. (2008) consider bank specific, industry specific and macroeconomic factors as determinants of banking firm profitability. Inflation rate and GDP are used as macroeconomic factors. Panayiotis et al. (2008) find that surprise inflation and the output gap both positively impact the output gap. These findings are supported by Ali et al. (2011) who find a positive relationship between economic growth and profitability. Contrary to this however, Naceur (2003) does not find a significant relationship between profitability as well as both inflation and growth for Tunisia.

Literature that links shadow banking to economic performance is still in its infancy, mostly as a result of the unavailability of data for shadow banking in Emerging markets and even in advanced economies (Adrian and Ashcraft, 2016). However, several studies have analysed the

growth and impact of shadow banking on financial stability stemming from the role shadow banks played during the GFC (Bengtsson, 2013, Hsu et al., 2013, McCulley, 2009, Meeks et al., 2017). More so, only a handful of studies have linked shadow banking to macroeconomic or firm specific variables, although shadow banking is encouraged on the premise that it affords firms to acquire capital at low cost (Tang and Wang, 2015, Barbu et al., 2016). This is due to reduced transaction and finance costs associated with shadow bank financing.

Lumpkin (2010) posits that financial innovations are neither totally harmful or absolutely beneficial. Thus, whilst shadow banking has been blamed for its role in the GFC, others have argued for growth and proper regulation of shadow banks to allow market agents to derive economic benefits stemming from shadow banking activities (Claessens et al., 2012, Pozsar et al., 2013). The study by Tang and Wang (2015) investigates the effect of shadow banking on Chinese banks' return and risk-adjusted return. Their study employs return on average assets (ROAA) and the Sharpe ratio as measures of return and risk-adjusted return respectively within Ordinary Least Squares (OLS) and Generalised Least Squares (GLS) regressions. They find that shadow banking activities increase commercial banks' return. Their finding supports earlier literature on financial innovation that argues for the positive effect of financial innovations on the economy (Beck et al., 2016, Boot and Marinč, 2010). According to this strand of literature, shadow banking's higher returns come on the backdrop of higher risk and regulation is required to ensure that the benefits of shadow banking are not eroded by costs from heightened risks.

Agostino and Mazzuca (2011) and Barbu et al. (2016) empirically analyse the determinants of securitisation and shadow banking respectively. Agostino and Mazzuca (2011) consider bank specific and market related ratios as influences of the decision for a bank to securitise in a given year. Securitisation is measured with a dummy variable and the authors employ probit regressions. They find that Italian banks securitise as way of diversification, funding and capital arbitrage. In Barbu et al. (2016) macroeconomic determinants of shadow banking are analysed using quarterly data for 15 countries covering 2008 to 2015. Their study uses panel Generalised method of moments technique and find a negative relationship between shadow banking and GDP growth, short term interest rates and money supply. On the other hand, stock index and long term interest rates positively influence shadow banking.

### 8.4 Interconnectedness between Shadow Banking and Non-Financial Corporate Sector

Proponents of the financial instability view of shadow banking concentrate on instability channelled through interconnectedness of shadow banks with the traditional banking sector. Moreover, literature shows three ways in which shadow banking can be linked to non-financial corporate sector profitability.

The first channel is through traditional banks. Harutyunyan et al. (2015) suggest that banks in the formal system also engage in shadow banking activities such as securitisations. By removing a bank's assets from its balance sheet, banks can be provided with more capacity to issue new credit and allow more non-bank corporates to access loans. This is supported by evidence from the FSB (FSB, 2017) showing that OFIs account for higher shares in formal banking sector liabilities. In addition, net positions in the wholesale market have tilted towards OFIs who have a positive net position in the repo market, signifying that they are net suppliers of financing to the rest of the financial system. This suggests shadow banks directly supply credit to other financial institutions who in turn fund non-financial firms. Both explanations lead to higher access to credit by non-financial firms.

Secondly, shadow banks have linkages with the non-financial corporates through direct lending to non-financial firms. Barbu et al. (2016) show that MMFs pool financial resources which can be directly channelled to the real sector. In this case, MMFs can finance firms directly and therefore contribute more to money supply in the economy. In the FSB report (FSB, 2017) loans extended by shadow banks (OFIs) increased with more than 10% between 2011 and 2015 in South Africa and other countries. Large public and private non-financial corporates also participate in the wholesale market directly through treasuries. For instance, participation of non-financial corporates in the repo market is acknowledged in South Africa and other countries (Pozsar et al., 2013). Direct lending to non-financial firms by shadow banks is therefore expected to have an influence on non-financial firms' profitability.

The third channel can be termed the 'asset' channel where firms are holders of financial assets issued by shadow banks. Using the FSB Economic Function 3 (EF3) measure, activities dependent on short term funding such as short-selling securities and financing client

securities are undertaken by shadow banks. These could be important in determining asset value of securities held by non-financial firms, resulting changes in firm profitability. In addition, shadow banks can issue Asset Backed Securities (ABS) in tranches which investors, including non-financial firms purchase. The impact on net income of this channel will however depend on the accounting treatment of the asset where recognition in the accounting Income Statement (profit and loss) could result in a higher net income for the firm. On the other hand, if the investment returns are recognised in Other Comprehensive Income, the holding may not have a significant effect on either ROA or ROE.

**8.5 Measuring Firm Performance**

ROA is the most widely applied measure of profitability in firm level studies (Issah and Antwi, 2017). ROA is an accounting profitability ratio computed by dividing a firm's net income by its total assets. It measures the ability of the firm to generate income using its assets and may demonstrate management's efficiency.

$$ROA = \frac{Net\ Income}{Total\ Assets} \tag{8.1}$$

The current Chapter uses the ratio of net profit before tax to book value of fixed assets as reported by Statistics South Africa (Statssa) as a proxy for ROA of non-financial firms. ROA for banks follows the above definition.

Unlike McNamara and Duncan (1995)'s assertion that ROA has limited effects of earnings management, ROA is susceptible to earnings smoothing by the management of the firm. For instance, off-balance sheet activities can result in an overstated ROA ratio. However, it is preferable for analysis as it is the most popular and available measure in terms of data availability (Issah and Antwi, 2017).

Other variables in use for measuring firm performance include ROE, net profit margin and Earnings per share. ROE is the net income of the firm expressed as a percentage of a firm's equity capital. It signifies the return to the suppliers of equity share capital (Panayiotis et al., 2008).

$$ROE = \frac{Net\ Income}{Equity\ capital} \tag{8.2}$$

The present study uses ROA as a measure of profitability for both banks and non-financial firms. Further, the study employs the stock market index, Johannesburg Stock Exchange All Share Index (JSEASLI) to measure profitability of all listed firms (financial and non-financial).

### 8.6 Methodology

The current study employs quarterly data on growth of shadow banking assets from the South African Reserve Bank (SARB). Our sample uses data from the 1st quarter of 2006[16] to the 4th quarter of 2016. Profitability is measured using data on Return On Assets (ROA) and the JSE all share index. Other variables used in the model are credit to GDP, money supply, inflation, interest rate (spread), and research and development (Variable selection is done considering the linkages between macroeconomic factors and firm performance). Shadow banking[17] is measured using the broad measure which takes into account all assets of Other Financial Institutions (OFIs) (FSB, 2018). The data for shadow banking is obtained from the SARB and is defined as the percentage of OFIs assets to total assets of all financial institutions.

#### 8.6.1 Variable Description and Model

The variables used in the study are explained in Table 8.1 below. The variables are derived from the literature in Sections 3 and 4.

Table 8.1. Variable Description

| Variable | Abbreviation | Data Source |
|---|---|---|
| Return on assets | ROA | Statistics South Africa, Federal Reserve of St Louis |
| Shadow Banking | OFI | South African Reserve Bank |
| Inflation | INFLATION | Statistics South Africa |
| Gross Domestic Product | GROWTH | South African Reserve Bank |
| Unemployment | UNEMP | Statistics South Africa |

[16] Sample size is restricted by data availability on profitability measures.

[17] Our choice of variable is underscored by the lack of high frequency data on the narrow measure, which is computed by the FSB. Data on the narrow measure of Shadow Banking is currently available at an annual frequency and for a limited time series (2010 to 2016). The nature of our model requires estimation of a number of parameters and we find the shorter nature of the time series inhibitive for that purpose and in order to increase the degrees of freedom, we opt for quarterly data on OFIs covering 2002Q1 to 2016Q4.

Table 8.1. Variable Description (Continued)

| | | |
|---|---|---|
| Total bank assets | LTA | South African Reserve Bank |
| Bank credit | CREDIT | South African Reserve Bank |
| Interest rate spread | INTSPR | South African Reserve Bank |
| JSE All Share Index | LALSIJSE | Johannesburg Stock Exchange |

Following previous studies (Panayiotis et al., 2008), the study adopts a model in which current profit is determined by the previous period's profit, shadow banking and macroeconomic influences. The specified model is as follows;

$$\Pi_t = \varphi + \beta_1 \Pi_{t-1} + \beta_2 SB_t + \sum_{j=1}^{j} \beta_j X_{it} + \varepsilon_t \quad (8.3)$$

where $\Pi_{t-1}$ is the lagged profit for the industry and $SB_t$ is the ratio of shadow bank assets to total assets of the financial sector. $X_i$ are macroeconomic variables. $\varphi$ is a constant and $\beta$s are slope coefficients in the regression. The error term $\varepsilon_t$ is assumed to be independently and identically distributed (i.i.d), with a constant variance and zero mean.

In order to meet our objectives, three distinct but related models are specified. The choice of variables for each model is driven by theoretical considerations on the determinants of profitability in both the banking sector and the non-bank sector. Model 3 uses variables that have an impact on all firms, regardless of them being in the financial industry or otherwise. In addition, robustness and statistical validity of results is considered in selecting the model variables for the three models.

**Model 1**: investigates the effect of shadow banking and macroeconomic influences on non-financial firms' profitability.

$$LROA_{NONFIN} = f\begin{pmatrix} LROA_{NONFIN_{t-1}}, shadow\ banking, unemployment, interest\ rate\ spread, \\ inflation, bank\ credit, GDP\ growth \end{pmatrix} + e_t \quad (8.4)$$

**Model 2**: investigates the effect of shadow banking, bank specific and macroeconomic factors on profitability of banks in South Africa.

$$LOG(ROABNK)_t = f(LOG(ROABNK)_{t-1}, shadow\ banking, inflation, total\ bank\ assets, GDP\ growth) + e_t \quad (8.5)$$

**Model 3**: Analyses the impact of shadow banking, bank specific factors and macroeconomic factors on profitability of all South African firms using the JSE all share index (jsealsi) as a proxy.

$$LALSIJSE_t = f\begin{pmatrix} LALSIJSE_{t-1}, shadow\ banking, inflation, interest\ rate\ spread, unemployment, \\ GDPgrowth, \end{pmatrix} + e_t \quad (8.6)$$

### 8.6.2 Estimation Technique

Time series methodology is employed as determined by the available data. Our main results are estimated using the Fully Modified Ordinary Least Squares (FMOLS) technique of (Phillips & Hansen, 1990). The FMOLS uses semi-parametric correction to correct for endogeneity and bias in OLS estimator. The FMOLS estimator is unbiased and has fully efficient mixture normal asymptotics. The estimator can be expressed as follows:

$$\hat{\theta} = \begin{bmatrix} \hat{\beta} \\ \hat{\gamma}_1 \end{bmatrix} = \left( \sum_{t=1}^{T} Z_t \, Z'_t \right)^{-1} \left( \sum_{t=1}^{T} Z_t \, y_t^+ - T \begin{bmatrix} \hat{\vartheta}_{12}^{+\prime} \\ 0 \end{bmatrix} \right) \quad (8.7)$$

Where $\hat{\vartheta}_{12}^{+\prime}$ is the bias correction term.

However, to confirm robustness of results, results from Canonical regression (CCR) of Park (1992) are also presented.

### 8.6.3 Data Analysis and Pre-Estimation Tests

Choosing the appropriate time series technique depends on the characteristics of the data itself. Thus firstly, data in rand terms is transformed into logarithms to reduce the impact of outliers and also the possibility of heteroscedasticity. Furthermore, parameters can be interpreted as elasticities. After the transformation we present individual statistical characteristics of individual variables as shown in Table D2 in ***Appendix D***. Table D3 presents the correlation matrix. This information is used to define *a priori* expectations on relationships of various variables. In addition, it also aides in avoiding multi-collinearity by selecting variables that are not highly correlated for three individual models.

Both financial and macroeconomic time series often resemble characteristics of unit root series (Bispham, 2005). It is therefore important to test the series for unit roots. The study uses three unit roots tests and reports the results in Table D1 in ***Appendix D***. In summary, all variables are found to be integrated of order one, I (1). Since all variables are I (1), cointegration tests are conducted on the variables. However, because three different estimations will be carried out, the variables are grouped into three different groups. Thus, separate cointegration tests are conducted for each model. The study employs residual based cointegration tests, namely: The Engle-Granger and Phillips-Ouliaris tests. Both tests employed unit root tests on the residuals from ordinary least squares regression but differ in accounting for serial correlation in the residuals with Engle-Granger using a parametric approach whilst Phillips-Ouliaris use a non-parametric approach (Schwert, 2009). The null hypothesis in both tests is that there is no cointegration in the series. Our cointegration results presented in Tables 2, 3 and 4 below. Results for the three models show that the series are cointegrated.

Table 8.2. Model 1. Cointegration Test

Specification: LPROFITALL INFLATION LGDP OFI UNEMP INTSPR LPROFITALL(-1)

Null hypothesis: Series are not cointegrated

| | Engle-Granger | | Phillips-Ouliaris | |
|---|---|---|---|---|
| | Value | Prob.* | Value | Prob.* |
| tau-statistic | -6.05 | 0.030 | -6.12 | 0.026 |
| z-statistic | -38.77 | 0.035 | -37.92 | 0.044 |

Table 8.3. Model 2 Cointegration Test

Specification: LPROFITALL INFLATION LGDP OFI UNEMP INTSPR LPROFITALL(-1)

Null hypothesis: Series are not cointegrated

| | Engle-Granger | | Phillips-Ouliaris | |
|---|---|---|---|---|
| | Value | Prob.* | Value | Prob.* |
| tau-statistic | -5.39 | 0.068 | -5.72 | 0.030 |
| z-statistic | -31.07 | 0.077 | -34.14 | 0.061 |

Table 8.4. Model 3 Cointegration Test

Specification: LPROFITALL INFLATION LGDP OFI UNEMP INTSPR LPROFITALL(-1)

Null hypothesis: Series are not cointegrated

| | Engle-Granger | | Phillips-Ouliaris | |
|---|---|---|---|---|
| | Value | Prob.* | Value | Prob.* |
| tau-statistic | -5.95 | 0.026 | -5.56 | 0.051 |
| z-statistics | -61.14 | 0.000 | -13.12 | 0.920 |

In all the three models, the findings show that the series are cointegrated at either 1%, 5% or 10% level of significance implying that long-run relationships exists.

### 8.7 Estimation Results

The preceding finding points out to the use of cointegrated techniques in estimating the models. The main results are estimated using the Fully Modified ordinary least squares (FMOLS) technique of (Phillips and Hansen, 1990). However, to confirm robustness of results, results from Canonical regression (CCR) of Park (1992) are also reported. The results for all the three models are presented in Table 8.5 below. All models estimated are subjected to diagnostic checks which show that the residuals are normally distributed. No serial correlation is reported and parameters are stable as shown by the CUSUM test in Appendix D ***(See Figure D1 in Appendix D)***. The results from each model are discussed separately for clarity purposes.

**Model 1 – Impact of shadow banking on non-financial firms' profitability**

Model 1 relates shadow banking to performance of non-financial firms. Estimation results for model 1 are reported in columns (1) and (2) of Table 8.5. The data for firm profitability is obtained from Statistics South Africa as reported earlier and covers Manufacturing, Mining and quarrying, Transport, storage and communication industry, Real estate and other business services industry (excluding financial intermediation and insurance) and Trade industry. As reported in table 8.5, there is convincing evidence that shadow banking positively impacts performance of non-financial firms in South Africa. The coefficient of shadow banking takes a positive and statistically significant sign at 5% level in both FMOLS and CCR estimations. Specifically, a 1 percentage change in shadow banking (OFI) results in a 0.043

percentage change in non-financial firms' profitability. The results may be an indication that non-financial corporates in South Africa borrow from non-bank financial firms directly.

Growth in bank credit to the private sector *(CREDIT)* has a positive and significant impact on firm profitability as expected. This is in line with the Modigliani-Miller theorem which suggests an increase in profitability as a firm employ more debt capital due to tax advantages of debt over equity capital. Contrary to our findings however, Zeitun et al. (2007) do not find a statistically significant relationship between credit and firm profitability. This could be indicative of dependence on bank credit by the firms in our industry sample. On the other hand, economic growth also has a positive impact on firm profitability which supports the findings of Issah and Antwi (2017). Inflation and unemployment have negative and significant relationships with non-financial firm profitability. The negative sign on inflation is expected from literature as higher prices tend to increase a firm's costs and reduce its mark-up (Wamucii, 2010). In addition, our findings show that an increase in the interest rate spread negatively affects profitability of non-financial firms. Economic growth has a positive influence on firm profitability as expected.

**Model 2 – Impact of shadow banking on bank profitability**

Column 4 and 5 of Table 8.5 presents results for Model 2. Shadow banking has a negative and significant association with bank profitability in South Africa. A 1 percentage increase in shadow banking assets results in a -0.025% change in bank profit. The result is important in particular as it confirms the presence of a trade-off between shadow banking and traditional banking. However, this is contrary to the notion that banks participate in shadow banking to increase their profits (Harutyunyan et al., 2015, Tang and Wang, 2015). In essence, this important finding shows that traditional banking activities in South Africa do not directly benefit from shadow banking activities rather assets are directed towards shadow banking activities, hence, traditional banking assets are reduced. Further, bank profitability is found to be determined by its own lagged value, total bank assets and macroeconomic variables. Total bank assets (LTA) have a positive and significant impact on profitability contrary to the findings of (Panayiotis et al., 2008) who do not find a significant relationship. The finding however supports evidence in Asma'Rashidah Idris et al. (2011) and Ali et al. (2011).

Table 8.5: Estimated Long-run Coefficients[18]

| | **Model 1** | | **Model 2** | | **Model 3** | |
|---|---|---|---|---|---|---|
| | *(2006Q1-2016Q4)* | | *(2008Q1-2016Q4)* | | *(2006Q1-2016Q1)* | |
| **Dependent variable:** | $LROA_{NONFIN}$ **(1)** | **(2)** | *LOG(ROABNK)* (3) | (4) | *LALSIJSE* (5) | (6) |
| **Independent variables** | **FMOLS** | **CCR** | **FMOLS** | **CCR** | **FMOLS** | **CCR** |
| *INFLATION* | -0.065*** | -0.042** | -0.009*** | -0.011** | -0.064*** | -0.053 |
| | [-3.75] | [-2.43] | [-2.86] | [-2.42] | [-2.86] | [-1.11] |
| *OFI* | 0.043** | 0.054*** | -0.025*** | -0.024** | 0.037*** | 0.042* |
| | [2.72] | [4.74] | [-2.45] | [-2.58] | [2.21] | [1.75] |
| *Intspr* | -0.147*** | -0.099*** | | | -0.196*** | -0.196*** |
| | [-5.26] | [-4.21] | | | [-5.51] | [-4.63] |
| $LOG(ROA_{NONFIN}$ *(-1))* | 0.157** | 0.293*** | | | | |
| | [2.01] | [3.82] | | | | |
| *Credit* | 0.690*** | 0.583*** | | | | |
| | [3.51] | [3.98] | | | | |
| *Lta* | | | 0.215*** | 0.247* | | |
| | | | [-2.86] | [1.77] | | |
| *LALSIJSE(-1)* | | | | | 0.383*** | 0.254** |
| | | | | | [4.18] | [2.17] |
| *UNEMP* | -0.185*** | -0.160*** | | | -0.195*** | -0.212*** |
| | [-7.87] | [-6.22] | | | [-6.40] | [-4.04] |
| *GROWTH* | 0.085** | 0.097*** | 0.033*** | 0.034*** | 0.101*** | 0.196** |
| | [2.69] | [2.99] | [5.00] | [3.37] | [2.52] | [2.47] |
| | | | 0.923*** | 0.936*** | | |
| *LOG(ROA$_{bank}$(-1))* | | | [23.41] | [24.43] | | |
| *Constant* | -6.668** | -5.946*** | -2.825* | -3.299 | 2.418*** | 2.329** |
| | [-2.51] | [-2.87] | [-1.77] | [-1.64] | [3.62] | [1.86] |
| $D_{200902}$ | 0.349** | 0.272*** | | | 0.880*** | 0.834*** |
| | [-2.32] | [2.09] | | | [5.87] | [4.64] |

**, **, *** imply 10%, 5% and 1% level of significance respectively. Values in parenthesis are t-statistics. The reported results, especially he parameter signs are robust to changes in estimation techniques and models (adding or removing other variables).*

**Model 3 – Impact of shadow banking on profitability of all firms (Listed)**

This model uses the JSE all share index as a measure of firm profitability and estimates the determinants of firm profitability in South Africa, including shadow banking. Column 6 and 7 of Table 8.5 reports the results for Model 3. Shadow banking is found to be positively related to firm profitability and the coefficient is significant at 1% level. Specifically, a 1 percentage change in the proportion of shadow bank assets results in a 0.037 percentage change in firm profitability. This could be indicative of the role shadow banks play amongst listed firms. It would suggest that the JSE listed firm sample is dominated by non-bank financial firms and other firms that benefit from shadow banking activities. Meanwhile, macroeconomic

[18] Diagnostic tests were conducted using residuals for each model to validate the model specification and check consistency with OLS assumptions. The tests conducted show that the residuals are normally distributed and there is no serial correlation is detected. These tests are available on request.

variables, economic growth and unemployment take positive and negative signs respectively as expected. Also, this finding is in line with several studies that have sought to analyse the relationship between firm profitability and macroeconomic variables (Issah and Antwi, 2017, Zeitun et al., 2007, Broadstock et al., 2011). The coefficient of the interest rate spread is positive but not statistically significant.

### 8.8 Concluding Remarks

The present study investigates the relationship between shadow banking growth and various measures of profitability in South Africa. Our findings show that growth of shadow banking negatively affects profitability of traditional banks and positively affects non-financial firms. This is not surprising since shadow banking is expected to increase firm profitability through its impact of firm leverage. In addition, shadow banking positively impacts profitability of all firms put together. Thus, overall shadow banking has a positive effect on firm profitability in South Africa. However, there is a trade-off between expansion of shadow banking activities and formal banking profitability.

In view of these findings, it is recommended continued efforts in monitoring the growth of shadow banking considering its interconnectedness with the rest of the financial system. Targeted regulation should be implemented to monitor shadow banking activities by both formal banking institutions and non-bank financial institutions. Furthermore, regulation should be reviewed from time to time to consider new financial products and processes which may be lying outside the regulatory framework.

This study provides new evidence on the relationship between shadow banking and economic performance. As such, it provides a point of departure in efforts to enhance understanding of the role shadow banks in the economy. We therefore recommend further research on how shadow banking could be used to finance productive sectors of the economy.

# CHAPTER 9

# CONCLUSION AND POLICY RECOMMENDATIONS

This Chapter summarizes the study and provides policy recommendations from the main findings of the investigations conducted in Chapters 4 to 8 with a view to addressing the four objectives of the study as outlined in Chapter 1. This section is of an introductory nature and will be followed by a summary of the study in Section 1. Section 2 provides the man findings and conclusions of the study. In section 3, the study presents policy recommendations. Section 4 outlines limitations of the study and provide suggestions for future research.

## 9.1 Summary of the Study

The increase in shadow banking activities in emerging economies at the back drop of its role in propagating risk during the GFC presents a challenge to regulators and other financial agents. The study was aimed at providing evidence on the risk propagating capabilities of shadow banking between emerging market countries; and between emerging market economies and the rest of the world. On the other hand, recognition has been made of the potential of shadow banking activities to contribute positively to general economic activity through activities such as credit creation. Therefore, the study also sought to provide evidence on the real economic impacts of shadow banking. In addition, the study was aimed at analyzing the relationship between shadow banking and monetary policy in emerging economies. Lack of empirical studies on shadow banking mainly due to lack of long time series data and the opacity that characterizes the shadow banking sector provides an opportunity for a novel enquiry into the shadow banking phenomenon. Therefore, the study set out to empirically reveal the impact of shadow banking on economic performance, financial stability and monetary policy transmission in emerging economies.

The aim of the study was to empirically analyse the impact of shadow banking on both economic activity and financial stability. The following four specific objectives were aimed at.
Specific Objectives

i To investigate the relationship between shadow banking and economic growth; and firm performance in emerging economies.

ii To understand the role of shadow banks in exacerbating financial instability across borders due to financial linkages amongst emerging economies.

iii To analyse the impact of shadow banking on monetary policy transmission in emerging economies.

iv To investigate the relationship between shadow banking and bank risk within the monetary policy transmission mechanism.

In meeting the above objectives, several empirical models were formulated and estimated using data from emerging economies. Five different empirical Chapters are used to address these objectives. Objective (i) is addressed by essays in Chapters 4 and 8. In Chapter 4, the study analyses the impact of shadow banking on economic growth. The second essay in Chapter 8 analyses the impact of shadow banking on firm profitability, accounting for the differences between non-financial firms and banks. Objective (ii) is addressed in Chapter 5 by an essay on shadow banking and cross border financial stability. In Chapter 6, the study addresses objective (iii) and provides an empirical investigation on the relationships among shadow banking, bank liquidity and monetary policy. The essay in Chapter 7 addresses objective (iv) and analyses the nexus between shadow banking, risk taking and monetary policy.

Different empirical models are employed to meet the objectives outlined above. The models estimated are founded upon theoretical literature reviewed in Chapter 3. Each empirical essay follows a different methodology as determined by the model and data characteristics. Different econometric estimation techniques were required in estimating each model. In the first empirical paper (Chapter 4), the Pooled Mean Group (PMG) estimation technique is employed. Chapter 5 applies the global VAR technique and in Chapter 6 the panel VAR technique is used. The empirical paper in Chapter 7 employs panel Fully Modified and Panel Dynamic Least Squares techniques for estimation of the model. Pooled OLS, fixed effects and random effects techniques are used also for robustness purposes. Chapter 8 presents three separate models which are estimated using the time series version of the Fully Modified OLS technique. The methodologies used are summarized in Table 9.1 below.

TABLE 9.1: Summary of the Study

| OBJECTIVE | METHODOLOGY/TECHNIQUE | CHAPTER |
|---|---|---|
| To investigate the relationship between shadow banking and economic growth in emerging economies; and the relationship between shadow banking and firm performance in emerging economies. | ▪ Panel data - Pooled Mean Group, Fixed and Random Effects.<br>▪ Time series – Fully Modified OLS | Four and Eight |
| To understand the role of shadow banks in exacerbating financial instability across borders due to financial linkages amongst emerging economies. | ▪ Global Vector Autoregressive (GVAR) Method | Five |
| To analyse the impact of shadow banking on monetary policy transmission in emerging economies. | ▪ Panel Vector Autoregressive (PVAR) Method | Six |
| To investigate the relationship between shadow banking and bank risk within the monetary policy transmission mechanism. | ▪ Panel data - Panel Fully Modified OLS and Panel Dynamic OLS | Seven |

## 9.2 Discussion of Findings and Conclusions

In addressing each objective, the present study conducts empirical investigation on the relationship between shadow banking and various financial and macroeconomic variables. Chapters 2 and 3 provide the imperative detailed theoretical literature on shadow banking and the linkages among shadow banking, economic performance, financial stability and monetary policy. Chapters 4-8 provide empirical work on the relationships between shadow banking and the various macro-economic and financial variables.

To achieve objective (i), the study carries empirical investigations in Chapter 4 and Chapter 8. Chapter 4 investigates the relationship between shadow banking and economic growth in emerging economies. The study finds a uni-directional positive relationship between shadow banking and economic growth. Shadow banking influences economic growth positively. This result suggests that shadow banking is an important driver of economic activity and it could

be beneficial to allow growth of shadow banks as they can drive investment and consumption in emerging countries. The study provides support for the proposition that financial innovation drives economic growth.

This finding provides a fundamental argument against the intuition that shadow banking represents the dark side of finance. The findings support studies that see shadow banking as an alternative source of finance which is able to provide economic benefits in the long term. In emerging economies where financial sectors are relatively smaller compared to their developed countries counterparts, shadow banking could provide the much needed finance to promote economic growth. To further understand the impact of shadow banking on real economic variables, the study undertakes an empirical analysis of the impact of shadow banking on firm profitability in South Africa as presented in Chapter 8. Shadow banking is found to impact non-financial firms' profitability positively and on the other hand impact bank profitability negatively. The results confirm that shadow banking is an important source of finance for non-financial firms. However, it also points to the existence of a trade-off between formal bank activities and shadow banking activities.

In Chapter 5, the study addresses objective (ii) and provides an analysis of the impact of shadow banking on cross border financial stability. The study finds that cross border linkages through bank balance sheets and shadow banks provide a channel through which financial contagion could be transferred. Increases in shadow banking at global level results in worsening of financial conditions in the majority of emerging economies covered by the study. The study uses the Global VAR approach and further establishes the presence of contagion risk across national borders. Specifically, worsening financial conditions at the global level can be transferred to emerging economies, except for a few which appear resilient.

Chapter 5 also illustrates an important characteristic of shadow banking liabilities. The study establishes that worsening financial conditions induce a decrease in shadow bank liabilities which points to the fact that shadow bank liabilities are susceptible to sudden withdrawals. This finding is in accordance with both theoretical and empirical literature on shadow banking. Shadow bank liabilities are therefore riskier compared to commercial bank deposits

and other insurable liabilities. Thus, any economic occurrence that impacts negatively on the financial sector could trigger flight to safety, hence, a draw-down of shadow bank liabilities as financial agents seek safe assets. The evidence is important as it reinforces available literature on the dynamics surrounding the GFC.

The study addresses objective (iii) in Chapter 6. Objective (iv) is addressed in Chapter 7 which also provides further evidence to validate the findings in Chapter 6. The two chapters are however different in two ways. Chapter 6 provides a short run analysis of monetary policy and shadow banking dynamics in a Panel VAR framework. In Chapter 7, the study first develops a loan demand and loan supply framework to explain the determination of shadow banking and uses it to provide an empirical analysis using cointegrated panel methods which provide long-run estimates. The second way in which the two chapters are different is that Chapter 7 investigates the role of shadow banking within the risk taking framework. Thus, in Chapter 7, importance is attached on the role of bank risk in either amplifying or dampening monetary policy effects on the shadow banking sector. Therefore, Chapter 7 fully addresses objective (iv) and partly addresses objective (iii).

Chapter 6 of the study investigates the presence of a shadow banking channel of monetary policy. The findings of the study suggest that a shock in the policy rate dampens shadow bank activity. At the same time, it also dampens commercial bank liquidity. Such findings are contrary to recent studies which suggest that contractionary monetary policy increases shadow banking. The differences could be accounted by using different measures of shadow banking and individual countries considered in these studies. Findings of the present study however provides an intuitive idea in that theoretical literature suggests closer linkages between commercial banks and shadow banks in emerging economies. Thus, high participation of commercial banks in shadow banking activities could explain the shrinking in shadow banking assets when the policy rate hikes.

A shock in shadow banking however does not significantly influence monetary policy action. However, the study finds that a shock to shadow banking results in an upsurge in bank liquidity in line with theory suggesting that shadow banks provide finance for commercial banks. Furthermore, Chapter 6 finds that a positive shock in bank liquidity increases shadow

bank growth. This finding further cements the notion that shadow banking is driven by commercial banks. Shadow banks borrow from commercial banks, and vice-versa resulting in shadow bank liabilities on commercial banks' balance sheets. In addition, the Chapter establishes that a positive shock in liquidity has a positive impact on economic growth and inflation. The finding is in line with traditional theory on the short-run effects of monetary policy.

In Chapter 7, the study investigates the nexus among shadow banking, bank risk and monetary policy. Our results confirm the findings in Chapter 6 and point to the existence of a channel of monetary policy through the shadow banking system. In both the short-run and the long-run, the policy rate has a negative influence on shadow banking. However, when the model is transformed to account for bank risk using the bank z-score index, the negative influence of monetary policy on shadow banking is reduced. This shows that reduction in riskiness of banks decreases the pass through effect of monetary policy to shadow banks. This finding is in line with the theory on bank risk taking in which an improvement in financial agents' risk perceptions due to low interest rates encourages high risk taking. In our case, we conclude that banks engage in high risk activities through the shadow banking sector.

Another strand of the findings in Chapter 7 points to the increased shadow bank activity when bank risk is low. The study finds that the log of the bank z-score index has a positive effect on shadow banking in the long-run. The implication is that shadow banking responds to improvements in riskiness of banks. Combining this with the behaviour of commercial banks in the risk taking channel of monetary policy, it can be concluded that perceived low risk increases financial agents' risk appetite resulting in increased shadow bank activities. By construct, commercial banks and other financial intermediaries engage in riskier financial activities through the shadow banking sector. The study therefore provides a novel proposition that links bank risk taking to shadow banking. Unlike available studies on bank risk taking, the present study is able to show that high risk activities in the financial system are undertaken within the shadow banking sector. The following relationships between the policy rate, bank risk and shadow banking can be envisaged from the results of the study:

An increase in the policy rate increases bank risk. Banks react by reducing their risk taking which in turn lead to a decrease in shadow banking activity. By construct, a decrease in the policy rate should result in an increase in shadow banking through the following channel:


The study also establishes a negative relationship between bank credit and shadow bank growth which is in line with the extant literature on shadow bank credit versus commercial bank credit. A trade-off therefore exists between shadow bank growth and bank credit in the short-run. The result suggests that shadow bank credit and commercial bank credit compete for liabilities. Two explanations can be proffered for this trade-off. Firstly, commercial banks have to divide their resources between their formal lending activities and shadow bank activities. Thus, an increase in shadow banking may imply a decrease in formal bank lending funds. The second explanation hinges on the susceptibility of shadow bank liabilities to sudden withdrawals established above. During periods of crises or whenever market risk is high, banks withdraw money out of the shadow banking system and increase their deposits which in turn could lead to increased formal bank lending. On the other hand, shadow banks have to reduce their credit during times of high risk.

In summary some cross cutting issues can be identified from the different empirical papers. Firstly, that shadow banking in emerging economies competes with bank credit for formal banks' liquid liabilities. Banks face a trade-off when channelling money to the shadow bank system. The relationship between shadow banks and bank liquidity as confirmed in the study is complementary, which further cements the notion that both shadow bank credit and bank credit depends on bank liquidity for expansion. A second issue arising from the study is the negative relationship between monetary policy and shadow banking, where a contractionary monetary policy stance results in a decrease in shadow banking activities. The result is contrary to similar studies in the US and Europe. It may indicate the dominance of the risk-taking channel of monetary policy in emerging markets.

### 9.3 Policy Implications and Recommendations

The findings described in section 9.2 have strong implications for both monetary and prudential regulation. The positive relationship between economic growth and shadow banking implies a need for a regulatory environment that can create a balance between formal banking and shadow banks in order to provide the much needed finance for investment. Shadow banking should not be treated with scepticism as the dark side of the financial system but monitored and natured to ensure economic benefits of shadow banking can be realized. However, regulators should be aware of the detrimental effects of shadow banking and regulation should evolve to capture new financial activities and instruments as they are added into the markets.

The findings on the negative relationship between credit and economic growth could imply the existence of a threshold beyond which financial development may become undesirable for growth. Therefore, the study proposes finding a balance between financial development and economic growth following Ductor and Grechyna (2015) to minimise harmful effects of accelerated financial development coupled with slow economic growth. In addition, targeted regulation could be used to ensure the control of certain financial activities in the shadow banking sector.

From Chapter 5 of the study, cross country linkages of bank balance sheets through the shadow banking sector needs monitoring to steam out contagion risk before it can be spread to other countries. International banking and international financing through the shadow banking sector increases risky liabilities on banks' balance sheets. Thus, we suggest the provision of insurance for cross border financial liabilities to stabilize cross border shadow bank liabilities. The insurance should boost confidence of financial market participants in both the borrowing and the lending countries.

Our results provide evidence of linkages between monetary policy and shadow banking. This finding challenges the assumed dichotomy between price stability objective and the financial stability objective of the central bank and macro-prudential authority respectively. Monetary policy authorities should consider the impact of their decisions on bank risk taking and shadow bank activities. For instance, a negative interest rate shock should increase bank

liquidity, increase bank risk taking and increase shadow banking activities. Increases in shadow banking activities could result in higher risk in the financial sector. In light of such linkages, the conduct of monetary policy should account for possible external effects on the rest of the financial sector which could trigger financial instability.

To avoid a fall back on the 2008 crisis, the study suggests coordination between prudential regulation (both micro and macro) and monetary policy. In countries where all policies are administered by the same institution, coordination could be easier. However, it is still possible for countries whose macro-prudential supervision is not a mandate of the central bank to ensure that the different institutions liaise and coordinate the different policies.

### 9.4 Limitations of the Study and Suggestions for Future Research

Whilst the findings of the study are consistent with theoretical foundations provided in the literature review and other empirical studies, it is expedient to outline limitations that underlie the study. Firstly, data for shadow banking is still scarce being unavailable for a greater number of developing and emerging countries. Meanwhile, where it is available, the data is of short time series. The data used for example from the FSB has starts from 2002 to 2016. In order to undertake robust analyses in some cases, the study has used bank liabilities to foreign entities as a proxy for shadow banking. Thus, data availability is the major constraint in the study. Extending the data sample could improve the results established in this study.

The second limitation of the study is the lack of comparable studies on the topic of shadow banking. In spite of the study filling an important empirical gap in literature, it is by no means encouraging that similar studies providing comparative results are scarce. Only a few studies compare to our results, raising the challenge of lack of comparisons or weak comparisons for results in Chapters 4 and 5.

In Chapter 5 the study employs data from the GVAR toolbox as collected by Smith and Galesi (2014). Whilst these data have been used in various other studies, the researcher recognizes the inconsistency that may accompany their data collection techniques. Thus, any inconsistency in the data has potential to influence our findings. In addition, our proxy for

shadow bank liabilities, foreign liabilities of commercial banks do not capture all elements of shadow bank liabilities. Future studies may consider other proxies of shadow bank liabilities.

The study employs panel VAR approach in Chapter 6 to investigate the transmission of monetary policy shocks and shadow bank shocks. Whilst the study is well suited to cover cross country study, it could be more beneficial in future to consider individual country studies for specific policy recommendations. The dynamics of monetary policy differ from country to country and financial systems are not similar to some extent, which could make a, "bundled" policy approach to fail. Future studies can therefore be conducted at country level and country level policy suggestions can be proffered to the different central banks.

Chapter 7 investigates the effect of monetary policy on shadow banking. Due to lack of high frequency data (preferably quarterly frequency), the study employed annual data. The results may be affected by the short time series dimension of the data. The results of the panel FMOLS estimator are argued to be less robust in small samples. Thus, it would be more meaningful to use long time series data in further investigations. Further study could use mixed data sampling techniques which allow for data of different frequency to be employed in a regression.

In view of the findings above and the limitations stated, it would be ideal for further analysis of the role of shadow banking by widening the sample to explore possible effects of using a larger data set. Furthermore, it could also be helpful to use specific measures of shadow banking instead of using aggregated data. The researcher therefore, proposes that new studies investigate the contribution of individual shadow bank instruments or processes to economic performance and financial stability. Such studies can be more relevant for specific policy analysis, and individual countries could benefit.

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## 11.0 APPENDICES

## Appendix A - Chapter 4

Table A1. Pedroni Residual Cointegration Test

Series: Y LSBS LSM X Z CRED
Date: 12/02/18 Time: 03:36
Sample: 2002 2017
Included observations: 160
Cross-sections included: 10
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

| | Statistic | Prob. | Weighted Statistic | Prob. |
|---|---|---|---|---|
| Panel v-Statistic | -3.934340 | 1.0000 | -4.199269 | 1.0000 |
| Panel rho-Statistic | 3.272334 | 0.9995 | 3.433785 | 0.9997 |
| Panel PP-Statistic | -24.33602 | 0.0000 | -23.99952 | 0.0000 |
| Panel ADF-Statistic | -5.500771 | 0.0000 | -4.776542 | 0.0000 |

Alternative hypothesis: individual AR coefs. (between-dimension)

| | Statistic | Prob. |
|---|---|---|
| Group rho-Statistic | 4.928090 | 1.0000 |
| Group PP-Statistic | -22.88091 | 0.0000 |
| Group ADF-Statistic | -4.729694 | 0.0000 |

## Appendix B - Chapter 5

Table B1. ADF Unit Root Test Statistics

| | critical value 5% | ARG | BRA | CAN | CHINA | CHL | EURO | INDIA | INDNS | JAPAN | MAL | MEX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| y | -3.45 | -1.86 | -1.96 | -2.36 | -1.61 | -2.41 | -2.16 | -2.57 | -3.89 | -3.16 | -3.85 | -3.28 |
| dy | -2.89 | -3.51 | -4.73 | -4.48 | -2.34 | -3.65 | -3.67 | -4.68 | -3.42 | -5.49 | -5.44 | -4.95 |
| ddy | -2.89 | -6.87 | -7.00 | -6.97 | -7.08 | -6.62 | -7.06 | -8.56 | -7.77 | -6.56 | -6.36 | -6.81 |
| | | | | | | | | | | | | |
| sl (no Trend) | -2.89 | -2.40 | -1.77 | -0.16 | 0.02 | -0.65 | -1.06 | -2.18 | -1.21 | -1.88 | -1.41 | -0.92 |
| dsl | -2.89 | -4.07 | -7.10 | -3.39 | -7.26 | -6.70 | -4.47 | -4.90 | -5.23 | -5.85 | -5.35 | -8.06 |
| ddsl | -2.89 | -9.60 | -6.48 | -6.85 | -7.79 | -7.45 | -6.55 | -9.35 | -9.08 | -8.94 | -10.19 | -6.86 |
| | | | | | | | | | | | | |
| eq (no trend | -2.89 | -1.90 | | -2.47 | | -1.14 | -2.71 | -1.33 | | -2.55 | -2.39 | |
| deq | -2.89 | -5.86 | | -6.10 | | -5.67 | -5.06 | -5.89 | | -5.38 | -5.30 | |
| ddeq | -2.89 | -8.31 | | -6.89 | | -6.87 | -7.60 | -7.80 | | -7.80 | -9.64 | |
| | | | | | | | | | | | | |
| ep (no trend) | -2.89 | -2.32 | -1.21 | -1.11 | 0.67 | -0.99 | -1.27 | -0.23 | -1.32 | -2.05 | -1.45 | -2.57 |
| dep | -2.89 | -5.84 | -5.89 | -5.73 | -3.09 | -5.81 | -5.39 | -5.16 | -6.31 | -3.48 | -4.78 | -6.72 |
| ddep | -2.89 | -6.54 | -8.33 | -6.62 | -4.38 | -6.76 | -7.66 | -7.39 | -8.57 | -6.69 | -8.16 | -7.67 |
| | | | | | | | | | | | | |
| r (no trend) | -2.89 | -3.15 | -1.82 | -1.18 | -3.23 | -2.63 | -1.61 | -2.20 | -2.98 | -2.70 | -2.54 | -2.53 |
| dr | -2.89 | -4.98 | -9.90 | -4.00 | -6.39 | -5.85 | -4.51 | -5.07 | -4.94 | -4.93 | -4.71 | -5.85 |
| ddr | -2.89 | -14.96 | -10.19 | -5.88 | -8.12 | -6.69 | -6.47 | -8.75 | -8.43 | -8.77 | -12.19 | -6.12 |
| | | | | | | | | | | | | |
| zs | -3.45 | -2.35 | -2.88 | -1.35 | -3.17 | -1.67 | -1.32 | -2.12 | -2.34 | -4.31 | -2.25 | -1.88 |
| dzs | -2.89 | -4.30 | -2.78 | -3.04 | -3.74 | -4.30 | -4.01 | -2.84 | -4.34 | -4.45 | -3.98 | -3.48 |
| ddzs | -2.89 | -7.13 | -7.12 | -8.08 | -4.99 | -7.90 | -6.89 | -7.45 | -7.58 | -5.33 | -6.70 | -7.16 |

| | critical value 5% | PER | PHLP | SAFRC | SARBIA | SING | THAI | TURK | UK | USA |
|---|---|---|---|---|---|---|---|---|---|---|
| Y | -3.45 | -1.90 | -2.11 | -2.30 | -2.39 | -2.91 | -3.49 | -2.39 | -1.66 | -2.51 |
| dy | -2.89 | -4.41 | -5.79 | -3.88 | -2.73 | -5.23 | -5.67 | -5.34 | -4.17 | -3.65 |
| ddy | -2.89 | -6.89 | -6.28 | -6.41 | -9.17 | -6.60 | -6.67 | -7.22 | -5.44 | -7.18 |
| | | | | | | | | | | |
| sl (no Trend) | -2.89 | -0.83 | -2.12 | -2.28 | -0.25 | -2.53 | -1.67 | -0.83 | -1.73 | -3.17 |
| dsl | -2.89 | -5.99 | -3.11 | -6.16 | -7.02 | -2.85 | -3.83 | -2.71 | -4.14 | -4.25 |
| ddsl | -2.89 | -9.14 | -11.06 | -7.74 | -7.42 | -7.84 | -12.89 | -8.64 | -7.82 | -6.99 |
| | | | | | | | | | | |
| eq (no trend | -2.89 | | -1.89 | -0.52 | | -2.99 | -2.27 | | -2.45 | -2.53 |
| deq | -2.89 | | -5.39 | -6.70 | | -5.47 | -5.42 | | -4.98 | -4.81 |
| ddeq | -2.89 | | -6.67 | -7.30 | | -6.96 | -7.99 | | -7.00 | -6.73 |
| | | | | | | | | | | |
| ep (no trend) | -2.89 | -0.31 | -0.45 | -1.56 | 0.85 | -0.16 | -0.96 | -1.28 | -1.60 | |
| dep | -2.89 | -4.88 | -4.56 | -5.57 | -2.48 | -4.19 | -5.71 | -6.42 | -6.70 | |
| ddep | -2.89 | -7.42 | -8.37 | -7.35 | -8.60 | -6.73 | -6.96 | -8.34 | -7.77 | |
| | | | | | | | | | | |
| r (no trend) | -2.89 | -1.38 | -1.28 | -1.98 | | -1.47 | -3.00 | -1.42 | -1.04 | -1.67 |
| dr | -2.89 | -8.28 | -6.90 | -5.95 | | -5.44 | -5.09 | -7.16 | -4.13 | -3.69 |
| ddr | -2.89 | -7.07 | -9.16 | -9.20 | | -7.37 | -8.79 | -7.52 | -9.64 | -8.69 |
| | | | | | | | | | | |
| Zs | -3.45 | -1.09 | -1.92 | -3.18 | -2.43 | -3.61 | -2.81 | -1.93 | -1.40 | -2.12 |
| dzs | -2.89 | -3.78 | -3.26 | -6.37 | -3.68 | -2.77 | -3.79 | -3.62 | -2.77 | -3.53 |
| ddzs | -2.89 | -7.78 | -6.97 | -6.49 | -6.72 | -6.58 | -7.62 | -7.43 | -7.42 | -6.98 |

## Table B2. Weighted Symmetric ADF Unit Root Test Statistics

| | critical value 5% | ARG | BRA | CAN | CHINA | CHl | EURO | INDIA | INDNS | JAPAN | MAL | MEX |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| y | -3.24 | -1.94 | -1.91 | -1.04 | -1.31 | -2.63 | -1.71 | -1.61 | -1.49 | -3.37 | -3.64 | -2.16 |
| dy | -2.55 | -3.66 | -5.03 | -4.67 | -2.52 | -3.90 | -3.86 | -4.91 | -3.67 | -5.68 | -5.66 | -5.15 |
| ddy | -2.55 | -7.08 | -7.34 | -7.19 | -7.12 | -6.90 | -7.26 | -8.85 | -7.68 | -6.83 | -6.72 | -6.75 |
| | | | | | | | | | | | | |
| sl (no | -2.55 | -2.62 | -1.89 | -0.22 | 0.58 | 0.12 | -0.88 | -1.29 | -1.36 | -1.53 | -1.42 | 1.03 |
| Trend) | -2.55 | -4.30 | -7.10 | -3.49 | -7.47 | -6.90 | -4.63 | -4.98 | -5.44 | -5.87 | -5.27 | -8.28 |
| dsl | -2.55 | -9.90 | -6.51 | -6.93 | -8.14 | -7.69 | -6.85 | -9.58 | -9.17 | -9.21 | -10.32 | -7.69 |
| ddsl | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| eq (no | -2.55 | -2.13 | | -0.71 | | -1.38 | -2.12 | -1.25 | | -2.55 | -2.37 | |
| trend | -2.55 | -6.07 | | -6.30 | | -5.86 | -5.26 | -6.09 | | -5.59 | -5.51 | |
| deq | -2.55 | -8.59 | | -7.21 | | -7.15 | -7.81 | -8.07 | | -7.93 | -9.89 | |
| ddeq | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| ep | -3.24 | -2.64 | -1.49 | -1.46 | -1.49 | -1.65 | -1.38 | -2.32 | -2.56 | -2.35 | -1.85 | -1.98 |
| dep | -2.55 | -6.05 | -6.09 | -5.93 | -3.25 | -5.99 | -5.60 | -5.33 | -6.57 | -3.59 | -4.94 | -6.73 |
| ddep | -2.55 | -6.87 | -8.70 | -6.86 | -4.38 | -7.06 | -7.89 | -7.69 | -8.88 | -6.98 | -8.35 | -7.98 |
| | | | | | | | | | | | | |
| r (no | -2.55 | -3.37 | -0.81 | -1.45 | 1.39 | -1.53 | -0.92 | -1.63 | -3.23 | -2.30 | -1.33 | 1.07 |
| trend) | -2.55 | -5.21 | -9.98 | -4.08 | -3.75 | -6.07 | -4.62 | -4.33 | -5.29 | -5.13 | -4.98 | -4.05 |
| dr | -2.55 | - | -10.44 | -6.04 | -6.88 | -7.30 | -6.66 | -9.01 | -8.64 | -9.01 | -12.49 | -5.82 |
| ddr | | 15.31 | | | | | | | | | | |
| | | | | | | | | | | | | |
| zs | -3.24 | -2.91 | -0.18 | -1.56 | -2.90 | -1.57 | -1.41 | -1.47 | -1.93 | -4.54 | -2.58 | -0.71 |
| dzs | -2.55 | -5.44 | -2.81 | -3.02 | -3.39 | -4.56 | -4.28 | -2.63 | -4.47 | -4.69 | -4.07 | -3.03 |
| ddzs | -2.55 | -6.20 | -7.43 | -8.44 | -4.84 | -8.27 | -7.21 | -7.74 | -7.93 | -5.57 | -6.93 | -7.47 |

| | **critical value 5%** | **PER** | **PHLP** | **SAFRC** | **SARBIA** | **SING** | **THAI** | **TURK** | **UK** | **USA** |
|---|---|---|---|---|---|---|---|---|---|---|
| y | -3.24 | -1.15 | -1.35 | -2.46 | -0.61 | -3.06 | -2.26 | -2.56 | -1.18 | -1.08 |
| dy | -2.55 | -4.61 | -5.97 | -3.78 | -2.97 | -5.52 | -5.77 | -5.60 | -4.39 | -3.62 |
| ddy | -2.55 | -7.06 | -6.63 | -6.14 | -9.49 | -6.83 | -7.01 | -7.60 | -5.75 | -7.37 |
| | | | | | | | | | | |
| sl (no | -2.55 | 0.06 | -1.13 | 0.21 | -0.59 | -0.28 | -1.39 | -1.27 | -0.43 | 0.72 |
| Trend) | -2.55 | -6.05 | -3.36 | -6.20 | -7.23 | -3.12 | -3.50 | -2.72 | -4.34 | -4.44 |
| dsl | -2.55 | -9.44 | -11.30 | -7.55 | -7.73 | -7.57 | -12.64 | -8.51 | -8.09 | -6.67 |
| ddsl | | | | | | | | | | |
| | | | | | | | | | | |
| eq (no trend | -2.55 | | -1.44 | -0.45 | | -3.17 | -1.23 | | -2.51 | -1.76 |
| deq | -2.55 | | -5.55 | -6.90 | | -5.62 | -5.49 | | -5.17 | -5.01 |
| ddeq | -2.55 | | -6.73 | -7.63 | | -7.27 | -8.25 | | -7.31 | -7.02 |
| | | | | | | | | | | |
| ep (no | -3.24 | -1.05 | -1.11 | -1.74 | -0.92 | -0.81 | -0.80 | -2.05 | -2.18 | |
| trend) | -2.55 | -5.08 | -4.76 | -5.59 | -2.71 | -4.40 | -5.91 | -6.63 | -6.90 | |
| dep | -2.55 | -7.75 | -8.60 | -7.21 | -8.72 | -7.10 | -7.53 | -8.71 | -8.12 | |
| ddep | | | | | | | | | | |
| | | | | | | | | | | |
| r (no trend) | -2.55 | -1.37 | -0.82 | -1.62 | | -1.64 | -2.77 | -0.21 | -0.97 | -1.56 |
| dr | -2.55 | -8.51 | -7.11 | -6.04 | | -5.70 | -5.21 | -7.44 | -4.40 | -3.95 |
| ddr | -2.55 | -7.28 | -9.43 | -9.37 | | -7.71 | -9.02 | -8.03 | -9.78 | -8.89 |
| | | | | | | | | | | |
| zs | -3.24 | -1.10 | -2.02 | -3.12 | -1.56 | -3.65 | -1.27 | -2.26 | -1.47 | -2.42 |
| dzs | -2.55 | -2.90 | -3.53 | -6.57 | -3.79 | -2.99 | -2.15 | -3.88 | -3.05 | -3.76 |
| ddzs | -2.55 | -8.09 | -7.31 | -6.62 | -7.05 | -6.79 | -7.92 | -7.78 | -7.78 | -7.31 |

Table B3. Contemporaneous Effects of Foreign Variables on their Domestic Counterparts

| | Domestic Variables | | | | |
|---|---|---|---|---|---|
| *Country* | $y$ | $sl$ | $eq$ | $r$ | $zs$ |
| *ARG* | 0.29 | 0.22 | 1.81 | 0.59 | 0.00 |
| | [0.97] | [1.08] | [4.14] | [1.73] | [-0.09] |
| *BRA* | 0.66 | 0.39 | | -1.02 | 0.00 |
| | [2.29] | [1.14] | | [-2.91] | [-0.54] |
| *CHINA* | 1.23 | 0.19 | | 0.22 | -0.01 |
| | [4.37] | [0.42] | | [1.38] | [-2.15] |
| *CHL* | 0.57 | 0.27 | 0.74 | 0.16 | 0.01 |
| | [2.44] | [1.30] | [3.24] | [0.47] | [0.51] |
| *EURO* | 0.96 | 0.02 | 0.90 | 0.25 | 0.00 |
| | [5.44] | [0.07] | [2.77] | [3.53] | [-0.13] |
| *INDIA* | 0.27 | 0.31 | 1.42 | 0.76 | 0.01 |
| | [1.02] | [0.68] | [4.40] | [3.44] | [5.36] |
| *INDNS* | 0.26 | -0.21 | | 6.96 | 0.09 |
| | [1.45] | [-0.72] | | [4.54] | [11.19] |
| *JAPAN* | 0.55 | 0.17 | 0.73 | 0.05 | -0.03 |
| | [2.95] | [0.89] | [3.55] | [3.07] | [-3.39] |
| *MAL* | 0.82 | 0.41 | 1.05 | 0.16 | -0.01 |
| | [4.90] | [1.10] | [5.13] | [1.69] | [-0.45] |
| *MEX* | 0.53 | 0.29 | | 1.19 | 1.06 |
| | [2.61] | [1.15] | | [1.80] | [5.80] |
| *PER* | 0.40 | 0.21 | | -2.15 | 0.05 |
| | [1.34] | [0.71] | | [-3.42] | [2.63] |
| *PHLP* | 0.28 | 0.44 | 1.70 | 1.47 | 0.38 |
| | [1.76] | [1.46] | [7.53] | [4.19] | [5.56] |
| *SAFRC* | 0.36 | 0.06 | 0.70 | 0.98 | -364.81 |
| | [4.44] | [0.17] | [4.99] | [2.78] | [-1.74] |
| *SARBIA* | 0.69 | 1.17 | | | 0.02 |
| | [3.68] | [3.37] | | | [9.15] |
| *SING* | 1.48 | 0.26 | 0.89 | 0.11 | -0.04 |
| | [4.63] | [2.07] | [7.92] | [0.96] | [-0.76] |
| *THAI* | 0.80 | 0.18 | 1.13 | 3.49 | 0.00 |
| | [1.56] | [0.62] | [4.34] | [12.58] | [1.38] |
| *TURK* | 1.21 | 0.17 | | 1.30 | -0.01 |
| | [3.07] | [0.85] | | [0.67] | [-1.23] |
| *UK* | 0.23 | 0.13 | 0.17 | 0.47 | -0.01 |
| | [2.35] | [1.35] | [3.06] | [4.10] | [-0.74] |
| *USA* | 0.08 | 0.00 | | | -0.01 |
| | [0.80] | [0.04] | | | [-1.66] |

*Numbers in parenthesis are t-values.

Table B4. VARX* Lag Order and Cointegrating Relationships for each Country Model

| country | lag order of domestic variables | lag order of foreign variables) | # Cointegrating relations |
|---|---|---|---|
| ARG | 2 | 1 | 2 |
| BRAZIL | 2 | 1 | 2 |
| CHINA | 2 | 1 | 2 |
| CHILE | 1 | 1 | 2 |
| EURO | 2 | 1 | 1 |
| INDIA | 2 | 1 | 2 |
| INDOS | 2 | 1 | 3 |
| JAPAN | 2 | 1 | 2 |
| MAL | 2 | 1 | 2 |
| MEX | 2 | 1 | 2 |
| PERU | 2 | 1 | 2 |
| PHL | 2 | 1 | 3 |
| SAFRC | 2 | 1 | 2 |
| SARBIA | 2 | 1 | 1 |
| SING | 2 | 1 | 1 |
| THAIL | 2 | 1 | 2 |
| TURK | 2 | 1 | 1 |
| UK | 2 | 1 | 2 |
| USA | 2 | 1 | 2 |

Table B5. Generalized FEVD: Response to a Negative 1% SE Global Shock in *sl*

| Period | | *Impact* | *1* | *2* | *3* | *4* | *5* | *15* | *20* | *25* | *30* | *35* | *40* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ARG | Y | 0.00000 | 0.00094 | 0.00208 | 0.00252 | 0.00277 | 0.00283 | 0.00129 | 0.00067 | 0.00037 | 0.00022 | 0.00016 | 0.00014 |
| | Sl | 0.00244 | 0.00231 | 0.00156 | 0.00116 | 0.00087 | 0.00063 | 0.00015 | 0.00021 | 0.00023 | 0.00024 | 0.00025 | 0.00026 |
| | Zs | 0.00277 | 0.00176 | 0.00117 | 0.00143 | 0.00224 | 0.00363 | 0.01607 | 0.01814 | 0.01861 | 0.01850 | 0.01810 | 0.01751 |
| BRAZIL | Y | 0.00450 | 0.00714 | 0.00739 | 0.00902 | 0.01001 | 0.01022 | 0.00491 | 0.00481 | 0.00512 | 0.00563 | 0.00624 | 0.00688 |
| | Sl | 0.00494 | 0.00415 | 0.00421 | 0.00479 | 0.00495 | 0.00457 | 0.00053 | 0.00030 | 0.00025 | 0.00024 | 0.00024 | 0.00024 |
| | Zs | 0.00040 | 0.00035 | 0.00027 | 0.00058 | 0.00102 | 0.00174 | 0.00404 | 0.00364 | 0.00347 | 0.00338 | 0.00331 | 0.00325 |
| CHINA | Y | 0.01859 | 0.01368 | 0.01350 | 0.01466 | 0.01896 | 0.02431 | 0.05943 | 0.06256 | 0.06319 | 0.06278 | 0.06184 | 0.06060 |
| | Sl | 0.38538 | 0.44081 | 0.43896 | 0.39173 | 0.32725 | 0.26386 | 0.02888 | 0.01443 | 0.01101 | 0.01135 | 0.01304 | 0.01514 |
| | Zs | 0.00099 | 0.00090 | 0.00550 | 0.02137 | 0.04836 | 0.07875 | 0.20257 | 0.21301 | 0.21445 | 0.21157 | 0.20662 | 0.20063 |
| CHILE | Y | 0.00004 | 0.00021 | 0.00023 | 0.00063 | 0.00117 | 0.00192 | 0.00722 | 0.00835 | 0.00898 | 0.00938 | 0.00965 | 0.00984 |
| | Sl | 0.00037 | 0.00068 | 0.00112 | 0.00092 | 0.00068 | 0.00050 | 0.00099 | 0.00134 | 0.00162 | 0.00187 | 0.00209 | 0.00227 |
| | Zs | 0.00208 | 0.00340 | 0.00411 | 0.00392 | 0.00331 | 0.00266 | 0.00084 | 0.00123 | 0.00158 | 0.00185 | 0.00204 | 0.00217 |
| EURO | Y | 0.00068 | 0.00501 | 0.00608 | 0.00557 | 0.00465 | 0.00380 | 0.00257 | 0.00270 | 0.00286 | 0.00306 | 0.00325 | 0.00343 |
| | Sl | 0.01698 | 0.01390 | 0.01116 | 0.00936 | 0.00814 | 0.00717 | 0.00259 | 0.00165 | 0.00106 | 0.00069 | 0.00046 | 0.00032 |
| | Zs | 0.01388 | 0.01218 | 0.01855 | 0.02528 | 0.03187 | 0.03554 | 0.02227 | 0.01847 | 0.01618 | 0.01468 | 0.01365 | 0.01292 |
| INDIA | Y | 0.00110 | 0.00564 | 0.01001 | 0.01239 | 0.01243 | 0.01089 | 0.00125 | 0.00100 | 0.00126 | 0.00167 | 0.00209 | 0.00248 |
| | Sl | 0.06207 | 0.05149 | 0.04562 | 0.03778 | 0.03010 | 0.02316 | 0.00240 | 0.00170 | 0.00166 | 0.00177 | 0.00190 | 0.00202 |
| | Zs | 0.00422 | 0.00427 | 0.00395 | 0.00306 | 0.00225 | 0.00163 | 0.00198 | 0.00230 | 0.00239 | 0.00236 | 0.00226 | 0.00213 |
| INDO | Y | 0.00068 | 0.00100 | 0.00177 | 0.00246 | 0.00307 | 0.00355 | 0.00474 | 0.00449 | 0.00428 | 0.00409 | 0.00392 | 0.00377 |
| | Sl | 0.01161 | 0.00728 | 0.00686 | 0.00610 | 0.00558 | 0.00521 | 0.00247 | 0.00174 | 0.00132 | 0.00104 | 0.00085 | 0.00071 |
| | Zs | 0.00104 | 0.00063 | 0.00083 | 0.00062 | 0.00046 | 0.00034 | 0.00017 | 0.00025 | 0.00034 | 0.00042 | 0.00051 | 0.00059 |
| JAPAN | Y | 0.01018 | 0.00955 | 0.00843 | 0.00804 | 0.00816 | 0.00848 | 0.01350 | 0.01498 | 0.01587 | 0.01644 | 0.01679 | 0.01697 |
| | Sl | 0.00619 | 0.00368 | 0.00290 | 0.00312 | 0.00317 | 0.00291 | 0.00046 | 0.00045 | 0.00054 | 0.00063 | 0.00071 | 0.00076 |
| | Zs | 0.00590 | 0.00405 | 0.00463 | 0.00557 | 0.00664 | 0.00704 | 0.00400 | 0.00371 | 0.00369 | 0.00375 | 0.00383 | 0.00391 |
| MAL | Y | 0.00035 | 0.00377 | 0.00759 | 0.01027 | 0.01181 | 0.01283 | 0.01568 | 0.01556 | 0.01532 | 0.01510 | 0.01490 | 0.01473 |
| | Sl | 0.00157 | 0.00126 | 0.00193 | 0.00262 | 0.00287 | 0.00268 | 0.00041 | 0.00045 | 0.00061 | 0.00080 | 0.00098 | 0.00115 |
| | Zs | 0.00000 | 0.00025 | 0.00167 | 0.00364 | 0.00579 | 0.00741 | 0.00944 | 0.00856 | 0.00761 | 0.00673 | 0.00598 | 0.00534 |
| MEX | Y | 0.01423 | 0.01051 | 0.00937 | 0.01004 | 0.01177 | 0.01397 | 0.01992 | 0.01809 | 0.01641 | 0.01494 | 0.01369 | 0.01262 |
| | Sl | 0.00685 | 0.00398 | 0.00268 | 0.00267 | 0.00355 | 0.00489 | 0.01103 | 0.01134 | 0.01110 | 0.01076 | 0.01041 | 0.01008 |
| | Zs | 0.00019 | 0.00032 | 0.00079 | 0.00196 | 0.00379 | 0.00579 | 0.01118 | 0.01002 | 0.00867 | 0.00744 | 0.00636 | 0.00543 |

Table B5. Generalized FEVD: Response to a Negative 1% SE Global Shock in Shadow Bank Liabilities (Continued)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| PERU | Y | 0.00107 | 0.00068 | 0.00089 | 0.00127 | 0.00150 | 0.00160 | 0.00077 | 0.00055 | 0.00042 | 0.00032 | 0.00026 | 0.00021 |
| | SI | 0.00001 | 0.00011 | 0.00009 | 0.00007 | 0.00005 | 0.00004 | 0.00025 | 0.00043 | 0.00061 | 0.00079 | 0.00095 | 0.00111 |
| | Zs | 0.00153 | 0.00114 | 0.00152 | 0.00175 | 0.00187 | 0.00180 | 0.00027 | 0.00013 | 0.00007 | 0.00004 | 0.00003 | 0.00002 |
| PHIL | Y | 0.00608 | 0.00458 | 0.00380 | 0.00316 | 0.00274 | 0.00243 | 0.00119 | 0.00083 | 0.00060 | 0.00044 | 0.00032 | 0.00024 |
| | SI | 0.00474 | 0.00474 | 0.00331 | 0.00234 | 0.00187 | 0.00182 | 0.00366 | 0.00329 | 0.00284 | 0.00241 | 0.00202 | 0.00168 |
| | Zs | 0.00120 | 0.00205 | 0.00363 | 0.00319 | 0.00230 | 0.00188 | 0.01477 | 0.02090 | 0.02582 | 0.02984 | 0.03314 | 0.03585 |
| SAFRIC | Y | 0.00248 | 0.00292 | 0.00611 | 0.00918 | 0.01164 | 0.01344 | 0.01613 | 0.01593 | 0.01588 | 0.01588 | 0.01589 | 0.01590 |
| | SI | 0.00055 | 0.00255 | 0.00345 | 0.00398 | 0.00473 | 0.00513 | 0.00618 | 0.00678 | 0.00719 | 0.00750 | 0.00775 | 0.00796 |
| | Zs | 0.03925 | 0.02886 | 0.02321 | 0.02292 | 0.02442 | 0.02686 | 0.03456 | 0.03624 | 0.03731 | 0.03818 | 0.03888 | 0.03943 |
| SAUDI | Y | 0.00022 | 0.00191 | 0.00152 | 0.00150 | 0.00154 | 0.00180 | 0.00842 | 0.01015 | 0.01100 | 0.01144 | 0.01161 | 0.01162 |
| | SI | 0.02287 | 0.02673 | 0.02684 | 0.02508 | 0.02212 | 0.01895 | 0.00658 | 0.00572 | 0.00550 | 0.00558 | 0.00577 | 0.00601 |
| | Zs | 0.00039 | 0.00026 | 0.00047 | 0.00044 | 0.00041 | 0.00032 | 0.00013 | 0.00007 | 0.00004 | 0.00003 | 0.00003 | 0.00004 |
| SING | Y | 0.00254 | 0.00167 | 0.00115 | 0.00086 | 0.00075 | 0.00076 | 0.00521 | 0.00730 | 0.00893 | 0.01026 | 0.01136 | 0.01226 |
| | SI | 0.00267 | 0.00158 | 0.00248 | 0.00423 | 0.00551 | 0.00597 | 0.00226 | 0.00129 | 0.00076 | 0.00046 | 0.00031 | 0.00025 |
| | Zs | 0.00698 | 0.00872 | 0.01860 | 0.03236 | 0.04501 | 0.05418 | 0.04957 | 0.04097 | 0.03445 | 0.02940 | 0.02539 | 0.02214 |
| THAI | Y | 0.00516 | 0.00370 | 0.00525 | 0.00660 | 0.00905 | 0.01112 | 0.02129 | 0.02253 | 0.02315 | 0.02345 | 0.02358 | 0.02360 |
| | SI | 0.01043 | 0.01445 | 0.01580 | 0.01696 | 0.01716 | 0.01711 | 0.01717 | 0.01685 | 0.01679 | 0.01685 | 0.01693 | 0.01701 |
| | Zs | 0.00103 | 0.00060 | 0.00092 | 0.00170 | 0.00250 | 0.00298 | 0.00170 | 0.00118 | 0.00084 | 0.00061 | 0.00045 | 0.00034 |
| TURK | Y | 0.00008 | 0.00023 | 0.00140 | 0.00188 | 0.00198 | 0.00183 | 0.00037 | 0.00063 | 0.00109 | 0.00164 | 0.00220 | 0.00274 |
| | SI | 0.00005 | 0.00030 | 0.00084 | 0.00241 | 0.00375 | 0.00493 | 0.00805 | 0.00788 | 0.00740 | 0.00685 | 0.00631 | 0.00582 |
| | Zs | 0.00551 | 0.00489 | 0.00459 | 0.00571 | 0.00796 | 0.01054 | 0.01962 | 0.02124 | 0.02253 | 0.02362 | 0.02451 | 0.02522 |
| UK | Y | 0.00030 | 0.00017 | 0.00013 | 0.00027 | 0.00061 | 0.00099 | 0.00201 | 0.00206 | 0.00206 | 0.00207 | 0.00207 | 0.00208 |
| | SI | 0.00004 | 0.00068 | 0.00177 | 0.00247 | 0.00287 | 0.00304 | 0.00215 | 0.00160 | 0.00122 | 0.00095 | 0.00075 | 0.00060 |
| | Zs | 0.00047 | 0.00033 | 0.00096 | 0.00229 | 0.00474 | 0.00805 | 0.02664 | 0.02754 | 0.02681 | 0.02549 | 0.02399 | 0.02246 |
| USA | Y | 0.00568 | 0.00339 | 0.00278 | 0.00208 | 0.00150 | 0.00127 | 0.00798 | 0.01363 | 0.01940 | 0.02503 | 0.03045 | 0.03560 |
| | SI | 0.02858 | 0.02406 | 0.01854 | 0.01513 | 0.01242 | 0.01033 | 0.00322 | 0.00320 | 0.00369 | 0.00442 | 0.00526 | 0.00616 |
| | Zs | 0.00734 | 0.00648 | 0.01074 | 0.01284 | 0.01411 | 0.01376 | 0.00277 | 0.00166 | 0.00131 | 0.00130 | 0.00148 | 0.00181 |

## Appendix C - Chapter 6

## Estimation Results using Annual data – Robustness model results (Chapter 6)

### Table C1. Descriptive Statistics

```
. summarize sbs reer lgdp infl pr liquid1
```

| Variable | Obs | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| sbs | 221 | 10.75841 | .7043388 | 8.771751 | 12.98063 |
| reer | 240 | 1.977854 | .0552421 | 1.742901 | 2.117536 |
| lgdp | 240 | 11.73038 | .4416969 | 10.95922 | 13.00694 |
| infl | 237 | 1.983731 | .0999931 | 1.663666 | 2.24296 |
| pr | 240 | .0639573 | .0618971 | 0 | .4408333 |
| liquid1 | 240 | 111.6875 | 69.11701 | 1 | 231 |

### Table C2. Correlation Matrix

```
. correlate sbs reer lgdp infl pr liquid1
(obs=219)
```

| | sbs | reer | lgdp | infl | pr | liquid1 |
|---|---|---|---|---|---|---|
| sbs | 1.0000 | | | | | |
| reer | 0.0969 | 1.0000 | | | | |
| lgdp | 0.6636 | -0.0548 | 1.0000 | | | |
| infl | 0.5081 | 0.1331 | 0.1863 | 1.0000 | | |
| pr | -0.0509 | -0.3788 | 0.2649 | -0.3241 | 1.0000 | |
| liquid1 | 0.2547 | -0.2105 | 0.1328 | 0.0392 | 0.2019 | 1.0000 |

## Table C3. Cross Sectional Dependence Test Results

Average correlation coefficients & Pesaran (2004) CD test

Variables series tested: sbs infl lgdp reer pr liquid1
Group variable: Country
Number of groups: 15
Average # of observations: 15.34
Panel is: unbalanced

| Variable | CD-test | p-value | corr | abs(corr) |
|---|---|---|---|---|
| sbs | 33.66 | 0.000 | 0.868 | 0.868 |
| infl | 38.04 | 0.000 | 0.982 | 0.982 |
| lgdp | 37.96 | 0.000 | 0.980 | 0.980 |
| reer | 4.88 | 0.000 | 0.124 | 0.454 |
| pr | 9.91 | 0.000 | 0.254 | 0.383 |
| liquid1 | 5.32 | 0.000 | 0.134 | 0.490 |

Notes: Under the null hypothesis of cross-section independence CD ~ N(0,1)

## Table C4. Pesaran (2007) Unit Root Test Results

| | Specification with trend | | | |
|---|---|---|---|---|
| Variable | lags | Zt-bar | p-value | t-bar |
| sbs | 0 | 1.151 | 0.875 | . |
| sbs | 1 | 1.625 | 0.948 | . |
| reer | 0 | -0.404 | 0.343 | . |
| reer | 1 | -1.361 | 0.087 | . |
| lgdp | 0 | 5.181 | 1.000 | . |
| lgdp | 1 | 6.444 | 1.000 | . |
| infl | 0 | -1.136 | 0.128 | . |
| infl | 1 | -0.076 | 0.470 | . |
| pr | 0 | -0.849 | 0.198 | . |
| pr | 1 | 0.046 | 0.518 | . |
| liquid1 | 0 | 3.233 | 0.999 | . |
| liquid1 | 1 | 2.912 | 0.998 | . |

Null for MW and CIPS tests: series is I(1).
MW test assumes cross-section independence.
CIPS test assumes cross-section dependence is in form of a single unobserved common factor.

| | Specification with trend | | | |
|---|---|---|---|---|
| Variable | lags | Zt-bar | p-value | t-bar |
| dsbs | 0 | -6.812 | 0.000 | . |
| dsbs | 1 | -5.257 | 0.000 | . |
| dreer | 0 | -2.498 | 0.006 | . |
| dreer | 1 | 0.125 | 0.550 | . |
| dlgdp | 0 | -2.199 | 0.014 | . |
| dlgdp | 1 | 0.942 | 0.827 | . |
| dinfl | 0 | -3.455 | 0.000 | . |
| dinfl | 1 | -1.542 | 0.062 | . |
| dpr | 0 | -2.873 | 0.002 | . |
| dpr | 1 | -0.773 | 0.220 | . |
| dliquid1 | 0 | -2.260 | 0.012 | . |
| dliquid1 | 1 | -1.599 | 0.055 | . |

Null for MW and CIPS tests: series is I(1).
MW test assumes cross-section independence.
CIPS test assumes cross-section dependence is in
form of a single unobserved common factor.

## Table C5. Model Selection Criterion

```
. pvarsoc dlgdp dliquid dinfl dpr dsbs dreer, maxlag(3) pvaropts(instl(1/3))
Running panel VAR lag order selection on estimation sample
...

Selection order criteria
Sample:  2006 - 2015                              No. of obs      =       144
                                                  No. of panels   =        15
                                                  Ave. no. of T   =     9.600
```

| lag | CD | J | J pvalue | MBIC | MAIC | MQIC |
|---|---|---|---|---|---|---|
| 1 | .9695178 | 67.91816 | .6144528 | -289.9084 | -76.08184 | -162.9689 |
| 2 | .9948501 | 36.48006 | .4463418 | -142.4332 | -35.51994 | -78.96346 |
| 3 | -.8517614 | . | . | . | . | . |

# Table C6. PVAR Estimation

```
. pvar dlgdp dliquid dinfl dpr dsbs dreer,instl(1/3)gmmstyle overid

Panel vector autoregresssion


GMM Estimation

Final GMM Criterion Q(b) =       .448
Initial weight matrix: Identity
GMM weight matrix:      Robust
                                                No. of obs       =        174
                                                No. of panels    =         15
                                                Ave. no. of T    =     11.600
```

| | Coef. | Std. Err. | z | P>\|z\| | [95% Conf. | Interval] |
|---|---|---|---|---|---|---|
| **dlgdp** | | | | | | |
| dlgdp L1. | .359843 | .0569882 | 6.31 | 0.000 | .2481483 | .4715378 |
| dliquidl L1. | .0001355 | .000093 | 1.46 | 0.145 | -.0000469 | .0003178 |
| dinfl L1. | -.28586 | .0976801 | -2.93 | 0.003 | -.4773095 | -.0944105 |
| dpr L1. | -.0197455 | .0110314 | -1.79 | 0.073 | -.0413667 | .0018758 |
| dsbs L1. | .022306 | .0039484 | 5.65 | 0.000 | .0145673 | .0300448 |
| dreer L1. | -.0901364 | .0218658 | -4.12 | 0.000 | -.1329925 | -.0472803 |
| **dliquidl** | | | | | | |
| dlgdp L1. | 214.3923 | 160.245 | 1.34 | 0.181 | -99.68204 | 528.4666 |
| dliquidl L1. | .506925 | .1414012 | 3.59 | 0.000 | .2297839 | .7840662 |
| dinfl L1. | 2079.143 | 322.0018 | 6.46 | 0.000 | 1448.031 | 2710.255 |
| dpr L1. | -72.83388 | 37.68332 | -1.93 | 0.053 | -146.6918 | 1.02407 |
| dsbs L1. | 19.97763 | 5.988867 | 3.34 | 0.001 | 8.239662 | 31.71559 |
| dreer L1. | 204.1839 | 56.08308 | 3.64 | 0.000 | 94.26308 | 314.1047 |
| **dinfl** | | | | | | |
| dlgdp L1. | .3873381 | .0805319 | 4.81 | 0.000 | .2294985 | .5451777 |
| dliquidl L1. | .0001248 | .0000764 | 1.63 | 0.102 | -.000025 | .0002746 |
| dinfl L1. | -.102988 | .1013495 | -1.02 | 0.310 | -.3016293 | .0956534 |
| dpr L1. | .0721434 | .0339095 | 2.13 | 0.033 | .0056819 | .1386048 |
| dsbs L1. | .0003702 | .0038194 | 0.10 | 0.923 | -.0071157 | .0078562 |
| dreer L1. | -.2182248 | .0307453 | -7.10 | 0.000 | -.2784844 | -.1579652 |
| **dpr** | | | | | | |
| dlgdp L1. | -.0029995 | .126565 | -0.02 | 0.981 | -.2510625 | .2450634 |
| dliquidl L1. | -.0000155 | .0000919 | -0.17 | 0.866 | -.0001957 | .0001647 |
| dinfl L1. | -1.641409 | .1603011 | -10.24 | 0.000 | -1.955593 | -1.327225 |
| dpr L1. | .1967237 | .0248887 | 7.90 | 0.000 | .1479427 | .2455047 |
| dsbs L1. | -.0197052 | .0050657 | -3.89 | 0.000 | -.0296337 | -.0097767 |
| dreer L1. | .143991 | .0484597 | 2.97 | 0.003 | .0490119 | .2389702 |
| **dsbs** | | | | | | |
| dlgdp L1. | 2.727264 | 1.13797 | 2.40 | 0.017 | .4968827 | 4.957645 |
| dliquidl L1. | .0004306 | .0007891 | 0.55 | 0.585 | -.001116 | .0019772 |
| dinfl L1. | 2.68057 | 1.87753 | 1.43 | 0.153 | -.999322 | 6.360462 |
| dpr L1. | -.6563347 | .2831044 | -2.32 | 0.020 | -1.211209 | -.1014602 |
| dsbs L1. | .1084573 | .0618004 | 1.75 | 0.079 | -.0126693 | .229584 |
| dreer L1. | 2.90687 | .5488993 | 5.30 | 0.000 | 1.831047 | 3.982693 |
| **dreer** | | | | | | |
| dlgdp L1. | .2679613 | .1363155 | 1.97 | 0.049 | .0007878 | .5351347 |
| dliquidl L1. | .000181 | .0001594 | 1.14 | 0.256 | -.0001314 | .0004933 |
| dinfl L1. | 1.745452 | .3200026 | 5.45 | 0.000 | 1.118259 | 2.372646 |
| dpr L1. | -.0510903 | .0448685 | -1.14 | 0.255 | -.139031 | .0368504 |
| dsbs L1. | .0435114 | .0082278 | 5.29 | 0.000 | .0273852 | .0596376 |
| dreer L1. | .020051 | .0698875 | 0.29 | 0.774 | -.1169259 | .157028 |

```
Instruments : l(1/3).(dlgdp dliquidl dinfl dpr dsbs dreer)
```



```
Test of overidentifying restriction:
  Hansen's J chi2(72) = 77.930565 (p = 0.296)
```

Table C6. PVAR Estimation Results (Continued)

```
Instruments : l(1/3).(dlgdp dliquid1 dinfl dpr dsbs dreer)


Test of overidentifying restriction:
  Hansen's J chi2(72) = 77.930565 (p = 0.296)
```

Table C7. PVAR Stability Graph

```
. pvarstable,graph

   Eigenvalue stability condition
```

| Eigenvalue | | |
|---|---|---|
| Real | Imaginary | Modulus |
| .9373595 | 0 | .9373595 |
| -.0512786 | -.6588945 | .6608869 |
| -.0512786 | .6588945 | .6608869 |
| .3375234 | 0 | .3375234 |
| -.2706836 | 0 | .2706836 |
| .18737 | 0 | .18737 |

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

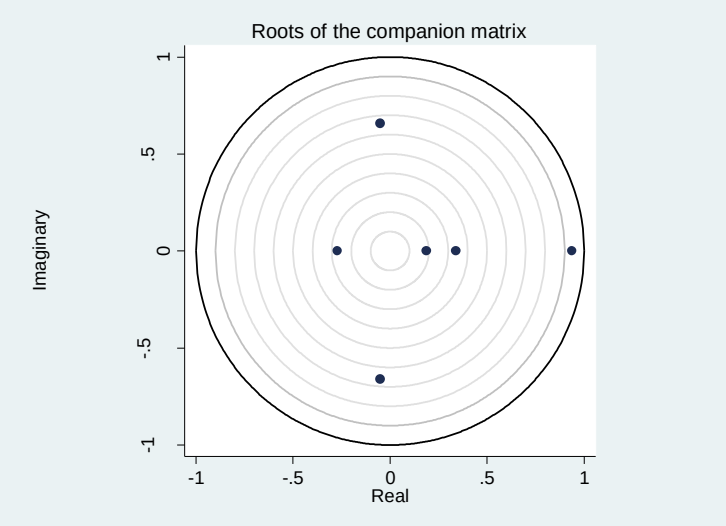



Figure C1. AR Roots Graph for Testing PVAR Model Stability

## Table C8. PVAR Granger Causality Test

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

| Equation \ Excluded | chi2 | df | Prob > chi2 |
|---|---|---|---|
| dlgdp | | | |
| dliquid1 | 2.120 | 1 | 0.145 |
| dinfl | 8.564 | 1 | 0.003 |
| dpr | 3.204 | 1 | 0.073 |
| dsbs | 31.916 | 1 | 0.000 |
| dreer | 16.993 | 1 | 0.000 |
| ALL | 84.103 | 5 | 0.000 |
| dliquid1 | | | |
| dlgdp | 1.790 | 1 | 0.181 |
| dinfl | 41.692 | 1 | 0.000 |
| dpr | 3.736 | 1 | 0.053 |
| dsbs | 11.128 | 1 | 0.001 |
| dreer | 13.255 | 1 | 0.000 |
| ALL | 87.490 | 5 | 0.000 |
| dinfl | | | |
| dlgdp | 23.134 | 1 | 0.000 |
| dliquid1 | 2.667 | 1 | 0.102 |
| dpr | 4.526 | 1 | 0.033 |
| dsbs | 0.009 | 1 | 0.923 |
| dreer | 50.379 | 1 | 0.000 |
| ALL | 84.371 | 5 | 0.000 |
| dpr | | | |
| dlgdp | 0.001 | 1 | 0.981 |
| dliquid1 | 0.028 | 1 | 0.866 |
| dinfl | 104.848 | 1 | 0.000 |
| dsbs | 15.132 | 1 | 0.000 |
| dreer | 8.829 | 1 | 0.003 |
| ALL | 150.248 | 5 | 0.000 |
| dsbs | | | |
| dlgdp | 5.744 | 1 | 0.017 |
| dliquid1 | 0.298 | 1 | 0.585 |
| dinfl | 2.038 | 1 | 0.153 |
| dpr | 5.375 | 1 | 0.020 |
| dreer | 28.046 | 1 | 0.000 |
| ALL | 53.164 | 5 | 0.000 |
| dreer | | | |
| dlgdp | 3.864 | 1 | 0.049 |
| dliquid1 | 1.289 | 1 | 0.256 |
| dinfl | 29.751 | 1 | 0.000 |
| dpr | 1.297 | 1 | 0.255 |
| dsbs | 27.967 | 1 | 0.000 |
| ALL | 46.244 | 5 | 0.000 |

## Table C9. Forecast Error Variance

| Response variable and Forecast horizon | Impulse variable: dlgdp | dliquid1 | dinfl | dpr | dsbs | dreer |
|---|---|---|---|---|---|---|
| **dlgdp** | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | .772108 | .06105 | .0743543 | .0020357 | .066905 | .0235469 |
| 3 | .704621 | .0894328 | .0688846 | .0069256 | .0736578 | .0564781 |
| 4 | .668837 | .085809 | .1078839 | .0071905 | .0793887 | .050891 |
| 5 | .6596419 | .0938475 | .1052509 | .0067578 | .0787367 | .0557653 |
| 6 | .6487308 | .1103741 | .1009326 | .0065263 | .0797014 | .0537348 |
| 7 | .6388221 | .1184213 | .1025634 | .0066032 | .0815559 | .0520341 |
| 8 | .6323744 | .1222701 | .1057695 | .006462 | .0825089 | .0506151 |
| 9 | .6279658 | .1275201 | .1052606 | .006303 | .0829924 | .049958 |
| 10 | .6236812 | .1328285 | .1046671 | .0062177 | .0836438 | .0489616 |
| **dliquid1** | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | .0269386 | .9730614 | 0 | 0 | 0 | 0 |
| 2 | .0618683 | .5767263 | .3212688 | .002572 | .0136735 | .0238912 |
| 3 | .1621098 | .4466476 | .3071322 | .0024982 | .0229347 | .0586776 |
| 4 | .2021137 | .4473311 | .2592398 | .0022269 | .0285837 | .0605049 |
| 5 | .2161614 | .4478896 | .2393396 | .0028116 | .0385313 | .0552665 |
| 6 | .2339071 | .4273774 | .2396657 | .0030054 | .0459774 | .050067 |
| 7 | .252619 | .4151323 | .2307385 | .0028122 | .0499422 | .0487558 |
| 8 | .2640351 | .4125364 | .2208629 | .002729 | .0532046 | .046632 |
| 9 | .2717234 | .4090789 | .2156319 | .0027802 | .0563557 | .0444299 |
| 10 | .2789718 | .4041628 | .2125244 | .0027729 | .0587516 | .0428166 |
| **dinfl** | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | .0418838 | .0855977 | .8725185 | 0 | 0 | 0 |
| 2 | .081705 | .0651804 | .6329238 | .0132852 | .0005699 | .2063358 |
| 3 | .072741 | .1024299 | .6272077 | .0118279 | .0005386 | .1852549 |
| 4 | .0694066 | .0994809 | .6121366 | .0137734 | .0038841 | .2013185 |
| 5 | .0753286 | .0964924 | .6130278 | .0133395 | .0048851 | .1969267 |
| 6 | .0800467 | .0982221 | .6039379 | .0133754 | .0050199 | .1993981 |
| 7 | .0806064 | .1021434 | .6000879 | .0133337 | .005554 | .1982747 |
| 8 | .0815682 | .1025419 | .5986978 | .013379 | .0063494 | .1974638 |
| 9 | .083783 | .1026796 | .5967707 | .0133034 | .006789 | .1966743 |
| 10 | .0853537 | .1037821 | .5944049 | .0132493 | .0070899 | .19612 |
| **dpr** | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | .0023062 | .0568136 | .0067925 | .9340876 | 0 | 0 |
| 2 | .0222238 | .0668453 | .3100085 | .5647705 | .0162439 | .0199082 |
| 3 | .0566868 | .0596443 | .269096 | .492682 | .0143092 | .1075816 |
| 4 | .0548114 | .080334 | .2816986 | .4671852 | .0138834 | .1020874 |
| 5 | .0538338 | .0814111 | .2803612 | .4578709 | .0157346 | .1107885 |
| 6 | .0584671 | .0798787 | .2869224 | .4490005 | .0165793 | .1091521 |
| 7 | .0628722 | .0814434 | .2838081 | .4442113 | .0167501 | .110915 |
| 8 | .0641145 | .0845758 | .2821928 | .4416267 | .0172041 | .1102862 |
| 9 | .0653741 | .0854302 | .2821199 | .4393599 | .017838 | .1098779 |
| 10 | .0673992 | .0858783 | .281879 | .4371297 | .018237 | .1094767 |
| **dsbs** | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | .0640435 | .0083163 | .0769441 | .0051174 | .8455786 | 0 |
| 2 | .1243335 | .0333696 | .0677017 | .0081207 | .6574018 | .1090726 |
| 3 | .1620896 | .0343816 | .0988775 | .0080815 | .5991516 | .0974181 |
| 4 | .1922402 | .0529918 | .092981 | .0074643 | .5585896 | .095733 |
| 5 | .2028575 | .0736256 | .0891911 | .007307 | .5362203 | .0907986 |
| 6 | .2115654 | .0834501 | .0932171 | .0073072 | .5177056 | .0867545 |
| 7 | .2216845 | .0901285 | .0961228 | .0070755 | .5010718 | .0839171 |
| 8 | .2295687 | .0981213 | .095524 | .0068761 | .4880802 | .0818297 |
| 9 | .2349924 | .1050366 | .095428 | .0067707 | .4780517 | .0797207 |
| 10 | .2397424 | .1098358 | .0963517 | .0066833 | .4694623 | .0779245 |
| **dreer** | | | | | | |
| 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1 | .0453345 | .1309148 | .0007476 | .0000351 | .0034153 | .8195527 |
| 2 | .097263 | .0909375 | .183788 | .0022406 | .0566923 | .5690787 |
| 3 | .1632442 | .0988121 | .1623289 | .0028387 | .0538721 | .5189039 |
| 4 | .1759922 | .133557 | .1512114 | .0027008 | .0568559 | .4796827 |
| 5 | .1834468 | .144491 | .152577 | .003465 | .0616935 | .4543266 |
| 6 | .197576 | .1461076 | .1588855 | .0033981 | .0641685 | .4298643 |
| 7 | .2098695 | .1530411 | .1549485 | .0032567 | .0653037 | .4135805 |
| 8 | .2168189 | .1611593 | .1517306 | .0032386 | .0668471 | .4002056 |
| 9 | .2225839 | .1654575 | .1515757 | .0032744 | .0683885 | .3887202 |
| 10 | .2284891 | .1684365 | .1513208 | .0032391 | .0694262 | .3790883 |

**Impulse Response Functions: Robustness Model, using yearly data**

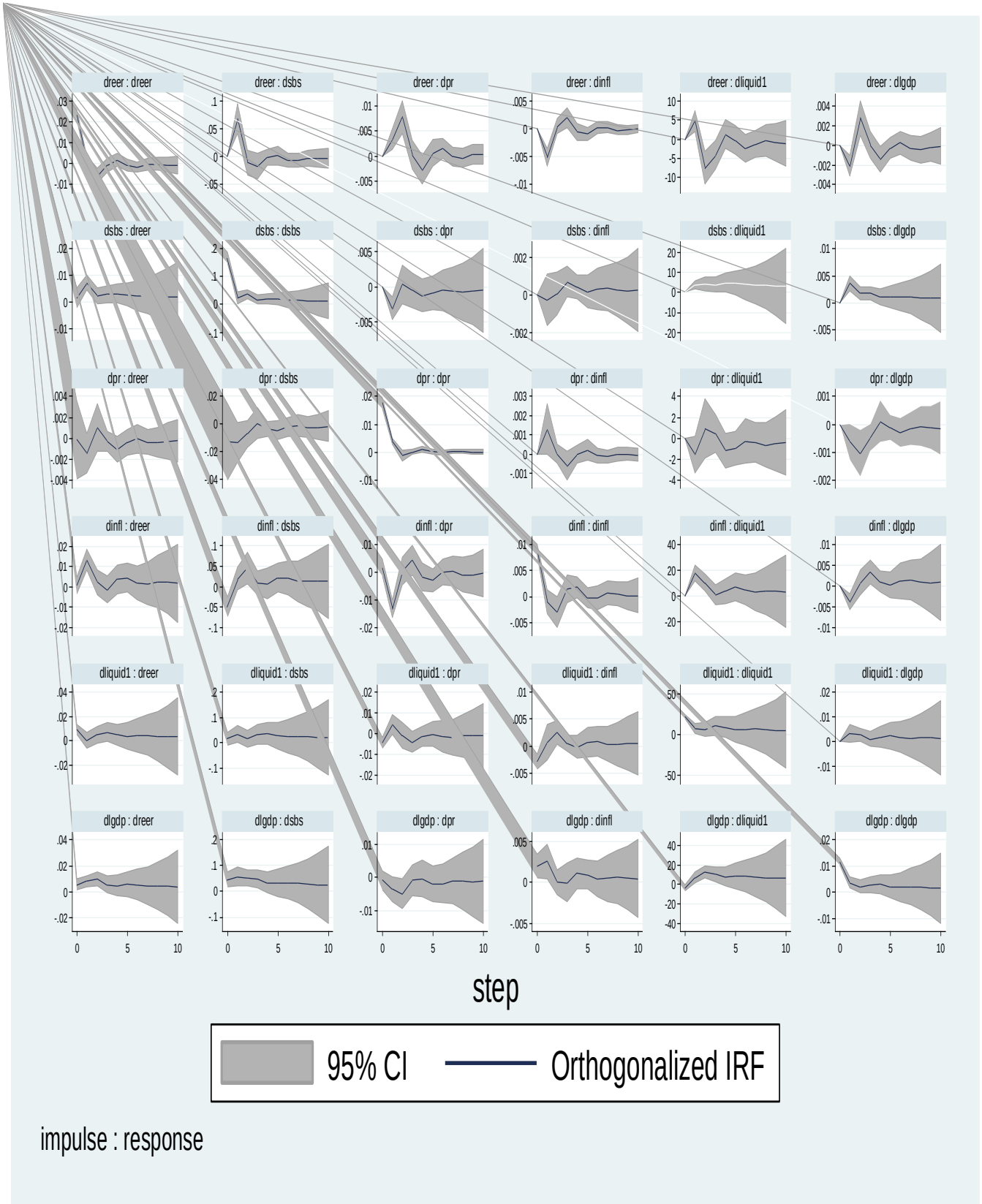



Figure C2. Robustness Model Impulse Response Functions

## Appendix D – Chapter 8

Table D1: Unit Root Tests for Chapter 8

| Variable | ADF statistic | PP Statistic | Breakpoint Test statistic | Overall Decision |
|---|---|---|---|---|
| $ROA_{bnks}$ | -2.829181 | -2.861533 | -6.3505*** | Non-stationary |
| LA -liquidity | -1.971224 | -2.001135 | -2.9170 | Non-stationary |
| OFI | -2.048543 | -2.115549 | -3.1549 | Non-stationery |
| Lnlp | -0.516984 | 0.151419 | -3.5479 | Non-stationary |
| Unempl | -2.120973 | -4.775994** | -2.5127 | Non-Stationary (use modified criterion) |
| Intspr | -1.633763 | -1.419061 | -4.7628** | Non-stationary |
| $ROA_{nonfin}$ | -1.927473 | -3.345827** | -3.6350 | Non-Stationary |
| ljsealsi | -3.125611 | -2.244967 | -3.9381 | Not-stationary |
| TA - size | -1.893555 | -2.012227 | -4.0133 | Non-stationary |
| LGDP | -0.921866 | -0.921866 | -5.5549** | Non-stationary |
| $LCPI$ | -3.415133* | -1.650872 | -4.0502 | Non -stationary |
| LCREDIT | -1.865791 | -1.865791 | -4.4963 | Non-stationary |
| lM2 | -3.272219* | -3.161027 | -3.6560 | Non-stationary |
| $\Delta ROAbnks$ | -4.475975*** | -3.576334** | | Stationary |
| $\Delta lnlp$ | -1.838436* | -3.357227*** | -5.5014*** | Stationary |
| $\Delta OFI$ | -6.593332*** | -6.594361*** | -7.0706*** | Stationary |
| $\Delta LA$ | -5.920028*** | -5.920028*** | -6.5985*** | Stationary |
| $\Delta LTA$ | -4.346587*** | -5.632513*** | -5.8365*** | Stationary |
| $\Delta LGDP$ | -7.063738*** | -7.105128*** | | Stationary |
| $\Delta LCPI$ | -4.805467*** | -7.180994*** | -4.9231** | Stationary |
| $\Delta intspr$ | -5.025978*** | -4.988335*** | -4.7628*** | Stationary |
| $\Delta ljsealsi$ | -4.270336*** | -3.773391** | -4.3603*** | Stationary |
| $\Delta lcred\$$ | -6.591382*** | -6.595619*** | -7.0102*** | stationary |
| $\Delta Unempl$ | -9.098188*** | -9.300893*** | -9.3524*** | Stationary |
| ΔProfitall | -8.776279*** | -8.856430*** | -8.7399*** | stationary |

Table D2: Descriptive Statistics for Chapter 8

| | GROWTH | INFLATION | OFI | INTSPR | CREDIT | LTA | UNEMP | ROANONFIN | LALSIJSE |
|---|---|---|---|---|---|---|---|---|---|
| Mean | 0.388889 | 5.647222 | 17.65748 | 1.769444 | 227852.7 | 15.09530 | 24.74167 | 0.070539 | 10.49941 |
| Median | 0.400000 | 5.500000 | 16.97754 | 2.235000 | 225940.5 | 15.06997 | 25.00000 | 0.070000 | 10.45039 |
| Maximum | 1.300000 | 9.200000 | 20.97699 | 3.200000 | 281879.0 | 15.39907 | 27.10000 | 0.140000 | 10.87855 |
| Minimum | -1.600000 | 2.400000 | 14.64632 | -2.310000 | 172883.0 | 14.82483 | 21.50000 | 0.040000 | 9.893425 |
| Std. Dev. | 0.611218 | 1.465895 | 1.958630 | 1.502814 | 28921.71 | 0.176228 | 1.221328 | 0.021912 | 0.299225 |
| Skewness | -0.970796 | 0.217487 | 0.202628 | -1.655125 | 0.137314 | 0.372148 | -0.417962 | 1.499741 | -0.235105 |
| Kurtosis | 4.372449 | 3.322967 | 1.699881 | 4.512447 | 2.275865 | 1.877506 | 3.227514 | 5.155234 | 1.886443 |
| Jarque-Bera | 8.480098 | 0.440266 | 2.781811 | 19.86788 | 0.899689 | 2.720952 | 1.125797 | 20.46288 | 2.191658 |
| Probability | 0.014407 | 0.802412 | 0.248850 | 0.000049 | 0.637727 | 0.256539 | 0.569556 | 0.000036 | 0.334262 |
| Sum | 14.00000 | 203.3000 | 635.6693 | 63.70000 | 8202698. | 543.4308 | 890.7000 | 2.539400 | 377.9788 |
| Sum Sq. Dev. | 13.07556 | 75.20972 | 134.2681 | 79.04579 | 2.93E+10 | 1.086975 | 52.20750 | 0.016805 | 3.133741 |
| Observations | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 | 36 |

Table D3: Correlation Matrix for Chapter 8

Covariance Analysis: Ordinary

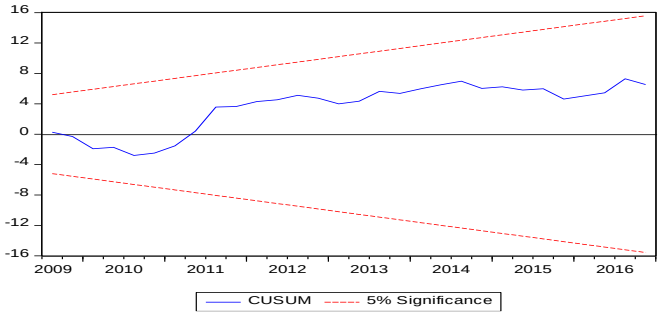
Sample: 2008Q1 2016Q4

Included observations: 36

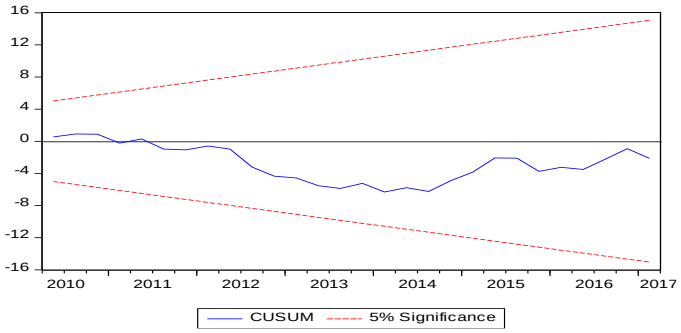
| Correlation | GROWTH | INFLATION | OFI | INTSPR | CREDIT | LTA | UNEMP | ROANONFIN | LALSIJSE |
|---|---|---|---|---|---|---|---|---|---|
| GROWTH | 1.0000 | | | | | | | | |
| INFLATION | -0.5488 | 1.0000 | | | | | | | |
| OFI | -0.0177 | -0.1602 | 1.0000 | | | | | | |
| INTSPR | 0.3557 | -0.7238 | 0.4711 | 1.0000 | | | | | |
| CREDIT | 0.4960 | -0.6057 | -0.4038 | 0.4679 | 1.0000 | | | | |
| LTA | -0.2131 | -0.0140 | 0.9540 | 0.3435 | -0.5435 | 1.0000 | | | |
| UNEMP | 0.1081 | -0.5585 | 0.7405 | 0.6233 | 0.0084 | 0.6702 | 1.0000 | | |
| ROANONFIN | 0.1008 | 0.3598 | -0.5545 | -0.6312 | -0.0366 | -0.5292 | -0.7097 | 1.0000 | |
| LALSIJSE | 0.1035 | -0.1973 | 0.9579 | 0.4770 | -0.3382 | 0.8893 | 0.6898 | -0.4563 | 1.0000 |

**Parameter Stability Tests (CUSUM test)**

**Model 1**




**Model 2**




**Model 3**

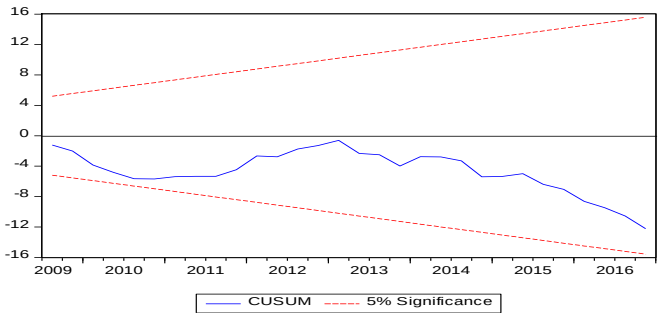



Figure D1. Cusum Test for Parameter Stability