Bank regulation and bank lending in selected sub-Saharan African countries

by

RETSELISITSOE I. THAMAE

submitted in accordance with the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in the subject

ECONOMICS

at the

UNIVERSITY OF SOUTH AFRICA

SUPERVISOR: PROF. N.M. ODHIAMBO

July 2023

DECLARATION

Name: Retselisitsoe I. Thamae

Student Number: 64071324

Degree: DOCTOR OF PHILOSOPHY IN ECONOMICS

Title: **Bank regulation and bank lending in selected sub-Saharan African countries**

I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

I further declare that I submitted the thesis to originality checking software and that it falls within the accepted requirements for originality.

I further declare that I have not previously submitted this work, or part of it, for examination at Unisa for another qualification or at any other higher education institution.

07 July 2023

SIGNATURE DATE

ABSTRACT

Most countries, including the ones in sub-Saharan Africa (SSA), have been facing pressure to increase the stringency of bank regulation since the aftermath of the 2007-2008 global financial crisis. Therefore, this study analyses the relationship between bank regulation and bank lending in selected SSA countries and/or their low-income and middle-income groups from 1995 to 2017. First, the empirical results from the linear panel autoregressive distributed lag (ARDL) model estimated through the dynamic common correlated effects (CCE) method showed that bank entry barriers impacted bank lending negatively in the long run in all selected SSA economies and low-income SSA countries, while macroprudential policies had a negative long-run impact on bank credit in middle-income SSA economies, but supervisory power mitigated these effects. Alternatively, the findings from the nonlinear panel ARDL model indicated that various shocks to bank regulatory measures affected bank lending differently. Second, the dynamic panel threshold regression model results estimated through the generalised method of moments approach revealed that the threshold values for the stringency of bank entry barriers and capital regulations in the case of all selected SSA economies were 62.8% and 76.5%, respectively. The effect of bank entry barriers stringency on bank credit was found to be positive below its threshold value but negative above it, while that of capital regulation stringency was insignificant either below or above its threshold level. Lastly, the empirical findings from the panel error correction-based Granger causality models generally highlighted that long-run causality existed between bank regulatory measures and bank lending in the context of selected SSA countries and their income groups, while various shocks to bank regulatory measures and bank credit had different causal effects. Thus, the study recommends that policymakers should not introduce bank regulatory and supervisory reforms for their own sake, since regulations that are too stringent could hamper bank credit. Furthermore, regulatory authorities should take into consideration the existence of nonlinear and threshold effects in the relationship between bank regulation and bank lending as not doing so could lead to biased estimates and result in wrong policy conclusions.

KEYWORDS

Bank regulation; bank regulatory measures; bank lending; bank credit; linear and nonlinear panel autoregressive distributed lag (ARDL); dynamic common correlated effects (CCE); dynamic panel threshold regression (PTR); generalised method of moments (GMM); symmetric and asymmetric panel Granger causality; error correction; sub-Saharan Africa.

DEDICATION

To my beloved wife, Matsooana Mary Thamae, and our adorable identical twin daughters, Mathe Jemimah Thamae and Nthati Jedidah Thamae.

ACKNOWLEDGEMENTS

I would like to express my sincere gratitude to the following:

- My supervisor, Prof. N.M. Odhiambo, for his availability, guidance and support throughout my studies.
- Dr M.J. Khumalo, for his guidance during the proposal and early stages of this thesis.
- UNISA Student Funding for financial support.
- My colleagues, in the Department of Economics at the National University of Lesotho and the Central Bank of Lesotho, for all the advice and support provided.
- My family and friends, for their support and encouragement.
- Editors and reviewers of the accredited journals that have published (or accepted for publication) manuscripts derived from this thesis, for their constructive comments. These journals include the *Journal of Central Banking Theory and Practice*, *Journal of Banking Regulation*, *Macroeconomics and Finance in Emerging Market Economies* and *International Journal of Emerging Markets*.
- All those who supported me during my studies.

Notwithstanding the guidance and contribution from people, institutions and journals mentioned, the responsibility for all views and any shortcomings are entirely mine.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

ADF	Augmented Dickey-Fuller
AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag
BRIC	Brazil, Russia, India, and China
CADF	Cross-sectionally Augmented Dickey-Fuller
CCE	Common Correlated Effects
CCEMG	Common Correlated Effects Mean Group
CCEP	Common Correlated Pooled
CD	Cross-sectional Dependence
CEMAC	Economic and Monetary Community of Central Africa
CIPS	Cross-sectionally Augmented Im-Pesaran-Shin
ECT	Error-correction Term
EU	European Union
GDP	Gross Domestic Product
GMM	Generalised Method of Moments
GNI	Gross National Income
IFRS	International Financial Reporting Standards
IMF	International Monetary Fund
IPS	Im, Pesaran and Shin
LLC	Levin, Lin and Chu
LM	Lagrange Multiplier
NARDL	Nonlinear Autoregressive Distributed Lag
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
PTR	Panel Threshold Regression
SIC	Schwarz Information Criterion
SSA	Sub-Saharan Africa
UK	United Kingdom
US	United States
VAR	Vector Autoregression
WAEMU	West African Economic and Monetary Union

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

Attaining and maintaining financial stability through bank regulation has been one of the fundamental policies for fostering financial development and economic growth. Consequently, different countries worldwide have carried out reforms in bank regulation following the introduction of the Basel accord in the late 1980s, and after the 2007-2008 global financial crisis (Anginer, Bertay, Cull, Demirgüç-Kunt & Mare, 2019; Enoch, Mathieu, Mecagni & Kriljenko, 2015; Barth, Caprio & Levine, 2001, 2008, 2013). Some of these reforms have been introduced to minimise financial risks borne by banking institutions and promote bank development. These reforms include measures on banking entry barriers, mixing of banking and commerce restrictions, banking activity restrictions and capital regulatory requirements. The majority of countries have also adopted macroprudential policies, both borrower-targeted and lender-targeted measures, with the central purpose of managing the build-up of systemic risk arising from the financial sector (Cerutti, Claessens & Laeven, 2017; Hanson, Kashyap & Stein, 2011). All these reforms have raised questions about the impact of bank regulatory measures on bank lending as well as the causal relationship between the two.

Past theoretical and empirical studies analysing how the stringency of bank regulatory measures affect bank credit[1] offer conflicting views, with the empirical evidence mainly emanating from studies focusing on linear and short-run adjustments. First, the theory of market structure contends that barriers to entry into the banking sector limit competition. These entry barriers can either improve the market power and profitability of banking institutions and enhance prudent lending (Keeley, 1990) or lead to market inefficiencies that can encourage banks to increase their banking service costs and result in a fall in demand for credit (Claessens & Klingebiel, 2001). Even though the evidence emanating from the empirical studies indicates that increasing the stringency of banking entry barriers restricts bank credit

[1] Bank credit and bank lending are used interchangeably in this study.

(Merrouche & Nier, 2017), the obtained effect at times became positive (Amidu, 2014) or insignificant (Barth, Caprio & Levine, 2004).

Second, the asymmetric information theory views restrictions imposed on the mixing of banking and commerce and on banking activities to prevent problems brought by conflict of interests as well as moral hazard. This can curtail banks' incentives to assume excessive risks, thereby promoting prudence in lending (Boyd, Chang & Smith, 1998). On the contrary, the theory of economies of scale and scope considers mixing of banking and commerce restrictions as well as banking activity restrictions to be obstacles aimed at restricting banks' ability to offer more lending (Claessens & Klingebiel, 2001). Although there is some empirical evidence in support of the hypothesis that these restrictions limit bank credit (Barth et al., 2004), other research evidence shows that they encourage the provision of lending (Amidu, 2014) or do not impact it at all (Merrouche & Nier, 2017).

Third, the risk-absorption theory postulates that capital regulatory requirements can enhance prudent lending by improving the risk-bearing capacity of banks, whereas the financial fragility-crowding out hypothesis contends that capital regulatory requirements can hinder prudence in lending by making banks put more reliance on equity than deposits and generally capital investors as the providers of equity are reluctant to lend (Kim & Sohn, 2017). The empirical findings on how higher capital requirements could affect lending are inconclusive as they are established to either hamper bank credit (Amidu, 2014; Bridges et al., 2014) or have no impact on it (Fratzscher, König & Lambert, 2016; Bridges et al., 2014; Barth et al., 2004).

Fourth, the nature of macroprudential policy instruments shows that their effect on bank lending should be countercyclical (Cerutti et al., 2017; IMF, 2013). But Lim et al. (2011) specify possible scenarios that, if not taken into consideration when designing macroprudential policies, could lead to unintended results. For example, multiple tools are preferred over choosing a single instrument, while discretionary macroprudential policies are more preferred than difficult rules-based policies. Moreover, targeted tools addressing specific risks could be more effective than broad-based instruments, while time-varying tools applied to different stages of a

financial cycle could perform better than fixed ones. Proper coordination of macroprudential tools with other policies is also necessary for their effectiveness as they can jointly reinforce a similar objective. Although the empirical evidence shows that many macroprudential instruments are found to be effective in curbing bank credit (Gómez, Murcia, Lizarazo & Mendoza, 2020; Kim & Oh, 2020; Revelo, Lucotte & Pradines-Jobet, 2020), the effect of some is revealed to be inconclusive (Carreras, Davis & Piggott, 2018; Greenwood-Nimmo & Tarassow, 2016) or insignificant (Zhang & Zoli, 2016).

The economic literature also asserts that bidirectional causality can exist between institutions and economic performance measures (Law, Lim & Ismail, 2013). This is because institutions shape the way societies interact and that affects economic performance (North, 1981, 1990). But economic development is also required before laws and regulations can be properly instituted (Rosenberg & Birdzel, 1986). Given that bank regulation forms part of formal institutions, while bank credit is an important component of financial development, bank regulation is not only expected to influence bank lending, but the reverse causality can exist whereby developments in bank credit are expected to shape the direction of bank regulation (Deli & Hasan 2017; Fratzscher et al. 2016; Kim, Park & Suh 2014). In line with Patrick (1966), bank regulation can cause bank lending at the early stages of financial development, but at the later stages, bank regulation can follow developments in bank credit. Nevertheless, the limited empirical studies, which have centred on bank capital and used symmetric causality approaches to modelling, obtained either unidirectional causal flow from bank capital to the growth of bank credit (Aiyar, Calomiris & Wieladek, 2016) or no causality between the two (Oyebowale, 2020).

Although there are possible various channels on how bank regulatory measures and bank lending can influence each other, the empirical evidence on sub-Saharan Africa (SSA) is not well-documented. For example, the few studies that have used the context of African countries, including the ones in the SSA region, analysed the short-run linear effects of certain bank regulatory reforms on bank lending (Adesina, 2019; Osei-Assibey & Asenso, 2015; Amidu, 2014). On the other hand, another study only assessed the causal relationship between growth in bank capital and growth in

aggregate bank loans and advances (Oyebowale, 2020). Nonetheless, these studies did not investigate how various bank regulatory measures influenced bank lending both in the long and short run, and whether the bank supervisory environment mitigated or enhanced the effects of bank regulatory measures on bank credit. In addition, the studies did not determine the threshold effects of bank regulatory measures on bank lending. Lastly, these studies did not account for the possible asymmetric responses between bank regulatory measures and bank credit. Therefore, this warrants further empirical investigation to provide sound and appropriate policy recommendations that can promote bank development and result in sustainable economic growth within the SSA region.

The SSA context also presents an interesting case study for examining the nexus between bank regulation and bank lending for various reasons. First, the majority of SSA countries have undergone major reforms in bank regulation since the 1990s, in line with the Basel accord (Anginer et al., 2019; Nyantakyi & Sy, 2015). Over time, the level of bank credit to the private sector and that of financial development, in general, have been increasing in SSA economies despite being relatively low when compared to other regions (IMF, 2019; Amidu, 2014). Hence, it is essential to determine the role played by bank regulatory reforms in shaping the direction of bank lending, and whether the trends in bank credit had any causal effect on the observed developments in bank regulation. Second, the banking sector in the SSA region provides the majority of financing since capital markets are underdeveloped (Nyantakyi & Sy, 2015). Given that the flow of funds from surplus to deficit units mostly happens through the banking sector, poor bank regulatory reforms could interrupt the allocation of credit and, ultimately, affect the performance of the economy. Lastly, income levels vary in SSA countries, and economies with relatively high-income levels normally have larger credit markets with higher degrees of financial deepening as a result of enjoying economies of scale in the network of the supporting institutions (Yi, Liu & Wu, 2022; Djankov, Mcliesh & Shleifer, 2007; Cottarelli, Dell'Ariccia & Vladkova-Hollar, 2005). Therefore, a comparison can be made, where possible, between low-income and middle-income SSA economies to determine whether their levels of bank credit respond differently to the stringency of bank regulatory measures or vice versa.

1.2 Statement of the Problem

The theoretical literature generally shows that bank regulation has both costs (such as market inefficiencies, limited economies of scale and scope, crowding out of deposits and countercyclicality) as well as benefits (such as increased market power, reduced information asymmetry, improved risk-bearing capacity and enhanced financial stability) (see Kim & Sohn, 2017; Lim et al., 2011; Claessens & Klingebiel, 2001; Boyd et al., 1998; Keeley, 1990). As a result, the effect of bank regulation on bank lending is anticipated to be ambiguous. This is supported by inconclusive evidence from the empirical studies that assessed how various bank regulatory measures influence bank credit (see Gómez et al., 2020; Carreras et al., 2018; Merrouche & Nier, 2017; Fratzscher et al., 2016; Greenwood-Nimmo & Tarassow, 2016; Zhang & Zoli, 2016; Bridges et al., 2014; Amidu, 2014; Barth et al., 2004). Furthermore, economic theory postulates that bank regulation, as part of formal institutions, can be influenced by the trends in bank credit. This implies that bi-directional causality is expected to exist between bank regulation and bank lending (Deli & Hasan 2017; Fratzscher et al. 2016; Kim, Park & Suh, 2014; Patrick, 1966). However, the empirical literature, though limited, provided mixed findings regarding the causal linkage between bank regulation and bank credit (see Oyebowale, 2020; Aiyar et al., 2016).

Although the empirical evidence pointed to different outcomes depending on various measures of bank regulation that countries chose to adopt, it was also influenced by how the relationship between bank regulation and bank lending was modelled. For instance, the majority of these studies focused on linear and short-run adjustments. But it remains paramount to analyse empirically how bank regulatory reforms influence bank credit, particularly in the long run, because banks, most of the time, undertake early preparation to comply with the planned banking regulations. There is also a belief that bank lending may only decline in the short run when banks start to abide by the implemented reforms. However, this negative effect may disappear in the long run when banks identify strategies that could help them cope with new reforms (Admati, DeMarzo, Hellwig & Pfleiderer, 2014; Buch & Prieto, 2014; Kashyap, Stein & Hanson, 2010). Moreover, the stringency of bank supervisory environment could either mitigate or enhance the long-run and/or short-run effects of

bank regulatory measures on bank lending. This is because bank supervisors with more power could have greater ability to enforce regulations and discipline banks, which might minimise moral hazard problems ex-ante, lower monitoring costs and motivate banks to engage in prudent lending (Merrouche & Nier, 2017). But strong supervisory power might also limit prudent behaviour in credit delivery if supervisors abuse their power and fail to enforce regulations (Barth et al., 2004).

Furthermore, in line with Shin, Yu and Greenwood-Nimmo (2014), positive and negative shocks to bank regulatory measures might yield different effects on bank lending, and the same could be said with the possible reverse causality from bank credit to bank regulation. However, the considered empirical studies did not fully account for these asymmetric effects brought by the likely differential impacts of positive and negative variations in bank regulation and bank credit. Again, the literature shows that changes in bank regulation do not only bring benefits but also involve costs of either imposing too much or too little regulation (Adesina, 2019; Barth et al., 2004). As a result, the effect of changes in bank regulation on bank credit could be nonlinear, depending on whether the benefits derived from implementing higher bank regulatory standards outweighed their inherent costs (Li, Liu & Veld, 2019; Neyapti & Dincer, 2014), occurring either below or above some threshold level. However, none of these empirical studies has given attention to the existence of threshold effects in the relationship between bank regulation and bank lending within a nonlinear framework.

The identified gaps from the literature also coincide with the period when most of the SSA countries were facing pressure to migrate not only to Basel II but also to the Basel III accord, with the latter being implemented in the aftermath of the 2007-2008 global financial crisis to address the observed weaknesses of the Basel II accord. Even though the adoption of higher standards of bank regulation could promote the resilience and safety of the banking system, a trade-off between obtaining such benefits and promoting financing via increased bank lending exists, which could be restricted by intensifying the stringency of bank regulation (Adesina, 2019). Therefore, this study adds to the literature on the relationship between bank regulation and bank lending by investigating, firstly, the linear and nonlinear impacts

of bank regulatory measures on bank lending within the dynamic panel autoregressive distributed lag (ARDL) cointegration framework and whether the bank supervisory environment mitigates or enhances these effects. Secondly, it determines the existence of threshold effects of measures of bank regulation on bank credit using the dynamic panel threshold regression (PTR) model. Finally, the symmetric and asymmetric causal linkages between bank regulation and bank lending are assessed by employing the error correction-based panel Granger-causality models.

1.3 Research Questions

The main question that forms the basis of this study is, what is the relationship between bank regulation and bank lending? Specifically, the study aims to address the following research questions:

i) How do bank regulatory measures affect bank credit in selected SSA countries[2] and their low-income and middle-income groups?

ii) How does the bank supervisory environment mitigate or enhance the impact of bank regulatory measures on bank credit in the study countries?

iii) What effect does the existence of threshold have on the relationship between bank regulatory measures and bank lending in selected SSA economies?

iv) What is the direction of causality between bank regulation and bank credit in the study countries?

1.4 Objectives and Hypotheses of the Study

1.4.1 Objectives of the Study

The main objective of this study is to analyse the relationship between bank regulation and bank lending in selected SSA countries and/or their low-income and

[2] Other countries were not selected owing to unavailability of data during the proposed study period, especially on bank regulatory measures.

middle-income groups from 1995 to 2017[3]. Specifically, the following objectives are determined:

i) To examine the linear and nonlinear impacts of bank regulatory measures on bank credit in selected SSA economies and their low-income and middle-income groups.

ii) To investigate whether the bank supervisory environment mitigates or enhances the effects of bank regulatory measures on bank credit in the study countries.

iii) To assess the existence and effects of threshold in the relationship between bank regulatory measures and bank lending in selected SSA economies.

iv) To determine the direction of symmetric and asymmetric causality between bank regulatory measures and bank credit in the study countries.

1.4.2 Hypotheses of the Study

The study tests whether the following hypotheses hold in the context of selected SSA economies and/or their low-income and middle-income groups:

i) Measures of bank regulation have negative effects on bank credit.

ii) The bank supervisory environment mitigates the impact of bank regulatory measures on bank lending.

iii) Threshold effects exist in the nexus between bank regulatory measures and bank credit.

iv) There is bidirectional causality between measures of bank regulation and bank lending.

[3] The chosen period is informed by the availability of data on five waves of the World Bank's Bank Regulation and Supervision Surveys (BRSS), including the last one administered in 2017. These surveys were completed in 1999, 2003, 2007, 2011 and 2019 by Barth et al. (2001, 2004, 2008), Cihak et al. (2013) and Anginer et al. (2019), respectively.

1.5 Significance of the Study

Although there is a significant body of empirical research analysing the nexus between bank regulation and bank lending, this study contributes to the literature through several approaches that have not been applied before in the context of SSA countries, at least to the best of my knowledge. First, it considers bank regulation to be a multifaceted phenomenon, and uses its different measures, namely, banking entry barrier, mixing of banking and commerce restriction, banking activity restriction, capital regulation stringency and macroprudential indices, to analyse its relationship with bank lending. The first four indices come from the updated databases of the World Bank's Bank Regulation and Supervision Surveys (BRSS), while the last index is derived from individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017).

Second, the study uses the dynamic common correlated effects (CCE) method of Chudik and Pesaran (2015) to estimate the symmetric and asymmetric panel ARDL models when determining the impacts of bank regulatory measures on bank credit and whether the supervisory environment enhances or mitigates such impact. This estimation technique is preferred over others since it allows for country-specific heterogeneity and controls for endogeneity and cross-sectional dependence using the lagged cross-sectional averages of the dependent and independent variables.

Third, the study employs the dynamic PTR model proposed by Kremer, Bick and Nautz (2013) to examine the existence of threshold effects of bank regulatory measures on bank lending. This approach is more appropriate than others as it uses the method of future orthogonal deviations transformation in eliminating individual effects and avoiding the serial correlation problem, which arises from the undertaking of first differences. It further incorporates the generalised method of moments (GMM)-type estimators and employs the lags of the dependent variable as instruments to circumvent the endogeneity problem.

Fourth, unlike most previous studies, this study uses the symmetric and asymmetric error correction-based panel Granger-causality models to investigate the direction of causality between measures of bank regulation and bank lending. These models are

capable of testing for both long-run and short-run causal relationships between bank regulation and bank credit.

Lastly, the study, where possible, compares the estimated results from the low-income and middle-income SSA countries. These classifications are based on the World Bank Atlas method that divides countries according to their GNI per capita[4]. These groupings enable the study to determine whether the relationship between measures of bank regulation and bank credit varies with the level of income.

The empirical results from this study should be a source of information for future research agendas as they shed some light on the nature of the nexus between bank regulation and bank lending. Additionally, the results allow bank regulators to understand the implications of bank regulatory reforms and how they are shaped by the developments in bank lending. This helps policymakers to exercise caution when implementing such reforms to ensure that they are well-targeted and well-designed so that they do not yield unintended effects on bank lending. Therefore, by offering policy recommendations on issues related to bank regulatory reforms and bank credit in SSA countries, the study contributes to the body of knowledge in the field of economics in various ways identified as it complements similar studies.

1.6 Organisation of the Study

The study is organised into six chapters. Chapter 1 provided an overview of the nexus between bank regulation and bank credit. Chapter 2 discusses the dynamics of bank regulation, as well as the trends in bank regulatory and bank lending measures in SSA countries, while Chapter 3 reviews both the theoretical and empirical literature on the relationship between bank regulation and bank credit. The estimation techniques and data sources of variables used in this study are discussed in Chapter 4. Chapter 5 offers the results of the study and their analysis, while Chapter 6 concludes the study.

[4] For 2017, the income groups comprised the following: High-income = more than $12,235; Upper middle-income = $3,956 - $12,235; Lower middle-income = $1,006 - $3,955; and Low-income = less than $1,006.

CHAPTER 2

BANK REGULATION AND BANK LENDING IN SSA COUNTRIES

2.1 Introduction

This chapter focuses on the dynamics of bank regulation and bank lending as well as their trends in SSA countries and their income groups. The chapter is divided into six sections. Following the introduction, Section 2.2 provides the dynamics of bank regulation and bank credit over time. Section 2.3 discusses the trends in bank regulatory measures in the selected low-income and middle-income SSA economies over the period 1995-2017 and undertakes a comparison of bank regulation between these income groups of countries. Section 2.4 presents the trends in bank lending in the selected low-income and middle-income SSA economies from 1995 to 2017 and offers a comparison of bank lending between these groups of countries. Section 2.5 discusses the co-movements between bank regulation and bank lending in the selected SSA countries and their income groups. Lastly, Section 2.6 concludes the chapter.

2.2 Dynamics of Bank Regulation and Bank Lending in SSA Countries

This section discusses the dynamics of bank regulation and bank lending in the SSA region. Before the 1990s, bank regulation in the majority of SSA countries was inadequate. Le Gall, Daumont and Leroux (2004) present various factors that contributed to such deficiency. First, central banks were not given enough authority to supervise banks under the outdated legislation that was used to regulate the financial sector. In addition, both the government and the central bank shared the responsibility of banking supervision, with the former limiting enforcement of prudential requirements in favour of government-related projects or businesses. Second, the central banks could not adequately monitor and supervise banks, and they often relied on insufficient information owing to the lack of data and irregular prudential reports. Lastly, the existing bank regulations were not well-defined when it came to issues of minimum capital requirements, exposures to risk and prudential limits on bank lending.

The observed weaknesses in bank regulation in the SSA region led to multiple occurrences of banking crises. For example, the region experienced about 39 systemic banking crises between the 1970s and mid-1990s, compared with 51 that occurred in the rest of the world (Laeven & Valencia, 2013). As a result, many SSA countries introduced financial sector reforms in the late 1980s that included major adjustments in the banking regulatory and supervisory frameworks (Nyantakyi & Sy 2015). According to Enoch et al. (2015), Mecagni, Marchettini and Maino (2015) as well as Mlachila et al. (2016), almost all the countries in SSA implemented the Basel I accord (developed in 1988 and launched in 1992), which imposed the minimum capital adequacy ratio of 8% (as a share of the risk-weighted assets) to minimise credit risk. Other countries later adopted higher standards of the Basel II (launched in 2004) and Basel III (launched in 2010), with Angola, Botswana, Malawi and Mozambique implementing the Basel II or parts of it, while Ghana, Kenya, Mauritius, Nigeria, Rwanda, Tanzania, West African Economic and Monetary Union (WAEMU)[5] and South Africa adopting the Basel II and III or parts thereof. The Basel II accord incorporated operational risk when determining the minimum capital required ratio, enhanced risk monitoring, and promoted transparency, while the Basel III accord strengthened Basel II's capital requirements and introduced the macroprudential perspective to limit systemic risk.

Furthermore, most of the SSA countries have aligned themselves with the international financial reporting standards, while a few, such as Angola, Comoros, Democratic Republic of Congo, Guinea, Madagascar and South Sudan, are still following their own national financial reporting standards. When it comes to deposit insurance schemes, these have only been implemented by the Economic and Monetary Community of Central Africa (CEMAC)[6], Ghana, Kenya, Namibia, Nigeria, Uganda, Tanzania and Zimbabwe. Table 2.1 summarises the banking sector regulatory and supervisory standards in the SSA region.

[5] WAEMU comprises the following countries: Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo.
[6] CEMAC includes the following countries: Gabon, Cameroon, the Central African Republic, Chad, the Republic of the Congo and Equatorial Guinea.

Table 2.1 Banking sector regulatory and supervisory standards in SSA countries

Country	Capital adequacy standard	Accounting standard	Deposit insurance
Angola	Parts of Basel II	IFRS	No
Botswana	Basel II	IFRS	No
Burundi	Basel II in progress	IFRS Plan	No
Cabo Verde	Basel II in progress	IFRS	No
CEMAC	No Basel II yet	IFRS Plan	Implemented
Comoros	Basel II in progress	National	No
Democratic Republic of Congo	No Basel II yet	National	No
Eritrea	N/A	N/A	No
Eswatini	No Basel II yet	IFRS	No
Ethiopia	No Basel II yet	IFRS Plan	No
Gambia	No Basel II yet	IFRS Plan	No
Ghana	Parts of Basel II/III	IFRS	Implemented
Guinea	No Basel II yet	National	No
Kenya	Parts of Basel II/III	IFRS	Implemented
Lesotho	No Basel II yet	IFRS	No
Liberia	Basel II in progress	IFRS	No
Madagascar	No Basel II yet	National	No
Malawi	Basel II	IFRS	No
Mauritius	Basel II/Parts of Basel III	IFRS	No
Mozambique	Basel II	IFRS	No
Namibia	Parts of Basel II	IFRS	Implemented
Nigeria	Parts of Basel II/III	IFRS	Implemented
Rwanda	Parts of Basel II/III	IFRS	No
São Tomé and Príncipe	Basel II in progress	IFRS Plan	No
Seychelles	No Basel II yet	IFRS Plan	No
Sierra Leone	No Basel II yet	IFRS	No
South Africa	Basel III	IFRS	No
South Sudan	No Basel II yet	National	N/A
Uganda	No Basel II yet	IFRS	Implemented
Tanzania	Parts of Basel II/III	IFRS	Implemented
WAEMU	Parts of Basel II/III	IFRS	No
Zambia	Basel II in progress	IFRS	No
Zimbabwe	Basel II in progress	IFRS	Implemented

Sources: Updated from Enoch et al. (2015), Mecagni et al. (2015), and Mlachila et al. (2016), with new information drawn from Bank of Mauritius (2014), Republic of Zambia (2014), Bank of Botswana (2015), Mambo (2015), Republic of Ghana (2016), Republic of Namibia (2018), Global Economic Governance (2019) and The IFRS Foundation (2019).

Notes: CEMAC=Economic and Monetary Community of Central Africa (Gabon, Cameroon, the Central African Republic, Chad, the Republic of the Congo and Equatorial Guinea); IFRS=International Financial Reporting Standards; N/A=Not Available; WAEMU=West African

Economic and Monetary Union (Benin, Burkina Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo).

The banking sector reforms, coupled with other financial reforms, were expected to promote financial stability and development by enhancing sustainable bank lending to the domestic private sector since banks played a dominant role in the allocation of credit in the SSA region (Nyantakyi & Sy, 2015). However, despite the increasing level of bank credit to the private sector and that of financial development, in general, in SSA economies, these levels remained relatively low when compared to other regions (IMF, 2019; Amidu, 2014). According to Nyantakyi and Sy (2015), financial depth remained shallow in SSA when compared to other regions because some banks in SSA faced difficulties in assessing customers' ability and willingness to pay back loans owing to a lack of legal support for creditors' rights. Moreover, other communities, especially in low-income SSA countries, had a limited degree of financial inclusion, which constrained their ability to access financial services, including credit from the banking sector. Lastly, even though banks in SSA economies appeared to be well-regulated with standards that were on a par with those of other regions, Adesina (2019) argued that the stringency of bank regulatory reforms within the SSA region could impose a trade-off between obtaining financial stability and promoting financing via increased bank lending.

2.3 Trends in Bank Regulation in the Selected Low-income and Middle-income SSA Countries

Section 2.3 discusses the trends in bank regulation captured by banking entry barrier, mixing of banking and commerce restriction, banking activity restriction, capital regulation stringency and macroprudential indices for the selected low-income and middle-income SSA countries[7]. The banking entry barrier index measures the stringency of restrictions on the licensing and foreign ownership of banks, while the mixing of banking and commerce restriction index captures the degree of ownership and control between banks, non-financial firms and non-bank financial firms. Moreover, the banking activity restriction index measures the stringency of restrictions on the participation of banks in activities related to securities, insurance

[7] The selection was based on countries that had data from at least three out of five surveys, including the last one completed in 2019, from the World Bank's BRSS.

and real estate, whereas the capital regulation stringency index captures the degree of bank regulatory requirements regarding capital. Finally, the macroprudential index measures the extent of macroprudential regulation using a simple sum of scores on relevant macroprudential policies. Table 2.2 shows the sub-components, qualification criteria and range for each index.

Table 2.2 Measurement of bank regulatory indices

Index	Sub-components	Qualification	Range
Banking entry barrier index	Limitations on foreign bank ownership of domestic banks	Are foreign entities prohibited from entering through: *a) Acquisition? b) Subsidiary? c) Branch? d) Joint Venture? [Yes=1; No=0; for each]*	0-4
	Entry into banking requirements	Are the following legal submissions required to obtain a banking licence: *a) Draft bylaws? b) Intended organisation chart? c) Financial projections? d) Financial information on main potential shareholders? e) Background/experience of future directors? f) Background/experience of future managers? g) Sources of funds to be disbursed in the capitalisation of a new bank? h) Market differentiation intended for a new bank? [Yes=1; No=0; for each]*	0-8
Mixing of banking and commerce restriction index	Bank ownership of non-financial firms	To what extent can banks own and control non-financial firms? *[Unrestricted: 1=a bank may own 100 percent of the equity in any nonfinancial firm; Permitted: 2=a bank may own 100 percent of the equity of a nonfinancial firm, but ownership is limited based on a bank's equity capital; Restricted: 3=a bank can only acquire less than 100 percent of the equity in a nonfinancial firm; and Prohibited: 4=a bank may not acquire any equity investment in a nonfinancial firm whatsoever]*	1-4
	Non-financial firm ownership of banks	To what extent can non-financial firms own and control banks? *[Unrestricted: 1=a nonfinancial firm may own 100 percent of the equity in a bank; Permitted: 2=unrestricted with prior authorization or approval; Restricted: 3=limits are placed on ownership, such as a maximum percentage of a bank's capital or shares; and Prohibited: 4=no equity investment in a bank]*	1-4
	Non-bank financial firms owning banks	The extent to which non-bank financial firms may own and control banks? *[Unrestricted: 1=a nonbank financial firm may own 100 percent of the equity in a bank; Permitted: 2=unrestricted with prior authorization or approval; Restricted: 3=limits are placed on ownership, such as a maximum percentage of a bank's capital or shares; and Prohibited: 4=no equity investment in a bank]*	1-4
Banking activity restriction index	Securities activities	To what extent can banks engage in the following activities: *a) Securities? b) Insurance? c) Real estate? [Unrestricted: 1=full range of activities can be conducted directly in the bank; Permitted: 2=full range of activities can be conducted, but some or all must be conducted in subsidiaries; Restricted: 3=less than the full range of activities can be conducted in the bank or subsidiaries; and Prohibited: 4=the activity cannot be conducted in either the bank or subsidiaries; for each]*	1-4
	Insurance activities		1-4
	Real estate activities		1-4

Index	Sub-components	Qualification	Range
Capital regulation stringency index	Overall capital stringency	Overall capital requirement questions: *a) Is it risk-weighted in line with Basle guidelines? b) Does the ratio vary with a bank's credit risk? c) Does the ratio vary with market risk? d) Before minimum capital adequacy is determined, which items are deducted from capital: i) Market value of loan losses? ii) Unrealised securities losses? iii) Unrealised foreign exchange losses? [Yes=1; No=0; for each]*	0-6
	Initial capital stringency	Questions: *a) Are the sources of funds to be used as capital verified by authorities? [Yes=1; No=0] b) Can assets other than cash/government securities be used to increase capital? c) Can borrowed funds be used? [Yes=0; No=1; for b) and c)]*	0-3
Macroprudential index	-	Does the following macroprudential policy exist: *a) Debt-to-Income Ratio [Constrains household indebtedness by enforcing or encouraging a limit]? b) Time-Varying/Dynamic Loan-Loss Provisioning [Requires banks to hold more loan-loss provisions during upturns]? c) General Countercyclical Capital Buffer/Requirement [Requires banks to hold more capital during upturns]? d) Leverage Ratio [Limits banks from exceeding a fixed minimum leverage ratio]? e) Capital Surcharges on Systemically Important Financial Institutions (SIFIs) [Requires SIFIs to hold a higher capital level than other financial institutions]? f) Limits on Interbank Exposures [Limits the fraction of liabilities held by the banking sector or by individual banks]? g) Concentration Limits [Limits the fraction of assets held by a limited number of borrowers]? h) Limits on Foreign Currency Loans [Limits banks' foreign currency loans, as a way to reduce vulnerability to foreign-currency risks]? i) Limits on Domestic Currency Loans [Limits credit growth directly]? j) Levy/Tax on Financial Institutions [Taxes revenues of financial institutions]? k) Loan-to-Value Ratio (LTV) Caps [Limits to LTV used as a strictly enforced cap on new loans, as opposed to a supervisory guideline or merely a determinant of risk weights]? l) Foreign Exchange (FX) and/or Countercyclical Reserve Requirements (RR) [Limits to RR which i) imposes a wedge of on foreign currency deposits, or ii) is adjusted countercyclically]? [Yes = 1; No = 0; for each]*	0-12

Sources: Barth et al. (2001, 2004, 2008, 2013), Cihak, Demirgüç-Kunt, Martinez Peria and Mohseni-Cheraghlo (2013), Anginer et al. (2019) and Cerutti et al. (2017).

In the case of banking entry barrier, mixing of banking and commerce restriction, banking activity restriction and capital regulation stringency indices, Table 2.3 presents their available surveys from the BRSS for each of the selected SSA countries. Time series figures for the periods 1995-1999, 2000-2003, 2004-2007, 2008-2011 and 2012-2017 are given by the indices from Survey I to V, respectively. For instances where data is unavailable on one of the surveys, the previous or subsequent available survey data is used.

Table 2.3 World Bank's bank regulation surveys for the selected SSA countries

Country name	Country code	Survey I (1999)	Survey II (2003)	Survey III (2007)	Survey IV (2011)	Survey V (2019)
Low- income countries						
1. Benin	BEN	-	✓	✓	✓	✓
2. Burkina Faso	BFA	-	✓	✓	✓	✓
3. Burundi	BDI	✓	✓	✓	✓	✓
4. Guinea-Bissau	GNB	-	✓	✓	-	✓
5. Madagascar	MDG	-	✓	-	✓	✓
6. Malawi	MWI	✓	-	✓	✓	✓
7. Mali	MLI	-	✓	✓	✓	✓
8. Niger	NER	-	✓	✓	✓	✓
9. Senegal	SEN	-	✓	✓	-	✓
10. Tanzania	TZA	-	-	✓	✓	✓
11. Togo	TGO	-	✓	✓	✓	✓
12. Uganda	UGA	-	-	✓	✓	✓
Middle- income countries						
1. Angola	AGO	-	-	✓	✓	✓
2. Botswana	BWA	✓	✓	✓	✓	✓
3. Cote d'Ivoire	CIV	-	✓	✓	✓	✓
4. Eswatini	SWZ	-	✓	-	✓	✓
5. Ghana	GHA	-	✓	✓	✓	✓
6. Kenya	KEN	✓	✓	✓	✓	✓
7. Lesotho	LSO	✓	✓	✓	✓	✓
8. Mauritius	MUS	✓	✓	✓	✓	✓
9. Namibia	NAM	✓	✓	-	✓	✓
10. Nigeria	NGA	✓	✓	✓	✓	✓
11. South Africa	ZAF	✓	✓	✓	✓	✓

Source: Own computation using data from Barth et al. (2001, 2004, 2008, 2013), Cihak et al. (2013) and Anginer et al. (2019).

Notes: The parenthesis gives the year of completion of the survey; A tick (✓) shows that the data is available; A dash (-) shows that the data is unavailable, and the previous or subsequent available survey data is used instead.

When it comes to the macroprudential index, the time series data for each of the selected SSA countries, covering the period 2000-2017, is derived from individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017). But owing to the unavailability of banking acts in many of the selected SSA countries during the period before 2000, the state of the macroprudential policies observed in 2000 is assumed to have prevailed from 1995.

2.3.1 Trends in Bank Regulation in the Selected Low-income SSA Countries

Section 2.3.1 begins by discussing the trends in bank regulation in the selected low-income SSA countries during the period 1995-2017. This group is composed of the economies of Benin, Burkina Faso, Burundi, Guinea-Bissau, Madagascar, Malawi, Mali, Niger, Senegal, Tanzania, Togo and Uganda. Despite reductions in bank activity restrictions and capital regulatory requirements, the bank regulatory environment became more stringent in these low-income SSA countries during the review period, driven by increased restrictions on bank entry and mixing of banking and commerce, as well as the introduction of macroprudential policies.

Starting with the banking entry barrier index, it generally increased over time in most of the low-income SSA countries (Benin, Burkina Faso, Burundi, Guinea-Bissau, Madagascar, Mali, Niger, Senegal and Togo). While the index only increased between 2008 and 2010 in Tanzania, it remained the same over time in Uganda, and it had a slight decline in Malawi between 2008 and 2010. Overall, the banking entry barrier index recorded the group's average score of 0.61 in the period 2008-2017, compared to that of 0.56 during the period 1995-2007. Over the entire period, only three countries registered the banking entry barrier mean scores that were above the group's average score of 0.58, namely, Tanzania (0.64), Uganda (0.63) and Malawi (0.61). However, the index experienced little variation relative to other bank regulatory indices during the period under consideration.

When it came to the mixing of banking and commerce restriction index, it increased over time in Burundi, Malawi, Tanzania and Uganda, while it only increased between 2008 and 2010 in Benin, Burkina Faso, Guinea-Bissau, Malawi, Niger, Senegal and Togo, while it declined in Madagascar in 2008. The index group's average score rose

from 0.60 to 0.67 between the periods 1995-2007 and 2008-2017, respectively. From 1995 to 2017, all the selected low-income SSA countries recorded the group's mean score of 0.63 in the mixing of banking and commerce restriction index, with Tanzania, Burundi and Uganda being the only countries with above-average mean scores, namely, 0.74, 0.73 and 0.71, respectively. In comparison with other bank regulatory measures, the index exhibited moderate variation over time.

Furthermore, the banking activity restriction index experienced a downward trend over time in Burundi and Malawi, but an upward trend in Burkina Faso before falling to the 2003 levels in 2008. In Benin, Guinea Bissau, Mali, Niger, Senegal and Togo, the index only increased between 2004 and 2007. Additionally, it increased in Madagascar and Uganda in 2008 and declined sharply in 2012, while it fell in Tanzania in 2008 but increased sharply in 2012. In general, the group's mean score of the banking activity restriction index fell from 0.66 in the period 1995-2007 to 0.61 during the period 2008-2017. Uganda (0.84), Malawi (0.77) and Burundi (0.66) are the only economies with mean scores that were higher than the group's average of 0.64 over the entire period. Thus, the index exhibited a relatively higher variation in relation to other bank regulatory indices.

On the contrary, the capital regulation stringency index generally increased before 2011 in almost all the low-income SSA countries but fell sharply thereafter, except in Tanzania, where it increased in 2008 and remained the same afterwards. The group's mean score of the index declined from 0.68 in the period 1995-2007 to 0.60 during the period 2008-2017. Between 1995 and 2017, all the selected low-income SSA countries recorded a capital regulation stringency mean score of 0.65, and the countries that recorded the above-average mean scores were Uganda (0.80), Malawi (0.67) and Guinea-Bissau (0.66). Hence, the variation of the index over time was relatively high when compared to other bank regulatory measures.

Lastly, the macroprudential index remained the same over time in the majority of low-income SSA economies (Benin, Burkina Faso, Burundi, Madagascar, Mali, Niger, Senegal and Togo). However, the index trended upwards in Malawi, which, on top of the already existing limits on foreign currency loans, introduced concentration limits in

2006 and capital surcharges on Systemically Important Financial Institutions (SIFIs) in 2016. It also trended upwards in Uganda, which adopted limits to interbank exposures, limits on foreign currency loans, leverage ratios and capital surcharges on SIFIs in 2004, 2010, 2013 and 2016, respectively. Other countries where the macroprudential index trended upwards included Guinea-Bissau, which implemented concentration limits in 2017, and Tanzania, which introduced concentration limits, time-varying or dynamic loan-loss provisions and limits on foreign currency loans in 2014 as well as loan-to-value ratio caps in 2015.

The average score of the macroprudential index for all the selected low-income SSA countries increased from 0.03 in the period 1995-2007 to 0.07 during the period 2008-2017. Overall, the index registered the group's mean score of 0.05 from 1995 to 2017, with Burundi, Uganda, Malawi and Tanzania recording above-average mean scores of 0.25, 0.15, 0.13 and 0.05, respectively. The former already had time-varying or dynamic loan-loss provisions, concentration limits as well as foreign exchange and/or countercyclical reserve requirements from the beginning of the period under review. In comparison with other indices, the degree of the macroprudential index was very low, and the index experienced very little variation over time. Figure 2.1 presents the trends in the bank regulatory indices for the selected low-income SSA countries over the period 1995 to 2017, while Table 2.4 provides the averages of such indices.

Figure 2.1 Trends in bank regulatory indices in the selected low-income SSA countries

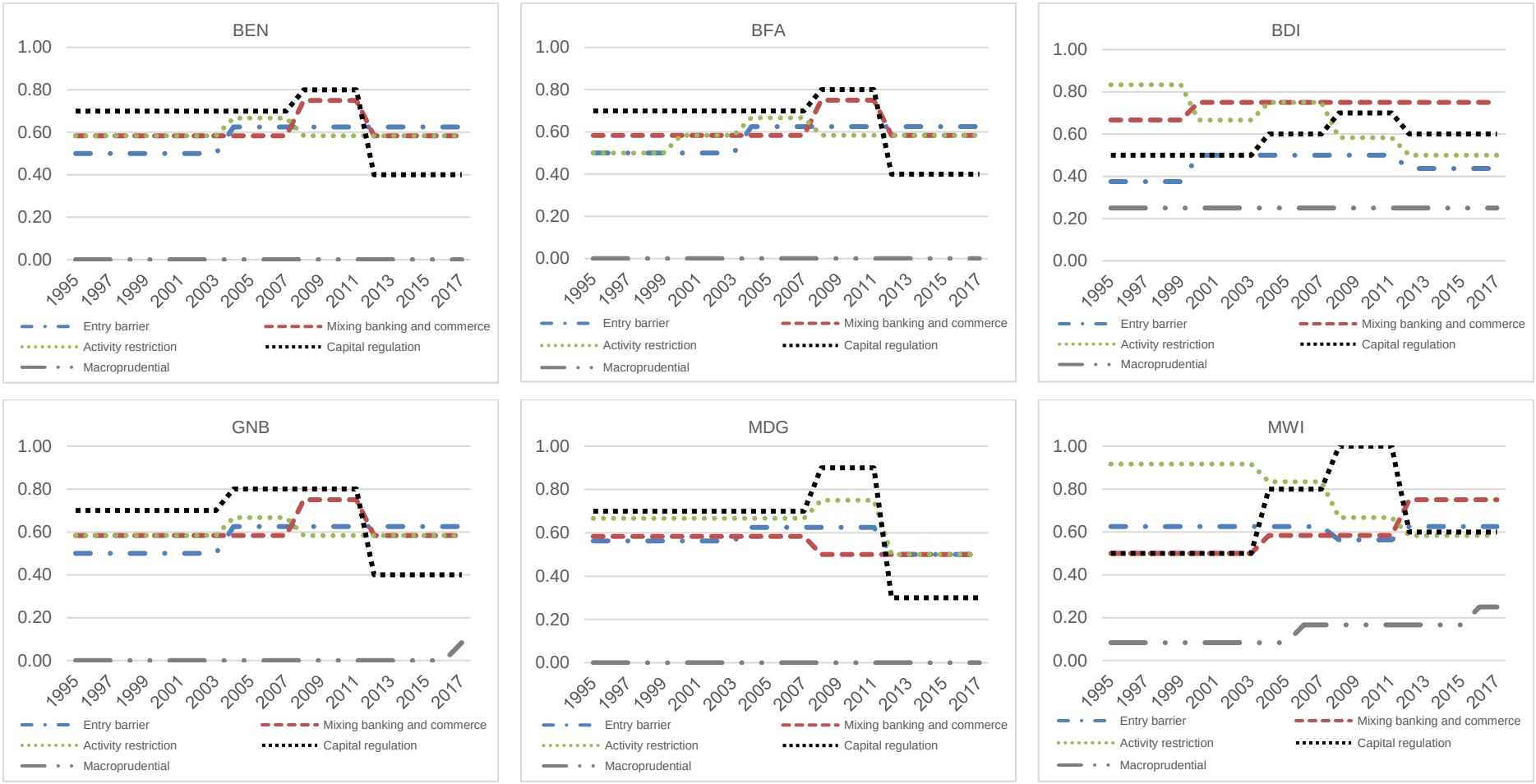
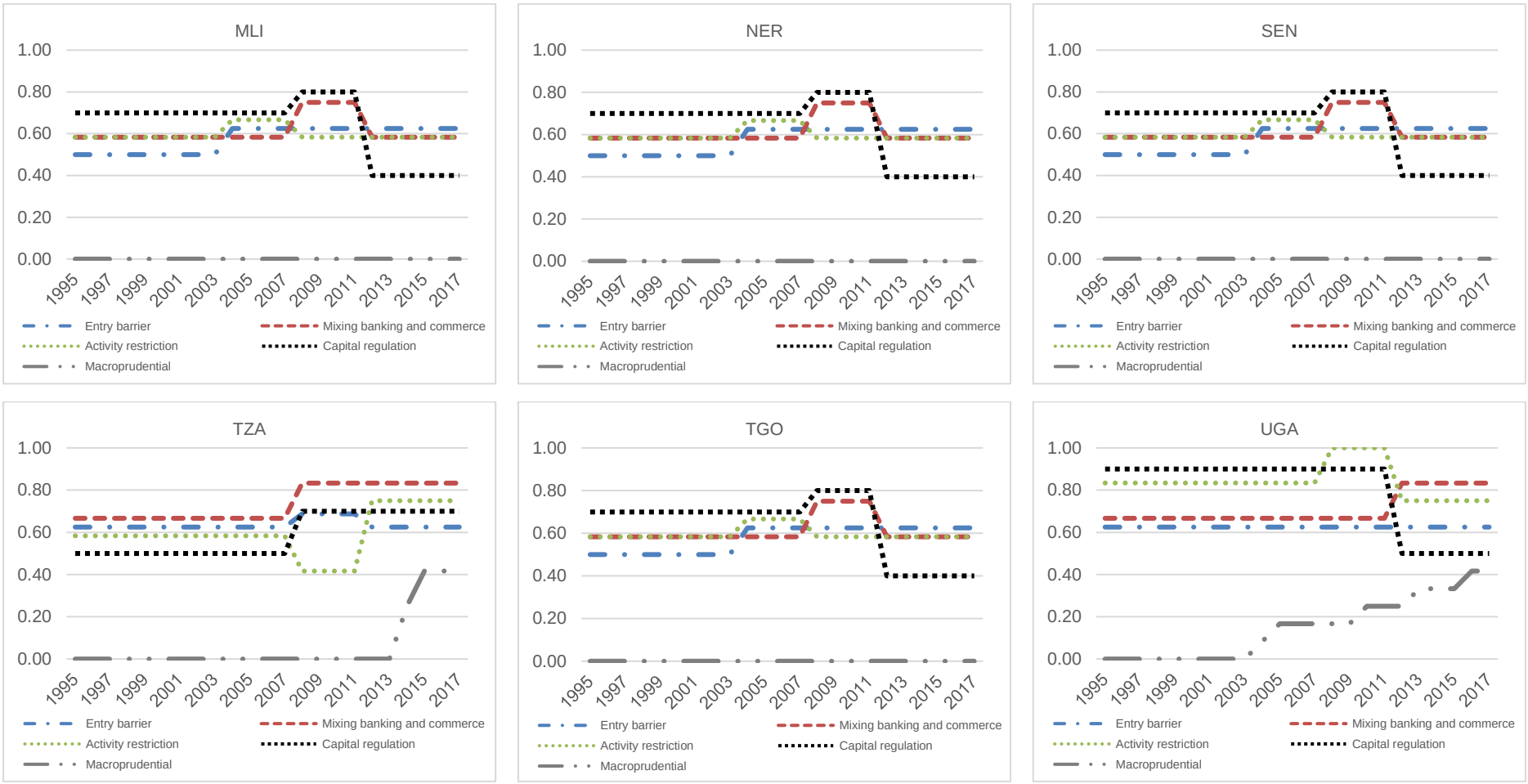


Figure 2.1 Trends in bank regulatory indices in the selected low-income SSA countries (continuation)



Source: Own graphs using data from Barth et al. (2001, 2004, 2008, 2013), Cihak et al. (2013), Anginer et al. (2019) and individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017).

Notes: All indices are normalised to one; Benin=BEN; Burkina Faso=BFA; Burundi=BDI; Guinea-Bissau=GNB; Madagascar=MDG; Malawi=MWI; Mali=MLI; Niger=NER; Senegal=SEN; Tanzania=TZA; Togo=TGO; Uganda=UGA.

Table 2.4 Bank regulatory indices in the selected low-income SSA countries

Countries	Entry barrier			Mixing banking and commerce			Activity restriction			Capital regulation			Macroprudential		
	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017
Benin	0.54	0.63	0.58	0.58	0.65	0.61	0.61	0.58	0.60	0.70	0.56	0.64	0.00	0.00	0.00
Burkina Faso	0.54	0.63	0.58	0.58	0.65	0.61	0.58	0.58	0.58	0.70	0.56	0.64	0.00	0.00	0.00
Burundi	0.45	0.46	0.46	0.72	0.75	0.73	0.76	0.53	0.66	0.53	0.64	0.58	0.25	0.25	0.25
Guinea-Bissau	0.54	0.63	0.58	0.58	0.65	0.61	0.61	0.58	0.60	0.73	0.56	0.66	0.00	0.01	0.00
Madagascar	0.58	0.55	0.57	0.58	0.50	0.55	0.67	0.60	0.64	0.70	0.54	0.63	0.00	0.00	0.00
Malawi	0.63	0.60	0.61	0.53	0.68	0.59	0.89	0.62	0.77	0.59	0.76	0.67	0.10	0.18	0.13
Mali	0.54	0.63	0.58	0.58	0.65	0.61	0.61	0.58	0.60	0.70	0.56	0.64	0.00	0.00	0.00
Niger	0.54	0.63	0.58	0.58	0.65	0.61	0.61	0.58	0.60	0.70	0.56	0.64	0.00	0.00	0.00
Senegal	0.54	0.63	0.58	0.58	0.65	0.61	0.61	0.58	0.60	0.70	0.56	0.64	0.00	0.00	0.00
Tanzania	0.63	0.65	0.64	0.67	0.83	0.74	0.58	0.62	0.60	0.50	0.70	0.59	0.00	0.15	0.07
Togo	0.54	0.63	0.58	0.58	0.65	0.61	0.61	0.58	0.60	0.70	0.56	0.64	0.00	0.00	0.00
Uganda	0.63	0.63	0.63	0.67	0.77	0.71	0.83	0.85	0.84	0.90	0.66	0.80	0.04	0.29	0.15
Average	***0.56***	***0.61***	***0.58***	***0.60***	***0.67***	***0.63***	***0.66***	***0.61***	***0.64***	***0.68***	***0.60***	***0.65***	***0.03***	***0.07***	***0.05***

Source: Own calculations using data from Barth et al. (2001, 2004, 2008, 2013), Cihak et al. (2013), Anginer et al. (2019) and individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017).

Note: All indices are normalised to one.

2.3.2 Trends in Bank Regulation in the Selected Middle-income SSA Countries

This section presents the trends in bank regulation in the selected middle-income SSA countries over the period 1995-2017, namely, Angola, Botswana, Côte d'Ivoire, Eswatini, Ghana, Kenya, Lesotho, Mauritius, Namibia, Nigeria and South Africa. Although the restrictions on bank activities fell over time while the entry barriers remained relatively the same, the bank regulatory environment in these middle-income SSA countries became more stringent during the period under consideration, driven by increased restrictions on mixing of banking and commerce and capital regulatory requirements, as well as the adoption of macroprudential policies.

To begin with, the banking entry barrier index did not change over time in Angola, Lesotho, Namibia and Nigeria, while it temporarily declined in Botswana, between 2008 and 2011, and in Kenya and Mauritius, between 2001 and 2003 as well as in 2012. However, the index increased in Côte d'Ivoire (in 2004), Ghana (in 2008), and Eswatini (between 2004 and 2011), but it trended downwards in South Africa. Furthermore, the index group's average score remained the same at 0.54 during the periods 1995-2007, 2008-2017 and 1995-2017. The countries that registered mean scores that were above the group's average over the entire period (1995-2017) were Ghana (0.68), Nigeria (0.63), Botswana (0.61) and Côte d'Ivoire (0.58). Consequently, the index exhibited little variation over time relative to other bank regulatory measures.

In the case of the mixing of banking and commerce restriction index, it trended upwards in most of the middle-income SSA economies (Angola, Botswana, Ghana, Kenya, Lesotho, Nigeria and South Africa), while it experienced a downward trend in Eswatini and Namibia and a flat trend in Côte d'Ivoire. The index group's average score increased from 0.59 to 0.65 during the periods 1995-2007 and 2008-2017, respectively. Between 1995 and 2017, all the selected middle-income SSA countries recorded the group's mean score of 0.62 in the mixing of banking and commerce restriction index, with Eswatini, Lesotho, Kenya and Côte d'Ivoire being the economies having above-average mean scores, namely, 0.78, 0.73, 0.67 and 0.63, respectively. In relation to other bank regulatory indices, the index experienced a higher variation over time.

When it came to the banking activity restriction index, it experienced a downward trend in many of the middle-income SSA economies (Angola, Eswatini, Ghana, Lesotho, Mauritius and South Africa) but an upward trend in Botswana, Kenya, and Nigeria. However, it trended upwards in Botswana, Kenya and Nigeria and exhibited a flat trend in Côte d'Ivoire (but with an increase between 2004 and 2007) and Namibia (but with a fall between 2008 and 2011). Overall, the group's mean score of the activity restriction index fell from 0.72 to 0.64 between the periods 1995-2007 and 2008-2017, respectively. The economies that recorded mean scores higher than the group's average score of 0.68 over the entire period (1995-2017) were Mauritius (0.82), Eswatini (0.76), Lesotho (0.75), Ghana (0.74), Botswana (0.72), Kenya (0.71) and Angola (0.69). Nevertheless, the index displayed a relatively moderate variation over time when compared to other bank regulatory measures.

Additionally, the capital regulation stringency index experienced an upward trend in Angola, Botswana and Eswatini, while it remained relatively high in Kenya (between 2001 and 2011), Nigeria (between 2008 and 2011), and South Africa (between 2004 and 2007). Nonetheless, the index trended downwards in Côte d'Ivoire, Lesotho, Mauritius and Namibia, but declined in Ghana between 2001 and 2007. The group mean score of the capital regulation stringency index increased from 0.67 in the period 1995-2007 to 0.68 during the period 2008-2017. Between 1995 and 2017, all the selected middle-income SSA countries registered a capital regulation stringency mean score of 0.67, with the economies of Botswana (0.86), Ghana (0.77), Mauritius (0.77), Nigeria (0.77), South Africa (0.77) and Kenya (0.69) recording above-average mean scores. Thus, the index exhibited a relatively high variation over time in comparison with other bank regulatory indices.

Finally, the macroprudential index increased over time in the majority of middle-income SSA economies, while it remained the same in Ghana. However, the index experienced an upward trend in various countries, namely,

- Angola, which introduced concentration limits in 2007 and limits on foreign currency loans in 2011
- Botswana, which, on top of the existing concentration limits, implemented limits to interbank exposures in 2016

- Côte d'Ivoire, which adopted concentration limits in 2013
- Eswatini, which introduced concentration limits as well as limits to foreign currency loans in 2001
- Kenya, which implemented debt-to-income ratios in 2007
- Lesotho, which adopted limits to interbank exposures in 2012 over the prevailing concentration limits and restrictions on domestic currency loans
- Mauritius, which introduced debt-to-income ratios and capital surcharges on SIFIs in 2014 and 2016, respectively, over the existing concentration limits and loan-to-value ratios
- Namibia, which implemented concentration limits, leverage ratios and loan-to-value ratios in 2003, 2009, and 2017, respectively
- Nigeria, which adopted concentration limits in 2004, limits to foreign currency loans in 2014, and capital surcharges on SIFIs in 2015
- South Africa, which introduced concentration limits, leverage ratios and capital surcharges on SIFIs in 2008, 2013, and 2016, respectively.

The mean score of the macroprudential index for all the selected middle-income SSA countries rose from 0.06 during the period 1995-2007 to 0.14 in the period 2008-2017. Overall, the index recorded the group's average score of 0.09 from 1995 to 2017. The countries that registered the above-average mean scores over the entire period (1995-2017) were Lesotho (0.19), Ghana (0.17) (which already had concentration limits and levy or tax on financial institutions from the beginning of the review period), Eswatini (0.12), Mauritius (0.12) and Namibia (0.9). When compared to other bank regulatory measures, the macroprudential index was relatively low and experienced little variation over time. The trends in all the bank regulatory indices for the selected middle-income SSA countries over the period 1995 to 2017 are depicted in Figure 2.2, while Table 2.5 gives the averages of such indices.

Figure 2.2 Trends in bank regulatory indices in the selected middle-income SSA countries

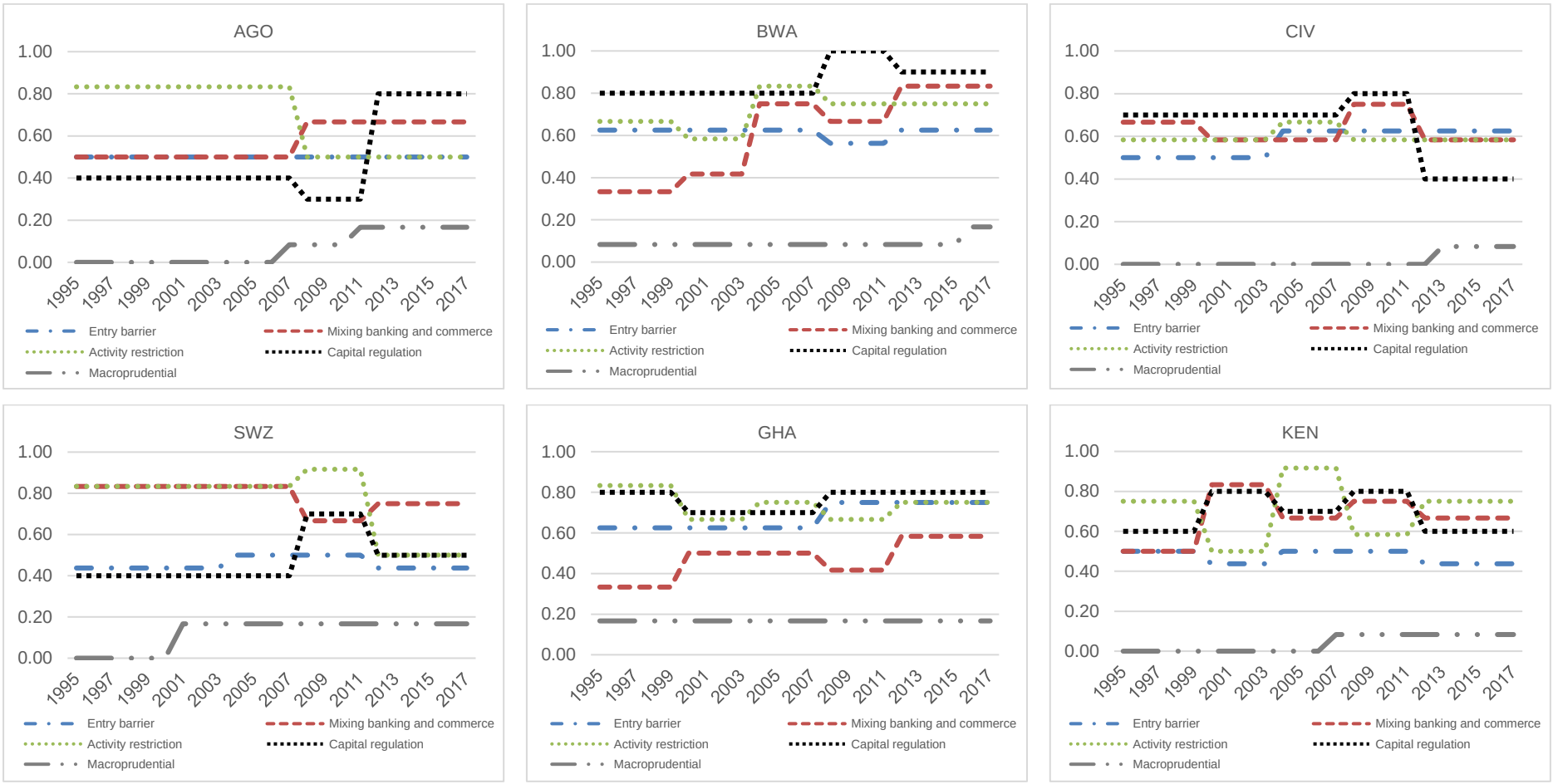
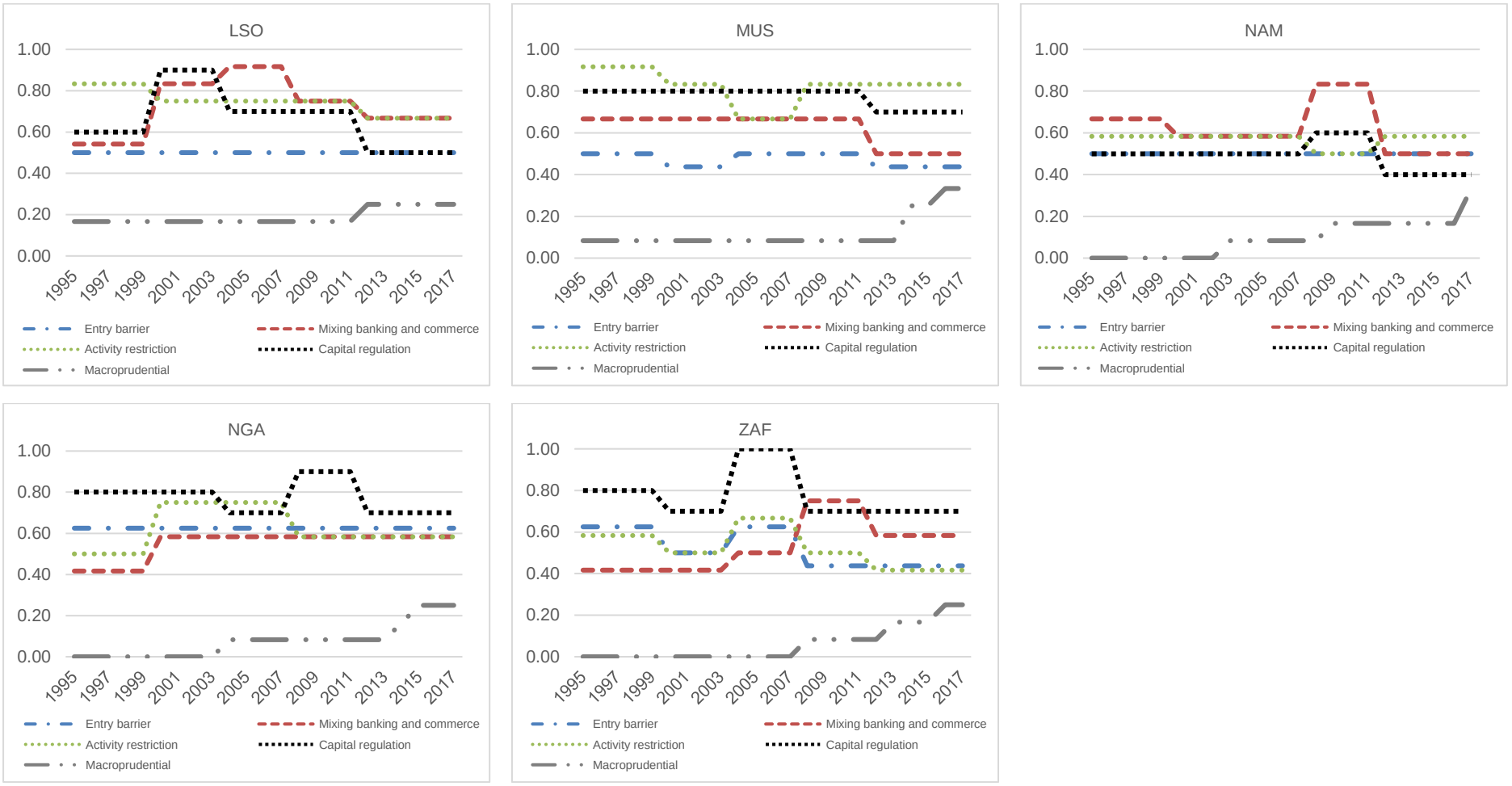


Figure 2.2 Trends in bank regulatory indices in the selected middle-income SSA countries (continuation)



Source: Own graphs using data from Barth et al. (2001, 2004, 2008, 2013), Cihak et al. (2013), Anginer et al. (2019) and individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017).

Notes: All indices are normalised to one; Angola=AGO; Botswana=BWA; Côte d'Ivoire=CIV; Eswatini=SWZ; Ghana=GHA; Kenya KEN; Lesotho=LSO; Mauritius=MUS; Namibia=NAM; Nigeria=NGA; South Africa=ZAF.

Table 2.5 Bank regulatory indices in the selected middle-income SSA countries

Countries	Entry barrier			Mixing banking and commerce			Activity restriction			Capital regulation			Macroprudential		
	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017
Angola	0.50	0.50	0.50	0.50	0.67	0.57	0.83	0.50	0.69	0.40	0.60	0.49	0.01	0.14	0.07
Botswana	0.63	0.60	0.61	0.49	0.77	0.61	0.69	0.75	0.72	0.80	0.94	0.86	0.08	0.10	0.09
Côte d'Ivoire	0.54	0.63	0.58	0.62	0.65	0.63	0.61	0.58	0.60	0.70	0.56	0.64	0.00	0.04	0.02
Eswatini	0.46	0.46	0.46	0.83	0.72	0.78	0.83	0.67	0.76	0.40	0.58	0.48	0.09	0.17	0.12
Ghana	0.63	0.75	0.68	0.44	0.52	0.47	0.76	0.72	0.74	0.74	0.80	0.77	0.17	0.17	0.17
Kenya	0.48	0.46	0.47	0.65	0.70	0.67	0.72	0.68	0.71	0.69	0.68	0.69	0.01	0.08	0.04
Lesotho	0.50	0.50	0.50	0.75	0.70	0.73	0.78	0.70	0.75	0.72	0.58	0.66	0.17	0.22	0.19
Mauritius	0.48	0.46	0.47	0.67	0.57	0.62	0.81	0.83	0.82	0.80	0.74	0.77	0.08	0.17	0.12
Namibia	0.50	0.50	0.50	0.62	0.63	0.62	0.58	0.55	0.57	0.50	0.48	0.49	0.03	0.18	0.09
Nigeria	0.63	0.63	0.63	0.52	0.58	0.55	0.65	0.58	0.62	0.77	0.78	0.77	0.03	0.14	0.08
South Africa	0.59	0.44	0.52	0.44	0.65	0.53	0.58	0.45	0.53	0.83	0.70	0.77	0.00	0.14	0.06
Average	***0.54***	***0.54***	***0.54***	***0.59***	***0.65***	***0.62***	***0.72***	***0.64***	***0.68***	***0.67***	***0.68***	***0.67***	***0.06***	***0.14***	***0.09***

Source: Own calculations using data from Barth et al. (2001, 2004, 2008, 2013), Cihak et al. (2013), Anginer et al. (2019), and individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017).

Note: All indices are normalised to one.

2.3.3 Comparison of Bank regulation in the Selected Low-income and Middle-income SSA Countries

This section compares the average measures of bank regulation in the selected low-income and middle-income SSA countries and further ranks these countries according to the sum of averages of bank regulatory measures as a proxy for the overall bank regulatory environment. Firstly, the average level of the banking entry barrier index was higher in low-income than in middle-income SSA countries over the period 1995 to 2017. The difference in the average levels of the index between these income groups of countries became even larger in the period 2008-2017 than during the period 1995-2007 owing to a considerably higher degree of the entry barrier index recorded in the selected low-income SSA economies.

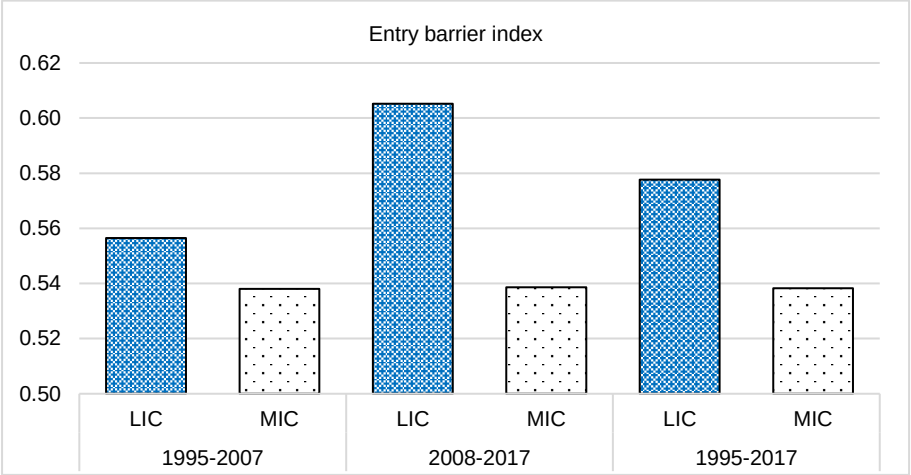
When it came to the average level of the mixing of banking and commerce restriction index, it was higher in the low-income than in the middle-income SSA countries between 1995 and 2017. Although the index increased in both income groups of countries during the period 2008-2017 when compared to the period 1995-2007, the low-income SSA economies still registered a higher increment than the middle-income SSA countries, which widened the gap between the average levels of the index in these groups of countries.

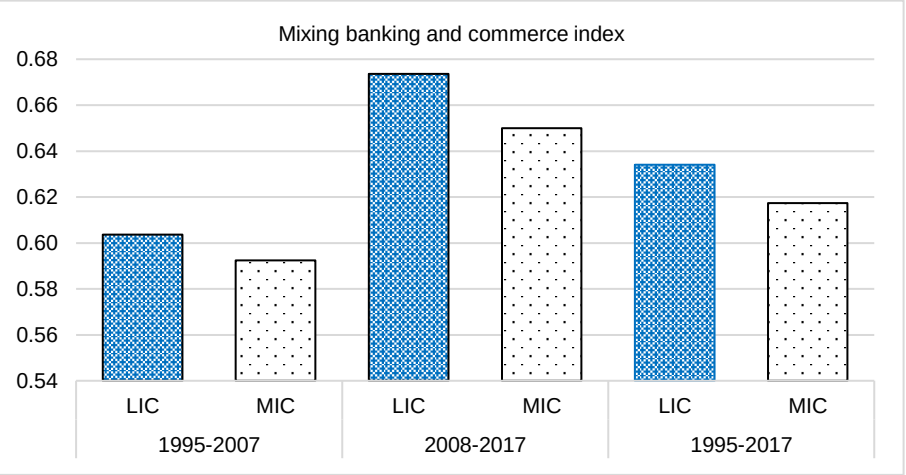
On the contrary, the middle-income SSA countries experienced a higher average degree of the banking activity restriction index than the low-income SSA economies from 1995 to 2017. Nevertheless, the index declined in both income groups of countries between the periods 1995-2007 and 2008-2017, with the gap between their average levels narrowing because of a steeper decline in the average index of the middle-income SSA countries than that of the low-income SSA economies.

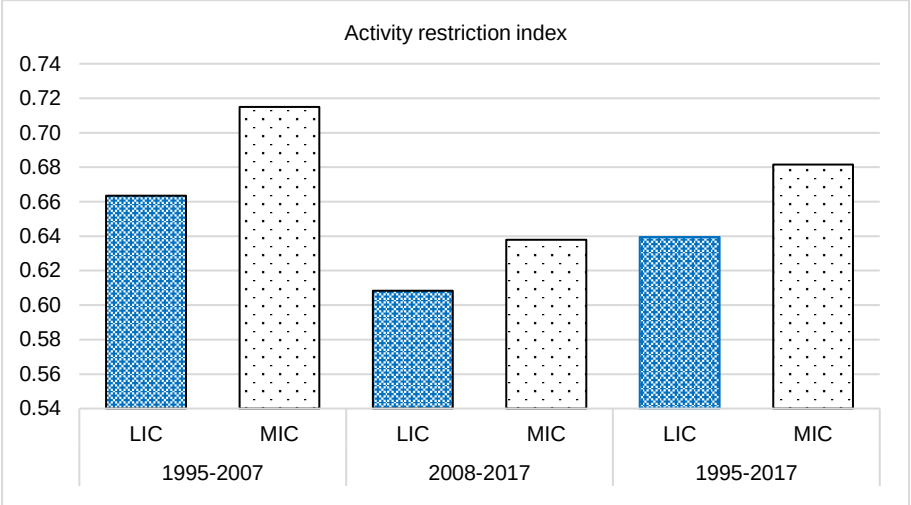
Similarly, the average degree of the capital regulation stringency index in the middle-income SSA countries was higher than that of the low-income SSA economies during the period 1995 to 2017. While the index significantly declined in the low-income SSA countries between the periods 1995-2007 and 2008-2017, it increased slightly in the middle-income SSA economies, thereby widening the gap between the average levels of the index between these income groups of countries.

Lastly, the average level of the macroprudential index was higher in the middle-income than in the low-income SSA countries over the period 1995-2017. The difference in the average levels of the index between these income groups of countries was even larger during the period 2008-2017 than in the period 1995-2007 owing to a considerably higher degree of the macroprudential index recorded in the selected middle-income SSA economies. The comparison of all the average measures of bank regulation in the selected low-income and middle-income SSA countries is provided in Figure 2.3.

Figure 2.3 Average bank regulatory measures in the selected low-income and middle-income SSA countries







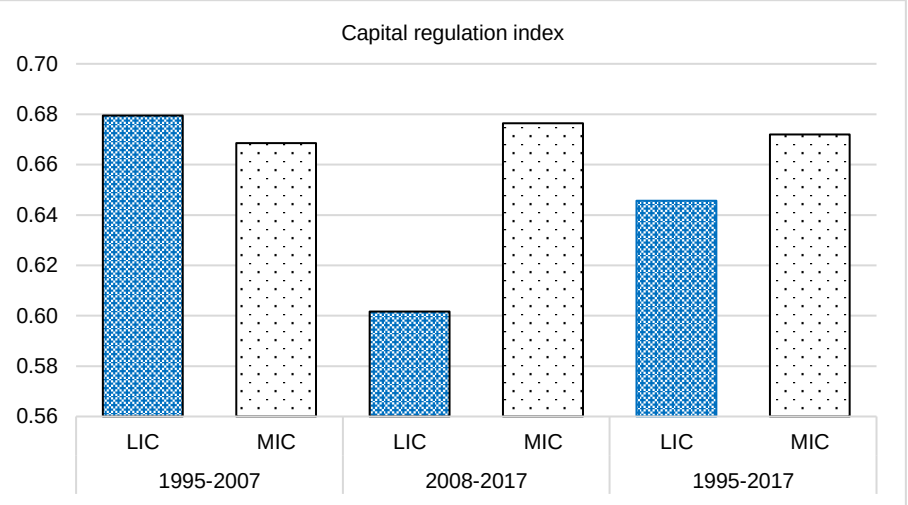
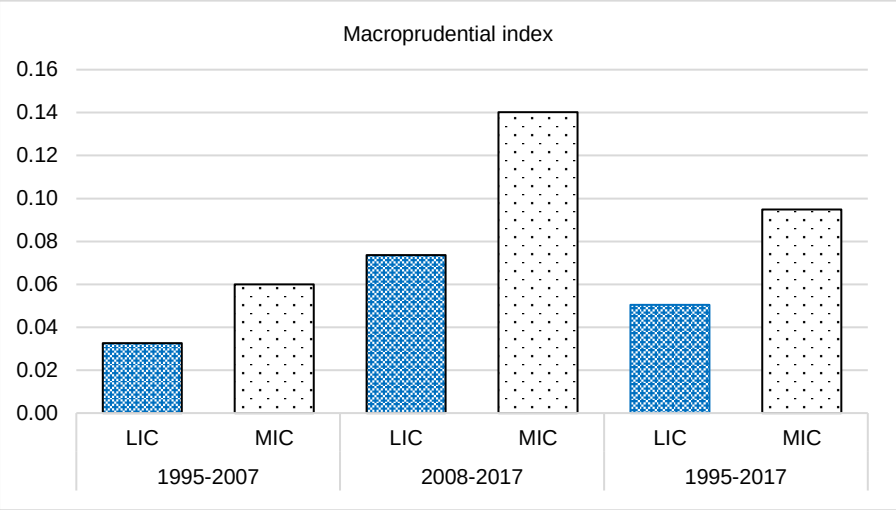


Figure 2.3 Average bank regulatory measures in the selected low-income and middle-income SSA countries (continuation)



Source: Own graphs using data from Barth et al. (2001, 2004, 2008, 2013), Cihak et al. (2013), Anginer et al. (2019) and individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017).

Notes: All indices are normalised to one and are in averages over the specified time periods; LIC=Low-income countries; MIC=Middle-income countries.

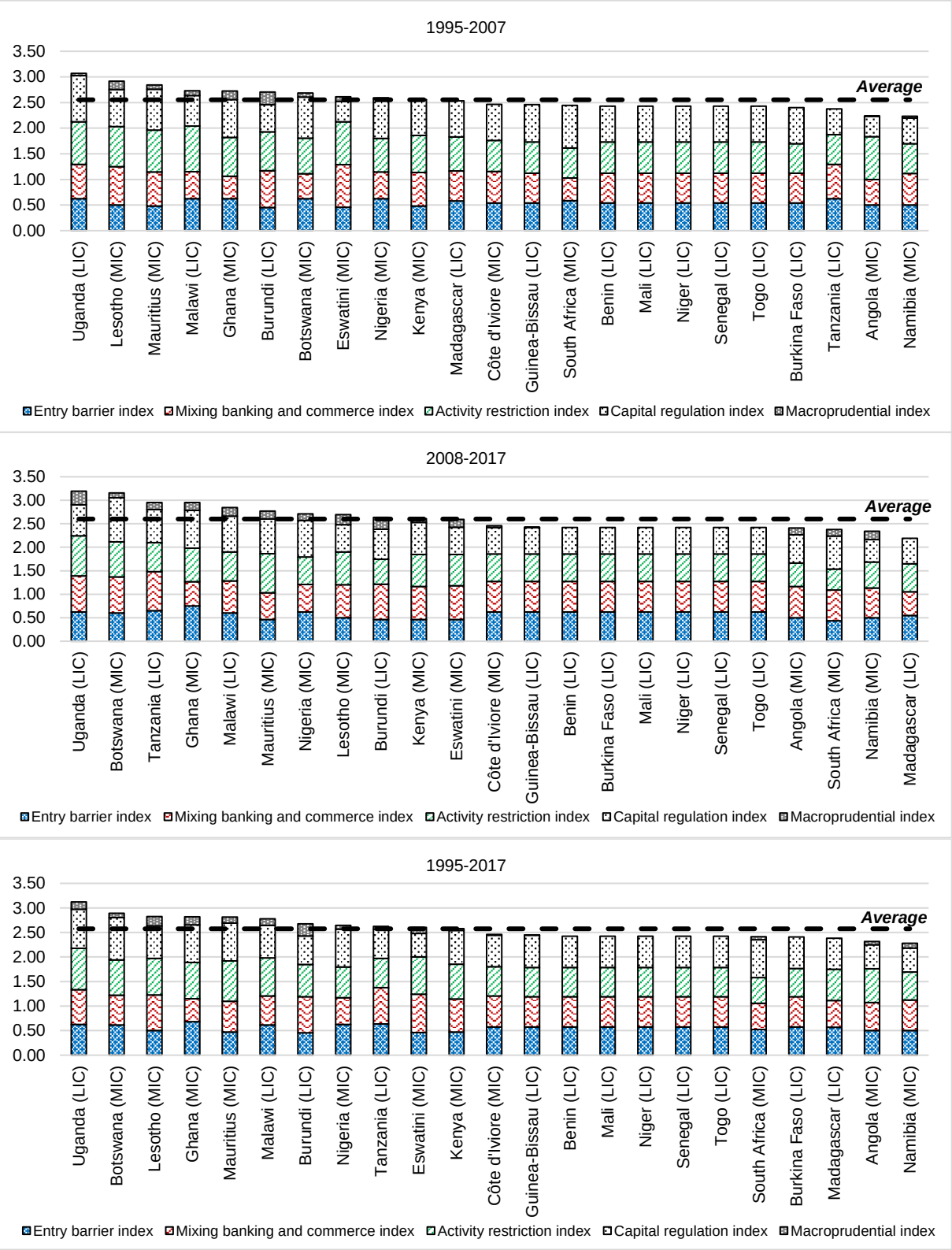
The study further ranks the selected low-income and middle-income SSA countries according to their cumulative averages of bank regulatory measures as a proxy for the overall bank regulatory environment. Between 1995 and 2007, the degree of overall bank regulation in nine out of 23 SSA countries was above the group's average. Six of them are middle-income countries (Lesotho, Mauritius, Ghana, Botswana, Nigeria, and Kenya), while the other three are low-income economies (Uganda, Malawi, and Burundi). Out of 14 countries that had below-average levels of overall bank regulation, five are middle-income countries (Eswatini, Côte d'Ivoire, South Africa, Angola, and Namibia), while nine are low-income economies (Madagascar, Guinea-Bissau, Benin, Mali, Niger, Senegal, Togo, Burkina Faso, and Tanzania). Thus, the bank regulatory environment was slightly stricter in the middle-income SSA countries than in the low-income SSA economies over the period 1995-2007.

Considering the period from 2008 to 2017, 10 out of 23 SSA countries recorded overall bank regulation levels that were above the group's average, with six of them being middle-income economies (Botswana, Ghana, Mauritius, Nigeria, Lesotho, and Kenya), while the other four are low-income countries (Uganda, Tanzania, Malawi, and Burundi). Five out of 13 SSA countries with levels of bank regulation that were below the group's average are middle-income economies (Côte d'Ivoire, Eswatini, Angola, South Africa, and Namibia), while the remaining eight are low-income countries (Guinea-Bissau, Benin, Burkina Faso, Mali, Niger, Senegal, Togo, and Madagascar). Despite having fewer middle-income economies registering the above-average degree of overall bank regulation during the period 2008-2017 than in the period 1995-2007, the stringency of bank regulation was still higher in the middle-income SSA economies than in the low-income SSA countries.

Finally, 10 out of 23 SSA countries exhibited above-average levels of overall bank regulation over the entire period (1995-2017), with six of them (Botswana, Lesotho, Ghana, Mauritius, Nigeria, and Kenya) coming from the middle-income group, while the other four (Uganda, Malawi, Burundi, and Tanzania) are part of the low-income group. Five of the 13 SSA countries that recorded levels of overall bank regulation that were below the group's average are middle-income economies (Eswatini, Côte

d’Ivoire, South Africa, Angola, and Namibia), while the other eight are low-income SSA countries (Guinea-Bissau, Benin, Mali, Niger, Senegal, Togo, Burkina Faso, and Madagascar). Therefore, the bank regulatory environment was a little more stringent in the middle-income SSA countries than in the low-income SSA economies during the period 1995-2017. The rankings of the selected low-income and middle-income SSA countries according to their cumulative averages of bank regulatory indices are given in Figure 2.4 and Figure 2.5.

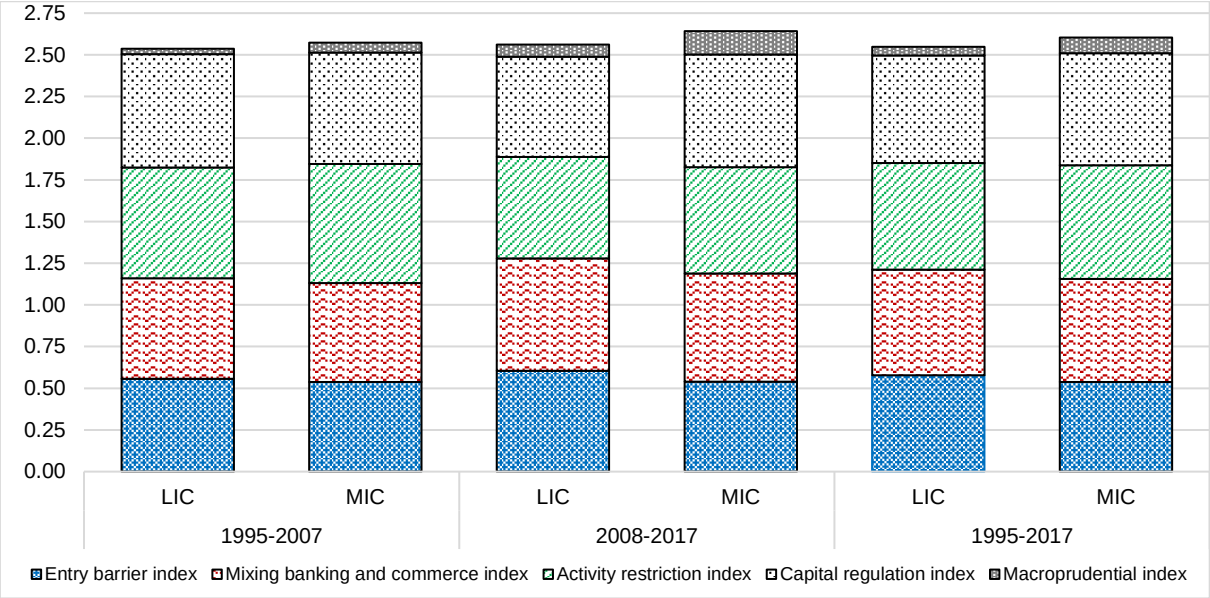
Figure 2.4 Cumulative averages of bank regulatory measures in the selected SSA countries



Source: Own graphs using data from Barth et al. (2001, 2004, 2008, 2013), Cihak et al. (2013), Anginer et al. (2019) and individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017).

Notes: All indices are normalised to one and are in averages over the specified time periods; LIC=Low-income country; MIC=Middle-income country.

Figure 2.5 Cumulative averages of bank regulatory measures in the selected low-income and middle-income SSA countries



Source: Own graphs using data from Barth et al. (2001, 2004, 2008, 2013), Cihak et al. (2013), Anginer et al. (2019) and individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017).

Notes: All indices are normalised to one and are in averages over the specified time periods; LIC=Low-income countries; MIC=Middle-income countries.

2.4 Trends in Bank Lending in Low-income and Middle-income SSA Countries

2.4.1 Trends in Bank Lending in the Selected Low-income SSA Countries

This section presents the trends in bank lending, captured by domestic private credit by deposit money banks as a ratio of deposits and as a share of GDP, in the selected low-income SSA countries from 1995 to 2017. Both measures of bank lending have generally increased over time in low-income SSA economies.

Starting with bank lending to the private sector as a share of deposits, it experienced an upward trend over time in the majority of low-income SSA economies (Benin, Burkina Faso, Guinea-Bissau, Madagascar, Malawi, Mali, Niger, Tanzania, and Uganda), while it trended downwards in Burundi, Senegal, and Togo. Overall, bank credit to deposits in the selected low-income SSA economies increased from 73.1% to 80.1% between the periods 1995-2007 and 2008-2017, with an overall group average of 76.1% over the entire period (1995-2017). The low-income countries that recorded above-average mean percentages in bank lending to deposits between 1995 and 2017 are Mali (99.5%), Burundi (99.2%), Senegal (92.1%), Niger (92.0%), Burkina Faso (88.7%), and Togo (87.1%).

When expressed as a ratio GDP, bank private credit also increased over time in all the selected low-income SSA countries (Benin, Burkina Faso, Burundi, Guinea-Bissau, Madagascar, Malawi, Mali, Niger, Senegal, Tanzania, Togo, and Uganda). As a group, these economies registered a bank credit mean of 16.8% in the period 2008-2017, from 9.6% recorded during the period 1995-2007. They also had a group mean score of 12.7% between 1995 and 2017, with the following countries registering above-average mean percentages during that period: Senegal (22.1%), Togo (21.6%), Burkina Faso (16.1%), Mali (15.3%), Burundi (15.1%), and Benin (15.0%). Nevertheless, bank private lending to GDP experienced fewer fluctuations than bank private lending to deposits over the considered time period. The trends in these variables are depicted in Figure 2.6, while their averages are presented in Table 2.6.

Figure 2.6 Trends in private credit by deposit money banks in the selected low-income SSA countries

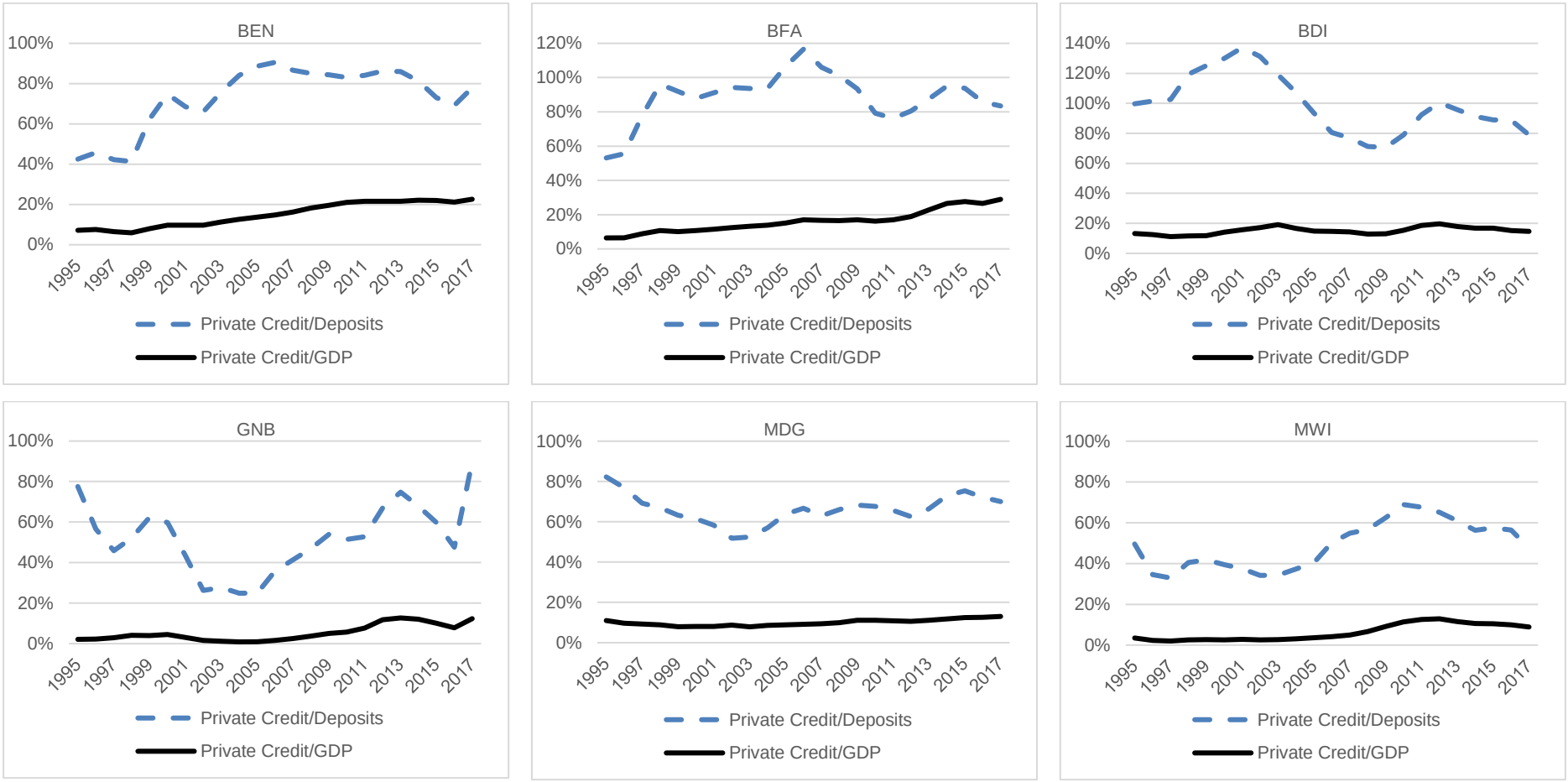
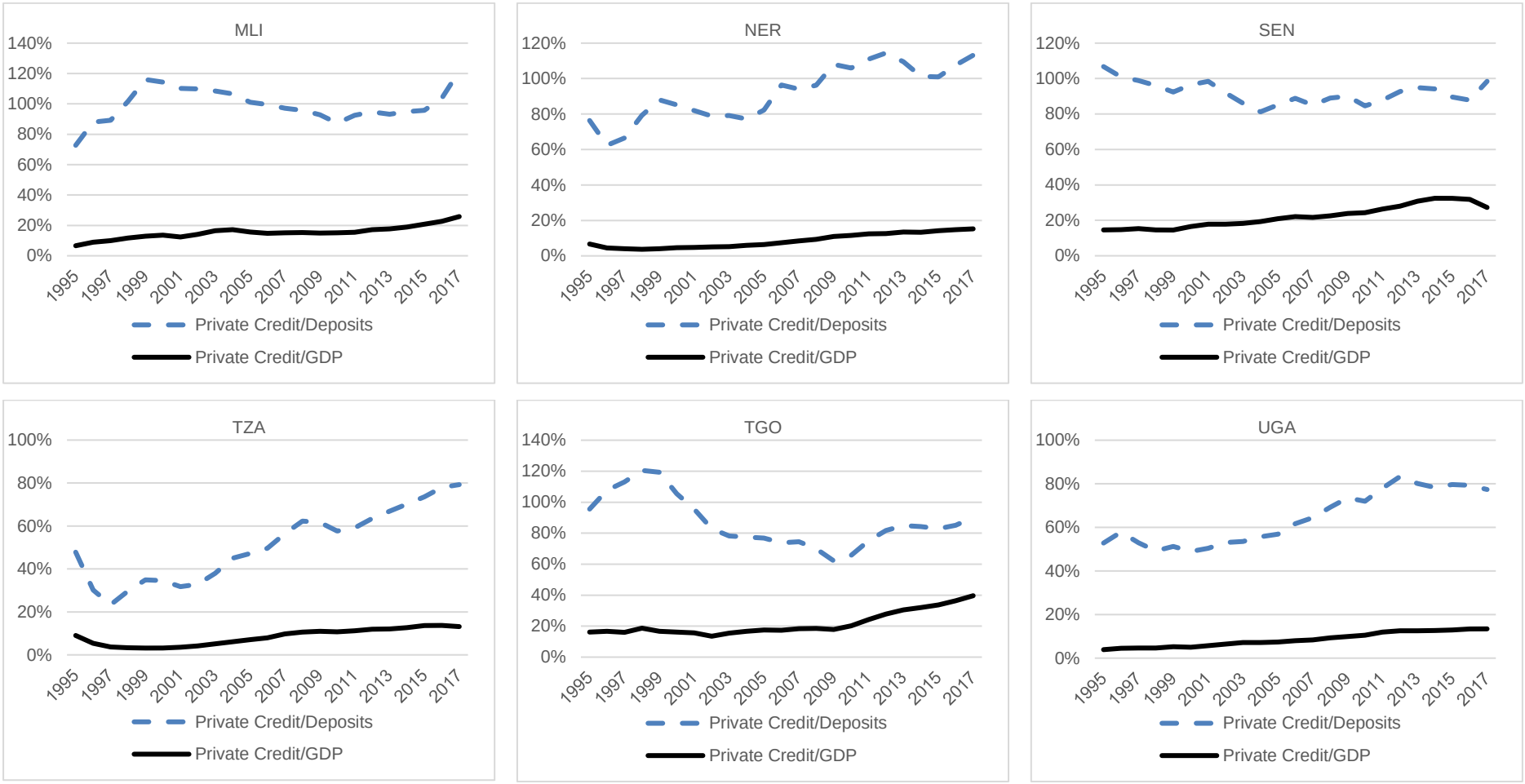


Figure 2.6 Trends in private credit by deposit money banks in the selected low-income SSA countries (continuation)



Source: Own graphs using data from the World Bank Financial Development and Structure and the World Bank Global Financial Development databases.

Notes: Benin=BEN; Burkina Faso=BFA; Burundi=BDI; Guinea-Bissau=GNB; Madagascar=MDG; Malawi=MWI; Mali=MLI; Niger=NER; Senegal=SEN; Tanzania=TZA; Togo=TGO; Uganda=UGA.

Table 2.6 Private credit by deposit money banks in the selected low-income SSA countries

Countries	Private credit/deposits (%)			Private credit/GDP (%)		
	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017
Benin	66.9	81.0	73.0	10.2	21.2	15.0
Burkina Faso	89.5	87.6	88.7	11.8	21.8	16.1
Burundi	109.5	85.7	99.2	14.4	16.1	15.1
Guinea-Bissau	44.5	61.2	51.7	2.4	8.9	5.3
Madagascar	64.1	68.7	66.1	8.9	11.5	10.0
Malawi	40.6	59.9	49.0	3.0	10.4	6.2
Mali	101.2	97.2	99.5	13.0	18.4	15.3
Niger	80.6	106.8	92.0	5.5	12.8	8.7
Senegal	92.9	90.9	92.1	17.5	28.0	22.1
Tanzania	38.6	67.2	51.0	5.5	12.1	8.4
Togo	93.9	78.2	87.1	16.5	28.1	21.6
Uganda	54.5	77.1	64.3	6.0	11.9	8.6
Average	***73.1***	***80.1***	***76.1***	***9.6***	***16.8***	***12.7***

Source: Own calculations using data from the World Bank Financial Development and Structure and the World Bank Global Financial Development databases.

2.4.2 Trends in Bank Lending in the Selected Middle-income SSA Countries

The trends in bank lending, still measured as domestic private credit by deposit money banks as a share of deposits and as a ratio of GDP, in the selected middle-income SSA countries are discussed in this section. These measures of bank credit have largely increased during the period 1995 to 2017 in the middle-income SSA economies.

Beginning with bank credit to the private sector as a ratio of deposits, it trended upwards over time in many of the selected middle-income SSA countries (Angola, Botswana, Eswatini, Ghana, Kenya, and Mauritius). But it exhibited a downward trend in Côte d'Ivoire, Lesotho, Namibia, Nigeria, and South Africa. Bank lending to deposits in all the selected middle-income SSA countries rose from 79.0% in the period 1995-2007 to 81.0% during the period 2008-2017, with an overall group mean of 79.9% over the period 1995-2017. The middle-income SSA countries with the above-average mean percentages in bank credit to deposits during the entire period

are South Africa (115.1%), Namibia (108.5%), Côte d'Ivoire (92.4%), Mauritius (85.8%), and Eswatini (82.5%).

When measured as a ratio of GDP, bank private lending increased over time in all the selected middle-income SSA economies (Angola, Botswana, Côte d'Ivoire, Eswatini, Ghana, Kenya, Lesotho, Mauritius, Namibia, Nigeria, and South Africa). In addition, bank credit to GDP in all the selected middle-income SSA countries registered a group's mean score of 33.2% between 2008 and 2017, from 23.1% recorded in the period 1995-2007. These economies had a group average score of 27.5% during the period 1995-2017, with the following countries registering above-average mean percentages that were relatively high compared to those of other countries over that period: Mauritius (72.1%), South Africa (64.5%), and Namibia (45.4%). Nonetheless, bank private credit to GDP experienced fewer variations than bank private credit to deposits over the period under discussion. The trends in these variables are provided in Figure 2.7, while their averages are given in Table 2.7.

Figure 2.7 Trends in private credit by deposit money banks in the selected middle-income SSA countries

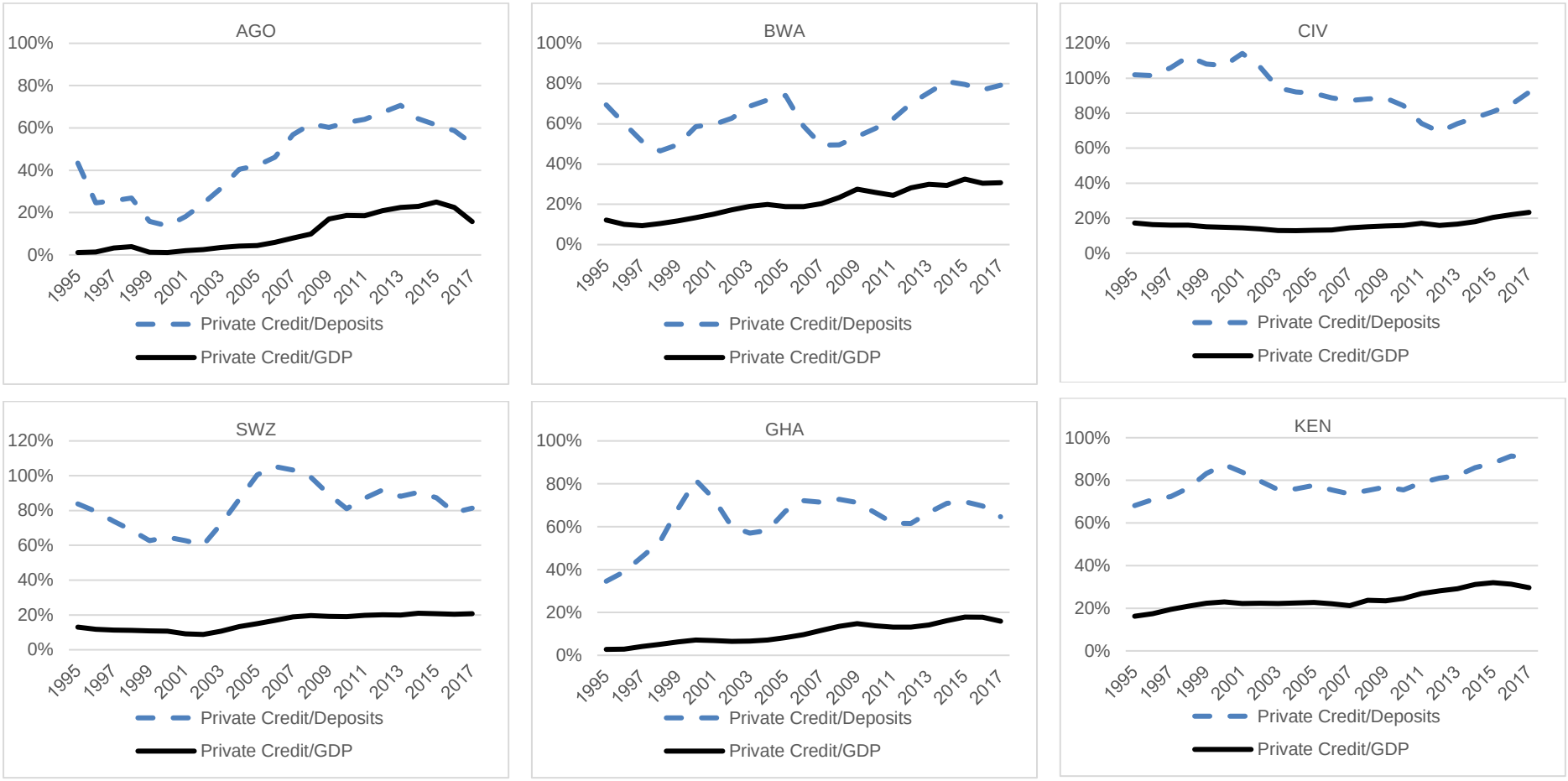
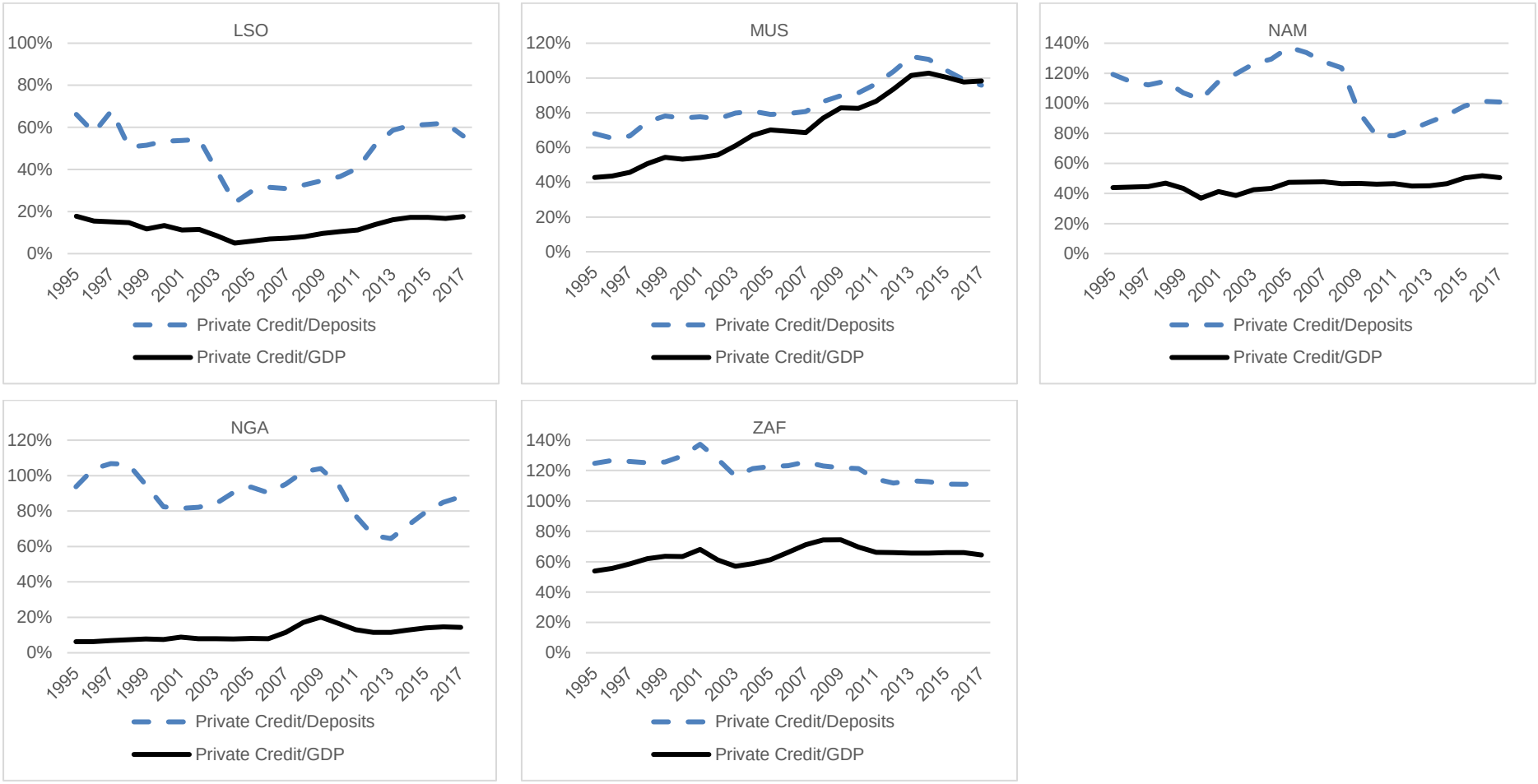


Figure 2.7 Trends in private credit by deposit money banks in the selected middle-income SSA countries (continuation)



Source: Own graphs using data from the World Bank Financial Development and Structure and the World Bank Global Financial Development databases.

Notes: Angola=AGO; Botswana=BWA; Côte d'Ivoire=CIV; Eswatini=SWZ; Ghana=GHA; Kenya KEN; Lesotho=LSO; Mauritius=MUS; Namibia=NAM; Nigeria=NGA; South Africa=ZAF.

Table 2.7 Private credit by deposit money banks in the selected middle-income SSA countries

Countries	Private credit/deposits (%)			Private credit/GDP (%)		
	1995-2007	2008-2017	1995-2017	1995-2007	2008-2017	1995-2017
Angola	31.5	62.4	44.9	3.3	19.4	10.3
Botswana	60.1	68.6	63.8	15.1	28.3	20.8
Côte d'Ivoire	100.9	81.4	92.4	14.7	18.0	16.1
Eswatini	78.8	87.4	82.5	12.4	20.1	15.8
Ghana	60.1	67.7	63.4	6.6	15.0	10.2
Kenya	77.0	82.6	79.4	21.1	28.0	24.1
Lesotho	47.0	49.5	48.1	11.1	13.8	12.3
Mauritius	75.7	99.0	85.8	56.6	92.3	72.1
Namibia	119.9	93.7	108.5	43.8	47.6	45.4
Nigeria	92.7	83.3	88.6	7.9	14.6	10.8
South Africa	125.5	115.1	121.0	61.5	67.8	64.3
Average	***79.0***	***81.0***	***79.9***	***23.1***	***33.2***	***27.5***

Source: Own calculations using data from the World Bank Financial Development and Structure and the World Bank Global Financial Development databases.

2.4.3 Comparison of Bank Lending in the Selected Low-income and Middle-income SSA Countries

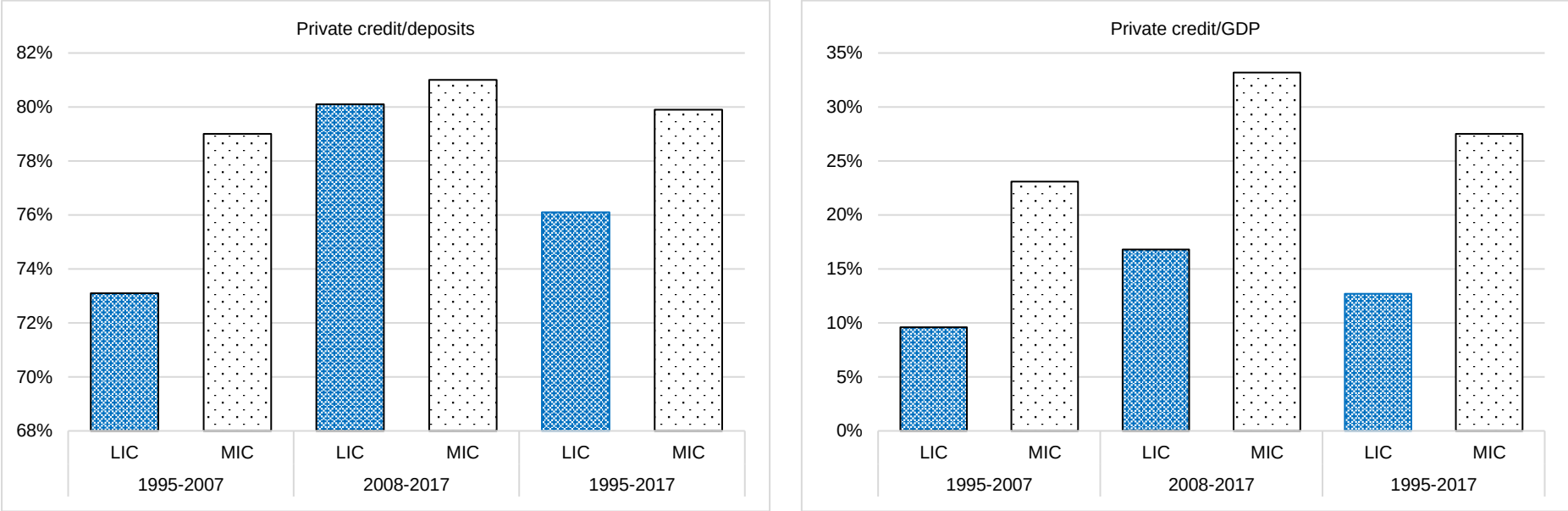
This section compares the trends in bank lending between the low-income and middle-income SSA economies during the period 1995-2017. The middle-income SSA countries have experienced a higher level of bank lending than the low-income SSA economies over the period under review.

Considering the average level of bank credit to deposits, it was higher in the middle-income than in the low-income SSA countries during the period 1995 to 2017. However, the difference in the average levels of bank lending to deposits between the two groups of countries became smaller in the period 2008-2017 than during the period 1995-2007 owing to a substantial increase in bank credit to deposits recorded in the selected low-income SSA economies.

Regarding bank lending as a ratio of GDP, it was still higher in the middle-income than in the low-income SSA countries between 1995 and 2017. Even though bank

credit to GDP increased in both income groups of countries during the period 2008-2017 when compared to the period 1995-2007, the middle-income SSA economies still registered a higher increment than the low-income SSA countries, which widened the gap between the average levels of bank lending to GDP in these groups of countries. The comparison of average measures of bank lending in the selected low-income and middle-income SSA countries is given in Figure 2.8.

Figure 2.8 Average bank lending measures in the selected low-income and middle-income SSA countries



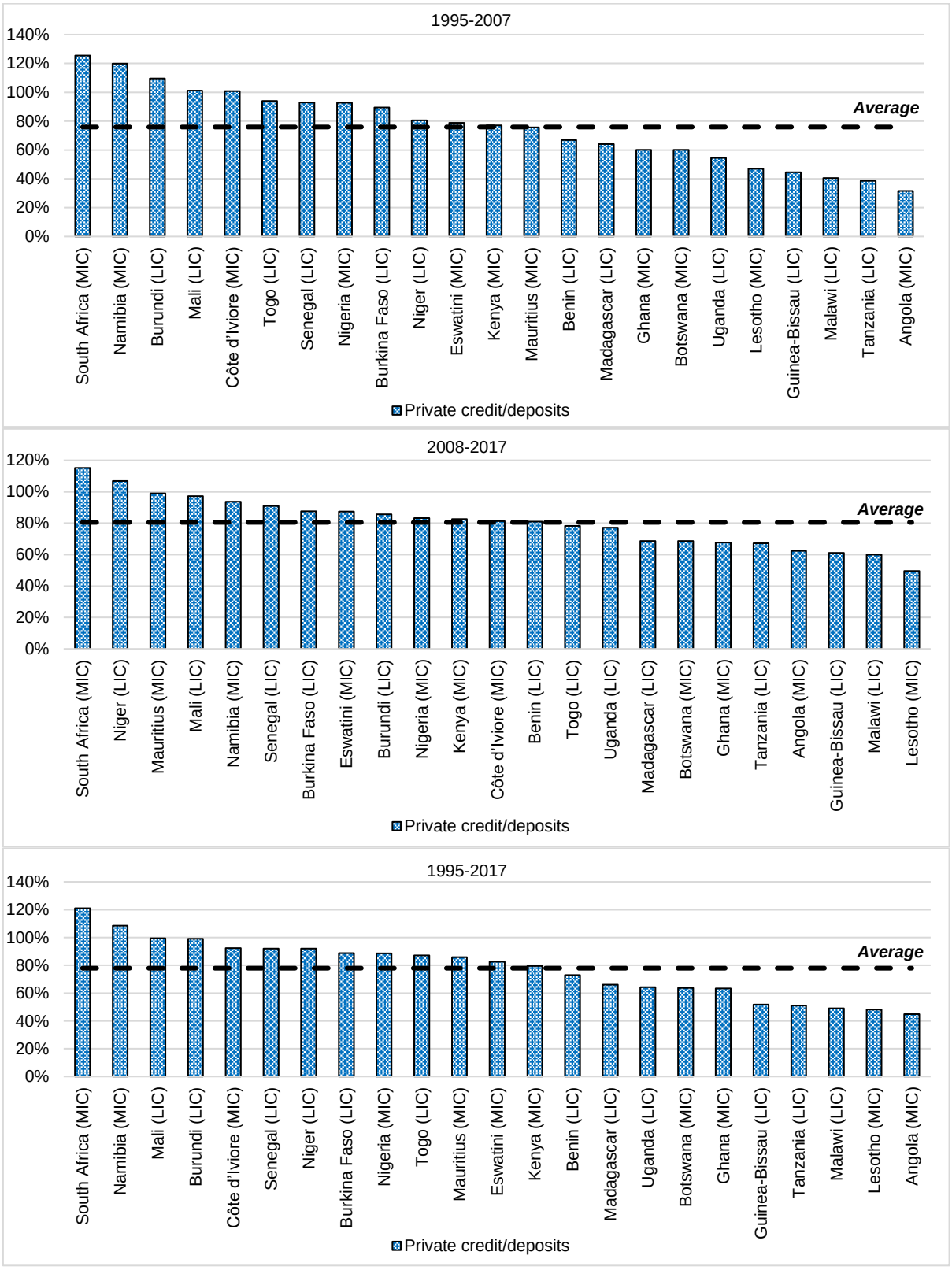
Source: Own graphs using data from the World Bank Financial Development and Structure and the World Bank Global Financial Development databases.
Notes: All measures are in averages over the specified time periods; LIC=Low-income countries; MIC=Middle-income countries.

The study further ranks all the selected low-income and middle-income SSA countries according to their average bank lending to deposits. Between 1995 and 2007, bank lending to deposits in 12 out of 23 SSA countries was above the group's average. Half of these countries (South Africa, Namibia, Côte d'Ivoire, Nigeria, Eswatini, and Kenya) comes from the middle-income group, while the other half (Burundi, Mali, Togo, Senegal, Burkina Faso, and Niger) is part of the low-income group. Out of 11 countries that had below-average levels of bank credit to deposits, five are middle-income countries (Mauritius, Ghana, Botswana, Lesotho, and Angola), while six are low-income economies (Benin, Madagascar, Uganda, Guinea-Bissau, Malawi, and Tanzania).

During the period from 2008 to 2017, bank lending to deposits in 13 out of 23 SSA countries was above the group's average, with seven of them being middle-income economies (South Africa, Mauritius, Namibia, Eswatini, Nigeria, Kenya, and Côte d'Ivoire), while the other six being low-income countries (Niger, Mali, Senegal, Burkina Faso, Burundi, and Benin). Four out of 10 SSA countries with levels of bank credit to deposits that were below the group's average are middle-income economies (Botswana, Ghana, Angola, and Lesotho), while the remaining six are low-income countries (Togo, Uganda, Madagascar, Tanzania, Guinea-Bissau, and Malawi).

When it came to the entire review period (1995-2017), 13 out of 23 SSA countries exhibited above-average levels of bank lending to deposits, with seven of them (South Africa, Namibia, Côte d'Ivoire, Nigeria, Mauritius, Eswatini, and Kenya) coming from the middle-income group, while the other six (Mali, Burundi, Senegal, Niger, Burkina Faso, and Togo) are part of the low-income group. Four of the 10 SSA countries that recorded levels of bank credit to deposits that were below the group's average are middle-income economies (Botswana, Ghana, Lesotho, and Angola), while the other six are low-income SSA countries (Benin, Madagascar, Uganda, Guinea-Bissau, Tanzania, and Malawi). Figure 2.9 presents the rankings of the average measures of bank lending to deposits in the selected low-income and middle-income SSA countries.

Figure 2.9 Average bank lending to deposits in the selected low-income and middle-income SSA countries



Source: Own graphs using data from the World Bank Financial Development and Structure and the World Bank Global Financial Development databases.

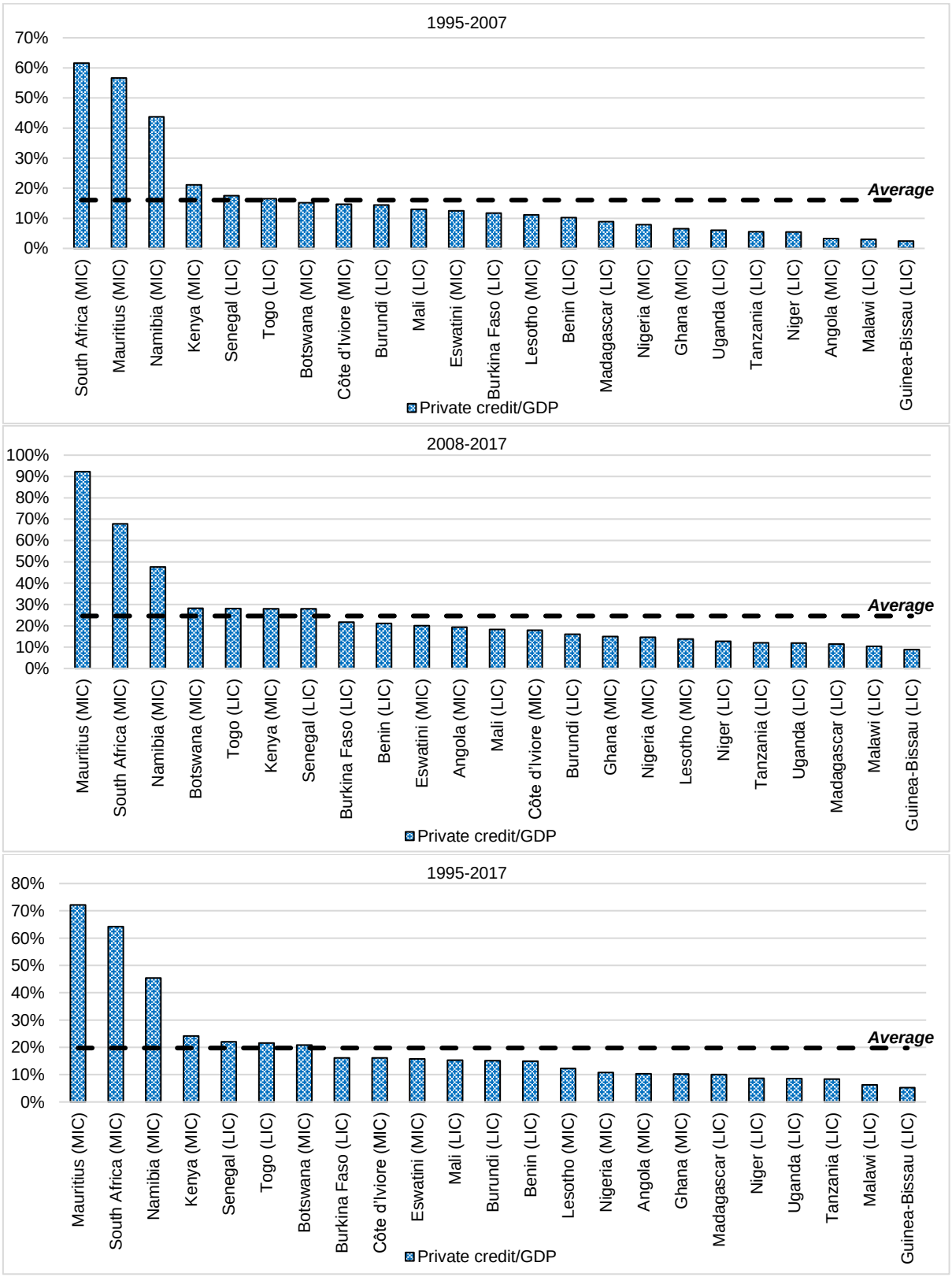
Notes: All measures are in averages over the specified time periods; LIC=Low-income countries; MIC=Middle-income countries.

Alternatively, the study ranks the selected low-income and middle-income SSA economies with respect to bank credit as a share of GDP. Only six out of 23 SSA countries recorded levels of bank lending to GDP that were above the group's average during the period 1995-2007. Four of them (South Africa, Mauritius, Namibia, and Kenya) belong to the middle-income group, while the other two (Senegal and Togo) are members of the low-income group. Out of 17 countries that had below-average levels of bank credit to GDP, seven are middle-income economies (Botswana, Côte d'Ivoire, Eswatini, Lesotho, Nigeria, Ghana, and Angola), while 10 are low-income countries (Burundi, Mali, Burkina Faso, Benin, Madagascar, Uganda, Tanzania, Niger, Malawi, and Guinea-Bissau).

Concerning the period from 2008 to 2017, bank lending to GDP in seven out of 23 SSA countries was above the group's average, with five of them being middle-income economies (Mauritius, South Africa, Namibia, Botswana, and Kenya), while the other two being low-income countries (Togo and Senegal). Six out of 16 SSA countries with levels of bank credit to GDP that were below the group's average are middle-income economies (Eswatini, Angola, Côte d'Ivoire, Ghana, Nigeria, and Lesotho), while the remaining 10 are low-income countries (Burkina Faso, Benin, Mali, Burundi, Niger, Tanzania, Uganda, Madagascar, Malawi, and Guinea-Bissau).

Lastly, seven out of 23 SSA countries exhibited above-average levels of bank lending to GDP over the entire period (1995-2017), with five of them (Mauritius, South Africa, Namibia, Kenya, and Botswana) belonging to the middle-income group, while the other two (Senegal and Togo) are part of the low-income group. Six of the 16 SSA economies that registered the levels of bank credit to GDP that were below the group's average are middle-income countries (Côte d'Ivoire, Eswatini, Lesotho, Nigeria, Angola, and Ghana), while the other 10 are low-income SSA economies (Burkina Faso, Mali, Burundi, Benin, Madagascar, Niger, Uganda, Tanzania, Malawi, and Guinea-Bissau). Figure 2.10 offers the rankings of the selected low-income and middle-income SSA countries with respect to bank credit as a share of GDP.

Figure 2.10 Average bank lending to GDP in the selected low-income and middle-income SSA countries



Source: Own graphs using data from the World Bank Financial Development and Structure and the World Bank Global Financial Development databases.

Notes: All measures are in averages over the specified time periods; LIC=Low-income countries; MIC=Middle-income countries.

2.5 Co-movement Between Bank Regulation and Bank Lending in the Selected SSA Countries

This section presents the co-movements between bank regulatory and bank lending measures in the selected SSA countries and their income groups over the period 1995-2017. It aims to characterize how these variables move together over the study period. The relationship between these measures varies from negative to positive, while it is almost non-existent in some cases.

Starting with the case of all selected SSA countries, there existed a negative association between bank credit to deposits and banking entry barrier, mixing of banking and commerce restriction, banking activity restriction and macroprudential indices during the period under consideration. But the relationship between bank lending to deposits and the latter two indices was relatively weak. On the contrary, there was almost no association between bank credit to deposits and the capital regulation index. When it came to bank lending to GDP, it had a negative association with banking entry barrier as well as mixing of banking and commerce restriction indices, albeit the relationship being relatively weak in the case of the latter. In contrast, the relationship between bank credit to GDP and the capital regulation index was positive, while the one between bank credit to GDP and banking activity restriction and macroprudential indices was almost non-existent. Figure 2.11 shows the scatterplots for the bank regulatory indices and bank credit variables in all the SSA economies over the period 1995 to 2017.

Figure 2.11 Bank regulation and bank lending in all selected SSA countries (averages from 1995 to 2017)

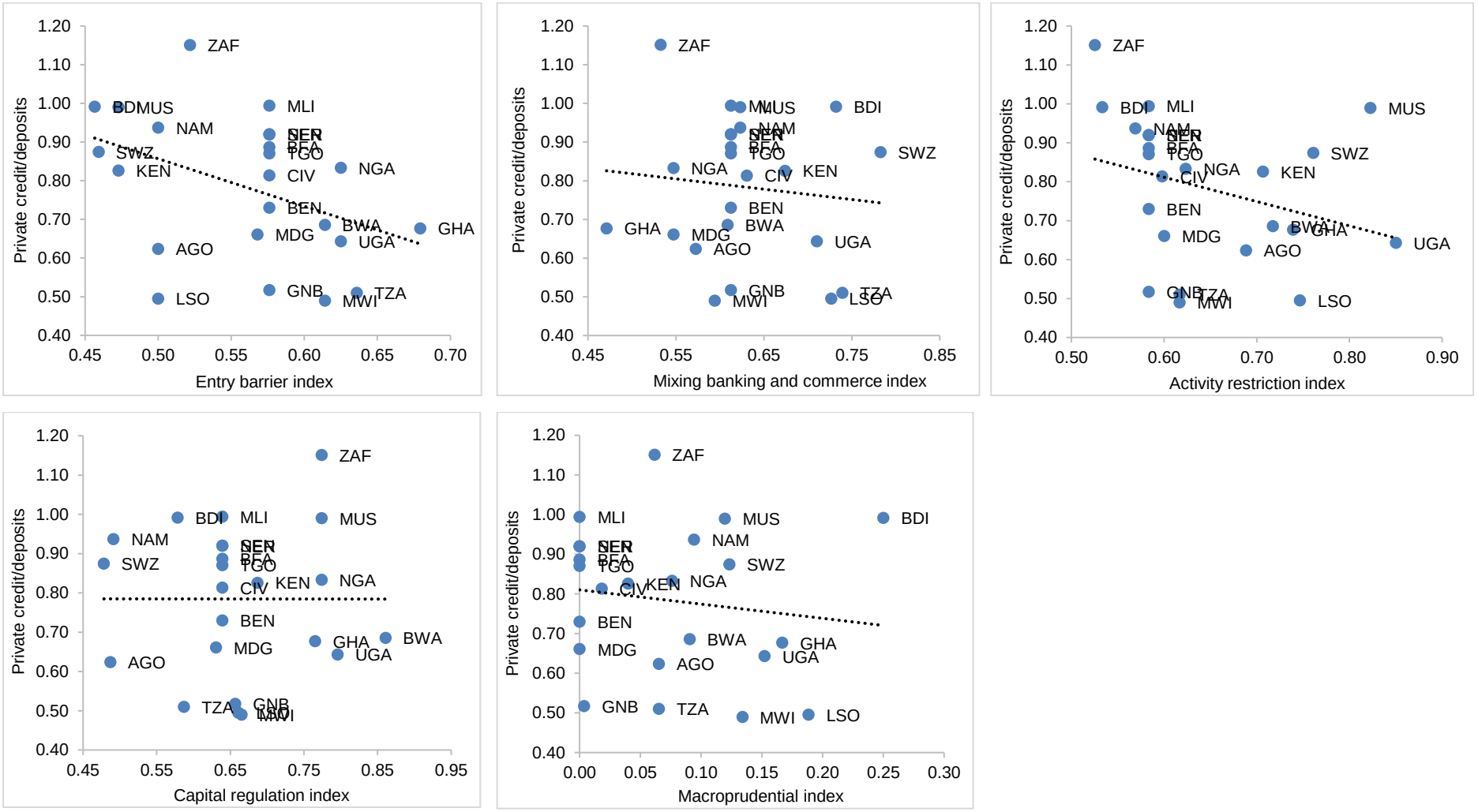
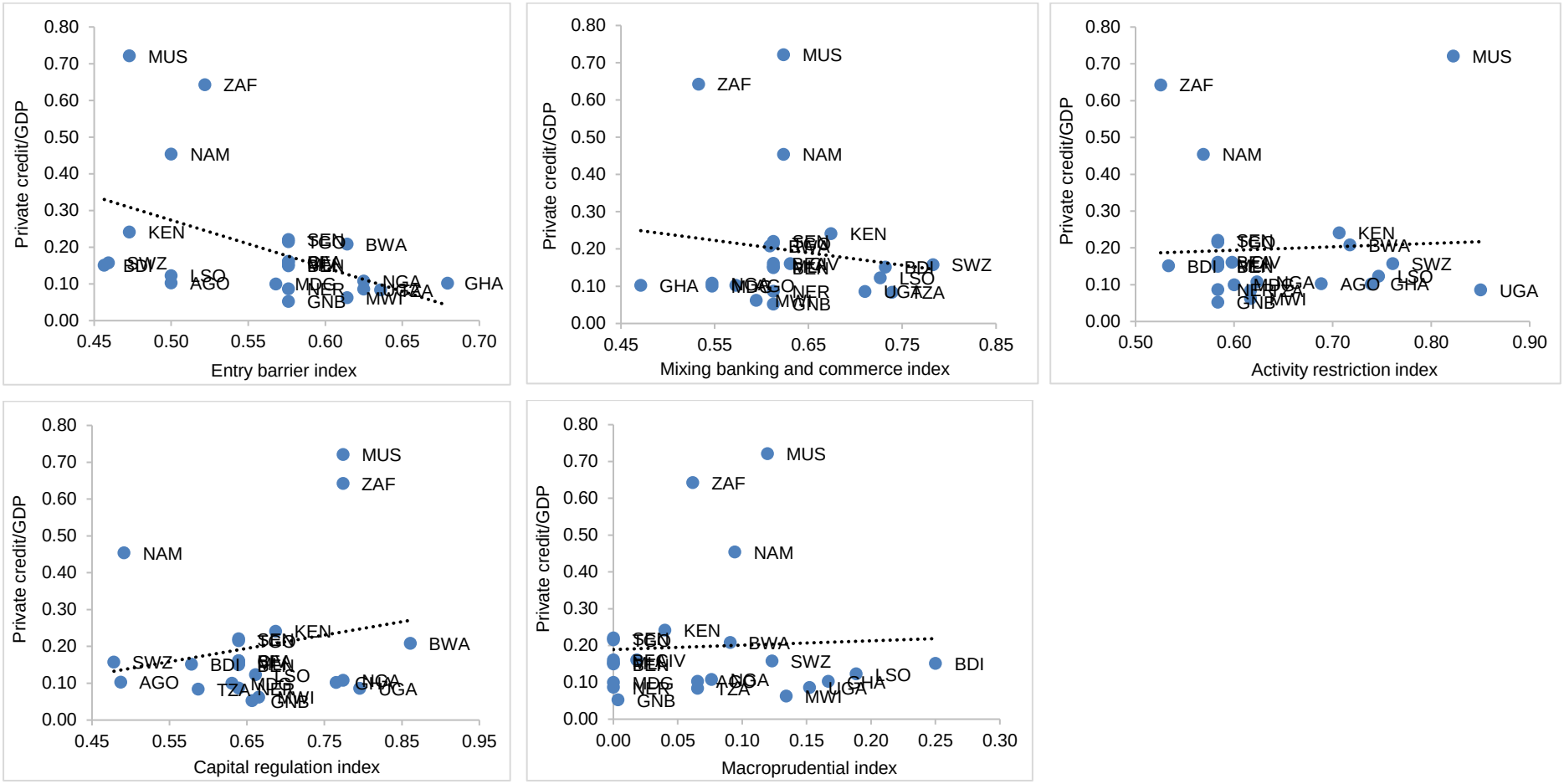


Figure 2.11 Bank regulation and bank lending in all selected SSA countries (averages from 1995 to 2017) (continuation)



Source: Own graphs using data from Barth et al. (2001, 2004, 2008, 2013); Cihak et al. (2013); Anginer et al. (2019); Individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017); World Bank Financial Development and Structure; and World Bank Global Financial Development.

Notes: Bank regulatory indices are normalised to one; AGO=Angola; BEN=Benin; BWA=Botswana; BFA=Burkina Faso; BDI=Burundi; CIV=Côte d'Ivoire; SWZ=Eswatini; GHA=Ghana; GNB=Guinea-Bissau; KEN=Kenya; LSO=Lesotho; MDG=Madagascar; MWI=Malawi; MLI=Mali; MUS=Mauritius; NAM=Namibia; NER=Niger; NGA=Nigeria; SEN=Senegal; ZAF=South Africa; TZA=Tanzania; TGO=Togo; UGA=Uganda.

Furthermore, the study separated the SSA countries into low-income and middle-income economies. In the case of the former, there was a negative association between bank credit to deposits and banking entry barrier, banking activity restriction and capital regulation stringency indices during the review period. However, the relationship between bank lending to deposits and mixing of banking and commerce restriction and macroprudential indices was nearly non-existent. But when bank credit was measured as a share of GDP, it had a negative association with all bank regulatory indices, although the relationship with the mixing of banking and commerce restriction and macroprudential indices was relatively weak. Figure 2.12 presents the scatterplots for the bank regulatory indices and bank lending variables in the low-income SSA countries during the period 1995 to 2017.

Figure 2.12 Bank regulation and bank lending in the selected low-income SSA countries (averages from 1995 to 2017)

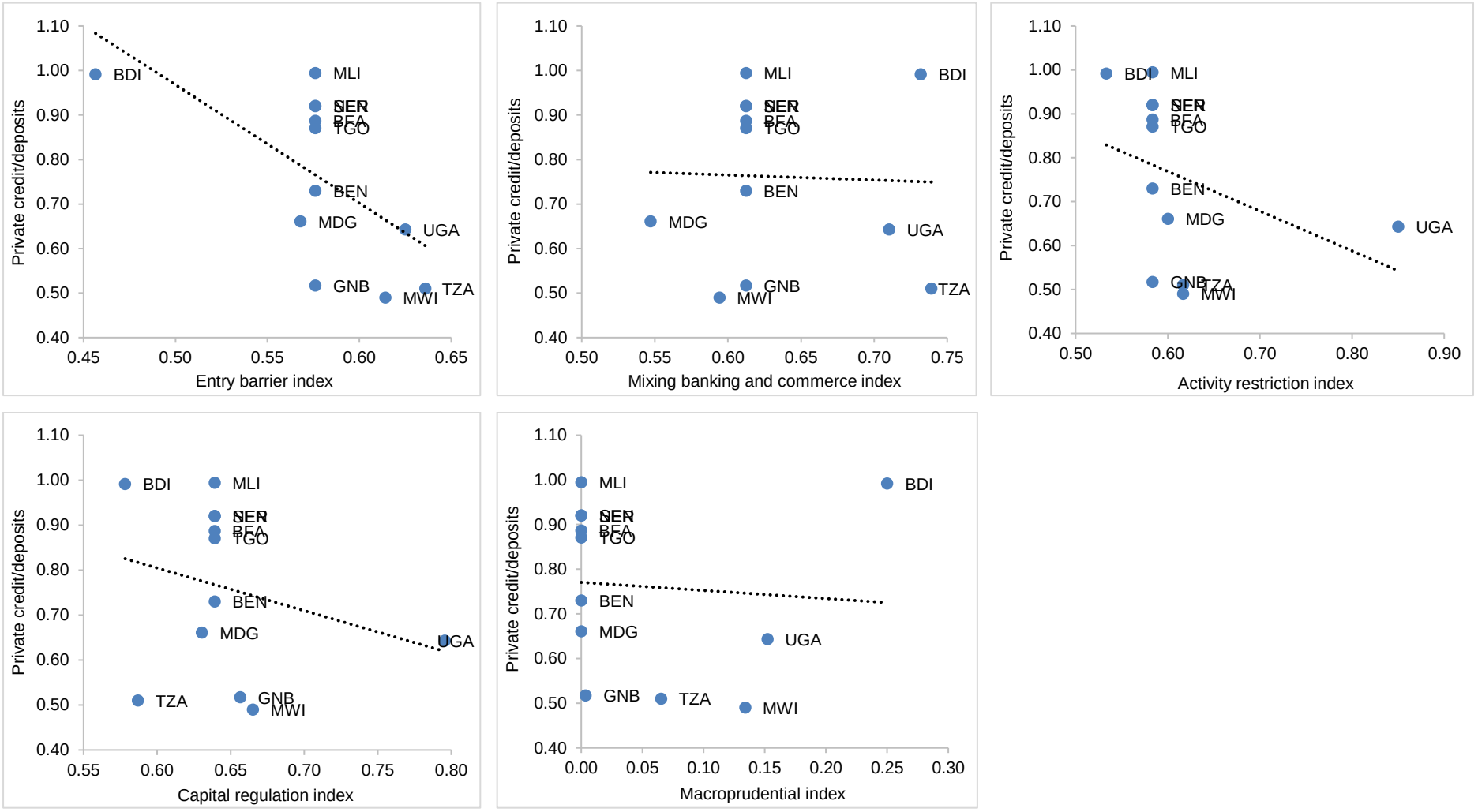
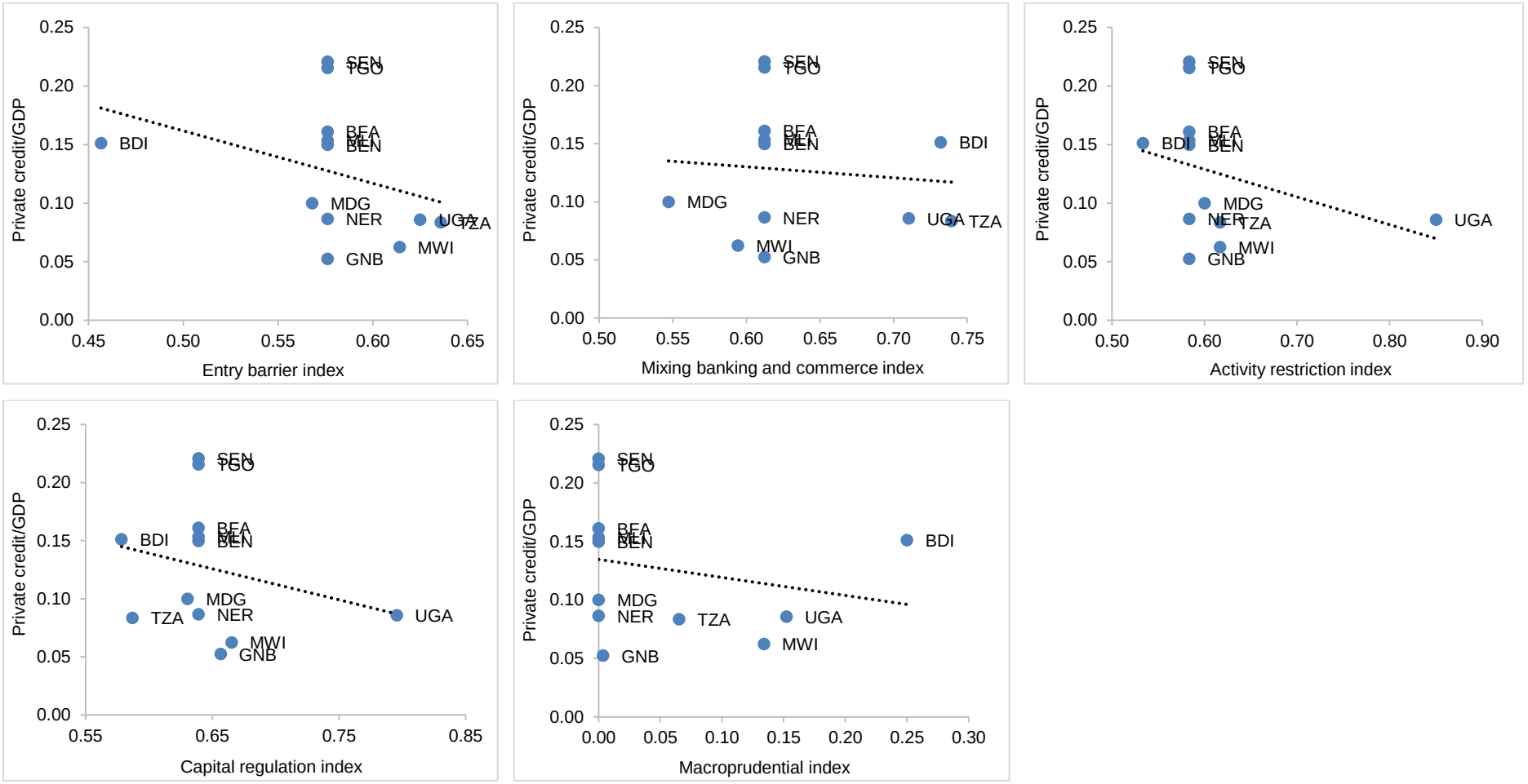


Figure 2.12 Bank regulation and bank lending in the selected low-income SSA countries (averages from 1995 to 2017) (continuation)



Source: Own graphs using data from Barth et al. (2001, 2004, 2008, 2013); Cihak et al. (2013); Anginer et al. (2019); Individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017); World Bank Financial Development and Structure; and World Bank Global Financial Development.

Notes: Bank regulatory indices are normalised to one; Benin=BEN; Burkina Faso=BFA; Burundi=BDI; Guinea-Bissau=GNB; Madagascar=MDG; Malawi=MWI; Mali=MLI; Niger=NER; Senegal=SEN; Tanzania=TZA; Togo=TGO; Uganda=UGA.

Finally, considering the case of the middle-income SSA economies, a negative relationship between bank lending to deposits and banking entry barrier, mixing of banking and commerce restriction, banking activity restriction and macroprudential indices existed during the period under discussion, while the relationship between bank credit to deposits and the capital regulation index was positive but relatively weak. Similarly, bank lending as a share of GDP had a negative association with banking entry barrier, mixing of banking and commerce restriction, banking activity restriction and macroprudential indices but a positive one with the capital regulation stringency index. Figure 2.13 depicts the scatterplots for the bank regulatory indices and bank lending variables in the middle-income SSA countries between 1995 and 2017.

Figure 2.13 Bank regulation and bank lending in the selected middle-income SSA countries (averages from 1995 to 2017)

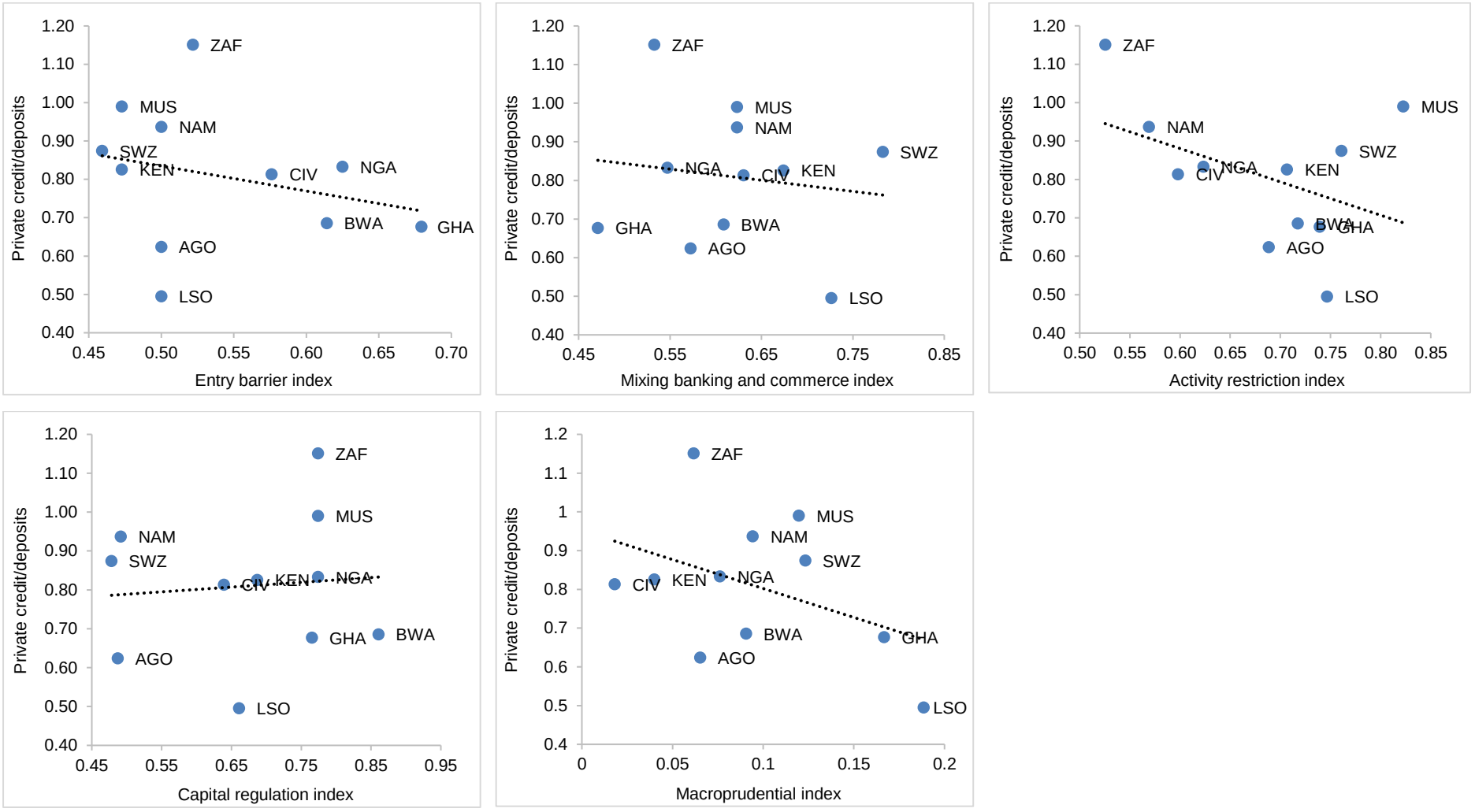
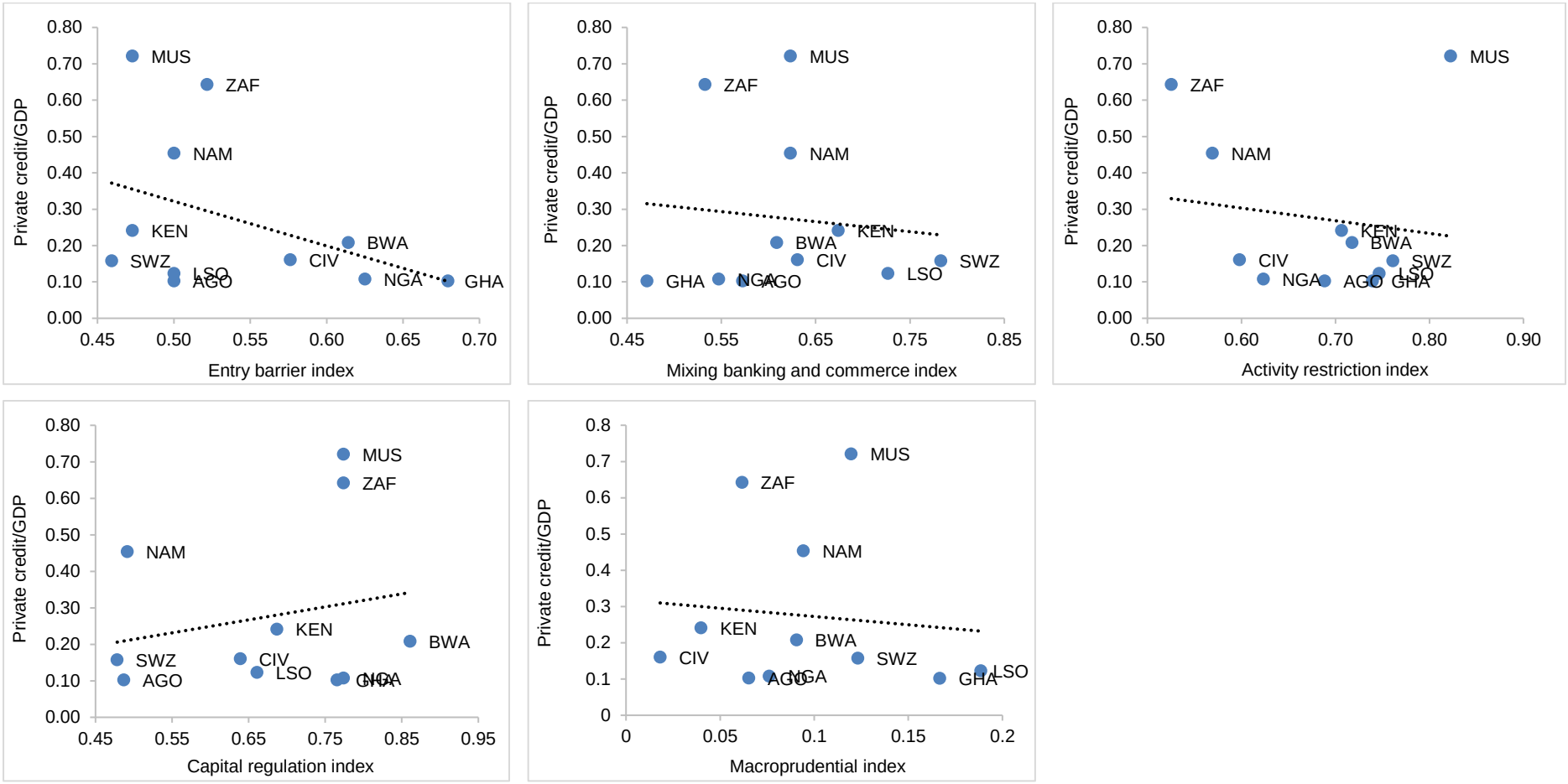


Figure 2.13 Bank regulation and bank lending in the selected middle-income SSA countries (averages from 1995 to 2017) (continuation)



Source: Own graphs using data from Barth et al. (2001, 2004, 2008, 2013); Cihak et al. (2013); Anginer et al. (2019); individual central bank or country laws and/or regulations following the approach by Cerutti et al. (2017); World Bank Financial Development and Structure; and World Bank Global Financial Development.

Notes: Bank regulatory indices are normalised to one Angola=AGO; Botswana=BWA; Côte d'Ivoire=CIV; Eswatini=SWZ; Ghana=GHA; Kenya KEN; Lesotho=LSO; Mauritius=MUS; Namibia=NAM; Nigeria=NGA; South Africa=ZAF.

2.6 Conclusion

This chapter has discussed the dynamics of bank regulation as well as trends in bank regulatory and bank lending measures in SSA countries and their income groups. As observed, bank regulation in the majority of SSA countries before the 1990s was inadequate and this led to multiple occurrences of banking crises. As a result, many countries introduced financial sector reforms in the late 1980s that included major adjustments in the banking regulatory and supervisory frameworks. Almost all countries in the SSA region implemented the Basel I accord, while others later adopted higher standards of Basel II and Basel III. Moreover, many of these economies have aligned themselves with international financial reporting standards, but a few have adopted deposit insurance schemes.

In both low-income and middle-income SSA economies, the bank regulatory environment became more stringent over time during the period between 1995 and 2017. In the case of the former, it was driven by increased restrictions on bank entry and mixing of banking and commerce, as well as the introduction of macroprudential policies, despite reductions in banking activity restrictions and capital regulatory requirements. But in the case of the latter, it was influenced by more restrictions on mixing of banking and commerce and capital regulatory requirements, as well as the adoption of macroprudential policies, even though the restrictions on bank activities fell over time while the entry barriers remained relatively the same. Nevertheless, the bank regulatory environment was slightly more stringent in middle-income than in low-income SSA economies over the period under review.

Moreover, the majority of the selected SSA countries realised increases in the provision of bank lending to the private sector during the period 1995-2017, with the middle-income SSA economies enjoying a higher average level of bank lending than the low-income SSA countries. However, the co-movement between bank regulation and bank credit in the selected SSA economies was mixed, ranging from negative to positive, while being almost non-existent in some cases. Based on these developments, it is imperative to determine the nature of the nexus between bank regulation and bank lending over time. Therefore, the next chapter discusses both

the theoretical and empirical literature on the relationship between bank regulation and bank credit.

CHAPTER 3

BANK REGULATION AND BANK LENDING: THEORETICAL AND EMPIRICAL LITERATURE REVIEW

3.1 Introduction

This chapter reviews both theoretical and empirical literature on the relationship between bank regulation and bank lending. Following the introduction overview, Section 3.2 discusses the theoretical literature on bank regulation and its nexus with bank credit, while Section 3.3 reviews the empirical literature on the relationship between bank regulation and bank lending. Section 3.4 presents a synthesis and critique of the existing literature on bank regulation and bank credit, with Section 3.5 providing the concluding remarks.

3.2 Theoretical Literature Review

This section presents the theoretical literature review on bank regulation and bank lending. Section 3.2.1 provides the conceptual definition of bank regulation, and the theories of bank regulation are discussed in Section 3.2.2, followed by a review of approaches to bank regulation in Section 3.2.3. Section 3.2.4 describes measures of bank regulation, while Section 3.2.5 provides the theoretical link between bank regulatory measures and bank lending.

3.2.1 Conceptual Definition of Bank Regulation

It is necessary to differentiate between various types of government intervention that can change economic behaviour before explaining what bank regulation means. The first distinction is made between regulation and general legal standards. According to Loevinger (1966), regulation differs from general legal standards in terms of its nature, operational processes and institutional structure. For example, general legal standards are found in laws published through the legislature, and they apply to everyone who falls within the limitations and standards set in them. On the other hand, regulation normally involves the use of direct orders targeted towards specific

economic entities by a delegated administrative authority that has limited powers. Moreover, laws dictating general legal standards are usually less restrictive or detailed when compared to regulations. The latter, however, are often restrictive and detailed, whether they come in a form of directives, licenses, certificates or any other name.

The second distinction is also made between other forms of government intervention and regulation (Loevinger, 1966). Such government intervention measures include the management of fiscal, monetary, competition, and structural policies. Although the implementation of these policies may be delegated to certain administrative agents, they are not necessarily regarded as regulation. This is because these other forms of government intervention usually involve the use of traditional legal methods in the enforcement of their general rules. But when it comes to regulation, the government exercises direct control over standard management decisions on important economic functions such as pricing, the quality and characteristics of goods and/or services provided, as well as the state of the market that is being served.

Furthermore, Llewellyn (1999) makes another distinction between regulation, monitoring and supervision. While regulation involves the establishment of specific orders to control economic behaviour, monitoring and supervision are concerned with the observation of whether such orders are being obeyed and the general behaviour of the regulated agencies, respectively. Therefore, even if all these three interventions are centralised to take advantage of economies of scale, regulatory authorities can still be regarded as suppliers of distinctive services of regulation, monitoring and supervision to their different stakeholders such as regulated agencies, consumers and government.

Based on these considerations regarding the observed differences between regulation and other types of government intervention, a conceptual definition of bank regulation is provided. In line with Schooner and Taylor (2010), Llewellyn (1999), as well as Loevinger (1966), bank regulation can be defined as specific laws, rules, or orders by government delegated authorities aimed at controlling the economic

behaviour of banks. Although bank regulation emanates from the legal standards promulgated by the legislative body, government agencies such as central banks are usually formed to implement these broad standards through binding regulations that force banks to align their management decisions and economic activities to specified rules or orders. Section 3.2.2 discusses the theoretical reasons behind government intervention in the banking sector through regulation.

3.2.2 Theories of Bank Regulation

This section provides the rationale for bank regulation, which is underpinned by two broad theories of economic regulation, namely, the public interest theory and the private interest theory.

Public Interest Theory

According to Hendrickson and Nichols (2001), the public interest theory asserts that economic regulation, including bank regulation, is necessary as it acts as a protection against market failures such as asymmetric information, externalities and monopolies. For example, a credit market is characterised by problems of adverse selection and moral hazard owing to the presence of information asymmetry (Stiglitz & Weiss, 1981). The former problem is similar to the one observed by Akerlof (1970) in the insurance industry, which occurs as a result of different repayment probabilities of borrowers that cannot be easily identified by lenders. Under this situation, banks, if they do not have appropriate screening mechanisms, are likely to give loans to high-risk borrowers who are willing to pay high interest rates. This increases the overall riskiness of banks with the possibility of reducing their profits in cases of loan defaults. The other problem that could occur is that of moral hazard, which happens as borrowers change their behaviour in a manner that may adversely affect the repayment of loans. For instance, borrowers, especially when monitoring efforts are insufficient, may assume more risk by deviating from the contracts they have with banks and use borrowed funds to finance projects that have little chance of success but that could yield high returns if they became successful.

Given that banks accept liabilities in a form of deposits and transform them into loans to finance illiquid assets, the presence of asymmetric information also makes them vulnerable to bank runs as argued by Diamond and Dybvig (1983). This kind of financial instability happens if defaults by borrowers create panic and make depositors rush to the bank to withdraw their monies, at the same time, forcing the bank to liquidate its assets at a price lower than what they are worth. On the other hand, the competition that exists in the banking industry can also motivate banks to finance more risky projects with the aim of earning higher returns, further exposing them to the risk of financial instability. If the instability occurs, it can then be propagated to other banks through contagion as banks often hold claims of other banks in their interbank market, thereby resulting in a bigger financial crisis with severe consequences to the economy (Crockett, 1996). The crisis emanating from one country may even affect banks in other countries owing to the interlinkages of their financial systems.

In line with Spong (2000) and Crockett (1996), the existence of market failures, therefore, supports the objectives of bank regulation from the public interest perspective, namely, the protection of depositors, the achievement of monetary and financial stability as well as the promotion of efficient and competitive financial systems. Firstly, a basic rationale for bank regulation is to protect depositors against losses that could be incurred as a result of risk-taking behaviour of banks. This is because by opening bank deposit accounts, businesses and individuals automatically become bank creditors, hence, they are linked with the performance of their banks. But only a fraction of their deposits is normally protected through the reserve requirement arrangement with the central banks, especially in the absence of deposit insurance schemes. Given the complexity and cost implications of monitoring banks accurately, which could be faced by depositors when they attempt to do so alone, public pressure also exists to provide bank regulation as protection of depositors' funds.

Secondly, bank regulation is meant to prevent fluctuations in bank business activities as well as problems they encounter that can disrupt the flow of transactions within the economy, thereby instilling confidence in the banking sector. This is plausible

since banks are likely to face liquidity shortages during economic downturns, which could lead to bank panics as the value of banks' assets declines. This situation could have adverse effects on the economy and depositors' confidence as the flow of financial transactions and lending activities become hampered. As a result, bank regulation aims to promote monetary and financial stability by encouraging banks to maintain adequate liquidity and avoid practices that could negatively affect depositors and interrupt the banking payment system. This will also limit systemic risk to avert the problem of contagion and protect governments as lenders of last resort against losses that could be incurred when bailing out too-big-to-fail banks.

Lastly, bank regulation can help in channelling financial resources towards prudent investment projects, hence promoting bank development and economic growth. This, therefore, requires the creation of an efficient and competitive financial system. This is necessary because a competitive banking system uses its resources efficiently by providing banking services to customers at relatively lower prices than if banks could engage in anticompetitive behaviour such as collusion and restrict their services to benefit from increased prices. Furthermore, competition encourages innovation in the banking sector through the introduction of new good quality services and operations that are essential for bank development. Thus, bank regulation should take into consideration issues such as the concentration of banking sector resources, the possibilities of entry and expansion within the sector, as well as the scope of banking activities as these factors have a bearing on the level of efficiency and competition that is conducive for bank development.

In line with Moosa (2015), several criticisms of the public interest theory have been raised. First, market mechanisms themselves, rather than regulation, can compensate for inefficiencies brought by market failures through measures such as brand names and extensive advertising, which signal quality and reduce information asymmetry. Second, regulators often lack enough information that will help them to correct market failures and act in the interest of the public. Third, the theory only presumes that regulation yields desirable results at relatively low implementation costs. Fourth, the theory does not provide a clear rationale for aiming at other objectives such as equity and redistribution at the cost of achieving economic

efficiency through regulation. Fifth, the theory does not show how a certain public interest view is considered when formulating legislative measures intended to promote economic welfare. Finally, regulators are regarded to be economic agents that may pursue their interests and, at times, at the expense of the interests of the public. This issue forms a basis for the private interest theory discussed in the next section.

Private Interest Theory

The private interest theory of (bank) regulation is often discussed from two perspectives, namely, the capture theory and the special interest groups theory (Moosa, 2015). Regarding the former perspective, regulatory agencies within the banking sector, which are established to protect the public, are captured if they pursue the commercial interests of the banks they are appointed to regulate. This occurs because the formation of certain bodies within the regulatory agencies, aimed at developing economic policies, may include members that have or had a relationship with the banking industry, or may aspire to join the industry in the future. As a result, they are likely to influence the regulatory process in a way that will maximise banks' profits. In this case, the regulator becomes captured by the industry, which opens room for banks to behave in a manner that may be against the interests of the public.

Nevertheless, this theory has faced various criticisms. First, just like the public interest theory, it assumes that the rationale for bank regulation is based on the notion of protecting the interests of the public, which makes it to be not significantly different from the public interest theory. Second, the reasons why the banking industry can capture the regulator, while it cannot influence the processes that established it, remains unclear. Third, banks may be against certain forms of bank regulation as they are normally deemed to deter their profit-making efforts. Fourth, it is not explained why customer groups are unable to prevent the banking industry from capturing the regulator. Lastly, bank regulation can at times advance the interests of certain groups of customers instead of serving the interests of banks, which is a scenario not explained by this theory.

These criticisms have led to the advocacy of the special interest groups theory. Unlike the capture theory, the special interest groups theory argues that various groups with special interests, such as banks, customers, regulators (or their staff members) and legislators, engage in an intensive competition geared towards controlling the activities of the regulator. The theory postulates that these pressure groups fight each other to influence the government to establish banking laws and regulations that will benefit their private interests. In this regard, bank regulation is perceived by special interest groups, not as a deterrence, but as an important strategy to preserve their influence and boost their gains. In the end, those who are not strong enough to prevent these laws and regulations, especially the unorganised members of the public, will bear the burden of such laws and regulations.

Like other theories, the special interest groups theory is subject to criticism. First, similar to the capture theory, this theory does not indicate the cause of regulation but rather explains why and how regulators are captured by special interest groups. Second, although redistribution may appear to be a rationale for the supply of regulation under this theory, in practice, it is linked with deregulation. Third, the theory does not distinguish the group that is likely to succeed in influencing the government and enjoy the benefits of regulation. Finally, it does not adequately explain the complex interactions, motivations, and behaviours of all the involved parties in honouring the expectations of the special interest groups. Following these discussions on the theories of bank regulation, Section 3.2.3 presents various approaches to bank regulation.

3.2.3 Approaches to Bank Regulation

The approach to bank regulation can be distinguished between various main categories including discretionary versus institutional approach, quantitative versus qualitative approach as well as protective versus prudential approach.

Discretionary versus Institutional Approach

According to Baltensperger and Dermine (1986), the delivery of bank regulation can be differentiated between discretionary and institutional (or contractual) approaches.

The former includes bank regulatory measures that are provided at the discretion of government authorities. Such measures include a policy of a lender of last resort as well as public subsidies and guarantees. Hence, under this approach, interventions by regulatory authorities are not awarded with certainty, but circumstances that may warrant such interventions are subjected to scrutiny, which leaves room for incurring a certain degree of private risk. If interventions eventually occur, the regulatory authorities (for example, central banks on behalf of taxpayers) and the troubled banks themselves will have to share the burden of providing a financial rescue.

Furthermore, Ayadi, Arbak, de Groen and Llewellyn (2012) show that although the discretionary approach may seem justified given that future conditions and circumstances of when banks will require bailouts are not known with certainty, valid arguments exist that oppose it. One argument is that this approach reduces the credibility of the intervention authorities as their actions in correcting distressed banks may be driven by unwarranted political influences. The other argument is that it can encourage regulators, especially those who are risk averse, to shun the responsibility of taking necessary measures to rescue troubled banks owing to a fear that these actions will be considered a regulatory failure. Thus, this increase in the probability of forbearance will imply higher costs in the future when the intervention is eventually made than if it had been executed much earlier. Nonetheless, Baltensperger and Dermine (1986) indicate that, with time, certain discretionary measures can be formalised (or institutionalised) by developing certain thresholds above which bailouts can be provided.

Under the institutional approach, bank regulation is awarded, with certainty, in line with clearly defined rules that must be followed. Such bank regulatory measures include deposit insurance systems arranged to help distressed banks. Even though this approach is considered to induce moral hazard problems (see Baltensperger & Dermine, 1986), Ayadi et al. (2012) present reasons why it is preferred over the discretionary approach. First, it instils confidence in the regulatory processes since bank market participants know with certainty that necessary regulatory measures, which are free from unwarranted political interferences, will be implemented. Second, it encourages the authorities to focus more on avoiding long-term rather than short-

term costs of regulatory intervention, thereby preventing them from adopting a 'wait-and-see' or a 'gambling for resurrection' strategy. Third, it prevents banks as well as regulatory authorities from being carried away by a common euphoria, and instead, follow clear and well-defined rules aimed to avert bank failures. Lastly, this approach may create incentives for the prudent management of banks, thereby reducing the likelihood of insolvencies.

Quantitative versus Qualitative Approach

In line with Goldenweiser (1936) and Dunkman (1933), bank regulation can follow a quantitative or qualitative approach. In the case of the quantitative approach, much emphasis is based on the control of the volume of bank lending, either from the perspective of bank assets or that of bank deposits. Its main aim is to address the question of how much bank lending there should be in existence. This approach uses measures such as reserve requirements and credit ceilings to control the quantity of bank credit. On the other hand, the qualitative approach focuses on the quality of bank lending. It aims to answer the question of how sound should bank lending structure be; that is, does it include appropriate elements in the right proportions? Thus, measures under this approach, such as specific requirements on the different types of borrowers to be awarded loans, are intended to instil confidence in the lender-borrower relationship.

Protective versus Prudential Approach

The delivery of bank regulation can also be distinguished between protective and prudential (or preventive) approaches. In line with Baltensperger and Dermine (1986) and Niehans (1983), the protective approach to bank regulation is indirectly concerned with the banking system's capacity to deal with bank runs and failures. As a result, it aims to shield bank customers or banks themselves against imminent or actual banking crises. This approach involves bank regulatory measures such as deposit insurance systems, facilities for the lender of last resort, as well as public subsidies and guarantees. Thus, under this approach, those who bear the burden of regulatory intervention are expected to earn the benefits too.

On the other hand, Baltensperger and Dermine (1986) indicate that the main objective of the prudential approach is to control the amount of risk that banks are willing to tolerate, thereby reducing the likelihood of bank failures. This approach includes regulatory measures such as banking entry barriers, restrictions on bank activities and on the mixing of banking and commerce, capital and liquidity regulatory requirements, as well as other asset diversification regulations. Nevertheless, both prudential and protective approaches to bank regulation are interrelated. For instance, while the latter aims to instil confidence in the banking sector, its benefits will affect the likelihood of bank runs and failures, which is related to the objective of the former. In addition, the protective approach can lead to moral hazard problems, with negative effects on the amount of risk assumed by banks. Hence, this approach will need to be accompanied by prudential (or preventive) regulatory instruments to limit the risk induced by protective regulatory measures. Section 3.2.4 describes the different measures of bank regulation found in the literature.

3.2.4 Description of Bank Regulatory Measures

This section gives an overview of various measures of bank regulation including minimum reserve requirements, lender of last resort policies, public subsidies and guarantees, deposit insurance systems, banking entry barriers, restrictions on the mixing of banking and commerce, banking activity restrictions, capital and liquidity regulatory requirements, as well as macroprudential policies.

Minimum Reserve Requirements

According to Spong (2000), minimum reserve requirements, which are calculated as a fraction of reserves to bank deposits, were initially imposed by the central banks as part of protection offered to bank customers and a measure of liquidity provision when banks were faced with a drawdown of deposits. However, these required reserves only provide a partial backup of the deposits and they are normally not available to the banks when they are faced with liquidity constraints. The availability of other measures such as lender of last resort policies and deposit insurance systems also weakens the original aim of the minimum reserve requirements.

Lender of Last Resort Policies and Public Subsidies and Guarantees

Generally, the lender of last resort policies and public subsidies and guarantees are offered to banks that are facing temporary liquidity shortages. According to Baltensperger and Dermine (1986), these measures are different from the normal monetary operations that enable banks from meeting their seasonal fluctuations in the demand for liquidity. Instead, they are meant to offer emergency support to troubled banks, whether solvent or insolvent, especially if their liquidity problems endanger their survival or that of the entire banking or financial system. Therefore, these measures are justified particularly in the absence or limited coverage of deposit insurance systems.

Deposit Insurance Systems

The deposit insurance systems are considered to be an efficient way of reducing the risks of bank runs, while at the same time allowing funding for short-term deposits and their maturity transformation (Baltensperger & Dermine, 1986). They are meant to provide a solution to the problem of lack of or limited private facilities that can offer insurance to banks against multiple failures, which can come at high costs if such insurance is available. Thus, these types of insurance schemes can either complement or be substitutes for the lender of last resort policies as well as public subsidies and guarantees.

Entry Barriers

The main purpose of the control of entry into the banking sector, which is normally driven by the fear of ‘over-banking’, is to limit competition and influence the banking market structure by safeguarding the existing banks and their profitability (Baltensperger & Dermine, 1986). In line with Barth et al. (2004), these bank entry barriers may comprise the authorisation procedures and licensing practices including limitations placed on foreign bank entry or ownership, banking entry requirements as well as the proportion of (foreign or domestic) bank applications denied entry.

Beginning with the limitations placed on foreign bank entry or ownership, they can include any prohibition against entry placed on foreign entities by limiting their ownership of domestic banks through acquisitions, subsidiaries, branches and joint

ventures. When it comes to bank entry requirements, these involve specific requirements for being awarded a banking licence such as legal submissions, namely, draft bylaws, intended organisation chart, financial information and/or background of potential shareholders, directors and managers, sources of funds to be used in the capitalisation of a new bank as well as market differentiation strategy. Finally, the proportion of (foreign or domestic) bank applications denied entry captures the degree to which new applications for the banking industry are denied.

Mixing of Banking and Commerce Restrictions and Banking Activity Restrictions

The restrictions on the mixing of banking and commerce as well as on banking activities are aimed at reducing the incentives for banks to assume more risk (Baltensperger & Dermine, 1986). According to Barth et al. (2004), limitations placed by regulatory authorities on the mixing of banking and commerce involve the extent to which banks are permitted to have ownership and control in non-financial firms or vice-versa or the extent to which non-bank financial firms are permitted to have ownership and control in banks. Furthermore, bank activity restrictions capture the degree to which banks can engage in underwriting, brokering and dealing with securities plus other related aspects, namely, underwriting and selling of insurance products as well as investment, development and management of real estate.

Capital and Liquidity Regulatory Requirements

Consistent with Baltensperger and Dermine (1986), the rationale behind capital regulatory requirements is to minimise the risk of bank failures by putting more capital at risk, thereby limiting the incentives for banks to engage in risk-taking behaviour. Barth et al. (2004) then characterise the capital regulatory requirements into two categories, namely, the initial capital requirements and the overall capital requirements. Initial capital requirements involve determining whether the sources of funds for bank capital are verified by the regulatory authorities and whether they can include other assets aside from cash or government securities as well as borrowed funds. Overall capital requirements measure the degree to which capital regulatory requirements must be adhered. This involves determining whether bank capital is risk-weighted according to the Basle guidelines, whether its ratio varies with credit

and market risks, and whether the market value of loan losses as well as unrealised securities and foreign exchange losses are deducted from the capital before calculating the minimum capital adequacy ratio.

On the other hand, Clerc (2008) indicates that banks, through liquidity requirements, are expected to hold adequate liquid assets that will help them to withstand adverse shocks during periods of financial distress. These requirements include the liquidity coverage ratio and the net stable funding ratio, which have been introduced by the Basel Committee on Banking Supervision (2013, 2014) in the aftermath of the 2007-2008 global financial crisis. The former requires banks to hold adequate high-quality liquid assets that will enable them to cope with pressing liquidity demands over a month, while the latter demands banks to have a stable funding profile between their assets and off-balance sheet activities.

Macroprudential Policies

Macroprudential policy instruments are aimed at achieving the stability, not of individual financial institutions, but that of the entire financial system by minimising systemic risk (Forbes, 2019; Hanson et al., 2011). Cerutti et al. (2017) indicate that this objective can be achieved through two broad categories of macroprudential policies, namely, the borrower-targeted and the lender-targeted instruments. The former includes restrictions imposed on borrowers such as loan-to-value and debt-to-income ratios. For example, loan-to-value ratios place limits or regulatory risk weights on down payments for mortgages, while debt-to-income ratios impose limits on household indebtedness. On the other hand, the lender-targeted policies comprise instruments such as countercyclical capital and loan-loss provisioning requirements, capital surcharges on systematically important financial institutions, taxes, and other restrictions on the balance sheets of financial institutions and/or limits on credit growth.

The countercyclical capital buffers and time-varying or dynamic loan-loss provisioning enforce banks to have more capital and loan-loss provisions, respectively, during periods of economic upturns, while capital surcharges impose a higher level of capital for systematically important financial institutions. Levies or taxes on financial

institutions are also imposed on financial institutions to limit credit growth, while other restrictions on the balance sheets of financial institutions and/or measures for reducing credit growth include leverage ratios, which place minimum required leverage ratios for banks; interbank exposure limits, which restrict the proportion of liabilities in the banking sector; concentration limits, which restrict the proportion of assets in the hands of a certain number of borrowers; reserve requirement ratios; foreign exchange and/or countercyclical reserve requirements and limits on loans denominated in domestic currency.

3.2.5 Theoretical Link Between Bank Regulation and Bank Lending

This section discusses the theoretical link between bank lending and bank regulatory measures including minimum reserve requirements, lender of last resort policies, public subsidies and guarantees, deposit insurance systems, banking entry barriers, restrictions on the mixing of banking and commerce, banking activity restrictions, capital and liquidity regulatory requirements as well as macroprudential policies.

Beginning with the minimum reserve requirements, they are, by design, anticipated to have a negative impact on bank credit. The reason behind this is that banks usually do not have access to the required reserves and no interest is attached to them, consequently, they are expected to limit bank profitability and ability to lend (Spong, 2000). On the other hand, other forms of bank regulation including lender of last resort policies, public subsidies and guarantees as well as deposit insurance systems are considered to be alternatives to the minimum reserve requirements in terms of protecting bank depositors. Nevertheless, these measures are regarded to induce moral hazard by tempting banks to be risk-takers and offer excessive lending (Barth et al., 2004; Baltensperger & Dermine, 1986). According to Crockett (1996), banks will, therefore, lack incentives to act prudently if they are guaranteed to be rescued when facing liquidity problems.

In the case of banking entry barriers, the theory of market structure hypothesises that such barriers hinder competition. As asserted by Peltzman (1965), if a new bank is allowed to enter the banking industry, that is equivalent to the creation of new capital investment. This will force banks to accept more deposits and/or engage in higher

risk-taking behaviour through excessive or imprudent lending to earn returns on their assets, which can result in bank failures. But if entry barriers are imposed, banks are likely to acquire more market power through expansion or mergers and gain above-normal industry profits (also see Keeley, 1985a). As that happens, Keeley (1990) and Keeley (1985b) argue that banks will obtain more franchise value, and their above-normal profits will cushion them in times of financial or economic crisis. Thus, the incentive for banks to risk failure will be minimised, and prudence in lending will be achieved accordingly.

Nevertheless, another part of the economic theory regards banking entry barriers to be detrimental to bank credit owing to their negative impact on competition (Barth et al., 2004; Baltensperger & Dermine, 1986). This is plausible since it is likely that banks will hike their costs of lending services when they are faced with less competition. This will reduce the demand for such services and result in low levels of lending. Furthermore, lack of competition is associated with other inefficiencies such as managerial slack and lack of innovation, which will negatively affect the performance of banks (Nickell, 1996). This will exert upward pressure on the costs of banking services, rendering lending expensive and lowering its demand. Additionally, in accordance with Claessens and Klingebiel (2001), imposing banking entry barriers on foreign banks can prevent domestic banks from gaining foreign expertise and enhancing their productivity and prudence in lending as a result of positive pressure brought by foreign banks.

When it comes to restrictions on the mixing of banking and commerce and banking activities, they are justified through the asymmetric information theory, which views them as limits to banks' risk-taking behaviour, thereby encouraging prudence in lending (Barth et al., 2004). First, restricting the mixing of banking and commerce and activities in which banks can engage, such as participating in the underwiring of securities and insurance as well as undertaking investment in real estate, can help to avert conflict of interests that may occur. For instance, these restrictions can prevent banks from gaining undue benefits out of uninformed investors with the aim of assisting their affiliated firms with overdue debts (also see John, John & Saunders, 1994).

Second, imposing restrictions on the mixing of banking and commerce and on banking activities can protect banks against moral hazard problems. For example, Boyd et al. (1998) indicate that if banks are allowed to have control rights over other firms, they can influence these firms to assume excessive risk by misallocating borrowed funds so that banks can gain more returns even if such behaviour will not be beneficial to the firms themselves. Similarly, giving banks the liberty to participate in a wider range of activities will increase the incentives to extract surplus and thereby exacerbate the moral hazard problems. Third, limiting the mixing of banking and commerce and engagement in banking activities can restrict banks from being too complex and powerful, both economically and politically, thereby keeping them within manageable sizes that are easy to monitor and discipline. Lastly, restrictions on the mixing of banking and commerce and on banking activities can restrict banks from developing into huge financial conglomerates with excessive market power to prevent competition together with its efficiency benefits.

Nonetheless, the theory of economies of scale and scope offers opposing arguments on the effects of restrictions on the mixing of banking and commerce and on banking activities (Barth et al., 2004; Claessens & Klingebiel, 2001). First, these controls are regarded to hamper economies of scale and scope that can enable banks to lower their operation and information access costs as well as enhance the provision of credit. Second, imposing limits on the mixing of banking and commerce and on banking activities can lower the franchise value of banks that could have been earned from the cross-selling of different products or services and incentify banks to exercise prudence in lending. Lastly, limiting the mixing of banking and commerce and engagement in banking activities can deny banks an opportunity to diversify their portfolio risk and income-generating mechanisms, which can assist them to remain resilient even in difficult periods of disintermediation. Thus, this can make banks more stable and enable them to maintain their ability to provide prudent lending.

Varying arguments emanating from the theories of risk absorption and financial fragility-crowding out also exist concerning the effects of capital regulatory and liquidity requirements on bank credit. On the one hand, the risk-absorption theory regards capital regulatory requirements to offer enough buffers for banks when going

through periods of losses and help them to maintain prudence in lending by putting a considerable proportion of their capital at risk (Bahaj & Malherbe, 2020; Repullo & Suarez, 2013; Shaw, Chang & Chen, 2013; VanHoose, 2007; Barth et al., 2004; Santos, 2001; Berger, Herring & Szegö, 1995). For example, Rochet (2008b) highlights that banks facing undercapitalisation banks can be risk-takers when considering limited liability. Consequently, it may be warranted to impose minimum capital regulatory requirements to lower the banks' appetite for opting to invest in high-risk portfolios, which will limit their risk of failure and enhance prudence in the provision of credit (Admati et al., 2014; Flannery, 2014; Thakor, 2014).

On the one hand, the financial fragility-crowding out hypothesis considers capital regulatory requirements to encourage banks to be risk-takers. Under this hypothesis, increasing costs of compliance with the required limits on bank capital can force banks to prioritise equity more than deposits and cause them to reduce their screening and monitoring activities towards the provision of credit when equity becomes expensive (Kim & Sohn, 2017; Berger & Bouwman, 2009; Thakor, 1996; Sharpe, 1995). Additionally, Calem and Rob (1999) as well as Blum (1999) contend that stringent capital regulatory requirements can induce banks to be risk-takers by lowering their profits and causing them to have little to lose when facing insolvency. Furthermore, banks that experience low profits will not have the capacity to attract more equity, and this could make them resort to more risk-taking behaviour by providing excessive lending (Martynova, 2015).

Liquidity requirements can also lead to higher costs of banking and increase the price of providing credit. Since banks participate in the liquidity transformation process, they are anticipated to reduce lending when faced with stringent liquidity regulatory requirements as the process will be more costly (Eichengreen, 2008). However, regulators still impose liquidity requirements with the aim of minimising systemic risk in the cases of bank runs (Ivashina & Scharfstein, 2010; Rochet, 2008a), and this can enhance prudence in lending.

Concerning macroprudential policies, the economic theory predicts that its effect on bank credit is countercyclical. This is because, by definition, macroprudential policies

are imposed to enhance financial stability by preventing the build-up of systemic risk and limiting excessive growth in lending (Cerutti et al., 2017; Freixas, Laeven & Peydró, 2015; Drehmann & Gambacorta, 2012; Hanson et al., 2011). According to IMF (2013), the macroprudential policy instruments are aimed at minimising three forms of systemic externalities or market failures. The first is linked to the occurrence of a credit crunch, which can hinder the provision of new credit and lead to a fire sale of illiquid assets as the costs of providing credit rise. The second concerns the build-up of financial vulnerabilities as a result of price interactions with the credit and asset markets, particularly during the financial cycle upswing that is normally followed by a downward in asset prices. The third relates to the contagion risk that could emanate from the exposure of financial institutions to liquidity risks, which could lead to the failure of the whole financial system because of its interconnectedness.

Although there are numerous macroprudential tools available for policymakers, Lim et al. (2011) specify possible scenarios that could result in the successful implementation of such policies and minimise their costs. First, multiple tools are preferred over choosing a single instrument since they could tackle various aspects arising from the same risk. Second, targeted tools that are addressing specific risks according to different types of transactions can be more effective than broad-based instruments. Third, time-varying tools can perform better than fixed ones as they will be able to address different stages of a financial cycle. Fourth, discretionary macroprudential policies are preferred over rules-based ones given the difficulties that can be encountered in designing some of the rules-based policies. Lastly, proper coordination of macroprudential tools with other monetary or fiscal policies is necessary for their effectiveness as they can jointly reinforce a similar objective.

As much as these discussions have shown that bank regulation can affect developments in bank lending, the economic theory implies that a bi-directional causality can exist between institutions and economic performance measures. This is because institutions shape the way societies interact and that affects economic performance (North, 1981, 1990), whereas economic development is also required before laws and regulations can be properly instituted (Rosenberg & Birdzel, 1986). Given that bank regulation forms part of formal institutions, while bank lending is an

important component of financial development, bank regulation is not only expected to influence bank lending, but the reverse causality can exist whereby developments in bank lending are expected to shape the direction of bank regulation. In line with Patrick (1966), bank regulation can, therefore, cause bank lending at the early stages of financial development, but at later stages, bank regulation can follow developments in bank lending.

3.3 Empirical Literature Review

This section focuses on the empirical literature review regarding the relationship between bank regulation and bank credit. Section 3.3.1 discusses the empirical evidence from studies in support of the negative effect of bank regulation on bank lending, while Section 3.3.2 reviews empirical studies in support of the positive effect of bank regulation on bank credit. Section 3.3.3 analyses the empirical evidence from studies in support of the insignificant or inconclusive effect of bank regulation on bank lending. Lastly, Section 3.3.4 presents the empirical evidence on the causal relationship between bank regulation and bank credit, which is, however, very limited in terms of its availability.

3.3.1 Empirical Studies in Support of the Negative Effect of Bank Regulation on Bank Lending

Although there are many empirical studies attempting to investigate the effect of bank regulation on bank credit, their findings point to diverse directions. This section presents the empirical evidence in support of the negative effect of various bank regulatory measures on bank lending.

Following the first World Bank's survey on bank regulation and supervision across the world, Barth et al. (2004) examined the impact of bank regulation and supervision on bank lending, using a worldwide sample of 107 countries over the period 1997-1999 and the estimation methods of ordinary least squares (OLS) and generalised method of moments (GMM). The results revealed that restrictions imposed on the mixing of banking and commerce, banking activities and banking entry or ownership by foreign banks had a negative impact on bank credit to the private sector as a

share of GDP. As a result, the study concluded that restricting banking activities and the mixing of banking and commerce as well as limiting foreign bank entry or ownership hindered bank development.

Furthermore, Amidu (2014) found that capital regulations impacted negatively on bank lending in 24 SSA countries during the period 2000-2007, using the random effects estimation technique. Therefore, Amidu (2014) concluded that the regulatory initiative characterised by stringent capital requirements restricted the delivery of bank credit to the private sector.

Similarly, Košak, Li, Lončarski and Marinč (2015) established that stringent bank capital regulations as well as higher bail-out probability impacted negatively on bank lending growth in a sample of various countries across the world between 2000 and 2010, after employing the fixed effects and instrumental variable models. Thus, the findings from the study offered evidence for the view that banks reduced their lending if the stringency of capital regulations within a country was more noticeable or if there was a higher likelihood that they would receive public guarantees from the government.

Likewise, Sum (2016) discovered that capital regulations related to credit and market risk impacted negatively on bank credit growth in 27 European Union (EU) economies over the period spanning 2005 to 2014, following the estimation of a cross-sectional model. Hence, the researcher obtained support for the hypothesis that credit risk-based capital regulations tended to limit bank lending because of their implied increasing costs of funding for banks.

Interested in the role played by bank regulation in influencing the build-up of financial imbalances ahead of the 2007-2008 global financial crisis, that is, from 1999 to 2007, in 22 countries of the OECD, using the fixed and random effects models, Merrouche and Nier (2017) established that bank entry barriers impacted negatively on bank credit to the private sector as a ratio of bank deposits. As a result, the study obtained evidence favouring the hypothesis that banking entry barriers are linked with a

reduced level of leverage since they constrain competition and promote franchise value, thereby reducing the incentives for banks to assume more risk.
Moreover, Ibrahim and Rizvi (2018) analysed the relationship between bank credit, deposits as well as risk-taking during times of crisis in 10 countries operating under the dual banking systems of Islamic and conventional banks during the period 2005-2012, using the random effects model. Their results showed that banking activity restrictions and capital regulation stringency had a negative effect on bank credit growth but in the case of conventional banks only. Thus, Ibrahim and Rizvi (2018) concluded that limiting banking activities and imposing stringent bank capital regulations tended to depress the credit growth of conventional banks.

Furthermore, Hu and Gong (2019), when using the fixed effects estimator and the data from 19 major economies, ranging from 2005 to 2011, to examine the relationship between prudential regulation and bank lending, discovered that the effect of banking activity restrictions and stringent bank capital regulations on the bank lending growth was negative. The researchers also revealed that these policies effectively moderated the impact of uncertainty on bank lending.

Similarly, Hsieh and Lee (2020) established that stringent bank capital regulations impacted bank credit negatively in the context of 30 Asian and Latin American economies in the period between 1987 and 2013, using the instrumental variable model. Hence, the researchers indicated that higher capital requirements limited the ability or willingness of banks in extending credit.

Likewise, Imbierowicz, Löffler and Vogel (2021), when analysing how developments in bank capital requirements were transmitted to bank credit in Germany during the period 2008 to 2018 using GMM, found that increasing bank capital requirements had an immediate negative impact on overall domestic bank lending as well as cross-border bank credit. Nonetheless, the study recommended that for bank capital requirements to be effective, close coordination between their developments and those of other policies such as monetary policy was vital.

When it comes to the effect of macroprudential policies on bank credit, c studied macroprudential policy instruments and how they could be used in 49 countries during the period spanning from 2000 to 2010, using the GMM estimator and the data from the International Monetary Fund (IMF) surveys on financial stability and macroprudential policy. The study revealed that most macroprudential policy measures (countercyclical capital requirements, credit or credit growth ceilings, debt-to-income ratio, loan-to-value ratio, reserve requirements, and time-varying or dynamic provisioning) managed to curb the growth of bank lending. Therefore, Ibrahim and Rizvi (2018) recommended that credit-related policies could be employed to reduce systemic risk generated by credit growth.

Similarly, the study by IMF (2013), which analysed the key aspects of different macroprudential policies in a cross-country context, using the dynamic panel regressions, established that loan-to-value ratio, reserve requirements, and sectoral risk weights on capital, were significant in limiting credit growth. On the other hand, debt-to-income ratio and reserve requirements led to a slowdown in loan to deposit ratio. The study further established that the effect of these macroprudential measures was prolonged.

Tillmann (2015), who estimated the impact of shocks arising from macroprudential policies in Korea during the period 2000-2012, using the qualitative vector autoregression (VAR) model, also discovered that loan-to-value ratios impacted negatively on credit growth. Thus, Tillmann (2015) concluded that the tightening of macroprudential policies was effective in mitigating the growth rate of real credit.

When investigating the response of credit supply to time-varying bank minimum capital requirements by employing the fixed effects estimation technique on the dataset from the United Kingdom (UK) covering the period from 1998 to 2007, Aiyar et al. (2016) revealed that the effect of capital requirement ratio on bank credit was negative. As a result, Aiyar et al. (2016) resolved that the capital requirement policy was a stronger instrument for promoting financial stability through the supply of loans.

Furthermore, Zhang and Zoli (2016) examined the impact of macroprudential policies on the growth rate of bank lending using the dataset from 13 Asian economies and 33 other economies, spanning from 2000 to 2013, and the GMM estimator. The researchers found that housing-related macroprudential policy index negatively affected credit growth. Hence, Zhang and Zoli (2016) suggested that these macroprudential tools could be of importance to policymakers during the expansion phase of the financial cycle since they could dampen the build-up of risks emanating from the financial sector.

Interested in the usage and effectiveness of macroprudential policies around the world, Cerutti et al. (2017) employed the GMM technique to estimate the dataset from a panel of 119 economies during the period 2000-2013. Their results revealed that macroprudential policy index resulted in a slowdown in credit growth, especially household credit. Nevertheless, the study established that the effect of macroprudential policies was less pronounced in countries that were more developed and had open economies.

After employing the GMM estimator to investigate the effectiveness of macroprudential policies in influencing credit cycles and capital flows in 18 emerging market economies from 2000 to 2013, Fendoğlu (2017) also established that borrower-based macroprudential policy index, domestic reserve requirements and macroprudential policy index with a domestic focus were effective in containing excessive credit cycles. As much as these macroprudential tools were effective in smoothing the cycles in credit, Fendoğlu (2017) recommended that it was important to adjust them in line with the necessary conditions called for by credit markets.

Akinci and Olmstead-Rumsey (2018), who analysed how effective macroprudential policies were in 57 countries from the advanced and emerging market economies over the period 2000-2015, using the GMM estimation technique, obtained negative effects of housing and non-housing macroprudential policies on bank credit. Thus, the researchers concluded that the tightening of macroprudential policies was effective in restraining the growth of bank lending.

In the context of 19 OECD countries, with data spanning from 2000 to 2015, Carreras et al. (2018) examined the effectiveness of macroprudential policies in influencing household credit within the cointegration frameworks (panel vector error-correction, pooled fully-modified least squares and seemingly unrelated regressions). Their results indicated that debt-to-income ratio limits, general capital requirements, strict loan-to-value ratios and taxes on financial institutions were effective both in the short-run and long-run in curbing credit growth. Nonetheless, Carreras et al. (2018) acknowledged that the effects of some macroprudential tools were more pronounced than others.

Hu and Gong (2019) also established that macroprudential policy index impacted negatively on the growth rate of bank credit in 19 major economies over the period spanning 2005 to 2011, using the fixed effects estimator. The study further showed that these macroprudential policies effectively moderated the effect of uncertainty on the growth rate of bank lending.

In addition, when evaluating the linkage between macroprudential policy, central banks' role and financial stability in China during the period 2000-2015, using the structural VAR model, Klingelhöfer and Sun (2019) also discovered that macroprudential indices on housing policy, reserve requirements, supervision pressure and window guidance reduced bank credit. The study concluded that the effect of these macroprudential policies on bank lending was immediate and persistent. As a result, Klingelhöfer and Sun (2019) recommended that macroprudential policy could be adopted to maintain financial stability or manage the build-up of financial risks emanating from the easing of monetary policy.

Furthermore, Richter, Schularick and Shim (2019), who examined the costs emanating from the adoption of macroprudential policy instruments in 56 countries from the advanced and emerging market economies during the period 1990 to 2012, using the local projection method, found that loan-to-value ratios impacted negatively on bank credit. The researchers obtained evidence that changes made on loan-to-value ratios given their financial objectives had significant effects on credit market activities. Hence, Richter et al. (2019) proposed that these macroprudential tools

could be used especially by central banks in advanced countries to control financial booms without necessarily interfering with the objectives of monetary policy.

Similarly, Gómez et al. (2020), when assessing the impact of macroprudential policy instruments on credit growth in Colombia over the period 2006-2009, using the fixed effects estimation techniques, established that countercyclical reserve requirements and dynamic-loss provisions, as well as the overall macroprudential index, had a negative effect on bank loans. Although the intensity of the effects of these measures varied with specific characteristics of banks and debtors, the study concluded that macroprudential policy was effective in stabilising cycles in bank credit and reducing risk-taking behaviour.

Moreover, Kim and Oh (2020), who investigated how macroprudential policy instruments affected the Korean macroeconomy between the period ranging from 2009 to 2019, using the structural VAR analysis, found that debt-to-income as well as loan-to-value ratios impacted negatively on the level of household bank loans. Their results further revealed that the effects of these measures were faster in reducing bank loans to households. Thus, Kim and Oh (2020) recommended that policymakers could tighten debt-to-income and loan-to-value ratios to restrain household indebtedness.

Lastly, Revelo et al. (2020), when examining the impacts of macroprudential policy and its interaction with monetary policy on credit growth in 37 countries from the advanced and emerging economies over the period 2000-2014, using the system GMM estimator, obtained evidence suggesting that macroprudential policy instruments managed to curb the growth of bank credit. Given that the effectiveness of macroprudential policies was enhanced by tightening monetary policy, the researchers concluded that close coordination between the two policy measures was necessary.

Table 3.1 presents a summary of the considered empirical studies in support of the negative effect of bank regulatory measures on bank lending.

Table 3.1 Empirical studies in support of the negative effect of bank regulation on bank lending

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
Barth et al. (2004)	Bank regulation and supervision: What works best?	107 countries (1997-1999)	Ordinary least squares, Generalised method of moments	Bank credit to the private sector as a share of GDP	Activity restriction and mixing of banking and commerce restriction index	Negative
					Limitations on foreign bank entry or ownership	Negative
Lim et al. (2011)	Macroprudential policy: What instruments and how to use them?	49 countries (2000-2010)	Generalised method of moments	Credit growth	Countercyclical capital requirements	Negative
					Credit or credit growth ceilings	Negative
					Debt-to-income ratio	Negative
					Loan-to-value ratio	Negative
					Reserve Requirements	Negative
					Time-varying or dynamic provisioning	Negative

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
IMF (2013)	Key aspects of macroprudential policy	Cross-country context	Dynamic panel regressions	Credit growth	Loan-to-value limits	Negative
					Reserve requirements	Negative
					Sectoral risk weights	Negative
				Loan to deposit ratio	Debt-to-income limits	Negative
					Reserve requirements	Negative
Amidu (2014)	What influences banks' lending in sub-Saharan Africa?	24 sub-Saharan African countries (2000-2007)	Random effects	Bank credit to the private sector	Capital regulation index	Negative
Košak et al. (2015)	Quality of bank capital and bank lending behavior during the global financial crisis	Worldwide sample (2000-2010)	Fixed effects, Instrumental variables	Growth rate of the logarithm of bank gross loans	Bail-out probability	Negative
					Capital regulation index	Negative
Tillmann (2015)	Estimating the effects of macroprudential policy shocks: A qual VAR approach	Korea (2000-2012)	Qualitative vector autoregression	Credit growth	Loan-to-value ratio	Negative

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
Aiyar et al. (2016)	How does credit supply respond to monetary policy and bank minimum capital requirements?	United Kingdom (1998-2007)	Fixed effects	Bank lending	Capital requirement ratio	Negative
Zhang and Zoli (2016)	Leaning against the wind: Macroprudential policy in Asia	13 Asian economies and 33 other economies (2000-2013)	Generalised method of moments	Credit growth	Housing related macroprudential policy index	Negative
Sum (2016)	Banking regulation and bank lending in the EU	27 EU countries (2005-2014)	Cross-sectional model	Growth rate of bank gross loans	Credit risk capital regulation	Negative
					Market risk capital regulation	Negative
Cerutti et al. (2017)	The use and effectiveness of macroprudential policies: New evidence	119 countries (2000-2013)	Generalised method of moments	Bank credit to private non-financial sector, Credit to households and non-profit institutions serving households, Credit to non-financial corporations	Macroprudential policy index	Negative

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
Fendoğlu (2017)	Credit cycles and capital flows: Effectiveness of the macroprudential policy framework in emerging market economies	18 major emerging market economies (2000-2013)	Generalised method of moments	Credit-to-GDP gap	Borrower-based Macroprudential policy index	Negative
					Domestic reserve requirements	Negative
					Macroprudential policy index with a domestic focus	Negative
Merrouche and Nier (2017)	Capital inflows, monetary policy, and financial imbalances	22 OECD countries (1999-2007)	Fixed effects, Random effects	Private credit by deposit money banks as a share of bank deposits	Entry barrier index	Negative
Akinci and Olmstead-Rumsey (2018)	How effective are macroprudential policies? An empirical investigation	57 advanced and emerging economies (2000-2015)	Generalised method of moments	Domestic bank credit	Housing related macroprudential policies	Negative
					Non-housing related macroprudential policies	Negative
Carreras et al. (2018)	Assessing macroprudential tools in OECD countries within a cointegration framework	19 OECD countries (2000-2015)	Panel vector error-correction, Pooled fully-modified ordinary least squares, Seemingly	Real household credit	Debt-to-income ratio limits	Negative
					General capital requirements	Negative
					Strict loan-to-value ratios	Negative

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
			unrelated regressions		Taxes on financial institutions	Negative
Ibrahim and Rizvi (2018)	Bank lending, deposits and risk-taking in times of crisis: A panel analysis of Islamic and conventional banks	10 dual-banking countries (2005-2012)	Random effects	Growth in gross loans by banks	Activity restriction index	Negative (for conventional banks)
					Capital regulation index	Negative (for conventional banks)
Hu and Gong (2019)	Economic policy uncertainty, prudential regulation and bank lending	19 major economies (2005-2011)	Fixed effects	Growth rate of net loans by banks	Activity restriction index	Negative
					Capital regulation index	Negative
					Macroprudential policy index	Negative
Klingelhöfer and Sun (2019)	Macroprudential policy, central banks and financial stability: Evidence from China	China (2000–2015)	Structural vector autoregression	Total bank loans	Housing policy index	Negative
					Reserve requirements	Negative
					Supervision pressure index	Negative
					Window guidance index	Negative

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
Richter et al. (2019)	The costs of macroprudential policy	56 countries – both advanced and emerging market economies (1990-2012)	Local projection method	Bank credit to households, Mortgage credit	Loan-to-value ratio	Negative
Gómez et al. (2020)	Evaluating the impact of macroprudential policies on credit growth in Colombia	Colombia (2006-2009)	Fixed effects	Bank loans	Aggregate macroprudential policy	Negative
					Countercyclical reserve requirement	Negative
					Dynamic provisions	Negative
Hsieh and Lee (2020)	Foreign bank lending during a crisis: The impact of financial regulations	30 Asian and Latin American countries (1987-2013)	Instrumental variables	Growth rate of bank loans	Capital regulation index	Negative
Kim and Oh (2020)	Macroeconomic effects of macroprudential policies: Evidence from LTV and DTI policies in Korea	Korea (2003-2019)	Structural vector autoregression	Household bank loans	Debt-to-income ratio	Negative
					Loan-to-value ratio	Negative

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
Revelo et al. (2020)	Macroprudential and monetary policies: The need to dance the Tango in harmony	37 advanced and emerging economies (2000-2014)	System general method of moments	Total credit to the private non-financial sector from banks, Total credit to households and non-profit institutions serving households	Macroprudential policy index	Negative
Imbierowicz, Löffler and Vogel (2021)	The transmission of bank capital requirements and monetary policy to bank lending in Germany	Denmark (2007–2014)	Generalised method of moments	Bank lending	Capital requirements	Negative

Source: Own compilation.

3.3.2 Empirical Studies in Support of the Positive Effect of Bank Regulation on Bank Lending

This section focuses on empirical studies in support of the positive effect of different bank regulatory measures on bank lending. For instance, when investigating the impact of bank capital on bank loan growth in the United States (US) over the period 1992-2009, using the fixed effects regression method, Berrospide and Edge (2010) discovered that total and tier 1 risk-based capital ratios had a positive effect on the growth rate of bank lending. As a result, the study concluded that banks that had higher capital ratios experienced a larger growth rate in lending than the ones with lower capital ratios.

Moreover, Gambacorta and Marques-Ibanez (2011) adopted the GMM estimator to examine the factors behind the bank lending channel in 15 developed economies during the period ranging from 1999 to 2009. The study found that the impact of imposing more limitations on banking activities and raising tier 1 capital ratio on the growth rate of bank lending was positive. Thus, Gambacorta and Marques-Ibanez (2011) provided evidence to the notion that banks normally devoted more lending in countries where the regulatory authorities did not allow them to get involved in non-traditional banking activities. Furthermore, their findings supported the Basel III initiatives of raising minimum capital requirements and strengthening the definition of bank capital.

In the African context, Amidu (2014), who analysed the factors influencing bank lending in 24 SSA economies during the period 2000-2007, using the random effects model, found that banking activity restrictions and entry barriers had a positive effect on bank lending. Hence, the researcher concluded that restricting banks to focus mostly on their core business of banking and having stringent banking entry requirements, which enhanced the quality of new entrants, encouraged the provision of bank loans to the private sector in the SSA region.

Using worldwide sample data from 2000 to 2010, Košak et al. (2015) employed the estimation method of instrumental variables to analyse the relationship between the quality of bank capital and bank credit during the period of the global financial crisis.

The study revealed that the impact of deposit insurance index and tier 1 capital ratio on the growth rate of bank credit was positive. It also found the impact of these measures to be more pronounced in non-Organisation for Economic Cooperation and Development (OECD) and BRIC (Brazil, Russia, India, and China) economies. Therefore, Košak et al. (2015) concluded that high-quality bank capital and deposit insurance coverage were crucial for bank lending growth during the period of the crisis, with high-quality bank capital seemingly being the banks' competitive strategy during these times.

Similarly, Osei-Assibey and Asenso (2015), in their study examining the effect of regulatory capital on bank credit growth in Ghana, using the GMM estimation technique on a sample data spanning from 2002-2012, established that net minimum capital ratio had a positive effect on the growth rate of bank credit. However, the study also discovered that high minimum capital requirements increased the risk-taking behaviour of banks by increasing the level of non-performing loans, which indicated that obtaining the optimal level of capital requirements was crucial.

In the case of European countries, Sum (2016), when assessing how bank regulation influenced bank lending in 27 economies within the EU from 2005 to 2014, using cross-sectional model techniques, found that banking activity restrictions impacted positively on the growth rate of bank gross loans. Thus, these findings could imply that imposing bank activity restrictions had increased specialisation or prevented bank lending from being subordinated to other activities, thereby leading to bank credit expansion.

Interested in how the Basel III liquidity rules would influence the growth of bank credit in 38 African economies during the period spanning 2005 to 2015, using the two-step system GMM and quasi-maximum likelihood estimators, Adesina (2019) established a positive effect of liquidity coverage ratio as well as net stable funding ratio on the growth rate of bank loans. The results further highlighted that the net stable funding ratio reduced the negative effect of poor loan performance on the growth rate of bank loans. As a result, Adesina (2019) concluded that compliance with the Basel III

liquidity regulations could bring benefits to the African continent in terms of enhancing policies aimed at increasing bank lending.

Hsieh and Lee (2020), who investigated the impact of financial regulations on bank lending in 30 Asian and Latin American economies, using the estimation method of instrumental variables on a sample data ranging from 1987 to 2013, discovered that banking activity restrictions had a positive effect on the growth rate of bank loans. Hence, the study indicated that banks appeared to lend more when facing more restrictions on their banking activities.

In their study on the role of liquidity and capital in influencing bank credit in 21 European countries during the period spanning from 2007 to 2017, using the unbalanced panel regressions with fixed effects, Thornton and Tommaso (2020) established that tier 1 capital ratio impacted positively on bank lending. This impact was found to occur after banks had retained enough liquidity. Therefore, the study concluded that policymakers should consider both capital and liquidity requirements if they wanted to change them to sustain bank lending growth since the two were complementary in the case of European banks.

Likewise, Polizzi, Scannella and Suárez (2020), who adopted the two-stage least squares technique to examine the role of bank regulation in influencing bank credit in 117 economies of developed and developing nations over the period ranging from 2000 to 2016, found that the effect of tier 1 capital ratio, liquidity coverage ratio and net stable funding ratio on the growth of bank loans was positive. But the researchers revealed that their findings were not homogeneous over legal and institutional environments and recommended that policymakers should consider that when implementing bank regulations.

Table 3.2 provides a summary of the reviewed empirical studies in support of the positive effect of bank regulatory measures on bank lending.

Table 3.2 Empirical studies in support of the positive effect of bank regulation on bank lending

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
Berrospide and Edge (2010)	The effects of bank capital on lending what do we know, and what does it mean?	United States (1992-2009)	Fixed effects	Bank loan growth	Total risk-based capital ratio	Positive
					Tier 1 risk-based capital ratio	Positive
Gambacorta and Marques-Ibanez (2011)	The bank lending channel: Lessons from the crisis	15 developed countries (1999-2009)	Generalised method of moments	Growth rate in nominal bank lending to residents	Activity restriction index	Positive
					Tier 1 capital ratio	Positive
Amidu (2014)	What influences banks' lending in sub-Saharan Africa?	24 sub-Saharan African countries (2000-2007)	Random effects	Bank credit to the private sector	Activity restriction index	Positive
					Entry barrier index	Positive
Košak et al. (2015)	Quality of bank capital and bank lending behavior during the global financial crisis	Worldwide sample (2000-2010)	Instrumental variables	Growth rate of the logarithm of bank gross loans	Deposit insurance index	Positive
					Tier 1 capital ratio	Positive
Osei-Assibey and Asenso (2015)	Regulatory capital and its effect on credit growth, non-performing loans and bank efficiency	Ghana (2002-2012)	Generalised method of moments	Bank credit growth	Net minimum capital ratio	Positive
Sum (2016)	Banking regulation and bank lending in the EU	27 EU countries (2005-2014)	Cross-sectional model	Growth rate of bank gross loans	Activity restriction index	Positive

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
Adesina (2019)	Basel III liquidity rules: The implications for bank lending growth in Africa	38 African countries (2005-2015)	Two-step system generalised method of moments, Quasi-maximum likelihood	Bank loan growth rate	Liquidity coverage ratio	Positive
					Net stable funding ratio	Positive
Hsieh and Lee (2020)	Foreign bank lending during a crisis: The impact of financial regulations	30 Asian and Latin American countries (1987-2013).	Instrumental variables	Growth rate of bank loans	Activity restriction index	Positive
Polizzi et al. (2020)	The Role of Capital and Liquidity in Bank Lending: Are Banks Safer?	117 developed and developing countries (2000-2016)	Two-stage least squares	Growth of bank net loans	Liquidity coverage ratio	Positive
					Net stable funding ratio	Positive
					Tier 1 capital ratio	Positive
Thornton and Tommaso (2020)	Liquidity and capital in bank lending: Evidence from European banks	21 European countries (2007-2017)	Unbalanced panel regressions with fixed effects	Real rate of growth of net loans and advances, Real rate of growth of net loans and advances plus unused credit commitments	Tier 1 capital ratio	Positive

Source: Own compilation.

3.3.3 Empirical Studies in Support of the Insignificant or Inconclusive Effect of Bank Regulation on Bank Lending

This section reviews the empirical studies in support of the insignificant or inconclusive effect of different bank regulatory measures on bank credit. When evaluating the impacts of bank regulation and supervision on bank credit in 107 economies over the period 1997-1999, using the OLS and GMM estimation techniques, Barth et al. (2004) found that bank capital regulations and banking entry barriers had no significant effect on bank credit to the private sector as a share of GDP. The researchers indicated that these results remained the same even after controlling for various aspects of bank regulation and supervision or including their interaction terms. Regarding capital regulations, Barth et al. (2004) highlighted that their finding was in line with the literature that recommended caution to be exercised when assessing the independent impacts of capital regulation stringency.

Likewise, Cottarelli et al. (2005) analysed the determinants of the growth of bank credit to the private sector in 24 economies from non-transition developing and industrialised nations of Central and Eastern Europe and in the Balkans during the period ranging from 1973 to 1996, using the random effects panel regression. Their results highlighted that banking entry barriers had an insignificant effect on bank lending to GDP.

Alternatively, Carlson, Shan and Warusawitharana (2013) employed the fixed effects method to investigate the relationship between capital ratios and bank lending on the dataset from the US covering the period from 2001 to 2011. Although the researchers found that the effect of bank capital ratios (risk-adjusted tier 1 and total risk-adjusted capital ratios) on bank credit was significant and positive over the period of the recent global financial crisis and immediately afterwards, it was not significant over other years before the crisis. The study also established that bank lending elasticity in relation to capital ratios became higher when capital ratios were relatively lower, which implied that the impact of capital ratios on bank lending was nonlinear. Therefore, Carlson et al. (2013) concluded that adjusting capital

requirements when the banking industry was facing financial distress could influence their ability to lend, but adjusting them during normal times might not affect their lending behaviour.

Furthermore, Fratzscher et al. (2016) determined the role played by bank regulation in credit provision after the great global financial crisis using the difference-in-difference method and the dataset from 50 economies of advanced and emerging market nations, ranging from 2003 to 2013. The study discovered that bank capital regulations did not affect the growth rate of bank lending. A similar finding was obtained by Sum (2016) regarding the impact of overall capital on the growth rate of bank credit in 27 EU economies over the period 2005-2014, using cross-sectional model techniques.

Interested in the nexus between macroprudential and monetary policy shocks and financial stability, Greenwood-Nimmo and Tarassow (2016) estimated the sign restricted VAR model on the dataset from the US, from 1960 to 2007. The study determined that macroprudential policy shock impacted bank credit to GDP only in the short-run, but had no significant effect on the share of business loans to internal funds. Therefore, Greenwood-Nimmo and Tarassow (2016) concluded that the effect of the macroprudential policy on bank lending growth when considered alone was likely to be ambiguous.

Zhang and Zoli (2016) also established that the effect of non-housing related macroprudential policies on bank lending growth was not significant in the context of 13 Asian countries and 33 other countries during the period spanning 2000 to 2013, using the estimation method of GMM. Thus, the study highlighted that these macroprudential policy instruments were ineffective in controlling bank lending growth inside and outside of the Asian region.

Alternatively, Deli and Hasan (2017) investigated the real impact of bank regulation on bank credit in 125 economies across the world during the period 1998-2011, using the GMM estimator. The study established that the stringency of capital regulations,

especially the components preventing the use of borrowed funds and other assets rather than cash or government securities as capital, resulted in a weak and negative effect on the growth rate of bank credit. However, that impact was no longer apparent when banks accumulated more capital as buffers. As a result, the researchers recommended that, within a policy mix, capital stringency could be increased but focusing on reducing risk-taking behaviour of banks while they were awarded more freedom in terms of using other assets as part of their capital.

Moreover, Merrouche and Nier (2017) found that banking activity restrictions and bank capital regulations did not influence bank lending in 22 OECD countries between 1999 and 2007, using the fixed and random effects models. Concerning the finding on capital regulations, the study highlighted that it supported the notion that capital regulation in isolation could not prevent the increasing dependence on wholesale funding and its related liquidity risks during the period preceding the recent global financial crisis. Ibrahim and Rizvi (2018) also obtained comparable findings regarding the effect of banking activity restrictions and bank capital regulations on the growth rate of Islamic bank loans in 10 economies with dual banking systems of Islamic and conventional banks during the period from 2005 to 2012, using the random effects model.

While Carreras et al. (2018) established that concentration, foreign currency lending and interbank exposure limits managed to curb bank lending to households in 19 OECD countries, with data spanning 2000 to 2015, they found the effect of the same macroprudential policy instruments to be insignificant in some of the estimated cointegration equations. The same ambiguity was observed by Ibrahim (2019), but regarding the effect of bank capital regulations on bank credit growth in 13 economies with both Islamic and conventional banking systems between 2000 and 2014, using the GMM estimation technique. The study discovered that smaller banks cut back the provision of loans when facing tighter bank capital regulations, but this effect disappeared or was reversed in the case of larger banks. Thus, Ibrahim (2019) discouraged a blanket adoption of capital requirements for Islamic banks.

Finally, Kim and Katchova (2020), who examined how the introduction of the Basel III bank regulations affected bank credit towards the agricultural sector in the US between 2008 and 2017, found that although such regulations led to a decline in the growth rates of agricultural bank credit, they resulted in increased volumes of bank lending towards the agricultural sector. Therefore, the study recommended that policymakers should find ways to use regulation to motivate banks to be resilient so that they could maintain the provision of liquidity needed by farmers.

Table 3.3 presents a summary of the discussed empirical studies in support of the insignificant or inconclusive effect of bank regulatory measures on bank lending.

Table 3.3 Empirical studies in support of the insignificant or inconclusive effect of bank regulation on bank lending

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
Barth et al. (2004)	Bank regulation and supervision: What works best?	107 countries (1997-1999)	Ordinary least squares, Generalised method of moments	Bank credit to the private sector as a share of GDP	Capital regulatory index	Insignificant
					Entry barrier index	Insignificant
Cottarelli et al. (2005)	Early birds, late risers, and sleeping beauties: Bank credit growth to the private sector in Central and Eastern Europe and in the Balkans	24 non-transition developing and industrialised countries (1973-1996)	Random effects	Bank credit to the private sector as a share of GDP	Entry barrier index	Insignificant
Carlson et al. (2013)	Capital ratios and bank lending: A matched bank approach	United States (2001-2011)	Fixed effects	Loan growth	Risk-adjusted tier 1 capital ratio	Inconclusive
					Total risk-adjusted capital ratio	Inconclusive
Fratzscher et al. (2016)	Credit provision and banking stability after the Great Financial Crisis: The role of bank regulation and the quality of governance	50 advanced and emerging market economies (2003-2013)	Difference-in-difference	Growth rate of domestic credit provided by banks to the private sector	Capital regulation index	Insignificant

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
Greenwood-Nimmo and Tarassow (2016)	Monetary shocks, macroprudential shocks and financial stability	United States (1960-2007)	Sign restricted vector autoregression	Credit to GDP, Real credit to non-financial corporate businesses	Macroprudential shock	Inconclusive
Sum (2016)	Banking regulation and bank lending in the EU	27 EU countries (2005-2014)	Cross-sectional model	Growth rate of bank gross loans	Overall capital regulatory index	Insignificant
Zhang and Zoli (2016)	Leaning against the wind: Macroprudential policy in Asia	13 Asian economies and 33 other economies (2000-2013)	Generalised method of moments	Credit growth	Non-housing related macroprudential policy index	Insignificant
Deli and Hasan (2017)	Real effects of bank capital regulations: Global evidence	125 countries (1998-2011)	Generalised method of moments	Growth in gross loans by banks	Capital regulation index	Inconclusive
Merrouche and Nier (2017)	Capital inflows, monetary policy, and financial imbalances	22 OECD countries (1999-2007)	Fixed effects, Random effects	Private credit by deposit money banks as a share of bank deposits	Activity restriction index	Insignificant
					Capital regulation index	Insignificant
Carreras et al. (2018)	Assessing macroprudential tools	19 OECD countries (2000-	Panel vector error-correction,	Real household	Concentration limits	Inconclusive

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Dependent variable	Measure(s) of bank regulation	Effect
	in OECD countries within a cointegration framework	2015)	Pooled fully-modified ordinary least squares, Seemingly unrelated regressions	credit	Limits on foreign currency lending	Inconclusive
					Limits on interbank exposures	Inconclusive
Ibrahim and Rizvi (2018)	Bank lending, deposits and risk-taking in times of crisis: A panel analysis of Islamic and conventional banks	10 dual-banking countries (2005-2012)	Random effects	Growth in gross loans by banks	Activity restriction index	Insignificant (for Islamic banks)
					Capital regulation index	Insignificant (for Islamic banks)
Ibrahim (2019)	Capital regulation and Islamic banking performance: Panel evidences	13 dual-banking countries (2000-2014)	Generalised method of moments	Growth rate of gross loans by banks	Capital regulation index	Inconclusive
Kim and Katchova (2020)	Impact of the Basel III bank regulation on US agricultural lending	United States (2008–2017)	Ordinary least squares	Agricultural loan growth and volume	Post-Basel III regulation period	Inconclusive

Source: Own compilation.

3.3.4 Empirical Studies Modelling a Causal Relationship Between Bank Regulation and Bank Lending

This section reviews the empirical evidence on the causal relationship between bank regulation and bank lending, which is very limited and has focused only on bank capital and its symmetric causal effect on bank credit. For example, the study by Aiyar et al. (2016) carried out further investigations to test for the possible existence of reverse causality from bank lending to bank regulation in the UK over the period from 1998 to 2007. The results from the estimated panel VAR model showed that while a positive shock to bank capital ratio impacted negatively on bank lending growth, the one to bank lending growth had no significant impact on bank capital ratio. As a result, the study concluded that there was no Granger causality running from bank lending growth to capital requirements, but only a unidirectional causality existed running from capital requirements to bank lending.

Furthermore, Oyebowale (2020), when examining the factors influencing bank credit in Nigeria over the period 1961-2016, also analysed the existence of Granger causality between bank capital growth and the growth rate in aggregate bank loans and advances. The study found no evidence of Granger causality between the two measures from the Wald (1943) test results. Hence, Oyebowale (2020) concluded that the Nigerian banks seemed to accumulate more capital, not to enhance their lending ability, but just to adhere to the requirements of the regulator.

Table 3.4 provides a summary of these empirical studies modelling the causal linkage between bank regulation and bank lending.

Table 3.4 Empirical Studies Modelling a Causal Relationship Between Bank Regulation and Bank Lending

Author(s)	Title of the study	Region/countries (period)	Method of analysis	Direction of Causality
Aiyar et al. (2016)	How does credit supply respond to monetary policy and bank minimum capital requirements?	United Kingdom (1998-2007)	Panel vector autoregression	Unidirectional causality from capital requirement ratio to bank lending
Oyebowale (2020)	Determinants of bank lending in Nigeria	Nigeria (1961-2016)	Granger causality Wald test	No causality between growth in bank capital and growth in aggregate bank loans and advances

Source: Own compilation.

3.4 Critique of the Existing Literature on Bank Regulation and Bank Lending

The reviewed theoretical and empirical literature on the relationship between bank regulation and bank credit is inconclusive. It shows that bank regulation can have a positive, negative or insignificant impact on bank lending. The existing empirical evidence also varies depending on the type of variables used to capture bank regulation as well as the sample datasets, methodologies, and control variables employed during the estimations of the model.

Additionally, the empirical studies examining the existence of asymmetric and threshold effects of bank regulatory measures on bank lending are almost non-existent[8]. Given that the reviewed theoretical literature indicated that bank regulation involved both benefits and costs, there is a possibility that its impact on bank credit could be asymmetric or nonlinear, depending on whether the benefits derived from the adoption of higher standards of bank regulation offset the costs. Therefore, it is imperative to determine empirically whether asymmetric and threshold effects of bank regulatory measures exist.

Lastly, although the empirical studies assessing the direction of causality between bank regulation and bank credit are limited and point to different directions, they focus only on symmetric causal effects between bank credit and bank capital. Given that the economic literature predicts that a two-way interplay between bank regulation and bank lending could exist and that positive and negative shocks to bank regulation or lending are not anticipated to yield the same effect, more empirical studies are needed to establish whether the bidirectional symmetric and asymmetric causality between bank regulation and bank credit could be supported.

[8] Neyapti and Dincer (2014) tested the claim that too much regulation can hinder banking performance but proxied it by deposits, investments and nonperforming loans, while Li et al. (2019) studied the nonlinear effects of the stringency of bank regulation but on the seasoned equity offerings announcements.

3.5 Conclusion

This chapter reviewed both the theoretical and empirical literature on the nexus between bank regulation and bank lending. It began by providing the conceptual definition of bank regulation, which in accordance with Loevinger (1966), Llewellyn (1999), as well as Schooner and Taylor (2010), is understood to mean specific laws, rules, or orders by government delegated authorities aimed at controlling the economic behaviour of banks. It further discussed the debates surrounding the broad theories of bank regulation, namely, the public interest theory and the private interest theory. For the public interest theory, bank regulation is provided as a protection against market failures brought by factors such as asymmetric information, externalities and monopolies (Hendrickson & Nichols, 2001). However, the private interest theory asserts that bank regulation tends to promote the interests of certain groups. This is either because the regulator has been captured by those who are supposed to be regulated or its establishment has been influenced by special interest groups who want to control its activities (Moosa, 2015).

Moreover, the chapter highlighted that bank regulation can follow different approaches. It can either be awarded at the discretion of government authorities or with certainty based on clearly defined rules (Baltensperger & Dermine, 1986). Alternatively, it can be based on either the control of the volume of bank lending or its quality (Goldenweiser, 1936; Dunkman, 1933). The delivery of bank regulation can be also concerned with either shielding the banking system against banking crises or controlling the amount of risk-taking assumed by banks (Niehans, 1983; Baltensperger & Dermine, 1986). In addition, the various measures of bank regulation were identified and described including minimum reserve requirements, lender of last resort policies, public subsidies and guarantees, deposit insurance systems, entry barriers, restrictions on the mixing of banking and commerce, banking activity restrictions, capital and liquidity regulatory requirements as well as macroprudential policies.

Furthermore, the chapter discussed the theoretical link between bank regulation and bank lending as well as the related empirical evidence. On the one hand, the theory

generally shows that although bank regulation has both costs and benefits, its effect on bank credit is ambiguous. This was supported by the empirical studies that analysed the effect of various bank regulatory measures on bank lending. On the other hand, economic theory postulated that bank regulation, as part of formal institutions, can be influenced by the trends in bank credit. This implies that bi-directional causality is expected to exist between bank regulation and bank lending (Patrick, 1966). The empirical literature, though limited, provided mixed findings regarding the causal linkage between bank regulation and bank credit.

From the issues reviewed in this chapter, it can be concluded that there is no clear-cut finding on the effect of bank regulatory measures on bank lending. It can range from positive to negative, and be insignificant at times, depending on the type of bank regulatory measures, sample datasets, methodologies, and control variables employed. Additionally, there is a lack of empirical studies analysing the asymmetric and threshold effects of bank regulatory measures on bank credit despite the theoretical literature highlighting that bank regulation involves both costs and benefits. Finally, there is a need for more empirical studies evaluating the symmetric and asymmetric causal effects between various bank regulatory measures and bank lending as the existing empirical evidence is scarce and points to different directions. Thus, the next chapter discusses the estimation techniques and data sources of variables used in this study to empirically examine the nature of the nexus between bank regulation and bank credit over time in the SSA region.

CHAPTER 4

EMPIRICAL MODEL SPECIFICATION AND ESTIMATION TECHNIQUES

4.1 Introduction

The main aim of this chapter is to discuss empirical model specifications and econometric estimation techniques used in this study. The chapter is divided into seven sections. Following the introduction, Section 4.2 presents the analytical framework indicating channels through which bank regulation and bank lending can affect each other, and how other macroeconomic and institutional factors can influence this relationship. Section 4.3 provides the empirical models on which the impact of bank regulation (and its interaction with bank supervision) on bank lending is determined. It also presents the dynamic panel ADRL models for analysing the long-run and short-run symmetric as well as asymmetric effects of bank regulation on bank lending. These models are estimated through the dynamic CCE estimator, which accounts for endogeneity and error cross-sectional dependence. The section also discusses the dynamic PTR model that is estimated using the GMM technique to investigate the threshold effects of bank regulatory measures on bank credit. Section 4.4 presents empirical models on the causal relationship between bank regulation and bank lending. It specifies the error correction-based panel Granger causality models used to determine the long-run and short-run symmetric as well as asymmetric causal relationship between bank regulation and bank lending. Section 4.5 discusses other estimation techniques used in this study including cross-sectional dependence tests, followed by panel unit root tests, slope homogeneity tests, and then panel cointegration tests. Section 4.6 discusses the data sources and definitions of variables used in this study, while Section 4.7 concludes this chapter.

4.2 Analytical Framework

As discussed in Chapter 3, bank regulation can play a significant role within a credit market, which usually faces market failures such as asymmetric information,

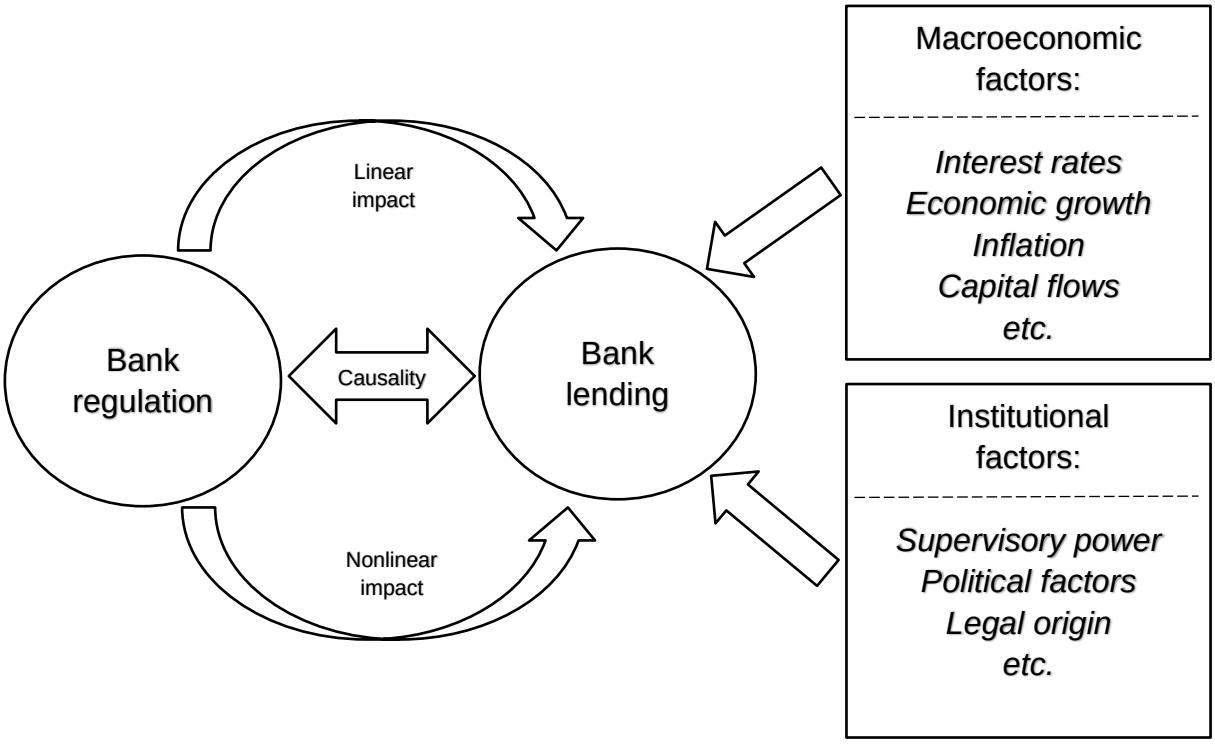
externalities and monopolies (Hendrickson & Nichols, 2001; Diamond & Dybvig, 1983; Stiglitz & Weiss, 1981). In line with Spong (2000) and Crockett (1996), bank regulation, firstly, can provide some measure of protection to depositors from losses they could incur owing to the excessive risk-taking behaviour of banks. Secondly, it can promote monetary and financial stability by encouraging banks to hold adequate liquidity and avert practices that could negatively affect depositors and disrupt the banking payment system. This could also help in limiting systemic risk to avoid the problem of contagion and shield governments against losses that could occur when bailing out banks that are too-big-to-fail. Lastly, bank regulation can facilitate the channelling of financial resources towards prudent investment projects, thereby enhancing bank development and economic growth.

In the literature, several measures have been proposed to capture bank regulation. These measures include minimum reserve requirements, lender of last resort policies, public subsidies and guarantees, deposit insurance systems, entry barriers, restrictions on the mixing of banking and commerce, bank activity restrictions, capital and liquidity regulatory requirements and macroprudential policies (Cerutti et al., 2017; Basel Committee on Banking Supervision, 2013, 2014; Barth et al., 2004; Spong, 2000; Baltensperger & Dermine, 1986; Clerc, 2008).

When it comes to the relationship between the proposed bank regulatory measures and bank credit, the theoretical literature, as discussed in Section 3.2.5 of Chapter 3, showed that these measures came with costs and/or benefits when impacting bank lending. Furthermore, it indicated that the developments in bank lending could shape the direction of bank regulation. However, other macroeconomic factors (for example, interest rates, economic growth, inflation and capital flows) or institutional factors (for example, supervisory power, political factors and legal origin) could also influence the nexus between bank regulation and bank credit (see Merrouche & Nier, 2017; Djankov et al., 2007; Cottarelli et al., 2005; Barth et al., 2004). The channels through which these variables could affect each other are conceptualised as proposed in Figure 4.1. First, depending on whether the benefits of bank regulation outweigh the costs, its impact on bank lending could be modelled within a linear relationship.

Secondly, positive and negative shocks to bank regulation are not anticipated to yield the same effect on bank credit. Furthermore, increasing the stringency of bank regulation might at first promote bank lending, but if such stringency becomes too much, it could lead to a reduction in lending. On the other hand, when bank regulation is at first inadequate, bank lending could be discouraged, but when such regulation becomes adequate, bank lending could be promoted. Hence, the impact of bank regulation on bank credit could be nonlinear. Finally, as the developments in bank regulation and bank lending could influence each other, this relationship could be analysed within a causality framework.

Figure 4.1 Analytical framework



Source: Own compilation.

4.3 Model 1: Impact of Bank Regulation on Bank Lending

This section provides the theoretical and empirical underpinnings of the models used to analyse the effect of bank regulation on bank lending. Section 4.3.1 discusses the general empirical specification of the first model to determine the impact of bank

regulation on bank credit. Section 4.3.2 presents the dynamic panel ARDL models employed to assess the symmetric and asymmetric long-run as well as short-run impact of bank regulation on bank lending, while Section 4.3.3 discusses the dynamic CCE technique used to estimate the panel ARDL models. Section 4.3.4 presents the dynamic PTR model employed to analyse the threshold effects of bank regulatory measures on bank credit, while Section 4.3.5 discusses the associated linearity test and GMM estimation technique.

4.3.1 General Empirical Specification of Model 1

In the literature, bank credit is commonly proxied either by domestic bank credit to the private sector (see Revelo et al., 2020; Akinci & Olmstead-Rumsey, 2018; Cerutti et al., 2017; Merrouche & Nier, 2017; Fratzscher et al., 2016; Amidu, 2014; Cottarelli et al., 2005; Barth et al., 2004) or total bank loans (see Gómez et al., 2020; Hsieh & Lee, 2020; Klingelhöfer & Sun, 2019; Ibrahim & Rizvi, 2018; Sum, 2016; Košak et al., 2015). Nevertheless, this study follows Barth et al. (2004), Cottarelli et al. (2005) as well as Merrouche and Nier (2017) by employing a more standard measure of bank credit given by bank lending to the private sector as a ratio of GDP, instead of bank lending to the private sector as a ratio of bank deposits or other measures. This chosen proxy effectively reflects the expansion of domestic private lending towards short-run and long-run investments as a share of individual country's output.

On the other hand, economic theory predicts that institutions affect economic performance measures since they shape the way societies interact (North, 1981, 1990). As part of formal institutions, bank regulation is then expected to influence bank development through the provision of lending (Merrouche & Nier, 2017; Barth et al., 2004). In measuring bank regulation, the study employs the banking entry barrier, mixing of banking and commerce restriction, banking activity restriction and capital regulation stringency indices as proposed by Barth et al. (2004), as well as the macroprudential policy index as suggested by Cerutti et al. (2017). As highlighted in Chapter 3 Section 3.2.5, these bank regulatory measures are generally expected to either limit or promote bank credit.

Furthermore, the study incorporates institutional and macroeconomic control variables that are commonly found in the literature[9] in its model specifications. Bank supervisory power is included as an institutional variable capturing the stringency of bank supervisory environment. Merrouche and Nier (2017) highlighted that bank supervisors with more power could have more ability to discipline banks, and this might minimise moral hazard problems ex-ante. Nonetheless, Barth et al. (2004) contended that, even though strong supervisory power could lower monitoring costs and motivate banks to engage in prudent lending, it might also limit prudent behaviour in credit delivery if supervisors could abuse their power and fail to enforce regulations. Therefore, bank supervisory power is anticipated to have an ambiguous impact on bank credit. Moreover, the strength of bank supervision might enhance or mitigate the effect of bank regulation on bank lending.

The study also incorporates the log of real GDP, which is a proxy for economic growth, as one of the macroeconomic control variables. In line with Cottarelli et al. (2005), Djankov et al. (2007) as well as Yi et al. (2022), economies with relatively high-income levels normally have larger credit markets with higher degrees of financial deepening as a result of enjoying economies of scale in the organisation of the supporting institutions. Hence, a rise in real GDP (or economic growth) is expected to stimulate the demand for bank credit.

Inflation is an additional macroeconomic control variable incorporated in the model specifications of this study as a proxy for macroeconomic stability. Higher rates of inflation are anticipated to prevent customers from obtaining new loans (Djankov et al., 2007). This could be expected since, during periods of high rates of inflation, banks are likely to hike interest rates, thereby resulting in a decline in the demand for bank lending (Adesina, 2019; Yi et al., 2022). However, according to Çatik and Karaçuka (2012), the way bank lending responds to developments in inflation may differ when the economy faces a low-inflation regime. For example, bank credit may rise even if inflation increases owing to the expectation that macroeconomic stability

[9] Other control variables are omitted due to patchy data availability in the selected SSA economies during the period under consideration.

would be maintained in a low-inflation environment. Thus, higher rates of inflation are expected to either have a negative or positive effect on bank credit.

Lastly, current account balance as a share of GDP, which captures external imbalances or net capital flows, is included in the model estimations as one of the macroeconomic variables. In accordance with Merrouche and Nier (2017), increases in the current account deficits need to be met by net capital inflows, and this could improve the supply of domestic lending by banks. Therefore, current account balance as a share of GDP is expected to have a negative association with bank credit.

Based on the preceding postulates, the relationship between bank lending and bank regulation (plus controls) is specified as Equation 4.1:

$$L_{i,t} = \mu_i + \Omega_t + \beta_{i1} R_{i,t} + \beta_{i2} S_{i,t} + \boldsymbol{\beta}'_{i3} \boldsymbol{X}_{i,t} + \nu_{i,t} \qquad (4.1)$$

where $L_{i,t}$ is a bank lending variable (bank credit to the private sector as a ratio of GDP) for a country i at time period t; $R_{i,t}$ a bank regulatory measure (banking entry barrier index, mixing of banking and commerce restriction index, banking activity restriction index, capital regulation stringency index or macroprudential index); $S_{i,t}$ is bank supervisory power index; $\boldsymbol{X}_{i,t}$ is a vector of macroeconomic control variables ($Y_{i,t}$ = real GDP, $\pi_{i,t}$ = inflation, and $C_{i,t}$ = current account balance as a share of GDP); μ_i represents country-specific fixed effects; Ω_t is a time dummy; β_{i1} and β_{i2} are scalars while $\boldsymbol{\beta}_{i3}$ is a vector, reflecting coefficients (of the corresponding variables) to be estimated; $\nu_{i,t}$ is an error term that is independently and normally distributed with mean zero and constant variance.

To determine whether the bank supervisory environment enhances or mitigates the effect of bank regulation on bank credit, the study also modifies Equation 4.1 by incorporating the interaction term between each of the bank regulatory measures and bank supervisory power index ($R_{i,t} \times S_{i,t}$) as:

$$L_{i,t} = \mu_i + \Omega_t + \beta_{i1}R_{i,t} + \beta_{i2}S_{i,t} + \boldsymbol{\beta}'_{i3}\boldsymbol{X}_{i,t} + \beta_{i4}\left(R_{i,t} \times S_{i,t}\right) + \nu_{i,t} \quad (4.2)$$

where β_{i4} is the coefficient of the interaction term between bank regulatory measure and bank supervisory power index, and other variables are as specified before. The total effect of $R_{i,t}$ on $L_{i,t}$ comprising the direct and indirect effects can be derived as:

$$\left.\frac{\partial L_{i,t}}{\partial R_{i,t}}\right|_{S_{i,t}=\bar{S}_{i,t}} = \beta_{i1} + \beta_{i4}S_{i,t} \quad (4.3)$$

where $\bar{S}_{i,t}$ is the mean value of $S_{i,t}$, given by:

$$\bar{S}_{i,t} = (NT)^{-1}\sum_{t=1}^{T}\sum_{i=1}^{N} S_{i,t} \quad (4.4)$$

Thus, the total effect of $R_{i,t}$ on $L_{i,t}$ is either directly captured through β_{i1} or indirectly captured through $\beta_{i4}\bar{S}_{i,t}$. Now, for $S_{i,t}$ to mitigate or enhance the effect of $R_{i,t}$ depends on β_{i4} and the mean value of $S_{i,t}$. For example, if $\bar{S}_{i,t} > 0$ (as in Table 5.1) and $\beta_{i1} > 0$, $S_{i,t}$ will diminish the effect of $R_{i,t}$ on $L_{i,t}$ if $\beta_{i4} < 0$ and enhance it, if $\beta_{i4} > 0$. Similarly, if $\bar{S}_{i,t} > 0$ and $\beta_{i1} < 0$, $S_{i,t}$ will aggravate the negative effect of $R_{i,t}$ on $L_{i,t}$, if $\beta_{i4} < 0$, and mitigate it, if $\beta_{i4} > 0$. But the influence of $S_{i,t}$ will be nil, if $\beta_{i4} = 0$. Furthermore, the total effect of $R_{i,t}$ on $L_{i,t}$ will be positive, if *i)* $\beta_{i1} > 0$ and $\beta_{i4} > 0$, *ii)* $|\beta_{i1}| > |\beta_{i4}\bar{S}_{i,t}|$ and $\beta_{i1} > 0$ and $\beta_{i4} < 0$ or *iii)* $|\beta_{i1}| < |\beta_{i4}\bar{S}_{i,t}|$ and $\beta_{i1} < 0$ and $\beta_{i4} > 0$. On the other hand, the total effect of $R_{i,t}$ on $L_{i,t}$ will be negative, if *i)* $\beta_{i1} < 0$ and $\beta_{i4} < 0$, *ii)* $|\beta_{i1}| < |\beta_{i4}\bar{S}_{i,t}|$ and $\beta_{i1} > 0$ and $\beta_{i4} < 0$ or *iii)* $|\beta_{i1}| > |\beta_{i4}\bar{S}_{i,t}|$ and $\beta_{i1} < 0$ and $\beta_{i4} > 0$. The same analogy applies on the effect of $S_{i,t}$ on $L_{i,t}$.

4.3.2 Model 1(a): Panel Autoregressive Distributed Lag (ARDL)

The study estimates both the linear (or symmetric) and nonlinear (or asymmetric) dynamic panel ARDL models to assess the effect of bank regulation and its interaction with bank supervision on bank lending in the long and short run. It first

specifies the symmetric dynamic panel ARDL models analysing the linear impact of bank regulation on bank credit. It then presents the asymmetric dynamic panel ARDL models to investigate the nonlinear response of bank lending to bank regulation.

Linear (or Symmetric) Panel ARDL

To determine the effect of bank regulation and its interaction with bank supervision on bank lending from Equations 4.1 and 4.2, the study first specifies the dynamic panel ARDL models based on Pesaran, Shin and Smith (1999) as Equations 4.5 and 4.6, respectively:

$$L_{i,t} = \mu_i + \Omega_t + \sum_{j=1}^{p} \pi_{ij} L_{i,t-j} + \sum_{j=0}^{q} \varrho_{ij} R_{i,t-j} + \sum_{j=0}^{r} \psi_{ij} S_{i,t-j} + \sum_{j=0}^{s} \boldsymbol{\zeta}'_{ij} \boldsymbol{X}_{i,t-j} + \varepsilon_{i,t} \qquad (4.5)$$

$$L_{i,t} = \mu_i + \Omega_t + \sum_{j=1}^{p} \pi_{ij} L_{i,t-j} + \sum_{j=0}^{q} \varrho_{ij} R_{i,t-j} + \sum_{j=0}^{r} \psi_{ij} S_{i,t-j} + \sum_{j=0}^{s} \boldsymbol{\zeta}'_{ij} \boldsymbol{X}_{i,t-j} + \sum_{j=0}^{u} \tau_{ij} \left(R_{i,t-j} \times S_{i,t-j} \right) + \varepsilon_{i,t} \qquad (4.6)$$

where π_{ij}, ϱ_{ij}, ψ_{ij}, and τ_{ij} are scalars capturing the coefficients of the lagged dependent variable, bank regulatory measure, bank supervisory power and the interaction term between bank regulatory measure and bank supervisory power, respectively; $\boldsymbol{\zeta}_{ij}$ is a vector of coefficients for macroeconomic control variables; $\varepsilon_{i,t}$ is a white noise error term; p, q, r, s, and u are the optimal lag lengths. All other variables are as specified before.

The lag structures of Equations 4.5 and 4.6 are based on the most common choice of the optimal lags using the Schwarz (1978) information criterion (SIC) after estimating the unrestricted ARDL model for each cross-sectional unit. This technique is found to be as valid as the Akaike (1974) information criterion (AIC) for optimal model selection (Wang & Liu, 2006; Kuha, 2004). However, Pesaran et al. (1999) indicate that the common lag structure can still be imposed on the model when the dataset

has limited observations. Thus, this approach is followed when the most chosen lag order results in a significant loss of degrees of freedom given the relatively small sample size employed in this study.

Furthermore, the reparameterisation of Equations 4.5 and 4.6, reflecting error correction in the presence of cointegration, are presented as Equations 4.7 and 4.8, respectively:

$$\Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{i,t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta R_{i,t-j} + \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j} + \sum_{j=0}^{s-1} \boldsymbol{\lambda}'_{ij} \Delta \boldsymbol{X}_{i,t-j} + \varepsilon_{i,t} \quad (4.7)$$

$$\Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{i,t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta R_{i,t-j} + \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j} + \sum_{j=0}^{s-1} \boldsymbol{\lambda}'_{ij} \Delta \boldsymbol{X}_{i,t-j} + \sum_{j=0}^{u-1} \vartheta_{ij} \Delta \left(R_{i,t-j} \times S_{i,t-j} \right) + \varepsilon_{i,t} \quad (4.8)$$

where Δ is a first difference operator; α_{ij}, δ_{ij}, φ_{ij} and ϑ_{ij} are scalars capturing the coefficients of the lagged dependent variable, bank regulatory measure, bank supervisory power and the interaction term between bank regulatory measure and bank supervisory power, respectively; $\boldsymbol{\lambda}_{ij}$ is a vector of coefficients for macroeconomic control variables; $\varepsilon_{i,t}$ is a white noise error term; ϕ_i captures the speed of adjustment towards a long-run equilibrium; and $ECT_{i,t-1}$ represents the lagged error-correction term, indicating a long-run association between bank credit and bank regulation plus the control variables. All other variables are as specified before. Thus, the lagged error-correction term is specified as:

$$ECT_{i,t-1} = L_{i,t-1} - \widehat{\boldsymbol{\theta}}' \boldsymbol{X}_{i,t-1} \quad (4.9)$$

where $\boldsymbol{\mathcal{X}}_{i,t}$ is a vector of regressors in the long-run specification similar to Equations 4.1 and 4.2, while $\widehat{\boldsymbol{\theta}}$ is a vector of their corresponding estimated coefficients.

Nonlinear (or Asymmetric) Panel ARDL

The study further employs the nonlinear (or asymmetric) dynamic panel ARDL model that was first proposed by Shin et al. (2014) for time series analysis and later applied in panel data analysis (see Mawejje & Odhiambo, 2022; Salisu & Isah, 2017). This model caters for the asymmetric response of bank credit to bank regulation, that is, positive and negative shocks to bank regulation are not anticipated to yield the same effect on bank credit. As a result, the asymmetric representations of Equations 4.1, 4.2, 4.7 and 4.8, respectively, are indicated as:

$$L_{i,t} = \mu_i + \Omega_t + \beta_{i1}^{+} R_{i,t}^{+} + \beta_{i1}^{-} R_{i,t}^{-} + \beta_{i2} S_{i,t} + \boldsymbol{\beta}_{i3}' \boldsymbol{X}_{i,t} + \nu_{i,t} \tag{4.10}$$

$$L_{i,t} = \mu_i + \Omega_t + \beta_{i1}^{+} R_{i,t}^{+} + \beta_{i1}^{-} R_{i,t}^{-} + \beta_{i2} S_{i,t} + \boldsymbol{\beta}_{i3}' \boldsymbol{X}_{i,t} + \beta_{i4}\left(R_{i,t} \times S_{i,t}\right) + \nu_{i,t} \tag{4.11}$$

$$\begin{aligned} \Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{i,t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \left(\delta_{ij}^{+} \Delta R_{i,t-j}^{+} + \delta_{ij}^{-} \Delta R_{i,t-j}^{-}\right) \\ + \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j} + \sum_{j=0}^{s-1} \boldsymbol{\lambda}_{ij}' \Delta \boldsymbol{X}_{i,t-j} + \varepsilon_{i,t} \end{aligned} \tag{4.12}$$

$$\begin{aligned} \Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{i,t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \left(\delta_{ij}^{+} \Delta R_{i,t-j}^{+} + \delta_{ij}^{-} \Delta R_{i,t-j}^{-}\right) \\ + \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j} + \sum_{j=0}^{s-1} \boldsymbol{\lambda}_{ij}' \Delta \boldsymbol{X}_{i,t-j} + \sum_{j=0}^{u-1} \vartheta_{ij} \Delta\left(R_{i,t-j} \times S_{i,t-j}\right) + \varepsilon_{i,t} \end{aligned} \tag{4.13}$$

where β_{i1}^{+} and β_{i1}^{-} are the long-run coefficients for positive $\left(R_{i,t}^{+}\right)$ and negative $\left(R_{i,t}^{-}\right)$ shocks of a bank regulatory measure, respectively, while δ_{ij}^{+} and δ_{ij}^{-} are the corresponding short-run coefficients (and all other variables are as explained

before)[10]. These shocks are theoretically considered to be positive and negative partial sum decompositions of changes in bank regulation, and are defined as Equations 4.14 and 4.15:

$$R_{i,t}^{+} = \sum_{k=1}^{t} \Delta R_{ik}^{+} = \sum_{k=1}^{t} \max(\Delta R_{ik}^{+}, 0) \tag{4.14}$$

$$R_{i,t}^{-} = \sum_{k=1}^{t} \Delta R_{ik}^{-} = \sum_{k=1}^{t} \min(\Delta R_{ik}^{-}, 0) \tag{4.15}$$

The study follows a popular choice of zero for the threshold value (see Tiwari, Apergis & Olayeni, 2015; Granger & Yoon, 2002), which makes negative shocks of regulation to carry the concept of deregulation, while positive shocks imply more regulation.

4.3.3 Common Correlated Effects (CCE) Estimation Technique for Model 1(a)

The study then uses the dynamic CCE method of Chudik and Pesaran (2015) to estimate the specified symmetric and asymmetric dynamic panel ARDL models. This method extends the CCE technique proposed by Pesaran (2006) to dynamic panel data models with weakly exogenous regressors. It controls for endogeneity and cross-sectional dependence by including cross-sectional averages as well as their lags in its estimation (Ahmad et al., 2021; Ditzen, 2018). First, the symmetric long-run equations (Equations 4.1 and 4.2) are rewritten with common factors, as proposed by Pesaran (2006), as Equations 4.16 and 4.17:

$$L_{i,t} = \mu_i + \Omega_t + \beta_{i1} R_{i,t} + \beta_{i2} S_{i,t} + \boldsymbol{\beta}_{i3}' \boldsymbol{X}_{i,t} + \sum_{\ell=0}^{p_T} \omega_{i\ell} \bar{Z}_{t-\ell} + \nu_{i,t} \tag{4.16}$$

[10] The interaction term $(R_{i,t} \times S_{i,t})$ is specified as an aggregate series in Equations 4.11 and 4.13 to avoid loss of degrees of freedom owing to the relatively small sample size employed in the study.

$$L_{i,t} = \mu_i + \Omega_t + \beta_{i1}R_{i,t} + \beta_{i2}S_{i,t} + \boldsymbol{\beta}'_{i3}\boldsymbol{X}_{i,t} + \beta_{i4}\left(R_{i,t} \times S_{i,t}\right) + \sum_{\ell=0}^{p_T} \omega_{i\ell}\bar{Z}_{t-\ell} + \nu_{i,t} \qquad (4.17)$$

where $\nu_{i,t}$ is now a composite error term given by:

$$\nu_{i,t} = \boldsymbol{\gamma}'_i\mathbf{f}_t + e_{i,t} \qquad (4.18)$$

with $\mathbf{f}_t$ is an $m \times 1$ vector of unobserved common factors; $\boldsymbol{\gamma}_i$ is the associated vector of parameters corresponding to the common factors; $e_{i,t}$ is the country-specific independent and identically distributed error term; $\bar{Z}_t = (\bar{L}_t, \bar{R}_t, \bar{S}_t, \overline{\boldsymbol{X}}_t)'$ under Equation 4.16 or $\bar{Z}_t = (\bar{L}_t, \bar{R}_t, \bar{S}_t, \overline{\boldsymbol{X}}_t, \overline{R_t \times S_t})'$ under Equation 4.17; p_T is the number of lags; ω's are coefficients of lagged cross-sectional averages. All other variables are as specified before.

The slope coefficients from Equations 4.16 and 4.17 are obtained either through the CCE mean group (CCEMG) estimator, which accounts for slope heterogeneity, or the CCE pooled (CCEP) estimator, which assumes slope homogeneity. Suppose β_{i1}, β_{i2}, and $\boldsymbol{\beta}_{i3}$ under Equation 4.16 are stacked into $\mathbf{b}_i = (\beta_{i1}, \beta_{i2}, \boldsymbol{\beta}_{i3})$ or β_{i1}, β_{i2}, $\boldsymbol{\beta}_{i3}$, and β_{i4} under Equation 4.17 are stacked into $\mathbf{b}_i = (\beta_{i1}, \beta_{i2}, \boldsymbol{\beta}_{i3}, \beta_{i4})$. Then the CCEMG estimator is given by a simple average of individual CCE estimators, $\hat{\mathbf{b}}_i$, as Equation 4.19:

$$\hat{\mathbf{b}}_{\text{CCEMG}} = \frac{1}{N}\sum_{i=1}^{N} \hat{\mathbf{b}}_i \qquad (4.19)$$

Alternatively, the CCEP estimator is obtained through the pooling of observations over the cross-sectional units, such that the individual slope coefficients are assumed to be the same, and it is given by Equation 4.20:

$$\hat{\mathbf{b}}_{\text{CCEP}} = \left(\sum_{i=1}^{N} \mathbf{W}'_i\bar{\mathbf{M}}\mathbf{W}_i\right)^{-1} \sum_{i=1}^{N} \mathbf{W}'_i\bar{\mathbf{M}}\mathbf{L}_i \qquad (4.20)$$

where $\mathbf{W}_i = (\mathbf{w}_{i,1}, \mathbf{w}_{i,2}, \dots \mathbf{w}_{i,T})'$ with $\mathbf{w}_{i,t} = (R_{i,t}, S_{i,t}, Y_{i,t}, \pi_{i,t}, C_{i,t})'$ under Equation 4.16 or $\mathbf{w}_{i,t} = (R_{i,t}, S_{i,t}, Y_{i,t}, \pi_{i,t}, C_{i,t}, R_{i,t} \times S_{i,t})'$ under Equation 4.17; $\mathbf{L}_i = (L_{i,1}, L_{i,2}, \dots L_{i,T})'$; $\bar{\mathbf{M}} = \mathbf{I}_T - \bar{\mathbf{H}}(\bar{\mathbf{H}}'\bar{\mathbf{H}})^{-1}\bar{\mathbf{H}}$ with $\bar{\mathbf{H}} = (\boldsymbol{\tau}_T, \bar{\mathbf{Z}})$, where $\boldsymbol{\tau}_T$ is a $T \times 1$ vector of unity and $\bar{\mathbf{Z}}$ is a $T \times (k+1)$ matrix of observations on $\bar{Z}_t$, with k being the number of independent variables. All other variables are as specified before.

Second, the symmetric error-correction models from Equations 4.7 and 4.8 are rewritten with common factors, in line with Holly, Pesaran and Yamagata (2010) as well as Mohammadi and Parvaresh (2014), as Equations 4.21 and 4.22, respectively:

$$\Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{i,t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta R_{i,t-j} + \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j} + \sum_{j=0}^{s-1} \boldsymbol{\lambda}'_{ij} \Delta \boldsymbol{X}_{i,t-j} + \sum_{\ell=0}^{p_T} \omega_{i\ell} \bar{Z}_{t-\ell} + \varepsilon_{i,t} \quad (4.21)$$

$$\Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{i,t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta R_{i,t-j} + \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j} + \sum_{j=0}^{s-1} \boldsymbol{\lambda}'_{ij} \Delta \boldsymbol{X}_{i,t-j} + \sum_{j=0}^{u-1} \vartheta_{ij} \Delta\left(R_{i,t-j} \times S_{i,t-j}\right) + \sum_{\ell=0}^{p_T} \omega_{i\ell} \bar{Z}_{t-\ell} + \varepsilon_{i,t} \quad (4.22)$$

where $\varepsilon_{i,t}$ is now a composite error term similar to the one specified in Equation 4.18; $\bar{Z}_t = (\Delta \bar{L}_t, \Delta \bar{R}_t, \Delta \bar{S}_t, \Delta \bar{\boldsymbol{X}}_t, \overline{ECT}_{t-1})'$ under Equation 4.21 or $\bar{Z}_t = (\Delta \bar{L}_t, \Delta \bar{R}_t, \Delta \bar{S}_t, \Delta \bar{\boldsymbol{X}}_t, \Delta(\overline{R_t \times S_t}), \overline{ECT}_{t-1})'$ under Equation 4.22, with $\overline{ECT}_{t-1}$ being the equilibrium error. All other variables are as specified before.

Furthermore, the asymmetric representations given by Equations 4.10 to 4.13 are also estimated using the dynamic CCE estimator, and they rewritten are as Equations 4.23 to 4.26, respectively:

$$L_{i,t} = \mu_i + \Omega_t + \beta_{i1}^{+} R_{i,t}^{+} + \beta_{i1}^{-} R_{i,t}^{-} + \beta_{i2} S_{i,t} + \boldsymbol{\beta}_{i3}' \boldsymbol{X}_{i,t} + \sum_{\ell=0}^{p_T} \omega_{i\ell} \bar{Z}_{t-\ell} + \nu_{i,t} \quad (4.23)$$

$$L_{i,t} = \mu_i + \Omega_t + \beta_{i1}^{+} R_{i,t}^{+} + \beta_{i1}^{-} R_{i,t}^{-} + \beta_{i2} S_{i,t} + \boldsymbol{\beta}_{i3}' \boldsymbol{X}_{i,t} + \beta_{i4}\left(R_{i,t} \times S_{i,t}\right) + \sum_{\ell=0}^{p_T} \omega_{i\ell} \bar{Z}_{t-\ell} + \nu_{i,t} \quad (4.24)$$

$$\Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{i,t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \left(\delta_{ij}^{+} \Delta R_{i,t-j}^{+} + \delta_{ij}^{-} \Delta R_{i,t-j}^{-}\right) + \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j} + \sum_{j=0}^{s-1} \boldsymbol{\lambda}_{ij}' \Delta \boldsymbol{X}_{i,t-j} + \sum_{\ell=0}^{p_T} \omega_{i\ell} \bar{Z}_{t-\ell} + \varepsilon_{i,t} \quad (4.25)$$

$$\Delta L_{i,t} = \mu_i + \Omega_t + \phi_i ECT_{i,t-1} + \sum_{j=1}^{p-1} \alpha_{ij} \Delta L_{i,t-j} + \sum_{j=0}^{q-1} \left(\delta_{ij}^{+} \Delta R_{i,t-j}^{+} + \delta_{ij}^{-} \Delta R_{i,t-j}^{-}\right) + \sum_{j=0}^{r-1} \varphi_{ij} \Delta S_{i,t-j} + \sum_{j=0}^{s-1} \boldsymbol{\lambda}_{ij}' \Delta \boldsymbol{X}_{i,t-j} + \sum_{j=0}^{u-1} \vartheta_{ij} \Delta\left(R_{i,t-j} \times S_{i,t-j}\right) + \sum_{\ell=0}^{p_T} \omega_{i\ell} \bar{Z}_{t-\ell} + \varepsilon_{i,t} \quad (4.26)$$

where all the variables are as specified before. The Wald test is then employed to assess if asymmetric long-run and short-run responses of bank credit to changes in bank regulation exist.

4.3.4 Model 1(b): Dynamic Panel Threshold Regression (PTR)

This study further uses the dynamic PTR model to investigate the existence of distortionary effects of bank regulation stringency on bank credit when bank regulation is either ‘too stringent’ (or ‘too lenient’). This technique is more suitable than the threshold model of Hansen (1999), which can yield inconsistent coefficients when using it to estimate a dynamic model because of the endogeneity problem that arises from the correlation between the lagged dependent variable and the error

term. Instead, the dynamic PTR model of Kremer et al. (2013) is used, which follows the approach by Arellano and Bover (1995) of using the future orthogonal deviations transformation to remove individual effects and avoid serial correlation problem arising from taking first differences. Moreover, the dynamic PTR employs the GMM-type estimators as recommended by Caner and Hansen (2004) and incorporates lagged values of the dependent variable as instruments in addressing the endogeneity problem.

This study follows Kremer et al. (2013) and presents the two-regime dynamic PTR model, which is suitable for studies with relatively small sample sizes, to capture the nexus between bank regulation and bank credit as Equation 4.27:

$$L_{i,t} = \mu_i + \Omega_t + \beta_1' \boldsymbol{x}_{i,t} I\left(q_{i,t} \leq \gamma\right) + \beta_2' \boldsymbol{x}_{i,t} I\left(q_{i,t} > \gamma\right) + \varepsilon_{i,t} \tag{4.27}$$

where the threshold level γ is estimated as Equation 4.28:

$$\hat{\gamma} = \underset{\gamma \in [\underline{\gamma}, \overline{\gamma}]}{\operatorname{argmin}} SSR(\gamma) \tag{4.28}$$

and SSR represents the panel sum of squared residuals; $i = 1, \ldots, N$ signifies the country; $t = 1, \ldots, T$ indexes the time; μ_i is a set of country-specific fixed effects; Ω_t is a time dummy variable; β is a k-dimensional vector of coefficients to be estimated; $\varepsilon_{i,t}$ is an independently and normally distributed disturbance term with mean zero and constant variance; $I(\cdot)$ is the indicator function with the value of 1 if the given argument stands, and 0 otherwise, and represents the regime defined by the threshold variable (bank regulatory measure) $q_{i,t}$ and the threshold level γ; $L_{i,t}$ is the dependent variable proxied by bank credit as a ratio of GDP; $\boldsymbol{x}_{i,t}$ is a $2k$-dimensional vector of independent variables, namely, bank regulatory measure (either banking entry barrier, mixing of banking and commerce restriction, banking activity restriction, capital regulation stringency or macroprudential policy index), control variables ($S_{i,t} =$ bank supervisory power, $Y_{i,t} =$ real GDP, $\pi_{i,t} =$ inflation, and $C_{i,t} =$ current account

balance as a ratio of GDP), $L_{i,t-1}$ as a lagged value of the dependent variable, and other endogenous explanatory variables. The vector of independent regressors is divided into two major sub-components, namely, $x_{1i,t}$ as a set of exogenous variables having no correlation with $\varepsilon_{i,t}$, and $x_{2i,t}$ as a set of endogenous variables having correlation with $\varepsilon_{i,t}$. Additionally, the model should have an appropriate set of $m \geq k$ instrumental variables $z_{i,t}$ including $x_{1i,t}$.

4.3.5 Linearity Test and Generalised Method of Moments (GMM) Estimation Technique for Model 1(b)

Prior to estimating Equation 4.27, the study employs the Fischer Lagrange Multiplier (LM) test from Colletaz and Hurlin (2006) to determine whether the null hypothesis of linearity holds. This test has better small-sample size properties over other asymptotic tests statistics that follow the χ^2 distribution. The Fischer LM test is then specified as Equation 4.29:

$$LM_F = \frac{NT(SSR_0 - SSR_1)/mk}{SSR_0/(NT - N - mk)} \tag{4.29}$$

where SSR_0 and SSR_1 are the panel sum of squared residuals under the null hypothesis (linear panel model with individual effects) and the alternative hypothesis (dynamic PTR model), respectively, and all other variables are as explained earlier. LM_F has an approximate $F(mk, NT - N - mk)$ distribution. If the study rejects the null hypothesis, the dynamic PTR model given in Equation 4.27 is estimated.

Following Kremer et al. (2013), the study uses the future orthogonal deviations transformation of Arellano and Bover (1995) to remove individual effects from Equation 4.24, with the disturbance term represented by Equation 4.30:

$$\varepsilon_{i,t}^{*} = \sqrt{\frac{T-t}{T-t+1}}\left[\varepsilon_{i,t} - \frac{1}{T-t}\left(\varepsilon_{i,t+1} + \cdots + \varepsilon_{i,T}\right)\right] \tag{4.30}$$

Therefore, the disturbance terms are uncorrelated, that is:

$$\mathrm{Var}(\varepsilon_i) = \sigma^2 I_T \Rightarrow \mathrm{Var}(\varepsilon_i^*) = \sigma^2 I_{T-1} \tag{4.31}$$

The study incorporates the lags of the dependent variable as instruments during the estimation of a reduced-form regression model for the endogenous variables. Equation 4.27 is then estimated using least squares for a fixed threshold γ whereby the predicted values from the reduced-form regression are used to replace the endogenous variables. Finally, the estimator of the threshold value γ that has the smallest sum of squared residuals is selected. After obtaining the $\hat{\gamma}$, the GMM is employed to determine the estimates of the slope coefficients. Given that the use of GMM requires $N > T$ (Odhiambo, 2020), this study follows Osei and Kim (2020) and averages its data over three-year non-overlapping periods to eliminate cyclical fluctuations and assess the effect of bank regulation on bank credit in the longer horizon. It further restricts the maximum lags of instruments to two in line with Law, Ng, Kutan and Law (2021) to avoid the overfitting of instrumental variables.

4.4 Model 2: Causality Between Bank Regulation and Bank Lending

This section discusses the theoretical and empirical underpinnings of models adopted to determine the symmetric and asymmetric long-run and short-run causality between bank regulatory measures and bank lending. Section 4.4.1 presents the symmetric and asymmetric error correction-based panel Granger-causality models, while Section 4.4.2 discusses the estimation techniques for the panel causality models.

4.4.1 Empirical Specification of Model 2

The theoretical literature further indicates that a reverse causality can exist from institutions to economic performance indicators. This is plausible since economic development is required before laws and regulations can be properly instituted (Rosenberg & Birdzel, 1986). As a result, developments in bank lending, which is a

component of financial development, are expected to shape the direction of bank regulation. In accordance with Patrick (1966), bank regulation can cause bank lending at the early stages of financial development, but at later stages, bank regulation can follow developments in bank lending. Thus, this study employs the symmetric and asymmetric error correction-based panel Granger-causality models to investigate the direction of causality between bank regulation and bank lending. These models are capable of testing for both long-run and short-run causal relationships between bank regulation and bank credit[11].

Symmetric Error Correction-based Panel Granger Causality

The direction of causality between bank lending and bank regulation is then determined within the error correction-based panel causality models specified as Equations 4.32 to 4.33:

$$\Delta L_{i,t} = \mu_{1i} + \phi_{1i} ECT_{1i,t-1} + \sum_{j=1}^{p} \alpha_{1ij} \Delta L_{i,t-j} + \sum_{j=1}^{q} \delta_{1ij} \Delta R_{i,t-j} + \varepsilon_{1i,t} \quad (4.32)$$

$$\Delta R_{i,t} = \mu_{2i} + \phi_{2i} ECT_{2i,t-1} + \sum_{j=1}^{p} \alpha_{2ij} \Delta R_{i,t-j} + \sum_{j=1}^{q} \delta_{2ij} \Delta L_{i,t-j} + \varepsilon_{2i,t} \quad (4.33)$$

where μ's are country-specific intercepts; α's and δ's are parameters to be estimated; ϕ's are coefficients capturing the speed of adjustment; $ECT_{i,t-1}$'s are error-correction terms; ε's are white noise error terms; p and q are the chosen lag lengths. All other variables are as specified before.

Asymmetric Error Correction-based Panel Granger Causality

In line with Hatemi-J (2012), Kouton (2019) as well as Asunka et al. (2020), this study further assesses the long-run and short-run asymmetric causal linkages between bank regulation and bank credit for combinations of $\left(L_{i,t}^{+}, R_{i,t}^{+}\right)$, $\left(L_{i,t}^{-}, R_{i,t}^{-}\right)$, $\left(L_{i,t}^{+}, R_{i,t}^{-}\right)$

[11] The lack of sufficient frequency data on bank regulatory measures could not allow the use of Dumitrescu and Hurlin (2012) approach to panel causality.

and $\left(L_{i,t}^{-}, R_{i,t}^{+}\right)$. Their error-correction representations are provided by Equations 4.34 to 4.41, respectively:

$$\Delta L_{i,t}^{+} = \mu_{1i} + \phi_{1i}^{+}\xi_{i,t-1}^{+} + \sum_{j=1}^{p} \alpha_{1ij}^{+}\Delta L_{i,t-j}^{+} + \sum_{j=1}^{q} \delta_{1ij}^{+}\Delta R_{i,t-j}^{+} + \varepsilon_{1i,t} \tag{4.34}$$

$$\Delta R_{i,t}^{+} = \mu_{2i} + \phi_{2i}^{+}\xi_{i,t-1}^{+} + \sum_{j=1}^{p} \alpha_{2ij}^{+}\Delta R_{i,t-j}^{+} + \sum_{j=1}^{q} \delta_{2ij}^{+}\Delta L_{i,t-j}^{+} + \varepsilon_{2i,t} \tag{4.35}$$

$$\Delta L_{i,t}^{-} = \mu_{3i} + \phi_{3i}^{-}\xi_{i,t-1}^{-} + \sum_{j=1}^{p} \alpha_{3ij}^{-}\Delta L_{i,t-j}^{-} + \sum_{j=1}^{q} \delta_{3ij}^{-}\Delta R_{i,t-j}^{-} + \varepsilon_{3i,t} \tag{4.36}$$

$$\Delta R_{i,t}^{-} = \mu_{4i} + \phi_{4i}^{-}\xi_{i,t-1}^{-} + \sum_{j=1}^{p} \alpha_{4ij}^{-}\Delta R_{i,t-j}^{-} + \sum_{j=1}^{q} \delta_{4ij}^{-}\Delta L_{i,t-j}^{-} + \varepsilon_{4i,t} \tag{4.37}$$

$$\Delta L_{i,t}^{+} = \mu_{5i} + \phi_{5i}^{+}\xi_{i,t-1}^{+} + \sum_{j=1}^{p} \alpha_{5ij}^{+}\Delta L_{i,t-j}^{+} + \sum_{j=1}^{q} \delta_{5ij}^{-}\Delta R_{i,t-j}^{-} + \varepsilon_{5i,t} \tag{4.38}$$

$$\Delta R_{i,t}^{-} = \mu_{6i} + \phi_{6i}^{-}\xi_{i,t-1}^{-} + \sum_{j=1}^{p} \alpha_{6ij}^{-}\Delta R_{i,t-j}^{-} + \sum_{j=1}^{q} \delta_{6ij}^{+}\Delta L_{i,t-j}^{+} + \varepsilon_{6i,t} \tag{4.39}$$

$$\Delta L_{i,t}^{-} = \mu_{7i} + \phi_{7i}^{-}\xi_{i,t-1}^{-} + \sum_{j=1}^{p} \alpha_{7ij}^{-}\Delta L_{i,t-j}^{-} + \sum_{j=1}^{q} \delta_{7ij}^{+}\Delta R_{i,t-j}^{+} + \varepsilon_{7i,t} \tag{4.40}$$

$$\Delta R_{i,t}^{+} = \mu_{8i} + \phi_{8i}^{+}\xi_{i,t-1}^{+} + \sum_{j=1}^{p} \alpha_{8ij}^{+}\Delta R_{i,t-j}^{+} + \sum_{j=1}^{q} \delta_{8ij}^{-}\Delta L_{i,t-j}^{-} + \varepsilon_{8i,t} \tag{4.41}$$

where:

$$L_{i,t}^{+} = \sum_{k=1}^{t} \Delta L_{ik}^{+} = \sum_{k=1}^{t} \max(\Delta L_{ik}^{+}, 0) \quad (4.42)$$

$$L_{i,t}^{-} = \sum_{k=1}^{t} \Delta L_{ik}^{-} = \sum_{k=1}^{t} \min(\Delta L_{ik}^{-}, 0) \quad (4.43)$$

$$R_{i,t}^{+} = \sum_{k=1}^{t} \Delta R_{ik}^{+} = \sum_{k=1}^{t} \max(\Delta R_{ik}^{+}, 0) \quad (4.44)$$

$$R_{i,t}^{-} = \sum_{k=1}^{t} \Delta R_{ik}^{-} = \sum_{k=1}^{t} \min(\Delta R_{ik}^{-}, 0) \quad (4.45)$$

and μ_i's are country-fixed effects; α_{ij}'s and δ_{ij}'s are coefficients to be estimated; $\xi_{i,t-1}$'s are the error-correction terms capturing the long-run equilibrium within each model. All other variables are as specified before.

4.4.2 Estimation Techniques for Model 2

This study employs the panel error correction method to estimate the long-run and short-run symmetric as well as asymmetric causal linkages between bank regulation and bank credit. First, after estimating Equations 4.32 to 4.33, the symmetric short-run causality between bank regulation and bank lending exists if the null hypotheses that each $\delta = 0$ is rejected, using the Wald test, while the symmetric long-run causality exists if the null hypotheses that each $\phi = 0$ in those equations is rejected (Odhiambo, 2017, 2021). However, if there is no cointegration between bank regulation and bank lending, only the symmetric short-run causality results are estimated.

Second, following the estimation of Equations 4.34 to 4.41, the asymmetric short-run causal effect running from, say $R_{i,t}^{+}$ to $L_{i,t}^{+}$, captured by Equation 4.34, is given by the rejection of the null hypothesis that all δ_{1ij}^{+}'s are equal to zero, using the Wald test,

while the asymmetric long-run causality exists if the null hypothesis that ϕ_{1i}^{+} equals to zero is rejected. The same applies to all other combinations. But if no cointegration exists between bank regulation and bank lending, only the asymmetric short-run causality results are estimated.

Lastly, after estimating the symmetric and asymmetric Granger causality models, the study runs the residual diagnostic tests. These include serial autocorrelation (Lagrange multiplier), heteroscedasticity (joint), as well as normality (Jarque-Bera) tests.

4.5 Other Estimation Techniques

This section presents other estimation techniques used in the analysis of this study. Sections 4.5.1 to 4.5.4 discusses the cross-sectional dependence, panel unit root, slope homogeneity, as well as panel cointegration tests, respectively.

4.5.1 Cross-sectional Dependence Tests

It is necessary to test for cross-sectional dependence in panel data analysis since similar countries such as developing economies could experience the effects of a shock emanating from any of the countries included in the sample because of their interconnectedness. Thus, the study employs four tests that are commonly used in the literature. The first one that is more valid when the time dimension (*T*) is greater than the number of cross-sectional units (*N*) is the Lagrange multiplier (LM) test proposed by Breusch and Pagan (1980). This test has a null hypothesis of cross-sectional independence and is asymptotically chi-squared distributed. However, in the case of large *N* and *T*, Pesaran (2004, 2021) suggested the scaled version of the LM test, which is asymptotically normally distributed under the null hypothesis of no cross-sectional dependence.

Given that the scaled LM test might experience significant size distortions when *N* is sufficiently large and *T* is relatively small, Pesaran (2004, 2021) proposed another

cross-sectional dependence (CD) test that is based on the pair-wise correlation coefficients instead of their squares. This test follows an asymptotically standard normal distribution under the null hypothesis of no cross-sectional dependence. Lastly, the bias-adjusted LM test was proposed by Pesaran, Ullah and Yamagata (2008) for a heterogeneous panel data model with a sequential asymptotic distribution whereby *T* approaches infinity first and then *N*, and by Baltagi, Feng and Kao (2012) in the case of a fixed effects homogeneous panel data model when both *T* and *N* approaches infinity. This test follows a normal distribution under the null hypothesis of cross-sectional independence.

4.5.2 Panel Unit Root Tests

Following cross-sectional dependence tests, this study undertakes panel unit root tests to analyse the order of integration of variables. In the absence of cross-sectional dependence, the study employs the first-generation unit root tests, namely, Levin, Lin and Chu (LLC) (2002), Im, Pesaran and Shin (IPS) (2003) and augmented Dickey-Fuller (ADF) Fisher-type tests (Maddala & Wu, 1999). These traditional unit tests impose an assumption of cross-sectional independence, and their null hypothesis is that the series has a unit root. For example, consider the data generating process given by Equation 4.46:

$$Y_{i,t} = \alpha_i + \rho_i Y_{i,t-1} + \varepsilon_{i,t} \qquad (4.46)$$

where α_i and ρ_i are parameters to be estimated and $\varepsilon_{i,t}$ is the mutually independent idiosyncratic error term. If $|\rho_i| = 1$, then Y_i has a unit root. The LLC panel unit root test then assumes common parameters across the cross-sectional units, that is $\rho_i = \rho$, while the IPS and ADF panel unit root tests allow the persistence parameters to vary across cross-sectional units.

If the study establishes that there is cross-sectional dependence among the series, the first-generation unit root tests would be biased and lead to incorrect conclusions. To circumvent this problem, the study employs the second-generation unit root test of

Pesaran (2007), namely, cross-sectionally augmented Im-Pesaran-Shin (CIPS) unit root test, which accounts for cross-sectional heterogeneity and error cross-sectional dependence. The CIPS unit root test is obtained by taking simple averages of individual cross-sectionally augmented Dickey-Fuller (CADF) statistics, whereby the standard ADF regressions are augmented with cross-sectional averages of lagged levels and first differences of the individual series. The test is applicable when *T* and *N* have similar orders of magnitudes and possesses satisfactory size properties and power even under relatively small sample sizes. Its null hypothesis is that the series has a unit root.

4.5.3 Slope Homogeneity Tests

Since countries are at different stages of development, it is imperative to determine whether the slope parameters are homogeneous or not. This study does so by employing the Roy-Zellner test (see Baltagi, 2008; Schiavo & Vaona, 2008). This technique estimates the random effects model for the unpooled panel data even in the case of nonspherical disturbances and tests for the equality of the slope parameters under the null hypothesis using the Wald test. If the null hypothesis of slope homogeneity is rejected, the study then employs models that account for parameter heterogeneity.

4.5.4 Panel Cointegration Tests

After determining the order of integration of variables and testing for slope homogeneity, the study then applies panel cointegration tests to establish the existence of a long-run relationship among variables that are integrated of order one. If no cross-sectional dependence is found among the series, the study employs the first-generation panel cointegration tests proposed by Kao (1999) and Pedroni (1999, 2004). The Kao (1999) and Pedroni (1999, 2004) tests are residual-based cointegration tests for panel data. The former test imposes a homogeneous cointegrating vector, while the latter tests allow it to be heterogeneous. Moreover, the Pedroni (1999, 2004) tests are seven in total but can be classified into two categories, namely, the panel statistics (or the within dimension) and the group mean

statistics (or between dimension). The former is similar to the unit root test against the homogeneous alternatives, while the latter averages individual estimated autoregressive coefficients for each cross-sectional unit (Mahembe & Odhiambo, 2016). The null hypothesis for the Kao (1999) and Pedroni (1999, 2004) tests is that no cointegration exists against the alternative hypothesis that there is cointegration.

In the case where the series are cross-sectionally dependent, the first-generation panel cointegration tests will yield incorrect results since these residual-based cointegration tests impose a common factor restriction (Kremers, Ericsson & Dolado, 1992). As a result, the study opts for the second-generation panel cointegration tests, which are broadly categorised into error correction-based and residual-based panel cointegration tests. The most common tests, in the case of the former, are the ones proposed by Westerlund (2007), which do not impose a common factor restriction. These tests are made up of four test statistics, with the first two classified as group mean-based tests, while the other two are panel-based tests. The group mean-based tests have the null hypothesis of no error correction against the alternative hypothesis that at least one cross-sectional unit is cointegrated. On the other hand, the panel-based tests have the null hypothesis that there is no error correction against the alternative hypothesis that the whole panel is cointegrated. Moreover, a bootstrap procedure of these tests accounts for the presence of cross-sectional dependence in panel data analysis. However, these tests are applicable when N is small and T is large. For instance, Westerlund (2007) considers Monte Carlo simulations of panels where N ranges from 10 to 20 and T ranges from 100 to 200.

This study then adopts a two-stage second-generation residual-based technique proposed by Holly et al. (2010) (also see Banerjee & Carrion-i-Silvestre, 2017) to determine the existence of cointegration among variables. In the first stage, the study uses the CCE estimator (discussed in Section 4.3.3), which allows for unobserved common factors that might be correlated with the observed regressors, to obtain the residuals. In the second stage, the study applies the CIPS panel unit root test, which is given by the simple averages of individual CADF statistics, to the obtained

residuals. If the null hypothesis of unit root is rejected, it can, therefore, be concluded that the variables are cointegrated.

4.6 Data Sources and Definition of Variables

This study uses an annual sample dataset from 23 SSA countries, with 12 low-income economies and 11 middle-income economies, during the period spanning 1995 to 2017. The income classifications are based on the World Bank Atlas method for 2017, which divided countries according to their gross national income (GNI) per capita, namely, High-income = more than $12,235; Upper middle-income = $3,956 - $12,235; Lower middle-income = $1,006 - $3,955; and Low-income = less than $1,006. The selected countries have data from at least three out of five World Bank's BRSS, including the last one administered in 2017 and released in 2019 (see Table 2.3 in Chapter 2 for a list of selected countries). These surveys were completed in 1999, 2003, 2007, 2011 and 2019 by Barth et al. (2001, 2004, 2008), Cihak et al. (2013) and Anginer et al. (2019), respectively. Barth et al. (2013) then provided a database from the first four surveys but also addressed their observed inconsistencies and missing values.

The data on the measure of bank lending, namely, bank credit to the domestic private sector as a share of GDP, are sourced from the databases of the World Bank Financial Development and Structure, the World Bank Global Financial Development and the International Monetary Fund International Financial Statistics. For bank regulatory measures, the study uses the banking entry barrier, mixing of banking and commerce restriction, banking activity restriction and capital regulation stringency indices from the World Bank's BRSS, and macroprudential indices computed using the approach by Cerutti et al. (2017) as well as the information from individual central bank or country laws and/or regulations. As explained in Section 2.3 of Chapter 2, the banking entry barrier index captures the degree of restrictions on the licensing and foreign ownership of banks, while the mixing of banking and commerce restriction index measures the extent of ownership and control between banks, non-financial firms and non-bank financial firms. The banking activity restriction index

measures the degree of restrictions on engagement in securities, insurance, and real estate activities by banks, whereas the capital regulation index captures the stringency of bank regulatory requirements regarding bank capital. Lastly, the macroprudential index measures the degree of macroprudential regulation using a simple sum of scores on relevant macroprudential policies. Table 2.2 in Chapter 2 provided the sub-components, qualification criteria, and range for each index.

In addition, the study uses the data from the World Bank's BRSS on bank supervisory power index as part of the control variables. This index measures the degree to which bank supervisory authorities possess the power to prevent, correct and resolve problem banks. Table 4.1 provides the qualification criteria and range for the supervisory power index. Furthermore, the data on macroeconomic control variables, namely, real GDP, inflation, and current account balance as a share of GDP, come from the International Monetary Fund World Economic Outlook and the World Bank World Development Indicators. Table 4.2 summarises the data sources and description of all variables used in the estimations of this study.

Table 4.1 Measurement of bank supervisory power index

Index	Sub-components	Qualification	Range
Supervisory power	-	Questions: *a) Can supervisors meet external auditors to discuss report without bank approval? b) Are auditors legally required to report misconduct by managers/directors to supervisory agency? c) Can legal action against external auditors be taken by supervisor for negligence? d) Can supervisors force banks to change internal organisational structure? e) Are off-balance sheet items disclosed to supervisors? f) Can the supervisory agency order directors/management to constitute provisions to cover actual/potential losses? g) Can the supervisory agency suspend director's decision to distribute: i) dividends? ii) bonuses? iii) management fees? h) Can the supervisory agency supersede bank shareholder rights and declare bank insolvent? i) Does banking law allow supervisory agency to suspend some or all ownership rights of a problem bank? j) Regarding bank restructuring and reorganisation, can supervisory agency or any government agency do the following: i) supersede shareholder rights? ii) remove and replace management? iii) remove and replace directors? [Yes = 1; No = 0; for each]*	0-14

Sources: Barth et al. (2001, 2004, 2008, 2013), Cihak et al. (2013) and Anginer et al. (2019).

Table 4.2 Data sources and definitions of variables

Variable	Source	Definition
Dependent variables		
Bank credit/GDP	World Bank Financial Development and Structure Dataset, Global Financial Development Database, International Monetary Fund International Financial Statistics	Bank credit to the domestic private sector as a share of GDP
Bank regulatory measures		
Entry barrier index	World Bank's Bank Regulation and Supervision Surveys	Measures the degree of restrictions on bank licensing and foreign ownership
Mixing of banking and commerce restriction index	World Bank's Bank Regulation and Supervision Surveys	Measures the extent to which banks, non-financial firms, and non-bank financial firms can own and control each other
Activity restriction index	World Bank's Bank Regulation and Supervision Surveys	Measures the degree of restrictions on engagement in securities, insurance, and real estate activities by banks
Capital regulation index	World Bank's Bank Regulation and Supervision Surveys	Measures the stringency of bank regulatory requirements regarding bank capital
Macroprudential Index	Individual central bank or country laws and/or regulations	Measures the degree of macroprudential regulation using the simple sum of the scores on relevant macroprudential policies
Macroeconomic and institutional variables		
Real GDP	International Monetary Fund World Economic Outlook, World Bank World Development Indicators	Real gross domestic product (in purchasing power parity, 2011 international dollar)
Current account balance/GDP	International Monetary Fund World Economic Outlook, World Bank World Development Indicators	Current account balance as a share of GDP
Inflation	International Monetary Fund World Economic Outlook, World Bank World Development Indicators	Consumer price index

Variable	Source	Definition
Supervisory power index	World Bank's Bank Regulation and Supervision Surveys	Measures the degree to which supervisory authorities have power to prevent, correct, and resolve problem banks

Source: Own compilation.

4.7 Conclusion

This chapter began by discussing the analytical framework providing channels through which bank regulation and bank lending could affect each other and how other macroeconomic and institutional factors could influence this relationship. It then presented empirical model specifications on the impact of bank regulation (and its interaction with bank supervision) on bank lending. It also explained the dynamic panel ADRL models estimated through the dynamic CCE technique, which accounted for endogeneity and cross-sectional dependence, used for analysing the long-run and short-run symmetric as well as asymmetric impact of bank regulation (and its interaction with bank supervision) on bank lending. Moreover, it presented the dynamic PTR model, which incorporated the GMM-type estimators to control for endogeneity and estimate the threshold effects of bank regulatory measures on bank credit. The chapter further specified the empirical models underpinning the causal relationship between bank regulation and bank lending. It discussed the error correction-based panel Granger causality models used to examine the long-run and short-run symmetric as well as asymmetric causal relationship between bank regulation and bank lending. Additionally, it outlined other estimation techniques used in this study, including the tests for cross-sectional dependence, panel unit root, slope homogeneity and panel cointegration. Lastly, the chapter discussed the data sources and definitions of variables used in the estimations of this study. Based on these estimation techniques and data sources, the next chapter presents the estimated results and their analysis.

CHAPTER 5

ECONOMETRIC ANALYSIS AND EMPIRICAL FINDINGS

5.1 Introduction

This chapter presents the econometric analysis and empirical findings from the empirical models and estimation techniques discussed in the preceding chapter. First, the study employed the dynamic panel ARDL model to determine the linear and nonlinear impact of bank regulatory measures, and their interaction with bank supervision, on bank lending. Furthermore, it used the dynamic PTR model to assess the threshold effects of bank regulatory measures on bank credit. Second, the study adopted the panel Granger causality model to investigate the symmetric and asymmetric causal relationship between bank regulatory measures and bank lending.

The chapter is divided into five sections. Following the introduction, Section 5.2 presents the estimated results on the linear and nonlinear impact of bank regulatory measures on bank lending, including the result on the threshold effects of bank regulatory measures on bank credit. Then Section 5.3 offers the empirical findings on the symmetric and asymmetric causal relationship between bank regulatory measures and bank lending. Section 5.4 provides the summary and discussion of the main empirical findings, and Section 5.5 concludes the chapter.

5.2 Results on the Impact of Bank Regulation on Bank Lending

This section presents the results on the impact of bank regulation, and its interaction with bank supervision, on bank lending. First, Section 5.2.1 to Section 5.2.6 provide the summary statistics, correlation analysis, cross-sectional dependence test results, panel unit root test results, slope homogeneity test results and panel cointegration test results, respectively. Second, Section 5.2.7 discusses the linear and nonlinear panel ARDL model results estimated through the CCEMG technique. Lastly, Section 5.2.8 presents and analyses the results from the dynamic PTR model obtained from the GMM estimation technique.

5.2.1 Summary Statistics

The panel sample for this study includes 23 SSA countries, with 12 low-income countries and 11 middle-income countries, over the period 1995 to 2017. The dependent variable is bank lending proxied by bank credit to the private sector as a share of GDP. Although this variable averaged 0.20 in all selected SSA economies, middle-income SSA countries exhibited a higher average (0.27) than low-income SSA economies (with an average of 0.13). While there is minimum overall variation in terms of standard deviation in the bank lending variable for all selected SSA economies, middle-income SSA countries still experienced higher variation than low-income SSA economies.

When it comes to bank regulatory and supervisory indices, which are normalised to one, the majority of the indices (namely, banking entry barrier, mixing of banking and commerce restriction, banking activity restriction, capital regulation stringency and bank supervisory power indices) exhibited the stringency that averaged over half in all selected SSA countries, as well as in low-income and middle-income SSA economies. Only the stringency of the macroprudential index averaged close to zero in all selected SSA economies and their income groups. Overall, all these bank regulatory and supervisory indices portrayed minimum variations in all the specified groups.

In the case of macroeconomic variables, economic growth, which is captured by the log of real GDP, as well as current account balance as a share of GDP averaged higher in middle-income SSA economies than in low-income SSA countries, while the reverse is seen with inflation, which is captured by the log of consumer price index. Nevertheless, all the macroeconomic variables generally experienced minimum variations in all the specified groups of countries. Therefore, Table 5.1 provides the summary statistics in a form of the mean, standard deviation, minimum and maximum for all variables under consideration.

Table 5.1 Summary statistics

Variables	Obs.	Mean	Std. dev.	Min.	Max.
All selected SSA countries					
Bank lending variable					
Bank credit/GDP (L)	529	0.20	0.18	0.01	1.03
Bank regulatory and supervisory indices[a]					
Entry barrier (R_{EB})	529	0.56	0.08	0.38	0.75
Mixing banking & commerce (R_{BC})	529	0.63	0.11	0.33	0.92
Activity restriction (R_{AR})	529	0.66	0.12	0.42	1.00
Capital regulation (R_{CR})	529	0.66	0.16	0.30	1.00
Macroprudential (R_{MP})	529	0.07	0.09	0.00	0.42
Supervisory power (S)	529	0.71	0.18	0.29	1.00
Macroeconomic variables					
Real GDP[b] (in log form) (Y)	529	24.00	1.40	21.14	27.66
Inflation (log of consumer price index) (π)	529	4.33	1.03	-6.91	6.06
Current account (balance)/GDP (C)	529	-0.04	0.08	-0.30	0.41
Low-income SSA countries					
Bank lending variable					
Bank credit/GDP (L)	276	0.13	0.07	0.01	0.40
Bank regulatory and supervisory indices[a]					
Entry barrier (R_{EB})	276	0.58	0.07	0.38	0.69
Mixing banking & commerce (R_{BC})	276	0.63	0.09	0.50	0.83
Activity restriction (R_{AR})	276	0.64	0.11	0.42	1.00
Capital regulation (R_{CR})	276	0.65	0.16	0.30	1.00
Macroprudential (R_{MP})	276	0.05	0.10	0.00	0.42
Supervisory power (S)	276	0.69	0.17	0.29	1.00
Macroeconomic variables					
Real GDP[b] (in log form) (Y)	276	23.48	0.98	21.14	25.73
Inflation (log of consumer price index) (π)	276	4.41	0.67	1.30	6.06
Current account (balance)/GDP (C)	276	-0.07	0.05	-0.26	0.03
Middle-income SSA countries					
Bank lending variable					
Bank credit/GDP (L)	253	0.27	0.23	0.01	1.03
Bank regulatory and supervisory indices[a]					
Entry barrier (R_{EB})	253	0.54	0.08	0.44	0.75
Mixing banking & commerce (R_{BC})	253	0.62	0.14	0.33	0.92
Activity restriction (R_{AR})	253	0.68	0.13	0.42	0.92
Capital regulation (R_{CR})	253	0.67	0.17	0.30	1.00
Macroprudential (R_{MP})	253	0.09	0.08	0.00	0.33
Supervisory power (S)	253	0.73	0.18	0.29	1.00

Variables	Obs.	Mean	Std. dev.	Min.	Max.
Middle-income SSA countries					
Macroeconomic variables					
Real GDP[b] (in log form) (Y)	253	24.57	1.55	21.78	27.66
Inflation (log of consumer price index) (π)	253	4.25	1.31	-6.91	5.83
Current account (balance)/GDP (C)	253	0.00	0.08	-0.30	0.41

Notes: The sample is composed of 23 SSA economies, with 12 low-income countries and 11 middle-income countries, over the period 1995-2017; [a]normalised to one; [b]in purchasing power parity (2011 international dollar); Obs. represents observations; Std. dev. represents standard deviation; Min. represents minimum; Max. represents maximum.

5.2.2 Correlation Analysis

The study employs pair-wise correlation analysis to ascertain correlations among the variables used in this study. Table 5.2 presents the correlation matrix of all variables in the selected SSA countries and their income groups. The two asterisks (**) next to the correlation coefficients represent statistical significance at the 5% level or better.

As shown in Table 5.2, there is a negative and significant relationship between bank credit to the private sector as a share of GDP and the banking entry barrier index in all selected SSA economies and middle-income SSA countries. However, the two variables are positively and significantly related in the context of low-income SSA economies. The mixing of banking and commerce restriction, banking activity restriction and capital regulation stringency indices have an insignificant association with bank credit to the private sector as a share of GDP in all selected SSA economies. However, the banking activity restriction index is negatively and significantly related to bank credit to the private sector as a share of GDP in both low-income and middle-income SSA countries. On the other hand, the capital regulation stringency index and bank credit to the private sector as a share of GDP are negatively associated in low-income SSA countries but positively and significantly related in middle-income SSA economies. The macroprudential index is positively and significantly associated with bank credit to the private sector as a share of GDP only in all selected SSA countries, while a negative and significant association exists between bank supervisory power and bank credit to the private sector as a ratio of GDP in all selected SSA countries and low-income SSA economies.

Table 5.2 further shows that real GDP and inflation have a positive and significant relationship with bank credit to the private sector as a share of GDP in all selected SSA countries and low-income SSA economies, whereas only inflation has a positive and significant association with bank credit to the private sector as a ratio of GDP in middle-income SSA economies. The current account balance as a share of GDP has a negative and significant relationship with bank credit to the private sector as a share of GDP only in the context of middle-income SSA economies. Lastly, even

though some significant and negative or positive correlations exist amongst bank regulatory and supervisory indices, as well as macroeconomic variables, the likelihood of multicollinearity among these independent variables is low as none of them has a correlation coefficient of 0.80 or above with another variable.

Table 5.2 Correlation matrix

Variables	L	R_{EB}	R_{BC}	R_{AR}	R_{CR}	R_{MP}	S	Y	π	C
All selected SSA countries										
L	1.00									
R_{EB}	-0.30**	1.00								
R_{BC}	-0.03	-0.18**	1.00							
R_{AR}	-0.08	0.03	0.01	1.00						
R_{CR}	0.06	0.20**	0.03	0.13**	1.00					
R_{MP}	0.12**	-0.16**	0.26**	0.25**	0.00	1.00				
S	-0.11**	0.08	0.00	0.25**	0.25**	0.13**	1.00			
Y	0.25**	0.24**	-0.21**	-0.15**	0.16**	0.01	0.23**	1.00		
π	0.11**	0.09**	0.30**	-0.30**	0.08	0.05	-0.09**	0.07	1.00	
C	0.04	-0.07	0.02	0.05	0.03	-0.01	-0.01	0.20**	-0.02	1.00
Low-income SSA countries										
L	1.00									
R_{EB}	0.12**	1.00								
R_{BC}	0.08	0.16**	1.00							
R_{AR}	-0.30**	0.20**	-0.04	1.00						
R_{CR}	-0.35**	0.00	0.21**	0.26**	1.00					
R_{MP}	-0.02	-0.18**	0.53**	0.38**	-0.02	1.00				
S	-0.42**	0.32**	0.28**	0.42**	0.46**	0.23**	1.00			
Y	0.23**	0.45**	0.24**	0.08	-0.05	0.06	0.43**	1.00		
π	0.30**	0.19**	0.19**	-0.50**	-0.10	-0.16**	0.08	0.44**	1.00	
C	-0.12	-0.08	-0.13**	0.11	-0.09	-0.09	-0.12	-0.05	-0.10	1.00

Variables	L	R_{EB}	R_{BC}	R_{AR}	R_{CR}	R_{MP}	S	Y	π	C
Middle-income SSA countries										
L	1.00									
R_{EB}	-0.34**	1.00								
R_{BC}	-0.02	-0.42**	1.00							
R_{AR}	-0.15**	-0.01	0.06	1.00						
R_{CR}	0.16**	0.42**	-0.07	0.00	1.00					
R_{MP}	0.06	-0.02	0.10	0.04	-0.02	1.00				
S	-0.11	-0.06	-0.18**	0.08	0.03	-0.04	1.00			
Y	0.09	0.36**	-0.39**	-0.42**	0.26**	-0.23**	0.05	1.00		
π	0.14**	0.02	0.34**	-0.20**	0.19**	0.25**	-0.18**	0.00	1.00	
C	-0.20**	0.12	0.13**	-0.12	0.04	-0.18**	-0.04	0.05	0.06	1.00

Notes: L = bank credit/GDP; R_{EB} = entry barrier index; R_{BC} = mixing banking & commerce restriction index; R_{AR} = activity restriction index; R_{CR} = capital regulation index; R_{MP} = macroprudential index; S = supervisory power index; Y = real GDP; π = inflation; C = current account/GDP; ** represents statistical significance at the 5% level or better.

5.2.3 Cross-sectional Dependence Test Results

The study investigates the extent of cross-sectional dependence of the errors from the ADF(p) regressions of bank lending, bank regulatory and supervisory indices, and macroeconomic variables across all selected SSA economies, as well as in low-income and middle-income SSA countries. First, the study computes the p-th-order augmented Dickey-Fuller [ADF(p)] with an intercept and a linear trend for all variables under each cross-sectional unit separately. It then calculates average sample estimates of the cross-correlation coefficients of the residuals ($\bar{\hat{\rho}}$) for the lag orders of p = 1, 2, 3, 4. The results reported in Table 5.3 are reasonably robust under different choices of the augmentation order, p. Overall, the average sample estimates of the cross-correlation coefficients of the residuals for all the variables range from around 16% to 58% in the case of all SSA economies, 21% to 88% in low-income SSA countries and 25% to 65% in middle-income SSA economies.

The cross-sectional dependence tests are then undertaken to determine if the observed residual cross-correlations from Table 5.3 are statistically significant. Table 5.4 to Table 5.7 present the Pesaran scaled LM, Breusch-Pagan scaled LM, Bias-corrected scaled LM and Pesaran CD test statistics, respectively. The Pesaran scaled LM test statistics (in Table 5.4) are preferred in the context of all SSA economies, since N and T are both large, while the Breusch-Pagan scaled LM test statistics (in Table 5.5) are preferred in the cases of low-income and middle-income countries, since T is greater than N. Other test statistics are, therefore, included as part of robustness check.

The results from the Pesaran scaled LM test in Table 5.4 indicate that the residual cross-correlations in the case of all selected SSA countries are statistically significant for almost all the variables under the chosen lags. Other test statistics from Table 5.5 to Table 5.7 are generally in agreement with the Pesaran scaled LM test results. Thus, the null hypothesis of no error cross-sectional dependence in the context of all SSA economies is rejected, thereby invalidating the use of panel unit root tests that do not account for error cross-sectional dependence.

In the case of low-income SSA countries, the results from the Breusch-Pagan scaled LM test in Table 5.5 show that the residual cross-correlations are statistically significant for almost all the variables under the chosen lags, except for real GDP (which has insignificant residual cross-correlations under lags 1 and 2) and macroprudential index (which has insignificant residual cross-correlations under all lags). Other test statistics reported in Table 5.4 as well as Table 5.6 to Table 5.7 are generally in agreement with the Breusch-Pagan scaled LM test results. Therefore, the null hypothesis of no error cross-sectional dependence in the context of low-income SSA economies is rejected where the test statistics for cross-sectional dependence are significant, and this nullifies the use of panel unit root tests that do not account for error cross-sectional dependence. The panel unit root tests that assume cross-sectional independence are valid only in the case of real GDP and macroprudential index in low-income SSA countries.

Finally, the Breusch-Pagan scaled LM test results for middle-income SSA economies reported in Table 5.5 indicate that the residual cross-correlations are statistically significant for almost all the variables under the chosen lags, except for the macroprudential index, which has insignificant residual cross-correlations under all lags. Other test statistics from Table 5.4 and Table 5.6 to Table 5.7 are generally in agreement with the Breusch-Pagan scaled LM test results. Hence, the null hypothesis of no error cross-sectional dependence in the case of middle-income SSA economies is rejected where the test statistics for cross-sectional dependence are significant, and this invalidates the use of panel unit root tests that do not account for error cross-sectional dependence. The panel unit root tests that assume cross-sectional independence are applicable only in the case of the macroprudential index in middle-income SSA countries.

Table 5.3 Average residual cross-correlation coefficients ($\bar{\hat{\rho}}$) from the ADF(*p*) regressions

Variables	ADF(1)	ADF(2)	ADF(3)	ADF(4)
All selected SSA countries				
L	0.22	0.22	0.20	0.20
R_{EB}	0.57	0.57	0.57	0.58
R_{BC}	0.27	0.27	0.27	0.25
R_{AR}	0.44	0.44	0.45	0.42
R_{CR}	0.52	0.52	0.52	0.54
R_{MP}	0.53	0.53	0.52	0.54
S	0.34	0.34	0.34	0.34
Y	0.20	0.20	0.20	0.19
π	0.35	0.32	0.36	0.34
C	0.17	0.16	0.16	0.16
Low-income SSA countries				
L	0.29	0.27	0.27	0.30
R_{EB}	0.63	0.63	0.63	0.64
R_{BC}	0.39	0.40	0.40	0.41
R_{AR}	0.58	0.58	0.58	0.57
R_{CR}	0.88	0.87	0.87	0.87
R_{MP}	0.83	0.83	0.84	0.84
S	0.67	0.66	0.67	0.65
Y	0.27	0.28	0.27	0.25
π	0.51	0.47	0.48	0.46
C	0.22	0.22	0.22	0.21
Middle-income SSA countries				
L	0.38	0.37	0.33	0.33
R_{EB}	0.65	0.65	0.65	0.65
R_{BC}	0.29	0.29	0.29	0.25
R_{AR}	0.42	0.41	0.42	0.37
R_{CR}	0.38	0.39	0.39	0.42
R_{MP}	0.34	0.34	0.34	0.36
S	0.37	0.38	0.38	0.41
Y	0.34	0.32	0.35	0.33
π	0.39	0.39	0.42	0.39
C	0.28	0.28	0.28	0.31

Notes: *p*-th-order augmented Dickey-Fuller [ADF(*p*)] for all variables are computed for each cross-sectional unit separately; ADF(*p*) regressions include an intercept and a linear trend; $\bar{\hat{\boldsymbol{\rho}}}$ = the simple average of the pair-wise cross-correlation coefficients of the residuals from the ADF(*p*) regressions; $\boldsymbol{L}$ = bank credit/GDP; $\boldsymbol{R_{EB}}$ = entry barrier index; $\boldsymbol{R_{BC}}$ = mixing banking & commerce restriction index; $\boldsymbol{R_{AR}}$ = activity restriction index; $\boldsymbol{R_{CR}}$ = capital regulation index; $\boldsymbol{R_{MP}}$ = macroprudential index; $\boldsymbol{S}$ = supervisory power index; $\boldsymbol{Y}$ = real GDP; $\boldsymbol{\pi}$ = inflation; $\boldsymbol{C}$ = current account/GDP.

Table 5.4 Pesaran scaled LM test statistics

Variables	ADF(1)	ADF(2)	ADF(3)	ADF(4)
All selected SSA countries				
L	6.73***	7.01***	6.67***	6.89***
R_{EB}	60.93***	59.96***	60.46***	60.27***
R_{BC}	99.49***	96.88***	97.86***	98.02***
R_{AR}	82.41***	78.72***	81.22***	77.08***
R_{CR}	127.24***	123.76***	124.73***	123.33***
R_{MP}	2.02**	1.61	1.76**	0.52
S	76.02***	75.41***	76.15***	77.38***
Y	3.18***	3.11***	5.41***	4.67***
π	25.02***	22.33***	22.99***	18.10***
C	5.43***	5.40***	6.46***	7.17***
Low-income SSA countries				
L	2.16**	2.16**	3.04***	4.34***
R_{EB}	50.02***	49.88***	49.88***	49.57***
R_{BC}	67.99***	66.25***	66.45***	64.39***
R_{AR}	48.48***	47.05***	48.30***	48.18***
R_{CR}	89.91***	89.01***	89.02***	88.10***
R_{MP}	-0.31	-0.81	-1.28	-1.47
S	55.04***	54.94***	55.29***	55.41***
Y	1.06	0.78	2.30**	3.25***
π	20.49***	19.04***	15.93***	11.79***
C	2.02**	2.39**	2.44**	2.73**
Middle-income SSA countries				
L	3.44***	3.47***	3.18***	3.13***
R_{EB}	20.18***	19.89***	20.48***	21.17***
R_{BC}	31.50***	30.59***	30.44***	31.65***
R_{AR}	28.74***	26.69***	27.53***	25.29***
R_{CR}	44.07***	41.72***	42.61***	39.66***
R_{MP}	-0.22	-0.33	0.21	-0.72
S	33.25***	32.98***	33.02***	31.65***
Y	4.05***	3.49***	5.17***	2.65***
π	8.36***	5.94***	10.00***	7.05***
C	4.46***	4.66***	5.61***	5.86***

Notes: The test statistics are based on the residuals from the *p*-th-order augmented Dickey-Fuller [ADF(*p*)] regressions; ADF(*p*) regressions include an intercept and a linear trend; LM = Lagrange multiplier; $L =$ bank credit/GDP; $R_{EB} =$ entry barrier index; $R_{BC} =$ mixing banking & commerce restriction index; $R_{AR} =$ activity restriction index; $R_{CR} =$ capital regulation index; $R_{MP} =$ macroprudential index; $S =$ supervisory power index; $Y =$ real GDP; π = inflation; $C =$ current account/GDP; H_0: no error cross-sectional dependence; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.5 Breusch-Pagan scaled LM test statistics

Variables	ADF(1)	ADF(2)	ADF(3)	ADF(4)
All selected SSA countries				
L	404.03***	410.76***	403.09***	407.91***
R_{EB}	1140.83***	1125.01***	1133.13***	1129.92***
R_{BC}	2490.87***	2432.27***	2454.34***	2457.96***
R_{AR}	2106.70***	2023.84***	2080.03***	1986.82***
R_{CR}	3115.16***	3036.80***	3058.70***	3027.16***
R_{MP}	118.31**	112.71*	114.69**	98.07
S	1963.02***	1949.34***	1965.89***	1993.59***
Y	324.59***	322.93***	374.63***	358.01***
π	815.89***	755.40***	770.13***	660.22***
C	375.06***	374.37***	398.27***	414.33***
Low-income SSA countries				
L	90.85**	90.78**	100.96***	115.82***
R_{EB}	579.57***	578.20***	578.16***	574.85***
R_{BC}	847.12***	827.15***	829.44***	805.79***
R_{AR}	623.04***	606.57***	620.95***	619.58***
R_{CR}	1098.96***	1088.65**	1088.73***	1078.15***
R_{MP}	4.93	3.20	1.55	0.92
S	698.34***	697.21***	701.29***	702.65***
Y	78.13	75.01	92.41**	103.29***
π	301.43***	284.80***	248.98***	201.45***
C	89.18**	93.42**	94.01**	97.39***
Middle-income SSA countries				
L	91.07***	91.43***	88.34***	87.80***
R_{EB}	151.78***	149.93***	153.70***	158.22***
R_{BC}	383.35***	375.87***	374.26***	386.92***
R_{AR}	356.47***	334.91***	343.75***	320.29***
R_{CR}	517.16***	492.57***	501.88***	470.94***
R_{MP}	42.88	41.91	47.03	38.15
S	403.77***	400.90***	401.29***	386.92***
Y	97.44***	91.55***	109.22***	82.81***
π	142.66***	117.31***	159.86***	128.93***
C	101.73***	103.90***	113.84***	116.48***

Notes: The test statistics are based on the residuals from the *p*-th-order augmented Dickey-Fuller [ADF(*p*)] regressions; ADF(*p*) regressions include an intercept and a linear trend; LM = Lagrange multiplier; $L =$ bank credit/GDP; $R_{EB} =$ entry barrier index; $R_{BC} =$ mixing banking & commerce restriction index; $R_{AR} =$ activity restriction index; $R_{CR} =$ capital regulation index; $R_{MP} =$ macroprudential index; $S =$ supervisory power index; $Y =$ real GDP; π = inflation; $C =$ current account/GDP; H_0: no error cross-sectional dependence; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.6 Bias-corrected scaled LM test statistics

Variables	ADF(1)	ADF(2)	ADF(3)	ADF(4)
All selected SSA countries				
L	6.20***	6.49***	6.15***	6.36***
R_{EB}	60.54***	59.58***	60.07***	59.88***
R_{BC}	98.96***	96.36***	97.34***	97.50***
R_{AR}	81.88***	78.20***	80.70***	76.55***
R_{CR}	126.72***	123.23***	124.21***	122.80***
R_{MP}	1.71*	1.29	1.44	0.21
S	75.50***	74.89***	75.62***	76.86***
Y	2.66***	2.59***	4.88***	4.15***
π	24.50***	21.81***	22.47***	17.58***
C	4.90***	4.87***	5.94***	6.65***
Low-income SSA countries				
L	1.89*	1.88*	2.77***	4.06***
R_{EB}	49.77***	49.63***	49.63***	49.32***
R_{BC}	67.71***	65.98***	66.18***	64.12***
R_{AR}	48.21***	46.78***	48.03***	47.91***
R_{CR}	89.63***	88.74***	88.74***	87.82***
R_{MP}	-0.40	-0.90	-1.37	-1.57
S	54.77***	54.67***	55.02***	55.14***
Y	0.78	0.51	2.03**	2.97***
π	20.22***	18.77***	15.65***	11.52***
C	1.74*	2.11**	2.16**	2.46**
Middle-income SSA countries				
L	3.19***	3.22***	2.93***	2.88***
R_{EB}	20.02***	19.74***	20.32***	21.01***
R_{BC}	31.25***	30.34***	30.19***	31.40***
R_{AR}	28.49***	26.44***	27.28***	25.04***
R_{CR}	43.82***	41.47***	42.36**	39.41***
R_{MP}	-0.45	-0.55	-0.01	-0.95
S	33.00***	32.73***	32.77***	31.40***
Y	3.80***	3.24***	4.92***	2.40***
π	8.11***	5.69***	9.75***	6.80***
C	4.21***	4.41***	5.36***	5.61***

Notes: The test statistics are based on the residuals from the *p*-th-order augmented Dickey-Fuller [ADF(*p*)] regressions; ADF(*p*) regressions include an intercept and a linear trend; LM = Lagrange multiplier; $L =$ bank credit/GDP; $R_{EB} =$ entry barrier index; $R_{BC} =$ mixing banking & commerce restriction index; $R_{AR} =$ activity restriction index; $R_{CR} =$ capital regulation index; $R_{MP} =$ macroprudential index; $S =$ supervisory power index; $Y =$ real GDP; π = inflation; $C =$ current account/GDP; H_0: no error cross-sectional dependence; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.7 Pesaran CD test statistics

Variables	ADF(1)	ADF(2)	ADF(3)	ADF(4)
All selected SSA countries				
L	5.50***	4.79***	2.88***	2.66***
R_{EB}	16.41***	16.31***	16.50***	17.13***
R_{BC}	8.82***	9.01***	8.87***	7.15***
R_{AR}	20.32***	19.99***	20.71***	19.08***
R_{CR}	37.40***	37.09***	37.49***	39.41***
R_{MP}	0.15	0.03	-0.07	0.41
S	18.94***	19.38***	19.50***	20.22***
Y	2.85***	2.49**	1.50	0.29
π	17.61***	15.67***	17.29***	15.70***
C	1.63	0.90	1.25	0.74
Low-income SSA countries				
L	0.07	0.08	-0.02	0.38
R_{EB}	7.32***	7.31***	7.33***	7.55***
R_{BC}	3.33***	3.51***	3.54***	4.17***
R_{AR}	7.33***	7.27***	7.36***	7.01***
R_{CR}	16.07***	15.91***	16.00***	15.93***
R_{MP}	-0.07	-0.06	-0.04	-0.04
S	11.28***	11.14***	11.27***	10.89***
Y	0.52	0.50	0.29	-0.61
π	6.34***	5.35***	5.28***	4.78***
C	-0.46	-0.68	-0.41	-0.73
Middle-income SSA countries				
L	1.97**	1.78*	0.95	0.96
R_{EB}	1.28	1.27	1.28	1.31
R_{BC}	0.77	0.78	0.68	-0.32
R_{AR}	2.22**	2.14**	2.28**	1.90*
R_{CR}	3.41***	3.44***	3.60***	4.45***
R_{MP}	-0.32	-0.40	-0.44	-0.14
S	3.23***	3.42***	3.39***	3.94***
Y	1.80*	1.52	2.09**	1.43
π	3.13***	2.88***	3.50***	2.89***
C	0.31	0.32	0.14	0.69

Notes: The test statistics are based on the residuals from the *p*-th-order augmented Dickey-Fuller [ADF(*p*)] regressions; ADF(*p*) regressions include an intercept and a linear trend; CD = cross-sectional dependence; L = bank credit/GDP; R_{EB} = entry barrier index; R_{BC} = mixing banking & commerce restriction index; R_{AR} = activity restriction index; R_{CR} = capital regulation index; R_{MP} = macroprudential index; S = supervisory power index; Y = real GDP; π = inflation; C = current account/GDP; H_0: no error cross-sectional dependence; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

5.2.4 Panel Unit Root Test Results

The study first employs the CIPS unit root test, which accounts for cross-sectional heterogeneity and error cross-sectional dependence. The CIPS test statistics are reported in Table 5.8. When taking into account the trended nature of the variables, the results show that the presence of unit root under the null hypothesis could not be rejected for the reported variables in levels except for current account balance to GDP, in the case of all selected SSA economies and low-income SSA countries. But this null is rejected when the reported variables are in first differences except for the macroprudential index in all selected SSA economies and the banking entry barrier index in middle-income SSA countries. As a result, the current account balance to GDP in the case of all selected SSA economies and low-income SSA countries is regarded to be $I(0)$, while all other reported variables are considered to be $I(1)$, except for the macroprudential index in all selected SSA economies, as well as the banking entry barrier index in middle-income SSA countries, which are non-stationary in first differences. Thus, the macroprudential index in all selected SSA economies and the entry barrier index in middle-income SSA countries are not included in the subsequent estimations of this study.

Secondly, the study uses the ADF (and IPS) panel unit root test for the macroprudential index in low-income and middle-income SSA countries, as well as for real GDP in low-income SSA economies in the absence of cross-sectional dependence. The ADF (and IPS) test statistics are presented in Table 5.9. Overall, the null hypothesis of unit root cannot be rejected even after accounting for the trended nature of these variables in levels. Nevertheless, this null is generally rejected when these variables are in first differences, except for the macroprudential index in low-income SSA countries. Hence, real GDP in low-income SSA countries and the macroprudential index in middle-income SSA economies are taken to be $I(1)$, whereas the macroprudential index in low-income SSA countries is not and is excluded in the subsequent estimations of this study.

Table 5.8 CIPS panel unit root test results

Variables	CADF(1)	CADF(2)	CADF(3)	CADF(4)
All selected SSA countries				
CIPS(*p*) statistics (with an intercept)				
ΔL	-3.14***	-3.19***	-3.19***	-3.28***
ΔR_{EB}	-3.06***	-3.06***	-3.41***	-3.34***
ΔR_{BC}	-4.48***	-4.48***	-4.05***	-2.40***
ΔR_{AR}	-4.52***	-4.52***	-4.92***	-4.59***
ΔR_{CR}	-4.64***	-4.64***	-2.06	-1.99
ΔR_{MP}	-1.41	-1.48	-1.19	-1.19
ΔS	-4.25***	-4.25***	-5.06***	-4.93***
ΔY	-3.78***	-3.76***	-3.78***	-3.78***
$\Delta\pi$	-3.57***	-3.69***	-3.51***	-3.49***
ΔC	-5.02***	-4.89***	-4.92***	-5.02***
L	-1.88	-2.29**	-2.39***	-2.28**
R_{EB}	-0.38	-0.38	-0.57	-0.46
R_{BC}	-1.37	-1.37	-1.71	-1.66
R_{AR}	-1.33	-1.33	-2.05	-1.86
R_{CR}	-0.66	-0.66	0.58	0.58
R_{MP}	0.12	0.06	0.09	0.09
S	-1.30	-1.30	-2.35***	-2.37***
Y	-1.56	-1.79	-1.63	-1.79
π	-2.11*	-2.44***	-2.87***	2.06
C	-2.30**	-2.39***	-2.37***	-2.30**
CIPS(*p*) statistics (with an intercept and a linear trend)				
L	-1.82	-2.41	-2.71**	-2.57
R_{EB}	-1.59	-1.59	-2.35	-2.42
R_{BC}	-1.78	-1.78	-1.93	-1.41
R_{AR}	-2.16	-2.16	-3.14***	-3.16***
R_{CR}	-2.27	-2.27	-1.77	-1.63
R_{MP}	-0.61	-0.74	-0.74	-0.56
S	-1.97	-1.97	-4.73***	-4.25***
Y	-1.92	-2.29	-2.02	-1.96
π	-1.78	2.05	-2.02	-1.68
C	-2.73**	-2.78**	-2.76**	-2.94***
Low-income SSA countries				
CIPS(*p*) statistics (with an intercept)				
ΔL	-3.27***	-3.35***	-3.27***	-3.27***
ΔR_{EB}	-3.63***	-3.63***	-3.97***	-3.63***
ΔR_{BC}	-4.79***	-4.79***	-2.77***	-3.02***

Variables	CADF(1)	CADF(2)	CADF(3)	CADF(4)
Low-income SSA countries				
CIPS(*p*) statistics (with an intercept)				
ΔR_{AR}	-4.60***	-4.60***	-5.10***	-4.84***
ΔR_{CR}	-4.57***	-4.57***	-3.65***	-4.24***
ΔS	-4.29***	-4.29***	-4.29***	-4.29***
$\Delta\pi$	-3.88***	-3.93***	-3.88***	-3.88***
ΔC	-4.65***	-4.64***	-4.66***	-4.68***
L	-1.86	-1.79	-1.94	-1.82
R_{EB}	-0.90	-0.90	-0.90	-0.90
R_{BC}	-1.07	-1.07	-5.38***	-5.38***
R_{AR}	-1.14	-1.14	-2.18*	-0.95
R_{CR}	-0.55	-0.55	-0.11	-0.07
S	-0.93	-0.93	-0.93	-0.97
π	-2.52***	-2.55***	-2.75***	-2.65***
C	-2.66***	-2.98***	-2.65***	-2.70***
CIPS(*p*) statistics (with an intercept and a linear trend)				
L	-1.71	-1.63	-1.73	-1.74
R_{EB}	-1.45	-1.45	-2.16	-2.16
R_{BC}	-2.28	-2.28	-4.92**	-4.77**
R_{AR}	-2.46	-2.46	-3.55***	-3.46***
R_{CR}	-2.30	-2.30	-2.10	-2.39
S	-1.89	-1.89	-2.82**	-2.71*
π	-2.53	-2.45	-2.83**	-2.53
C	-2.97***	-3.48***	-3.33***	-3.33***
Middle-income SSA countries				
CIPS(*p*) statistics (with an intercept)				
ΔL	-3.09***	-2.86***	-2.97***	-2.74***
ΔR_{EB}	-1.84	-1.84	-1.87	-1.56
ΔR_{BC}	-4.29***	-4.29***	-4.29***	-3.34***
ΔR_{AR}	-4.36***	-4.36***	-4.53***	-3.50***
ΔR_{CR}	-4.35***	-4.35***	-4.35***	-4.27***
ΔS	-4.26***	-4.26***	-4.59***	-4.37***
ΔY	-3.00***	-2.83***	-2.90***	-3.07***
$\Delta\pi$	-3.62***	-3.48***	-3.74***	-3.62***
ΔC	-4.87***	-4.67***	-4.90***	-4.87***
L	-1.64	-2.11	-1.99	-1.52
R_{EB}	0.11	0.11	-0.45	-0.52
R_{BC}	-1.54	-1.54	-1.54	-1.69
R_{AR}	-1.36	-1.36	-1.77	-2.14*

Variables	CADF(1)	CADF(2)	CADF(3)	CADF(4)
Middle-income SSA countries				
CIPS(*p*) statistics (with an intercept)				
R_{CR}	-0.94	-0.94	-0.94	-1.16
S	-1.37	-1.37	-2.36**	-2.90***
Y	-1.31	-1.32	-1.69	-1.69
π	-1.45	-1.57	-1.45	-1.45
C	-2.08	-2.18*	-2.32**	-2.08
CIPS(*p*) statistics (with an intercept and a linear trend)				
L	-1.63	-2.14	-2.12	-1.94
R_{EB}	-0.66	-0.66	-0.66	-2.42
R_{BC}	-1.92	-1.92	-1.92	-2.02
R_{AR}	-1.78	-1.78	-2.88**	-2.63
R_{CR}	-1.79	-1.79	-1.79	-1.97
S	-1.99	-1.99	-4.42***	-4.52***
Y	-1.18	-1.30	-1.63	-1.63
π	-1.65	-1.90	-1.97	-1.59
C	-2.47	-2.62	-2.62	-2.47

Notes: Cross-sectionally augmented Im-Pesaran-Shin [CIPS(*p*)] statistics are cross-section averages of *p*-th-order cross-sectionally augmented Dickey-Fuller [CADF(*p*)] test statistics; $\Delta =$ first difference operator; $L =$ bank credit/GDP; $R_{EB} =$ entry barrier index; $R_{BC} =$ mixing banking & commerce restriction index; $R_{AR} =$ activity restriction index; $R_{CR} =$ capital regulation index; $R_{MP} =$ macroprudential index; $S =$ supervisory power index; $Y =$ real GDP; π = inflation; $C =$ current account/GDP; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.9 ADF (and IPS) panel unit root test results

Variables	ADF(1)	ADF(2)	ADF(3)	ADF(4)
Low-income SSA countries				
ADF(*p*) statistics (with an intercept)				
ΔR_{MP}	0.49	-2.22	-1.90	0.49
ΔY	10.51***	5.38***	6.23***	2.46***
ΔY^{a}	-5.67***	-3.69***	-3.09***	-2.11**
R_{MP}	-3.38	-3.45	-3.24	-3.45
Y	-3.03	-3.07	-2.77	-2.87
Y^{a}	6.08	5.65	5.06	5.00
ADF(*p*) statistics (with an intercept and a linear trend)				
R_{MP}	-2.74	-2.89	-2.35	-2.69
Y	0.78	1.48*	4.52***	2.89***
Y^{a}	0.41	-0.89	-1.36*	-1.63
Middle-income SSA countries				
ADF(*p*) statistics (with an intercept)				
ΔR_{MP}	9.06***	4.42***	2.27**	1.17
R_{MP}	-2.82	-2.73	-2.58	-1.92
ADF(*p*) statistics (with an intercept and a linear trend)				
R_{MP}	-2.02	-2.13	-2.01	-1.72

Notes: *p*-th-order augmented Dickey-Fuller [ADF(*p*)] test statistics have been reported; [a]Im-Pesaran-Shin (IPS) statistics have also been provided for Y (they were not available for other variables); $\Delta =$ first difference operator; $R_{MP} =$ macroprudential index; $Y =$ real GDP; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

5.2.5 Slope Homogeneity Test Results

Since SSA economies are at different stages of development, it is imperative to determine whether the slope parameters are homogeneous or not before employing the panel cointegration tests. This study does so by using the Roy-Zellner slope homogeneity tests. The results of this test are given in Table 5.10 for the basic models with the banking entry barrier, mixing of banking and commerce restriction, banking activity restriction, capital regulation stringency or macroprudential index, under all selected SSA countries as well as low-income and middle-income SSA economies. All the reported chi-square statistics are significant at the 1% level, thereby strongly rejecting the null hypothesis that the slope parameters are homogeneous. Thus, the use of models accounting for the heterogeneity of slope parameters is justified.

Table 5.10 Slope homogeneity test results

Model	Roy-Zellner chi-square statistic[a]
All selected SSA countries	
$L = f(R_{EB}, S, Y, \pi)$	32189.26***
$L = f(R_{BC}, S, Y, \pi)$	42683.27***
$L = f(R_{AR}, S, Y, \pi)$	37798.65***
$L = f(R_{CR}, S, Y, \pi)$	39725.96***
Low-income SSA countries	
$L = f(R_{EB}, S, Y, \pi)$	3161.22***
$L = f(R_{BC}, S, Y, \pi)$	3140.95***
$L = f(R_{AR}, S, Y, \pi)$	3056.74***
$L = f(R_{CR}, S, Y, \pi)$	3459.28***
Middle-income SSA countries	
$L = f(R_{BC}, S, Y, \pi, C)$	25390.22***
$L = f(R_{AR}, S, Y, \pi, C)$	22828.75***
$L = f(R_{CR}, S, Y, \pi, C)$	22807.80***
$L = f(R_{MP}, S, Y, \pi, C)$	8527.34***

Notes: [a]H_0: slope parameters are homogeneous; $L =$ bank credit/GDP; $R_{EB} =$ entry barrier index; $R_{BC} =$ mixing banking & commerce restriction index; $R_{AR} =$ activity restriction index; $R_{CR} =$ capital regulation index; $R_{MP} =$ macroprudential index; $S =$ supervisory power index; $Y =$ real GDP; $\pi =$ inflation; $C =$ current account/GDP; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

5.2.6 Panel Cointegration Test Results

Given the presence of unit root among the variables of interest and the rejection of slope homogeneity assumption, the study uses the residuals from the CCEMG models to determine the existence of a long-run association between bank regulation and bank lending (plus controls) while at the same time accounting for the existence of error cross-sectional dependence. The computed residual-based panel cointegration test results for the basic models are shown in Table 5.11. The CIPS(*p*) statistics (with an intercept) for all CCEMG models with the banking entry barrier, mixing of banking and commerce restriction, banking activity restriction, capital regulation stringency or macroprudential index, under all selected SSA countries as well as low-income and middle-income SSA economies, reject the null of a unit root at the 1% significance level, thereby supporting the existence of cointegration between bank regulatory measures and bank credit (plus controls). The reported results are strongly robust to the choice of the augmentation order, *p*. Therefore, it is concluded that the specified variables are cointegrated.

Table 5.11 Residual-based panel cointegration test results

CIPS(*p*) statistics (with an intercept)				
Model[a]	**CADF(1)**	**CADF(2)**	**CADF(3)**	**CADF(4)**
All selected SSA countries				
$L = f(R_{EB}, S, Y, \pi)$	-2.86***	-2.91***	-2.91***	-3.00***
$L = f(R_{BC}, S, Y, \pi)$	-4.51***	-4.51***	-4.51***	-4.51***
$L = f(R_{AR}, S, Y, \pi)$	-4.51***	-4.51***	-4.51***	-4.51***
$L = f(R_{CR}, S, Y, \pi)$	-4.50***	-4.50***	-4.50***	-4.50***
Low-income SSA countries				
$L = f(R_{EB}, S, Y, \pi)$	-2.99***	-3.24***	-2.99***	-3.34***
$L = f(R_{BC}, S, Y, \pi)$	-6.17***	-6.17***	-6.17***	-6.11***
$L = f(R_{AR}, S, Y, \pi)$	-6.18***	-6.18***	5.92***	-6.18***
$L = f(R_{CR}, S, Y, \pi)$	-3.10***	-3.10***	-3.10***	-3.19***
Middle-income SSA countries				
$L = f(R_{BC}, S, Y, \pi, C)$	-6.12***	-6.12***	-6.12***	-6.12***
$L = f(R_{AR}, S, Y, \pi, C)$	-6.19***	-6.03***	-6.19***	-6.19***
$L = f(R_{CR}, S, Y, \pi, C)$	-3.38***	-3.47***	-3.62***	-3.46***
$L = f(R_{MP}, S, Y, \pi, C)$	-5.66***	-5.66***	-5.76***	-5.66***

Notes: Cross-sectionally augmented Im-Pesaran-Shin [CIPS(*p*)] statistics are cross-section averages of *p*-th-order cross-sectionally augmented Dickey-Fuller [CADF(*p*)] test statistics; [a]CIPS(*p*) statistics are based on the residuals of the specified common correlated effects mean group (CCEMG) models; L = bank credit/GDP; R_{EB} = entry barrier index; R_{BC} = mixing banking & commerce restriction index; R_{AR} = activity restriction index; R_{CR} = capital regulation index; R_{MP} = macroprudential index; S = supervisory power index; Y = real GDP; π = inflation; C = current account/GDP; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

5.2.7 Panel Autoregressive Distributed Lag (ARDL) Results

The study estimates both the linear (or symmetric) and nonlinear (or asymmetric) dynamic panel ARDL models using the CCEMG approach to assess the impact of bank regulation, and its interaction with bank supervision, on bank lending. Table 5.12 to Table 5.16 provide the linear ARDL and/or nonlinear ARDL (NARDL) long-run and short-run estimates for models with the banking entry barrier, mixing of banking and commerce restriction, banking activity restriction, capital regulation stringency and macroprudential indices, respectively, under all selected SSA economies, low-income SSA countries and/or middle-income SSA countries. The models with significant and negative coefficients for error-correction terms confirm the existence of a long-run association between bank credit and explanatory variables. Moreover, the lag of bank credit is positive and significant under all estimated models, in that way underscoring the persistent nature of bank lending and supporting the choice of the dynamic panel data estimation techniques.

In models with the banking entry barrier index, the long-run estimated results from the panel ARDL equations in Table 5.12 show that the banking entry barriers impact positively on bank lending in low-income SSA countries. Nonetheless, when an interactive term between banking entry barrier and supervisory power indices is incorporated into the estimated models, banking entry barriers significantly impact bank credit negatively in all selected SSA economies as well as in low-income SSA countries. Even though supervisory power impacts negatively and significantly on bank lending, it mitigates the negative impact of entry barriers on bank credit, as highlighted by highly significant and positive estimated coefficients of the interactive term. Other results from the long-run estimated equations generally indicate that the level of economic growth has a positive and significant impact on bank credit, while inflation has an insignificant effect.

Furthermore, the provided F-test statistics for the panel NARDL models in Table 5.12 show that the long-run nonlinear effect of banking entry barriers on bank lending is only significant under models with the interactive term between banking entry barrier

and supervisory power indices. These findings indicate that only positive shocks to entry barriers have a long-run negative and significant effect on bank lending. Supervisory power still mitigates the negative effect of banking entry barriers on bank lending. Then again, the short-run estimated results and F-test statistics show that positive shocks to banking entry barriers impact positively and significantly on bank credit, whereas negative shocks have a negative and significant impact. The findings further indicate that the short-run effects of other explanatory variables are generally insignificant.

Table 5.12 Panel ARDL and NARDL estimates (models with bank entry barrier index)

Variables	All selected SSA countries				Low-income SSA countries			
	ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Long-run (LR) estimates: The dependent variable is L								
R_{EB}	-2.58 (1.73)	-5.36*** (1.78)	-	-	0.18* (0.11)	-3.55*** (1.25)	-	-
R_{EB}^{+}	-	-	0.10 (0.20)	-15.26* (7.89)	-	-	-0.05 (0.35)	-12.86** (5.91)
R_{EB}^{-}	-	-	-0.27 (0.60)	-7.06 (5.96)	-	-	-0.54 (1.16)	-1.96 (2.52)
$R_{EB} \times S$	-	3.99*** (1.53)	-	25.72** (12.54)	-	5.72*** (2.12)	-	23.10** (10.21)
S	-0.15*** (0.04)	-2.51*** (0.94)	-0.55* (0.29)	-15.02** (6.55)	-0.21*** (0.08)	-3.82*** (1.35)	-0.92* (0.54)	-15.14** (6.30)
Y	0.20*** (0.06)	0.18*** (0.05)	0.17*** (0.06)	0.16*** (0.06)	0.14** (0.04)	0.13*** (0.04)	0.14*** (0.04)	0.13*** (0.04)
π	-0.06 (0.05)	-0.05 (0.05)	-0.05 (0.05)	-0.05 (0.05)	-0.08 (0.06)	-0.08 (0.06)	-0.08 (0.06)	-0.08 (0.06)
Short-run (SR) estimates: The dependent variable is $\Delta(L)$								
ECT_{t-1}	-0.74*** (0.06)	-0.78*** (0.06)	-0.77*** (0.05)	-0.65*** (0.09)	-0.65*** (0.06)	-0.69*** (0.06)	-0.66*** (0.06)	-0.69*** (0.06)
$\Delta(L_{t-1})$	0.43*** (0.05)	0.43*** (0.05)	0.43*** (0.04)	0.39*** (0.07)	0.42*** (0.06)	0.43*** (0.06)	0.43*** (0.06)	0.43*** (0.06)
$\Delta(R_{EB})$	0.07* (0.04)	-0.01 (0.16)	-	-	0.10** (0.04)	0.13 (0.28)	-	-

Variables	All selected SSA countries				Low-income SSA countries			
	ARDL		NARDL				ARDL	
	No $R \times S$	$R \times S$		No $R \times S$	$R \times S$		No $R \times S$	$R \times S$
Short-run (SR) estimates: The dependent variable is $\Delta(L)$								
$\Delta(R_{EB}^{+})$	-	-	0.15* (0.20)	-1.41 (2.07)	-	-	0.12*** (0.04)	0.18** (0.07)
$\Delta(R_{EB}^{-})$	-	-	-0.08** (0.60)	-0.17* (0.09)	-	-	-0.11* (0.06)	-0.11* (0.06)
$\Delta(R_{EB} \times S)$	-	0.08 (0.20)	-	-	-	-0.13 (0.32)	-	-0.09 (0.09)
$\Delta(S)$	-0.08** (0.04)	-0.12 (0.10)	-0.06* (0.03)	-0.06 (0.05)	-0.13** (0.05)	-0.05 (0.16)	-0.08 (0.05)	-0.03 (0.06)
$\Delta(Y)$	0.01 (0.04)	-0.01 (0.03)	-0.003 (0.03)	-0.16** (0.07)	0.001 (0.03)	-0.002 (0.03)	-0.001 (0.03)	-0.002 (0.03)
$\Delta(\pi)$	-0.07 (0.04)	-0.06 (0.04)	-0.06 (0.04)	-0.08 (0.06)	-0.05 (0.04)	-0.05 (0.04)	-0.05 (0.04)	-0.05 (0.04)
C	-0.003 (0.02)	-0.01 (0.02)	-0.003 (0.02)	-0.08 (0.07)	-0.03 (0.02)	-0.03 (0.02)	-0.02 (0.02)	-0.03 (0.02)
Intercept	0.005 (0.003)	0.005 (0.003)	-0.005 (0.003)	-0.0002 (0.01)	0.002 (0.002)	-0.03 (0.002)	0.003 (0.002)	0.002 (0.002)
Countries	23	23	23	23	12	12	12	12
Observations	529	529	529	529	276	276	276	276
F-test (LR)[a]	-	-	0.63	5.12**	-	-	0.31	3.22*
F-test (SR)[b]	-	-	6.39**	0.38	-	-	8.12***	9.93***
CD test[c]	0.30	1.35	1.52	-0.47	-0.24	0.71	0.41	0.71

Notes: $L =$ bank credit/GDP; $R_{EB} =$ entry barrier index; $S =$ supervisory power index; $Y =$ real GDP; $C =$ current account/GDP; $\pi =$ inflation; $R \times S$ is an interactive term between bank regulatory and supervisory indices; $+ =$ positive shock; $- =$ negative shock; Δ is the first difference operator; ECT is an error-correction term; standard errors are in parenthesis; CD is cross-sectional dependence; [a]H_0: entry barrier positive equals entry barrier negative; [b]H_0: Δ(entry barrier positive) equals Δ(entry barrier negative); [c]H_0: no error cross-sectional dependence; the chosen lag order for the baseline models is $\mathrm{ARDL}(1,0,0,0,0,0)$; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Under models with the mixing of banking and commerce restriction index, the long-run estimated results, together with their corresponding F-statistic from Table 5.13, indicate that positive shocks to the mixing of banking and commerce restriction index impact positively and significantly on bank credit in low-income SSA countries, whereas negative shocks have a long-run negative and significant impact on bank lending. Even though the short-run estimated results and their corresponding F-statistic show that negative shocks to the mixing of banking and commerce restriction index still affect bank credit negatively and significantly, positive shocks have no impact on bank lending in the short run. Other estimated results from Table 5.13 reveal that the supervisory power index does not affect bank lending under models with the mixing of banking and commerce restriction index. However, real GDP impacts positively on bank credit in the long run under panel NARDL models for low-income SSA economies, while inflation has a negative long-run impact on bank lending in the case of all selected SSA countries.

Table 5.13 Panel ARDL and NARDL estimates (models with mixing banking & commerce restriction index)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Long-run (LR) estimates: The dependent variable is L												
R_{BC}	-0.02 (0.16)	-3.54 (2.16)	-	-	-0.72 (0.53)	2.41 (2.88)	-	-	0.25 (0.26)	-3.85 (5.22)	-	-
R_{BC}^{+}	-	-	-21.19 (18.72)	-21.48 (17.42)	-	-	0.10** (0.05)	5.87 (4.04)	-	-	5.80 (3.41)	10.80 (9.32)
R_{BC}^{-}	-	-	-1.16 (26.25)	0.25 (26.20)	-	-	-0.16*** (0.04)	-1.20 (1.02)	-	-	-3.89 (10.21)	-5.06 (7.82)
$R_{BC} \times S$	-	5.65* (3.19)	-	0.48 (1.64)	-	-3.88 (4.39)	-	9.74 (6.17)	-	5.80 (6.89)	-	1.75 (4.08)
S	-0.11 (0.33)	-3.41 (2.09)	-0.25 (0.70)	-	-0.07 (0.18)	2.07 (2.73)	-0.03 (0.06)	-7.29 (4.73)	-0.23 (0.16)	-4.58 (4.52)	-2.44 (2.64)	-
Y	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.08 (0.23)	0.01 (0.09)	0.12*** (0.04)	0.12*** (0.04)	0.06 (0.21)	0.06 (0.26)	0.06 (0.21)	0.07 (0.20)
π	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.17 (0.17)	-0.13 (0.09)	-0.05 (0.05)	-0.06 (0.05)	0.02 (0.03)	0.08 (0.08)	0.02 (0.03)	0.03 (0.04)
C	-	-	-	-	-	-	-	-	0.05 (0.07)	0.17 (0.16)	0.05 (0.07)	0.08 (0.07)
Short-run (SR) estimates: The dependent variable is $\Delta(L)$												
ECT_{t-1}	-1.20*** (0.08)	-1.20*** (0.08)	-1.20*** (0.08)	-1.20*** (0.08)	-0.002 (0.003)	0.01 (0.004)	-0.76*** (0.07)	-0.76*** (0.07)	-1.17*** (0.11)	-1.27*** (0.15)	-1.43*** (0.13)	1.45*** (0.14)
$\Delta(L_{t-1})$	0.30*** (0.07)	0.30*** (0.07)	0.30*** (0.07)	0.31*** (0.07)	0.23*** (0.06)	0.23*** (0.06)	0.41*** (0.05)	0.41*** (0.05)	0.26*** (0.10)	0.33* (0.18)	0.17* (0.09)	0.18** (0.09)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Short-run (SR) estimates: The dependent variable is $\Delta(L)$												
$\Delta(R_{BC})$	-0.17 (0.15)	-0.21 (0.37)	-	-	-0.04** (0.02)	-0.01** (0.04)	-	-	-0.04 (0.08)	-0.05 (0.27)	-	-
$\Delta(R_{BC}^{+})$	-	-	-0.13 (0.12)	2.06 (2.02)	-	-	0.04 (0.02)	0.06 (0.05)	-	-	-0.20 (0.51)	-3.67 (2.67)
$\Delta(R_{BC}^{-})$	-	-	0.03 (0.04)	-30.35 (29.57)	-	-	-0.07** (0.03)	-0.05 (0.05)	-	-	0.69 (0.69)	3.77 (3.77)
$\Delta(R_{BC} \times S)$	-	0.15 (0.43)	-	-0.33 (0.30)	-	-0.04 (0.03)	-	-0.03 (0.06)	-	-0.13 (0.27)	-	-
$\Delta(S)$	0.05 (0.27)	-	-	-	-0.03 (0.02)	-0.001 (0.001)	-0.04 (0.03)	-0.01 (0.01)	-0.003 (0.07)	-	-	-
$\Delta(Y)$	-0.17* (0.09)	-0.17* (0.09)	-0.17* (0.09)	-0.17* (0.09)	-0.03 (0.04)	-0.03 (0.04)	0.01 (0.03)	0.01 (0.03)	-0.08 (0.09)	-0.39 (0.27)	0.06 (0.24)	0.11 (0.24)
$\Delta(\pi)$	-0.17 (0.10)	-0.17 (0.10)	-0.17 (0.10)	-0.16 (0.10)	0.01 (0.03)	0.0001 (0.04)	-0.01 (0.04)	-0.01 (0.04)	-0.05 (0.10)	-0.19 (0.19)	-0.05 (0.07)	-0.12 (0.08)
$\Delta(C)$[a]	-0.04 (0.03)	-0.04 (0.03)	-0.05 (0.03)	-0.05 (0.03)	-0.03 (0.002)	-0.03 (0.03)	0.001 (0.03)	0.001 (0.03)	-0.14 (0.15)	0.02 (0.05)	0.10 (0.08)	0.06 (0.07)
Intercept	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01** (0.003)	0.01 (0.002)	0.003 (0.004)	0.003 (0.004)	0.01 (0.01)	0.01 (0.02)	-0.01 (0.02)	0.003 (0.02)
Countries	23	23	23	23	12	12	12	12	11	11	11	11
Observations	529	529	529	529	276	276	276	276	253	253	253	253
F-test (LR)[b]	-	-	0.33	0.41	-	-	14.50***	1.17	-	-	0.76	1.86
F-test (SR)[c]	-	-	1.49	1.05	-	-	4.74**	2.93*	-	-	1.12	2.98*
CD test[d]	0.40	0.38	0.25	0.39	-0.03	0.01	0.96	1.00	1.44	0.57	-1.31	-1.01

Notes: $L =$ bank credit/GDP; $R_{BC} =$ mixing banking & commerce restriction index; $S =$ supervisory power index; $Y =$ real GDP; $C =$ current account/GDP; $\pi =$ inflation; $R \times S$ is an interactive term between bank regulatory and supervisory indices; $+ =$ positive shock; $- =$ negative shock; Δ is the first difference operator; ECT is an error-correction term; standard errors are in parenthesis; CD is cross-sectional dependence; [a]C for all selected SSA countries and low-income SSA countries; [b]H_0: mixing banking & commerce restriction positive equals mixing banking & commerce restriction negative; [c]H_0: Δ(mixing banking & commerce restriction positive) equals Δ(mixing banking & commerce restriction negative); [d]H_0: no error cross-sectional dependence; the chosen lag order for the baseline models is $\mathrm{ARDL}(1,0,0,0,0,0)$; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

When it came to models with the banking activity restriction index, Table 5.14 shows that banking activity restriction and supervisory power indices have no long-run effect on bank credit. Nonetheless, the short-run estimated results indicate that the banking activity restriction index impacted positively on bank credit in low-income SSA countries, with the F-statistic also revealing that positive shocks to the banking activity restriction index lead to increases in bank lending in the short-run, whereas negative ones have no effect. Other estimated results from Table 5.14 reveal that real GDP has a positive and significant effect on bank credit in the long run under panel NARDL models for low-income SSA economies, while inflation has a negative long-run impact on bank lending in all selected SSA countries as well as in low-income SSA economies but under the linear ARDL models in the context of low-income SSA economies.

Table 5.14 Panel ARDL and NARDL estimates (models with bank activity restriction index)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Long-run (LR) estimates: The dependent variable is L												
R_{AR}	-6.93 (6.86)	1.57 (4.89)	-	-	0.36 (0.41)	4.58 (5.20)	-	-	-0.02 (0.30)	8.66 (8.29)	-	-
R_{AR}^{+}	-	-	31.21* (16.84)	14.12** (7.10)	-	-	0.15 (0.41)	0.18 (0.30)	-	-	-6.60 (13.65)	-6.34 (12.69)
R_{AR}^{-}	-	-	15.73** (7.69)	8.05*** (2.61)	-	-	-0.11 (0.15)	-0.11 (0.22)	-	-	21.41 (9.56)	18.22* (9.50)
$R_{AR} \times S$	-	0.36 (6.03)	-	-	-	-6.75 (6.97)	-	0.01 (0.27)	-	-5.26 (7.89)	-	2.50 (0.21)
S	2.26 (2.38)	-0.21 (4.61)	-3.01 (2.10)	-	0.08 (0.47)	2.94 (4.05)	-0.65 (0.49)	-0.65 (0.52)	-0.26 (0.23)	2.51 (5.01)	1.53 (1.30)	-
Y	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.05 (0.09)	-0.02 (0.08)	0.13*** (0.04)	0.13*** (0.04)	0.06 (0.21)	0.06 (0.21)	0.06 (0.21)	0.06 (0.21)
π	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.19** (0.09)	-0.17** (0.08)	-0.06 (0.05)	-0.06 (0.05)	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)
C	-	-	-	-	-	-	-	-	0.05 (0.07)	0.05 (0.07)	0.05 (0.07)	0.05 (0.07)
Short-run (SR) estimates: The dependent variable is $\Delta(L)$												
ECT_{t-1}	-1.20*** (0.08)	-1.20*** (0.08)	-1.20*** (0.08)	-1.20*** (0.08)	0.005 (0.01)	0.00 (0.001)	-0.76*** (0.08)	-0.77*** (0.07)	-1.04*** (0.11)	-1.14*** (0.12)	-1.43*** (0.13)	-1.43*** (0.13)
$\Delta(L_{t-1})$	0.30*** (0.07)	0.30*** (0.07)	0.30*** (0.07)	0.30*** (0.07)	0.24*** (0.06)	0.23*** (0.06)	0.41*** (0.07)	0.41*** (0.06)	0.29*** (0.10)	0.28*** (0.10)	0.17* (0.09)	0.17* (0.09)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Short-run (SR) estimates: The dependent variable is $\Delta(L)$												
$\Delta(R_{AR})$	-6.84 (6.65)	1.80 (1.67)	-	-	0.10** (0.04)	0.31** (0.20)	-	-	0.23 (0.08)	0.37 (0.62)	-	-
$\Delta(R_{AR}^{+})$	-	-	-0.28 (0.21)	-0.50 (0.60)	-	-	0.17** (0.07)	0.31** (0.16)	-	-	-0.16 (0.40)	-0.17 (0.42)
$\Delta(R_{AR}^{-})$	-	-	-0.01 (0.02)	-0.28 (0.32)	-	-	0.04 (0.04)	0.17 (0.10)	-	-	-0.02 (0.05)	-0.22 (0.46)
$\Delta(R_{AR} \times S)$	-	-0.88 (0.74)	-	0.04 (0.05)	-	-0.16 (0.15)	-	-0.18 (0.14)	-	-0.30 (0.72)	-	-0.04 (0.05)
$\Delta(S)$	2.28 (2.36)	-	-	-	-0.10** (0.04)	-0.04 (0.05)	-0.11** (0.05)	0.004 (0.11)	-0.06 (0.07)	0.10 (0.43)	-	-
$\Delta(Y)$	-0.17* (0.097)	-0.17* (0.097)	-0.17* (0.097)	-0.17* (0.097)	-0.02 (0.04)	-0.03 (0.04)	0.01 (0.03)	0.01 (0.04)	-0.07 (0.07)	-0.03 (0.08)	0.06 (0.24)	0.06 (0.24)
$\Delta(\pi)$	-0.17 (0.10)	-0.17 (0.10)	-0.17 (0.10)	-0.17 (0.10)	0.01 (0.03)	0.01 (0.03)	-0.01 (0.04)	-0.01 (0.04)	-0.03 (0.09)	-0.03 (0.08)	-0.05 (0.07)	-0.05 (0.07)
$\Delta(C)$[a]	-0.05 (0.03)	-0.04 (0.03)	-0.05 (0.03)	-0.05 (0.03)	-0.03 (0.03)	-0.03 (0.03)	-0.04 (0.03)	0.001 (0.03)	-0.14 (0.14)	-0.14 (0.15)	-0.05 (0.08)	0.10 (0.08)
Intercept	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	0.004 (0.003)	0.005 (0.003)	0.003 (0.004)	0.003 (0.004)	0.01 (0.01)	0.01 (0.01)	-0.01 (0.02)	-0.01 (0.02)
Countries	23	23	23	23	12	12	12	12	11	11	11	11
Observations	529	529	529	529	276	276	276	276	253	253	253	253
F-test (LR)[b]	-	-	0.08	1.30	-	-	2.25	2.71	-	-	2.52	2.11
F-test (SR)[c]	-	-	1.74	0.21	-	-	3.04*	2.10	-	-	0.11	0.01
CD test[d]	0.29	0.29	0.29	0.29	-0.16	-0.15	0.71	0.37	1.13	0.25	-0.26	-1.31

Notes: $L =$ bank credit/GDP; $R_{AR} =$ activity restriction index; $S =$ supervisory power index; $Y =$ real GDP; $C =$ current account/GDP; $\pi =$ inflation; $R \times S$ is an interactive term between bank regulatory and supervisory indices; $+ =$ positive shock; $- =$ negative shock; Δ is the first difference operator; ECT is an error-correction term; standard errors are in parenthesis; CD is cross-sectional dependence; [a]C for all selected SSA countries and low-income SSA countries; [b]H_0: activity restriction positive equals activity restriction negative; [c]H_0: Δ(activity restriction positive) equals Δ(activity restriction negative); [d]H_0: no error cross-sectional dependence; the chosen lag order for the baseline models is $\mathrm{ARDL}(1,0,0,0,0,0)$; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Regarding models with the capital regulation stringency index, the long-run estimated results and their corresponding F-statistic from Table 5.15 show that negative shocks to the capital regulation stringency index impact negatively and significantly on bank lending in low-income SSA countries, while positive shocks have no long-run effect on bank lending. However, the short-run estimated results and their corresponding F-statistic, when incorporating the interaction between capital regulation stringency and supervisory power, indicate that positive shocks to the capital regulation index have a positive and significant impact on bank lending in low-income SSA economies, but negative shocks have no effect on bank lending in the short run. Other estimated results from Table 5.15 highlight that the supervisory power index has a negative linear long-run effect on bank credit in low-income SSA countries, whereas the level of economic growth affects bank lending positively in the long run primarily in the same group of economies. Nevertheless, inflation has a negative long-run effect on bank lending in the context of all selected SSA countries.

Table 5.15 Panel ARDL and NARDL estimates (models with capital regulation index)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Long-run (LR) estimates: The dependent variable is L												
R_{CR}	2.46 (2.70)	-15.10 (12.52)	-	-	0.01 (0.04)	4.27 (6.76)	-	-	-0.09 (0.14)	9.21 (10.78)	-	-
R_{CR}^{+}	-	-	13.54 (18.53)	-4.05** (1.65)	-	-	0.08 (0.07)	-1.96 (2.23)	-	-	-2.97 (5.33)	-4.11 (6.58)
R_{CR}^{-}	-	-	37.57 (72.93)	144.53 (128.75)	-	-	-0.11** (0.05)	-0.23 (0.58)	-	-	206.14 (204.51)	-503.88 (505.19)
$R_{CR} \times S$	-	15.07 (9.56)	-	4.05 (3.59)	-	-1.78 (5.18)	-	2.16 (2.48)	-	-5.64 (10.83)	-	37.62 (37.62)
S	0.10 (0.23)	-0.68 (3.55)	-5.13** (1.55)	-	-0.13** (0.06)	-3.27** (1.55)	0.05 (0.10)	-1.67 (1.79)	-0.08 (0.05)	2.99 (5.27)	-13.61 (13.61)	-
Y	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	-0.01 (0.06)	0.13*** (0.04)	0.13*** (0.04)	0.13*** (0.04)	0.12*** (0.04)	0.24** (0.11)	0.06 (0.23)	0.06 (0.21)	0.06 (0.21)
π	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.09** (0.04)	-0.01 (0.06)	-0.05 (0.05)	-0.05 (0.05)	-0.05 (0.05)	-0.02 (0.07)	0.02 (0.03)	0.02 (0.03)	0.02 (0.03)
C	-	-	-	-	-	-	-	-	-0.01 (0.05)	0.05 (0.07)	0.05 (0.07)	0.05 (0.07)
Short-run (SR) estimates: The dependent variable is $\Delta(L)$												
ECT_{t-1}	-1.20*** (0.08)	-1.20*** (0.08)	-1.20*** (0.08)	-1.28*** (0.07)	-0.70*** (0.07)	-0.77*** (0.07)	-0.75*** (0.07)	-0.79*** (0.07)	-0.97*** (0.13)	-1.43*** (0.13)	-1.43*** (0.13)	-1.43*** (0.13)
$\Delta(L_{t-1})$	0.30*** (0.07)	0.30*** (0.07)	0.30*** (0.07)	0.29*** (0.05)	0.41*** (0.06)	0.43*** (0.07)	0.42*** (0.06)	0.41*** (0.06)	0.47*** (0.10)	0.17* (0.09)	0.17* (0.09)	0.17* (0.09)

Variables	All selected SSA countries				Low-income SSA countries				Middle-income SSA countries			
	ARDL		NARDL		ARDL		NARDL		ARDL		NARDL	
	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$	No $R \times S$	$R \times S$
Short-run (SR) estimates: The dependent variable is $\Delta(L)$												
$\Delta(R_{CR})$	2.91 (3.06)	-1.51 (2.14)	-	-	0.001 (0.02)	-0.51 (0.35)	-	-	-0.07 (0.11)	0.48 (0.47)	-	-
$\Delta(R_{CR}^{+})$	-	-	1.22 (0.92)	1.78* (1.00)	-	-	0.03 (0.04)	0.25* (0.15)	-	-	-1.14 (1.97)	0.33 (0.26)
$\Delta(R_{CR}^{-})$	-	-	0.30 (0.70)	26.65 (25.29)	-	-	-0.02* (0.01)	0.14 (0.12)	-	-	0.23 (0.23)	1.34 (0.98)
$\Delta(R_{CR} \times S)$	-	-0.91 (0.63)	-	-0.94 (0.65)	-	0.75 (0.58)	-	-0.29 (0.21)	-	-1.21 (1.17)	-	-
$\Delta(S)$	-0.001 (0.20)	0.00 (0.00)	-	-	-0.08* (0.04)	-0.52 (0.39)	-0.03 (0.03)	0.14 (0.12)	-0.05 (0.03)	-	-	-0.05 (0.05)
$\Delta(Y)$	-0.17* (0.097)	-0.17* (0.097)	-0.17* (0.097)	-0.06 (0.06)	0.02 (0.03)	0.03 (0.04)	0.02 (0.03)	0.02 (0.03)	-0.02 (0.07)	0.06 (0.24)	0.06 (0.24)	0.06 (0.24)
$\Delta(\pi)$	-0.17 (0.10)	-0.17 (0.10)	-0.17 (0.10)	-0.10 (0.06)	0.005 (0.04)	-0.01 (0.04)	-0.01 (0.03)	-0.01 (0.04)	-0.09 (0.07)	-0.05 (0.07)	-0.05 (0.07)	-0.05 (0.07)
$\Delta(C)$[a]	-0.04 (0.03)	-0.04 (0.03)	-0.04 (0.03)	0.03 (0.04)	-0.02 (0.05)	-0.002 (0.03)	-0.004 (0.03)	-0.001 (0.03)	-0.05 (0.05)	0.10 (0.08)	0.10 (0.08)	0.10 (0.08)
Intercept	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)	-0.01 (0.01)	0.002 (0.004)	0.003 (0.004)	0.003 (0.004)	0.003 (0.004)	0.01 (0.01)	-0.01 (0.02)	-0.01 (0.02)	-0.01 (0.02)
Countries	23	23	23	23	12	12	12	12	11	11	11	11
Observations	529	529	529	529	276	276	276	276	253	253	253	253
F-test (LR)[b]	-	-	0.16	1.33	-	-	6.89***	0.63	-	-	1.05	0.98
F-test (SR)[c]	-	-	0.63	0.97	-	-	1.22	3.56*	-	-	0.49	0.97
CD test[d]	0.44	0.40	0.39	1.43	0.36	0.89	1.04	1.13	-0.15	-1.31	-1.31	-1.31

Notes: $L =$ bank credit/GDP; $R_{CR} =$ capital regulation index; $S =$ supervisory power index; $Y =$ real GDP; $C =$ current account/GDP; $\pi =$ inflation; $R \times S$ is an interactive term between bank regulatory and supervisory indices; $+ =$ positive shock; $- =$ negative shock; Δ is the first difference operator; ECT is an error-correction term; standard errors are in parenthesis; CD is cross-sectional dependence; [a]C for all selected SSA countries and low-income SSA countries; [b]H_0: capital regulation positive equals capital regulation negative; [c]H_0: Δ(capital regulation positive) equals Δ(capital regulation negative); [d]H_0: no error cross-sectional dependence; the chosen lag order for the baseline models is $\mathrm{ARDL}(1,0,0,0,0,0)$; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

When it comes to the introduction of macroprudential policies, the results in Table 5.16 show that the macroprudential and supervisory power indices have a negative and significant long-run linear impact on bank lending in middle-income SSA economies when an interactive term between the macroprudential and bank supervisory power indices is included. However, the power of bank supervision significantly mitigates the long-run negative effect of the macroprudential index on bank lending. Other estimated results from Table 5.16 indicate that economic growth (proxied by the log of real GDP), inflation and current account as a ratio of GDP have no significant long-run and short-run impact on bank credit in middle-income SSA economies.

Table 5.16 Panel ARDL estimates (models with macroprudential index)

Variables	Middle-income SSA countries	
	No $R \times S$	$R \times S$
Long-run (LR) estimates: The dependent variable is L		
R_{MP}	2.04 (2.15)	-26.75** (10.95)
$R_{MP} \times S$	-	42.57** (20.62)
S	-0.01 (0.04)	-4.95** (2.51)
Y	-0.01 (0.28)	0.26 (0.43)
π	-0.07 (0.15)	-0.16 (0.13)
C	0.06 (0.05)	0.06 (0.06)
Short-run (SR) estimates: The dependent variable is $\Delta(L)$		
ECT_{t-1}	-0.001 (0.001)	-1.08** (0.45)
$\Delta(L_{t-1})$	0.25*** (0.10)	0.50*** (0.16)
$\Delta(R_{MP})$	-0.03 (0.07)	-1.92 (1.26)
$\Delta(R_{MP} \times S)$	-	2.10 (1.33)
$\Delta(S)$	-0.02 (0.03)	-0.15 (0.13)
$\Delta(Y)$	-0.05 (0.09)	-0.05 (0.05)
$\Delta(\pi)$	-0.16 (0.14)	-0.22 (0.19)
$\Delta(C)$	-0.21 (0.18)	-0.08 (0.12)
Intercept	0.02 (0.01)	0.005 (0.01)
Countries	11	11
Observations	253	253
CD test[a]	1.44	0.35

Notes: $L =$ bank credit/GDP; $R_{MP} =$ macroprudential index; $S =$ supervisory power index; $Y =$ real GDP; $C =$ current account/GDP; $\pi =$ inflation; $R \times S$ is an interactive term between bank regulatory and supervisory indices; $+ =$ positive shock; $- =$ negative shock; Δ is the first difference operator; ECT is an error-correction term; standard errors are in parenthesis; CD is cross-sectional dependence; [a]H_0: no error cross-sectional dependence; the chosen lag order for the baseline models is $\mathrm{ARDL}(1,0,0,0,0,0)$; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Lastly, the study undertook tests for the existence of error cross-sectional dependence in all the estimated models in Table 5.12 to Table 5.16 to ascertain that, unlike other MG estimators, the CCEMG estimators are robust. This is crucial since the MG-type estimators are normally biased while cross-sectional dependence exists, which arises from the possibility that countries under consideration could be influenced by similar shocks emanating from any of the economies included in the sample because of their interconnectedness (Holly et al., 2010; Ditzen, 2018). As shown by the reported CD test statistics that are insignificant, all the estimated models are found to be free from error cross-sectional dependence. Thus, the CCEMG estimators used in this study are able to control for unobserved error dependence amongst cross-sectional units and provide unbiased regression estimates. The robustness of these results is maintained for different chosen measures of bank regulation and in the context of all selected SSA countries as well as their income groups.

5.2.8 Dynamic Panel Threshold Regression (PTR) Results

The further study further investigates the existence of the threshold effects of measures of bank regulation on bank credit using the dynamic PTR model. Before estimating this model, it employs the Fisher linearity test and its statistics are reported in Table 5.17. The test results reject the null hypothesis of linearity under models with the banking entry barrier and capital regulation stringency indices. However, this null hypothesis of linearity is not rejected under models with the mixing of banking and commerce restriction index as well as the ones with the banking activity restriction index. Overall, these linearity test results support the presence of nonlinear impacts in the nexus between bank credit and banking entry barriers or banking capital regulations. The linearity test (and other subsequent) results for models with the macroprudential index could not be obtained.

The study then uses the dynamic PTR model to estimate the nonlinear effects of banking entry barriers and capital regulations on bank credit (plus controls). This model is estimated through the GMM approach and its results are provided in Table

5.18. Both the banking entry barrier index and capital regulation stringency index are used in the model estimations as threshold variables, whereas other explanatory variables such as bank supervisory power index, real GDP (or economic growth), inflation and current account balance as a share of GDP are incorporated as covariates or control variables. First, Table 5.18. presents the threshold levels for the banking entry barrier index as well as for the capital regulation stringency index, together with their corresponding 95% confidence intervals, from the estimated dynamic PTR models. Second, the table provides the estimated regime-dependent coefficients of banking entry barrier and capital regulation stringency indices on bank credit. These estimates are represented by $\widehat{\beta_1}$ and $\widehat{\beta_2}$, which are the marginal estimated coefficients of the banking entry barrier index or capital regulation stringency index on bank credit in both the low and high regimes of the stringency of bank regulation, respectively. Finally, the table reports the estimates for the control variables.

The model results on the estimated threshold values show that the banking entry barrier index has a threshold level of 62.8% (or 0.628) with the 95% confidence interval of [49.9 – 62.8]. On the other hand, the estimated threshold value for the stringency of the capital regulation index is 76.5% (or 0.765) and its 95% confidence interval is [40.0 – 79.8]. These obtained confidence intervals show that the threshold value of the banking entry barrier index is estimated with more precision than the threshold level of the capital regulation stringency index. The implication emanating from this is that there is less uncertainty concerning the threshold value of the banking entry barrier index as compared to that of the capital regulation stringency index. Nonetheless, despite that the study does not necessarily contend that the obtained threshold values represent the optimal degrees of the stringency of the considered measures of bank regulation[12], they provide evidence of the presence of nonlinear effects in the nexus between the stringency of banking entry barriers or capital regulations and bank credit.

[12] The optimal degrees of the stringency of bank regulatory measures depend on other factors that are not considered within the scope of this study.

Furthermore, the obtained estimated coefficients of both the low and high regimes of the stringency of bank regulatory measures are used to validate the statistical significance of the presence of nonlinear impacts in the relationship between banking entry barriers or capital regulations and bank credit. Regarding the banking entry barrier index, both estimates of the low regime-dependent coefficient ($\widehat{\beta_1}$) and high regime-dependent coefficient ($\widehat{\beta_2}$) are significant at the 10% and 1% levels, respectively. Moreover, the low regime-dependent coefficient has a positive sign, whereas the sign of the high regime-dependent coefficient is negative. This implies that the impact of the banking entry barrier index on bank credit in the case of the selected SSA countries is positive and significant when the values of the banking entry barrier index are below the threshold level of 62.8%. However, this effect becomes negative and more statistically significant when the values of the banking entry barrier index are above that threshold level.

In the case of the model with the capital regulation stringency index, the sign of the estimated low regime-dependent coefficient is negative when its values are below the threshold level of 76.5%. But the sign becomes positive for values of the capital regulation stringency index that are above that threshold level. Nonetheless, the estimates of both coefficients are found to be statistically insignificant. Therefore, increasing the stringency of banking capital regulatory requirements in the context of the selected SSA economies does not influence bank credit, irrespective of whether the values of the capital regulation stringency index are below or above the obtained threshold level.

Additionally, other estimated results from Table 5.18 reveal that the effect of the bank supervisory power index on bank credit is negative at the 1% level of significance. The reported estimated results also indicate that both economic growth (captured by the log of real GDP) and inflation (proxied by the log of consumer price index) impacted positively and significantly on bank credit at the 1% level. Finally, the estimated results show that the effect of the current account balance as a share of GDP on bank credit is insignificant in the context of the selected SSA countries.

Table 5.17 Linearity test results

Model	Fisher (F-statistic)
$L = f(R_{EB}, S, Y, \pi, C)$	75.71***
$L = f(R_{BC}, S, Y, \pi, C)$	-5.26
$L = f(R_{AR}, S, Y, \pi, C)$	-57.92
$L = f(R_{CR}, S, Y, \pi, C)$	44.24***

Notes: The sample data has been averaged over three-year non-overlapping periods spanning 1997-2017 for all selected SSA countries; L = bank credit/GDP; R_{EB} = entry barrier index; R_{BC} = mixing banking & commerce restriction index; R_{AR} = activity restriction index; R_{CR} = capital regulation index; S = supervisory power index; Y = real GDP; π = inflation; C = current account/GDP; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.18 Dynamic PTR results

	Model with	
	Entry barrier index	**Capital regulation index**
Threshold estimates and confidence intervals		
Threshold estimates	62.8%	76.5%
95% confidence interval	[49.9 – 62.8]	[40.0 - 79.8]
Impact of bank regulation		
$\widehat{\beta_1}$	0.52* (0.29)	-0.08 (0.12)
$\widehat{\beta_2}$	-2.70*** (0.27)	0.79 (0.57)
Impact of covariates		
L_{t-1}	-0.01 (0.06)	0.02 (0.05)
S	-0.33*** (0.11)	-0.32*** (0.11)
Y	0.86*** (0.24)	0.82*** (0.21)
π	0.16*** (0.05)	0.14*** (0.05)
C	-0.01 (0.005)	-0.01 (0.01)
Countries	23	23
Observations	161	161

Notes: The sample is based on averaged data over three-year non-overlapping periods from 1997 to 2017 for all selected SSA countries; the dependent variable is bank credit/GDP (L); R_{EB} = entry barrier index; R_{CR} = capital regulation index; S = supervisory power index; Y = real GDP; π = inflation; C = current account/GDP; standard errors are in parenthesis; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

5.3 Results on the Causality Between Bank Regulation and Bank Lending

This section provides the results on the causality between bank regulation and bank credit. First, Section 5.3.1 provides the descriptive statistics, correlation analysis, cross-sectional dependence test results and panel unit root test results, while Section 5.3.2 present the panel cointegration test results. Second, Section 5.3.3 and Section 5.3.4 provide and discuss the symmetric and asymmetric panel error correction-based Granger causality results, respectively.

5.3.1 Descriptive Statistics, Correlation Analysis, Cross-sectional Dependence and Panel Unit Root Test Results

The panel for the analysis of causality between bank regulation and bank lending is still made up of 23 SSA countries, with 12 low-income countries and 11 middle-income countries, over the period spanning 1995 to 2017. The descriptive statistics in a form of the mean, standard deviation, as well as minimum and maximum values for bank regulatory measures and bank lending are the same as discussed in Section 5.2.1 and presented in Table 5.1. Likewise, the correlation analysis, cross-sectional dependence and panel unit root test results are similar to the ones discussed in Section 5.2.2 (and presented in Table 5.2), Section 5.2.3 (and presented in Table 5.3 to Table 5.7) and Section 5.2.4 (and presented in Table 5.8 to Table 5.9), respectively.

5.3.2 Panel Cointegration Test Results

The study uses a two-stage second-generation error-based cointegration method to determine the existence of a long-run association between bank regulatory measures and bank credit. First, the study estimates the long-run models. Second, it subjects the obtained errors to the CIPS panel unit root test to examine the presence of cointegration. Table 5.19 provides the test statistics for panel cointegration. The CIPS statistics significantly reject the null hypothesis of unit root on the obtained errors in almost all the specified models, except for models where: *i)* capital regulation index is a function of bank lending (in the case of all selected SSA

countries), *ii)* bank credit is a function of mixing banking and commerce restriction index (in the case of low-income SSA countries) or capital regulation index (in the case of middle-income SSA countries), and *iii)* mixing banking and commerce restriction index or activity restriction index is a function of bank lending (in the case of middle-income SSA countries). Overall, the presented results are strongly robust to the choice of the augmentation order, *p*. As a result, the study generally concludes that there is cointegration among variables in models where the CIPS statistics are significant.

Table 5.19 Residual-based panel cointegration test results (causality models)

CIPS(*p*) statistics (with an intercept)				
Model[a]	**CADF(1)**	**CADF(2)**	**CADF(3)**	**CADF(4)**
All selected SSA countries				
Models with entry barrier index				
$L = f(R_{EB})$	-2.73***	-2.98***	-2.88***	-2.83***
$R_{EB} = f(L)$	-2.14*	-2.33***	-2.38***	-2.20**
Models with mixing banking & commerce restriction index				
$L = f(R_{BC})$	-6.17***	-6.11***	-4.45***	-6.17***
$R_{BC} = f(L)$	-3.38***	-3.52***	-3.50***	-3.31***
Models with activity restriction index				
$L = f(R_{AR})$	-2.50***	-2.49***	-2.75***	-2.31***
$R_{AR} = f(L)$	-2.56***	-2.56***	-2.56***	-2.56***
Models with capital regulation index				
$L = f(R_{CR})$	-3.36***	-4.16***	-3.86***	-3.78***
$R_{CR} = f(L)$	-1.82	-1.82	-2.04	-2.04
Low-income SSA countries				
Models with entry barrier index				
$L = f(R_{EB})$	-5.80***	-5.65***	-5.80***	-5.80***
$R_{EB} = f(L)$	-3.98***	-3.63***	-4.00***	-3.98***
Models with mixing banking & commerce restriction index				
$L = f(R_{BC})$	2.22	2.31	2.27	2.22
$R_{BC} = f(L)$	-2.73***	-2.99***	-2.72***	-2.73***
Models with activity restriction index				
$L = f(R_{AR})$	-3.45***	-3.93***	-3.13***	-3.21***
$R_{AR} = f(L)$	-2.63***	-2.98***	-2.69***	-2.63***
Models with capital regulation index				
$L = f(R_{CR})$	-2.70***	-2.00	-2.42**	-2.70***
$R_{CR} = f(L)$	-3.96***	-4.37***	-3.97***	-3.96***
Middle-income SSA countries				
Models with mixing banking & commerce restriction index				
$L = f(R_{BC})$	-3.28***	-3.18***	-3.28***	-3.28***
$R_{BC} = f(L)$	-2.08	-2.08	-2.08	-2.05
Models with activity restriction index				
$L = f(R_{AR})$	-5.40***	-6.08***	-5.60***	-5.40***
$R_{AR} = f(L)$	-1.92	-3.87***	-3.34***	-2.07
Models with capital regulation index				
$L = f(R_{CR})$	-1.18	-2.71***	-2.14	-1.18
$R_{CR} = f(L)$	-4.84***	-4.84***	-4.84***	-4.84***

CIPS(*p*) statistics (with an intercept)				
Model[a]	**CADF(1)**	**CADF(2)**	**CADF(3)**	**CADF(4)**
Middle-income SSA countries				
Models with macroprudential index				
$L = f(R_{MP})$	-2.76***	-2.94***	-2.83***	-2.76***
$R_{MP} = f(L)$	-4.14***	-4.47***	-4.47***	-4.27***

Notes: Cross-sectionally augmented Im-Pesaran-Shin [CIPS(*p*)] statistics are cross-section averages of *p*-th-order cross-sectionally augmented Dickey-Fuller [CADF(*p*)] test statistics; [a]CIPS(*p*) statistics are based on the residuals of the specified models; L = bank credit/GDP; R_{EB} = entry barrier index; R_{BC} = mixing banking & commerce restriction index; R_{AR} = activity restriction index; R_{CR} = capital regulation index; R_{MP} = macroprudential index; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

5.3.3 Symmetric Panel Granger Causality Results

The study first tests for the symmetric causality between bank regulatory measures and bank credit within an error correction-based panel Granger-causality framework. Table 5.20 to Table 5.24 report the results for symmetric long- and short-run causality for models with banking entry barrier, mixing of banking and commerce restriction, banking activity restriction, capital regulation stringency and macroprudential indices, respectively, in all selected SSA countries, low-income SSA countries and/or middle-income SSA countries. The Chi-squared statistics are employed to test for Granger causality in the short run, while the *t*-statistics for the coefficients of the error-correction term are used to determine the long-run causality.

In the case of all selected SSA economies, the results from Table 5.20 to Table 5.23 indicate that there is a one-way long-run symmetric causality from *i)* banking entry barriers to bank lending (see Table 5.20), and *ii)* bank credit to mixing of banking and commerce restrictions (see Table 5.21) or banking activity restrictions (see Table 5.22). In the short run, the results show that there is a unidirectional symmetric Granger causality running from *i)* bank lending to banking entry barriers (see Table 5.20), *ii)* mixing of banking and commerce restrictions to bank credit (see Table 5.21), and *iii)* banking activity restrictions to bank lending (see Table 5.22).

When it comes to low-income SSA economies, the findings from Table 5.20 to Table 5.23 only portray a unidirectional long-run symmetric causality running from banking entry barriers to bank credit (see Table 5.20). In the short run, the results only indicate that there is a unidirectional symmetric Granger causality running from bank lending to capital regulations in low-income SSA countries (see Table 5.23).

In the context of middle-income SSA economies, the results from Table 5.21 to Table 5.24 highlight that no long- and short-run symmetric causality exists between bank credit and bank regulatory measures.

Lastly, Table 5.25 reports the post-estimation diagnostic test results for the residuals of the estimated symmetric causality models. The null hypothesis of no first-order autocorrelation is rejected in most models. However, the null hypotheses of constant variance and normality are not rejected in the majority of the estimated symmetric causality models. But given the absence of serial correlation in most of the estimated models, the reported error correction-based Granger causality results can generally be considered reliable (Wooldridge, 2002).

Table 5.20 Symmetric causality results (models with entry barrier index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
	$\Delta(L)$	$\Delta(R_{EB})$	ETC_{t-1}
All selected SSA countries			
$\Delta(L)$	-	1.55	-0.45***
$\Delta(R_{EB})$	3.94**	-	-0.01
Low-income SSA countries			
$\Delta(L)$	-	1.08	-0.59***
$\Delta(R_{EB})$	0.06	-	-0.003

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for the long run; Δ is the first difference operator; $L =$ bank credit/GDP; $R_{EB} =$ entry barrier index; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.21 Symmetric causality results (models with mixing banking & commerce index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
	$\Delta(L)$	$\Delta(R_{BC})$	ETC_{t-1}
All selected SSA countries			
$\Delta(L)$	-	3.14*	-0.001
$\Delta(R_{BC})$	1.11	-	-0.52***
Low-income SSA countries			
$\Delta(L)$	-	1.24	-
$\Delta(R_{BC})$	0.62	-	-0.001
Middle-income SSA countries			
$\Delta(L)$	-	1.67	-0.004
$\Delta(R_{BC})$	0.00	-	-

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for the long run; Δ is the first difference operator; $L =$ bank credit/GDP; $R_{BC} =$ mixing banking & commerce restriction index; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.22 Symmetric causality results (models with activity restriction index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
	$\Delta(L)$	$\Delta(R_{AR})$	ETC_{t-1}
All selected SSA countries			
$\Delta(L)$	-	0.16	-0.001
$\Delta(R_{AR})$	1.31	-	-0.40***
Low-income SSA countries			
$\Delta(L)$	-	0.12	-0.005
$\Delta(R_{AR})$	0.26	-	-0.001
Middle-income SSA countries			
$\Delta(L)$	-	0.07	0.001
$\Delta(R_{AR})$	1.55	-	-

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for the long run; Δ is the first difference operator; $L =$ bank credit/GDP; $R_{AR} =$ activity restriction index; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.23 Symmetric causality results (models with capital regulation index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
	$\Delta(L)$	$\Delta(R_{CR})$	ETC_{t-1}
All selected SSA countries			
$\Delta(L)$	-	0.76	-0.001
$\Delta(R_{CR})$	3.65*	-	-
Low-income SSA countries			
$\Delta(L)$	-	0.08	-0.003
$\Delta(R_{CR})$	4.49**	-	0.003
Middle-income SSA countries			
$\Delta(L)$	-	0.84	-
$\Delta(R_{CR})$	1.14	-	-0.004

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for the long run; Δ is the first difference operator; $L =$ bank credit/GDP; $R_{CR} =$ capital regulation index; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.24 Symmetric causality estimation results (models with macroprudential index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
	$\Delta(L)$	$\Delta(R_{MP})$	ETC_{t-1}
Middle-income SSA countries			
$\Delta(L)$	-	0.70	-0.03
$\Delta(R_{MP})$	0.91	-	-0.0002

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for the long run; Δ is the first difference operator; $L =$ bank credit/GDP; $R_{MP} =$ macroprudential index; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.25 Post-estimation test results (symmetric causality models)

Dependent variable	All selected SSA countries			Low-income SSA countries			Middle-income SSA countries		
	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]
Models with entry barrier index									
$\Delta(L)$	0.14	7.37***	192.90***	2.71	0.09	54.81***	-	-	-
$\Delta(R_{EB})$	0.10	12.75***	9064.00***	114.35***	22.54***	3497.00***	-	-	-
Models with mixing banking & commerce restriction index									
$\Delta(L)$	0.17	8.52***	249.60***	0.10	0.00	262.00***	0.16	3.65	48.31***
$\Delta(R_{BC})$	52.70***	42.98***	4006.00***	11.22***	13.45***	1222.00***	258214***	0.56	4001.00***
Models with activity restriction index									
$\Delta(L)$	0.21	14.46***	236.90***	0.08	0.02	45.59***	0.16	4.50**	44.68***
$\Delta(R_{AR})$	31.90***	0.23	5862.00**	0.68	0.29	4026.00**	0.83	0.68	9697.00***
Models with capital regulation index									
$\Delta(L)$	0.19	8.89***	238.90***	0.07	0.02	45.04***	0.26	4.51**	230.50***
$\Delta(R_{CR})$	0.42	5.38**	7149.00***	5.48**	34.60***	3433.00***	0.33	5.73**	2872.00***
Models with macroprudential index									
$\Delta(L)$	-	-	-	-	-	-	0.16	4.10**	41.02***
$\Delta(R_{MP})$	-	-	-	-	-	-	0.57	21.35***	2707.00***

Notes: [a]H_0: no first-order autocorrelation; [b]H_0: constant variance; [c]H_0: normality; Δ is the first difference operator; L = bank credit/GDP; R_{EB} = entry barrier index; R_{BC} = mixing banking & commerce restriction index; R_{AR} = activity restriction index; R_{CR} = capital regulation index; R_{MP} = macroprudential index; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

5.3.4 Asymmetric Panel Granger Causality Results

The study further tests for the asymmetric causality between bank regulatory measures and bank credit within an error correction-based panel Granger-causality framework. Table 5.26 to Table 5.30 present the asymmetric long- and short-run causality results for models with banking entry barrier, mixing of banking and commerce restriction, banking activity restriction, capital regulation stringency and macroprudential indices, respectively, in all selected SSA economies, low-income SSA economies and/or middle-income SSA economies. The Chi-squared statistics are used to test for the short-run Granger causality, while the *t*-statistics for the coefficients of the error-correction term are employed to determine the causality in the long run.

In the context of all selected SSA countries, the results from Table 5.26 to Table 5.29 reveal that long-run bidirectional asymmetric causality exists between *i)* positive shocks to mixing of banking and commerce restrictions and positive shocks to bank credit (see Table 5.27), *ii)* positive shocks to mixing of banking and commerce restrictions and negative shocks to bank lending (see Table 5.27), and *iii)* negative or positive shocks to banking activity restrictions and negative shocks to bank credit (see Table 5.28). Furthermore, there are one-way asymmetric long-run causal flows from *i)* positive or negative shocks to banking entry barriers to positive or negative shocks to bank lending (see Table 5.26), *ii)* negative shocks to mixing of banking and commerce restrictions to positive or negative shocks to bank credit (see Table 5.27), *iii)* positive or negative shocks to banking activity restrictions to positive shocks to bank lending (see Table 5.28), and *iv)* negative shocks to capital regulations to negative shocks to bank credit (see Table 5.29). Finally, in the short run, the Chi-squared statistics indicate that there is one-way causal flow from *i)* negative shocks to mixing of banking and commerce restrictions and negative shocks to bank lending (see Table 5.27), and *ii)* positive shocks to bank credit to negative shocks to capital regulations (see Table 5.29).

For low-income SSA economies, the findings from Table 5.26 to Table 5.29 portray that one-way long-run asymmetric causal flows exist from *i)* positive shocks to mixing of banking and commerce restrictions to positive or negative shocks to bank lending (see Table 5.27), *ii)* positive or negative shocks to banking activity restrictions to negative shocks to bank credit (see Table 5.28), *iii)* positive shocks to bank credit to negative shocks to banking activity restrictions (see Table 5.28), and *iv)* positive shocks to capital regulations to negative shocks to bank lending (see Table 5.29). Moreover, the Chi-squared statistics show that there is only one-way short-run asymmetric causal flow running from positive shocks to bank credit to negative shocks to mixing of banking and commerce (see Table 5.27).

In the case of middle-income SSA countries, the estimated results from Table 5.27 to Table 5.30 highlight that there are long-run bidirectional asymmetric causal flows between *i)* positive shocks to mixing of banking and commerce restrictions and negative shocks to bank credit (see Table 5.27), *ii)* negative shocks to banking activity restrictions and positive shocks to bank lending (see Table 5.28), *iii)* positive shocks to capital regulations and positive shocks to bank credit (see Table 5.29), *iv)* positive (negative) shocks to capital regulations and negative (positive) shocks to bank lending (see Table 5.29), and *v)* positive shocks to macroprudential policies and positive shocks to bank credit (see Table 5.30). Additionally, one-way long-run asymmetric causal flows exist running from *i)* negative shocks to mixing of banking and commerce restrictions to negative shocks to bank lending (see Table 5.27), *ii)* negative shocks to bank credit to positive or negative shocks to banking activity restrictions (see Table 5.28), *iii)* negative shocks to bank lending to negative shocks to capital regulations (see Table 5.29), and *iv)* negative shocks to bank credit to positive shocks to macroprudential policies (see Table 5.30). Lastly, the Chi-squared statistics reveal that there is only one-way short-run asymmetric causal flow running from negative shocks to capital regulations to negative shocks to bank lending (see Table 5.29).

Finally, Table 5.31 reports the post-estimation diagnostic test results for the residuals of the estimated asymmetric causality models. The null hypothesis of no first-order

autocorrelation is rejected in most models, especially when shocks to bank credit are dependent variables. Nevertheless, the null hypotheses of constant variance and normality are not rejected in the majority of the estimated asymmetric causality models. But due to the absence of serial correlation in most of the estimated models, the reported error correction-based Granger causality results can generally be relied upon (Wooldrgige, 2002).

Table 5.26 Asymmetric causality results (models with entry barrier index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
All selected SSA countries			
	$\Delta(L^+)$	$\Delta(R_{EB}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	0.33	-0.40***
$\Delta(R_{EB}^+)$	0.04	-	-
	$\Delta(L^-)$	$\Delta(R_{EB}^-)$	
$\Delta(L^-)$	-	2.67	-0.52***
$\Delta(R_{EB}^-)$	1.55	-	-
	$\Delta(L^+)$	$\Delta(R_{EB}^-)$	
$\Delta(L^+)$	-	1.68	-0.34***
$\Delta(R_{EB}^-)$	11.19***	-	-
	$\Delta(L^-)$	$\Delta(R_{EB}^+)$	
$\Delta(L^-)$	-	0.31	-0.42***
$\Delta(R_{EB}^+)$	0.53	-	-
Low-income SSA countries			
	$\Delta(L^+)$	$\Delta(R_{EB}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	1.10	-
$\Delta(R_{EB}^+)$	0.66	-	-
	$\Delta(L^-)$	$\Delta(R_{EB}^-)$	
$\Delta(L^-)$	-	0.38	-0.004
$\Delta(R_{EB}^-)$	0.58	-	-
	$\Delta(L^+)$	$\Delta(R_{EB}^-)$	
$\Delta(L^+)$	-	0.64	-0.03
$\Delta(R_{EB}^-)$	0.23	-	-
	$\Delta(L^-)$	$\Delta(R_{EB}^+)$	
$\Delta(L^-)$	-	0.02	-0.01
$\Delta(R_{EB}^+)$	0.22	-	-0.004

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for long run; Δ is the first difference operator; L = bank credit/GDP; R_{EB} = entry barrier index; $+$ = positive shock; $-$ = negative shock; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.27 Asymmetric causality results (models with mixing banking & commerce restriction index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
All selected SSA countries			
	$\Delta(L^+)$	$\Delta(R_{BC}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	0.37	-0.08***
$\Delta(R_{BC}^+)$	0.08	-	-0.14***
	$\Delta(L^-)$	$\Delta(R_{BC}^-)$	
$\Delta(L^-)$	-	3.70*	0.34***
$\Delta(R_{BC}^-)$	0.03	-	-
	$\Delta(L^+)$	$\Delta(R_{BC}^-)$	
$\Delta(L^+)$	-	2.70	-0.05***
$\Delta(R_{BC}^-)$	1.69	-	-
	$\Delta(L^-)$	$\Delta(R_{BC}^+)$	
$\Delta(L^-)$	-	0.06	-0.48***
$\Delta(R_{BC}^+)$	0.16	-	-0.34***
Low-income SSA countries			
	$\Delta(L^+)$	$\Delta(R_{BC}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	0.01	-0.36***
$\Delta(R_{BC}^+)$	0.09	-	-
	$\Delta(L^-)$	$\Delta(R_{BC}^-)$	
$\Delta(L^-)$	-	0.75	-0.002
$\Delta(R_{BC}^-)$	1.34	-	-
	$\Delta(L^+)$	$\Delta(R_{BC}^-)$	
$\Delta(L^+)$	-	2.20	-0.03
$\Delta(R_{BC}^-)$	6.05**	-	-
	$\Delta(L^-)$	$\Delta(R_{BC}^+)$	
$\Delta(L^-)$	-	0.00	-0.21***
$\Delta(R_{BC}^+)$	2.06	-	-0.01
Middle-income SSA countries			
	$\Delta(L^+)$	$\Delta(R_{BC}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	0.54	-
$\Delta(R_{BC}^+)$	0.03	-	-
	$\Delta(L^-)$	$\Delta(R_{BC}^-)$	
$\Delta(L^-)$	-	1.84	-0.05**
$\Delta(R_{BC}^-)$	0.34	-	-
	$\Delta(L^+)$	$\Delta(R_{BC}^-)$	
$\Delta(L^+)$	-	0.81	-0.03
$\Delta(R_{BC}^-)$	0.00	-	-

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
Middle-income SSA countries			
	$\Delta(L^{-})$	$\Delta(R_{BC}^{+})$	ETC_{t-1}
$\Delta(L^{-})$	-	0.03	-0.03*
$\Delta(R_{BC}^{+})$	1.09	-	-0.44***

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for long run; Δ is the first difference operator; L = bank credit/GDP; R_{BC} = mixing banking & commerce restriction index; $+$ = positive shock; $-$ = negative shock; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.28 Asymmetric causality results (models with activity restriction index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
All selected SSA countries			
	$\Delta(L^+)$	$\Delta(R_{AR}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	0.02	-0.38***
$\Delta(R_{AR}^+)$	0.71	-	-0.02
	$\Delta(L^-)$	$\Delta(R_{AR}^-)$	
$\Delta(L^-)$	-	0.00	-0.52***
$\Delta(R_{AR}^-)$	0.62	-	-0.14**
	$\Delta(L^+)$	$\Delta(R_{AR}^-)$	
$\Delta(L^+)$	-	0.19	-0.33***
$\Delta(R_{AR}^-)$	2.38	-	-0.05
	$\Delta(L^-)$	$\Delta(R_{AR}^+)$	
$\Delta(L^-)$	-	0.21	-0.05***
$\Delta(R_{AR}^+)$	0.36	-	-0.32***
Low-income SSA countries			
	$\Delta(L^+)$	$\Delta(R_{AR}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	2.05	-0.03
$\Delta(R_{AR}^+)$	0.24	-	-0.004
	$\Delta(L^-)$	$\Delta(R_{AR}^-)$	
$\Delta(L^-)$	-	0.00	-0.04**
$\Delta(R_{AR}^-)$	0.87	-	-0.05
	$\Delta(L^+)$	$\Delta(R_{AR}^-)$	
$\Delta(L^+)$	-	0.18	-0.04
$\Delta(R_{AR}^-)$	0.10	-	-0.34***
	$\Delta(L^-)$	$\Delta(R_{AR}^+)$	
$\Delta(L^-)$	-	0.03	-0.13***
$\Delta(R_{AR}^+)$	0.33	-	-
Middle-income SSA countries			
	$\Delta(L^+)$	$\Delta(R_{AR}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	0.02	-0.06
$\Delta(R_{AR}^+)$	0.48	-	-
	$\Delta(L^-)$	$\Delta(R_{AR}^-)$	
$\Delta(L^-)$	-	0.12	-0.0002
$\Delta(R_{AR}^-)$	0.02	-	-0.36***
	$\Delta(L^+)$	$\Delta(R_{AR}^-)$	
$\Delta(L^+)$	-	0.71	-0.47***
$\Delta(R_{AR}^-)$	2.10	-	-0.25***

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
Middle-income SSA countries			
	$\Delta(L^{+})$	$\Delta(R_{AR}^{-})$	ETC_{t-1}
$\Delta(L^{-})$	-	0.19	-0.01
$\Delta(R_{AR}^{+})$	0.02	-	-0.11**

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for long run; Δ is the first difference operator; $L =$ bank credit/GDP; $R_{AR} =$ activity restriction index; $+$ = positive shock; $-$ = negative shock; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

Table 5.29 Asymmetric causality results (models with capital regulation index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
All selected SSA countries			
	$\Delta(L^+)$	$\Delta(R_{CR}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	0.02	0.004
$\Delta(R_{CR}^+)$	0.20	-	-
	$\Delta(L^-)$	$\Delta(R_{CR}^-)$	
$\Delta(L^-)$	-	2.56	-0.36***
$\Delta(R_{CR}^-)$	0.57	-	-0.002
	$\Delta(L^+)$	$\Delta(R_{CR}^-)$	
$\Delta(L^+)$	-	0.17	-0.05***
$\Delta(R_{CR}^-)$	3.45*	-	-0.01
	$\Delta(L^-)$	$\Delta(R_{CR}^+)$	
$\Delta(L^-)$	-	0.17	-0.0002
$\Delta(R_{CR}^+)$	1.36	-	-
Low-income SSA countries			
	$\Delta(L^+)$	$\Delta(R_{CR}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	0.09	-0.03
$\Delta(R_{CR}^+)$	0.20	-	-
	$\Delta(L^-)$	$\Delta(R_{CR}^+)$	
$\Delta(L^-)$	-	0.12	-0.04*
$\Delta(R_{CR}^+)$	0.51	-	-0.02
Middle-income SSA countries			
	$\Delta(L^+)$	$\Delta(R_{CR}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	0.01	-0.30***
$\Delta(R_{CR}^+)$	1.62	-	-0.40***
	$\Delta(L^-)$	$\Delta(R_{CR}^-)$	
$\Delta(L^-)$	-	3.20*	-0.04
$\Delta(R_{CR}^-)$	0.22	-	-0.32***
	$\Delta(L^+)$	$\Delta(R_{CR}^-)$	
$\Delta(L^+)$	-	0.30	-0.32***
$\Delta(R_{CR}^-)$	0.19	-	-0.49***
	$\Delta(L^-)$	$\Delta(R_{CR}^+)$	
$\Delta(L^-)$	-	0.12	-0.13*
$\Delta(R_{CR}^+)$	1.64	-	-0.13*

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for long run; Δ is the first difference operator; $L =$ bank credit/GDP; $R_{CR} =$ capital regulation index; $+$ = positive shock; $-$ = negative shock; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively; other Granger causality results for low-income SSA countries could not be obtained owing to lack of negative shocks to capital regulation index.

Table 5.30 Asymmetric causality results (models with macroprudential index)

Dependent variable	Source of causation (independent variables)		
	Short run		Long run
All selected SSA countries			
	$\Delta(L^+)$	$\Delta(R_{MP}^+)$	ETC_{t-1}
$\Delta(L^+)$	-	1.29	-0.46***
$\Delta(R_{MP}^+)$	1.13	-	-0.22***
	$\Delta(L^-)$	$\Delta(R_{MP}^+)$	
$\Delta(L^-)$	-	0.02	-0.04
$\Delta(R_{MP}^+)$	0.07	-	-0.73***

Notes: Chi-squared statistics are reported for short run; coefficients for an error-correction term (*ECT*) are reported for long run; Δ is the first difference operator; $L =$ bank credit/GDP; $R_{MP} =$ macroprudential index; $+$ = positive shock; $-$ = negative shock; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively; other Granger causality results for middle-income SSA countries could not be obtained owing to lack of negative shocks to macroprudential index.

Table 5.31 Post-estimation test results (asymmetric causality models)

Dependent variable	All selected SSA countries			Low-income SSA countries			Middle-income SSA countries		
	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]
Models with entry barrier index									
$\Delta(L^+)$	0.04	92.21***	640.60***	0.23	22.12***	704.10***	-	-	-
$\Delta(R_{EB}^+)$	2618.84***	7.55***	19000***	53.28***	10.63***	19000***	-	-	-
$\Delta(L^-)$	1.71	338.40***	2251.00***	0.71	0.75	5100.00***	-	-	-
$\Delta(R_{EB}^-)$	61.97***	41.81***	150000***	41.13***	22.06***	150000***	-	-	-
$\Delta(L^+)$	0.00	87.44***	663.70***	1.03	17.22***	80.15***	-	-	-
$\Delta(R_{EB}^-)$	7.63**	429.01***	130000***	51.90***	0.13	150000***	-	-	-
$\Delta(L^-)$	0.65	401.43***	2734.00***	0.60	1.67	5072.00***	-	-	-
$\Delta(R_{EB}^+)$	57.26***	19.03***	19000***	64.84***	10.87***	5909.00***	-	-	-
Models with mixing banking & commerce restriction index									
$\Delta(L^+)$	0.20	81.03***	694.90***	0.00	25.98***	54.15***	0.39	21.13***	765.20***
$\Delta(R_{BC}^+)$	8.17***	267.58***	12000***	1601.23***	7.74*	14000***	9790.74***	7.70***	14000***
$\Delta(L^-)$	0.10	256.03***	2950.00***	0.56	1.42	5055.00***	0.45	74.74***	1164.00***
$\Delta(R_{BC}^-)$	2056.56***	8.14***	27000***	27.17***	24.75***	26000***	167.60***	4.14**	27000***
$\Delta(L^+)$	0.48	70.89***	707.30***	2.59	18.54***	76.62***	0.28	24.21***	214.00***
$\Delta(R_{BC}^-)$	130.10***	30.96***	27000***	33.24***	96.94***	24000***	57984***	5.41**	27000***
$\Delta(L^-)$	0.51	390.60***	3008.00***	1.11	39.46***	3972.00***	0.61	59.55***	1197.00***
$\Delta(R_{BC}^+)$	0.71	206.22***	11000***	95.64***	27.09***	4227.00***	1.62	261.49***	2570.00***
Models with activity restriction index									
$\Delta(L^+)$	0.04	93.38***	569.40***	1.52	20.58***	75.26***	0.21	22.57***	227.20***

Dependent variable	All selected SSA countries			Low-income SSA countries			Middle-income SSA countries		
	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]
Models with activity restriction index									
$\Delta(R_{AR}^{+})$	255.50***	44.17***	80000***	390.22***	22.17***	53000***	231.63***	15.65***	80000***
$\Delta(L^{-})$	1.62	332.65***	2405.00***	0.56	4.79**	5125.00***	0.42	67.02***	1221.00***
$\Delta(R_{AR}^{-})$	394.91***	97.25***	27000***	63.59***	27.10***	7299.00***	0.70	220.36***	6860.00***
$\Delta(L^{+})$	0.003	117.67***	555.80***	0.96	21.93***	75.44***	0.01	107.74***	93.25***
$\Delta(R_{AR}^{-})$	198.04***	43.30***	29000***	21.30***	195.56***	4549.00***	2.08	139.44***	8456.00***
$\Delta(L^{-})$	0.24	184.43***	5515.00***	1.67	37.29***	3998.00***	0.43	78.81***	1189.00***
$\Delta(R_{AR}^{+})$	0.73	377.60***	72000***	74.69***	14.28***	80000***	237.50***	58.96***	25000***
Models with capital regulation index									
$\Delta(L^{+})$	0.35	65.41***	724.20***	1.22	20.65***	74.92***	0.03	32.58***	199.50***
$\Delta(R_{CR}^{+})$	448.61***	17.89***	51000***	281.49***	9.48***	51000***	23.07***	654.93***	5704.00***
$\Delta(L^{-})$	0.02	221.69***	2858.00***	-	-	-	0.49	77.88***	1171.00***
$\Delta(R_{CR}^{-})$	598.28***	23.01***	20000***	-	-	-	22.03***	100.57***	7361.00***
$\Delta(L^{+})$	0.41	77.54***	699.50***	-	-	-	0.37	35.03***	189.20***
$\Delta(R_{CR}^{-})$	77.00***	37.64***	21000***	-	-	-	3.78*	81.05***	7989.00***
$\Delta(L^{-})$	0.19	148.53***	5836.00***	0.54	2.60	5065.00***	0.40	76.23***	1114.00***
$\Delta(R_{CR}^{+})$	32.98***	41.37***	51000***	635.00***	15.99***	13000***	3.24	102.53***	17000***
Models with macroprudential index									
$\Delta(L^{+})$	-	-	-	-	-	-	0.19	78.72***	117.20***
$\Delta(R_{MP}^{+})$	-	-	-	-	-	-	0.49	90.77***	2208.00***
$\Delta(L^{-})$	-	-	-	-	-	-	0.35	73.38***	1186.00***

Dependent variable	All selected SSA countries			Low-income SSA countries			Middle-income SSA countries		
	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]	Serial correlation[a]	Heterosce-dasticity[b]	Normality[c]
Models with macroprudential index									
$\Delta(R_{MP}^{+})$	-	-	-	-	-	-	3.22	227.91***	1166.00***

Notes: [a]H_0: no first-order autocorrelation; [b]H_0: constant variance; [c]H_0: normality; Δ is the first difference operator; L = bank credit/GDP; R_{EB} = entry barrier index; R_{BC} = mixing banking & commerce restriction index; R_{AR} = activity restriction index; R_{CR} = capital regulation index; R_{MP} = macroprudential index; ***, ** and * represent statistical significance at the 1%, 5% and 10% levels, respectively.

5.4 Summary and Discussion of Empirical Findings

This section presents a detailed summary and discussion of the main empirical findings from the analysis of this study and compares them to the results obtained in previous studies. It first discusses the main results from the models that assessed the linear and nonlinear impact of bank regulation, as well as its interaction with bank supervision, on bank lending, including the model on the analysis of threshold effects of bank regulatory measures on bank credit. Lastly, it highlights the main findings from the assessment of symmetric and asymmetric panel Granger causality between bank regulatory measures and bank lending.

5.4.1 Main Findings from the Impact Models

The linear and nonlinear dynamic panel ARDL results presented in Section 5.2.7 showed that the banking entry barrier index significantly influenced bank credit negatively in all selected SSA economies and low-income SSA economies when accounting for an interactive term between banking entry barrier and supervisory power indices. However, supervisory power managed to mitigate the negative effect of banking entry barriers on bank lending. Further analysis revealed that only positive shocks to the banking entry barrier index had a long-run negative and significant effect on bank credit. In the short run, the findings highlighted that positive shocks to the banking entry barrier index affected bank credit positively and significantly, whereas negative shocks to the banking entry barrier index had a negative and significant impact.

These findings generally showed that the benefit of rising bank credit enjoyed by all selected SSA countries as well as low-income SSA economies was short-lived. This was possibly derived from the increasing franchise value of banks as a result of the implementation of more stringent banking entry barriers (Keeley, 1990; Peltzman 1965). However, tightening the stringency of banking entry barriers led to a decline in bank credit in the long run. This was in accordance with the literature that postulated that banking entry barriers could restrict the provision of bank credit by limiting competition and its efficiency benefits (Barth et al., 2004; Claessens & Klingebiel,

2001; Nickell, 1996). Nevertheless, strengthening supervisory power managed to mitigate the negative effect of banking entry barriers by minimising moral hazard problems through monitoring and enforcement of regulations (Merrouche & Nier, 2017).

Moreover, the dynamic panel ARDL results showed that positive shocks to restrictions on the mixing of banking and commerce as well as on the banking activities enhanced bank credit in the long and short run, respectively, in low-income SSA economies. These findings were consistent with the asymmetric information theory. This theory argues that imposing limits on the extent of ownership between banks, non-financial firms and non-bank financial firms or on the banking activities such as securities, insurance and real estate minimises conflict of interest and moral hazard problems and promotes prudence in lending (see Boyd et al., 1998; John et al., 1994). The result on banking activity restrictions was partly aligned with the finding of Amidu (2014), who determined that banking activity restrictions improved the provision of bank lending in the short run in SSA countries.

Furthermore, the finding that positive shocks to the capital regulation stringency index increased bank credit in the short run in low-income SSA economies was consistent with the risk-absorption theory, which postulates that hiking capital regulation stringency promotes prudence in lending by improving the risk-bearing capacity of banks (see Kim & Sohn, 2017; Berger & Bouwman, 2009). Even though this impact disappeared in the long run, the results revealed that negative shocks to the capital regulation stringency index had a long-run detrimental effect on bank credit in low-income SSA countries, probably because they limited the risk-bearing capacity of banks, thereby restricting their ability to offer more lending, especially in times of crisis.

The findings from the dynamic panel ARDL results also showed that the introduction of macroprudential policies had a negative and significant long-run linear impact on bank lending in middle-income SSA economies after incorporating an interactive term between the macroprudential and bank supervisory power indices in the model

specifications. But the power of bank supervision significantly mitigated the long-run negative impact of the macroprudential index on bank credit. The negative long-run impact of macroprudential policies was similar to the findings from Carreras et al. (2018). It was also in line with expectations as the theoretical literature postulates that its effect on bank credit should be countercyclical since they are meant to enhance financial stability by curbing the build-up of systemic risk and limit excessive growth in bank credit (Cerutti et al., 2017; Freixas et al., 2015; Drehmann & Gambacorta, 2012; Hanson et al., 2011).

Considering the assessment of threshold effects of bank regulatory measures on bank credit, the results from the dynamic PTR model in Section 5.2.8 highlighted that the estimated threshold value for the banking entry barrier index was 62.8%. This implied that the effect of banking entry barriers on bank lending in the case of the selected SSA countries was positive when the stringency of these barriers was below its threshold level. Even though this finding was comparable to the one obtained by Amidu (2014), it held only when the stringency of banking entry barriers was lower than the threshold value of 62.8%. However, when the banking entry barrier stringency was more than that threshold level, the impact of banking entry barriers on bank credit became negative.

The results from the nonlinear impact of banking entry barriers on bank credit in the selected SSA countries were also in line with the theory of market structure. As asserted by Keeley (1990), restricting entry into the banking sector reduces competition and allows the existing banks to have more market power and enjoy higher profits. As a result, this increase in the franchise value of banks encourages more prudent lending. Nevertheless, in the context of the selected SSA economies, this theory was supported only when the banking entry barrier stringency increased from low to moderate levels and this occurred when this stringency was lower than its threshold value of 62.8%. However, when the stringency of the banking entry barriers increased from moderate to high, that is, it exceeded the threshold value of 62.8%, the banking entry barriers then had a negative and significant impact on bank credit in the case of the selected SSA countries. Consistent with Claessens and Klingebiel

(2001), this finding could be supported by the argument that stringent banking entry barriers tended to reduce competition excessively, resulting in inefficiencies that forced banks to hike the costs of offering their services, in that way leading to a fall in the demand for credit.

When coming to the model with the capital regulation stringency index, the estimated low regime-dependent coefficient exhibited a negative sign for values lower than the threshold level of 76.5%. But this index bore a positive sign for values higher than that threshold level. However, both the low and high regime-dependent coefficients were found to be statistically insignificant, which was a result that neither supported the risk-absorption theory nor the financial fragility-crowding out hypothesis (see Kim & Sohn, 2017). This was contrary to what Amidu (2014) established in the context of SSA economies whereby the stringency of capital regulatory requirements limited the provision of bank credit. Therefore, banking capital requirements had no impact on bank lending in the selected SSA economies considered in this study, irrespective of whether their stringency was lower or higher than the obtained threshold value; that is, when controlling for the presence of nonlinear impacts, the effect of the adjustments in capital regulation stringency on bank credit became insignificant. This was a finding that was comparable to other studies that used linear techniques in modelling the nexus between bank regulation and bank lending (see Fratzscher et al., 2016; Bridges et al., 2014; Barth et al., 2004).

Other estimated results showed that the stringency of bank supervisory power impacted bank credit negatively and significantly. This result aligned with the finding established by Merrouche and Nier (2017) and implied that while the strength of bank supervision minimised moral hazard problems by enhancing monitoring and enforcement of regulatory requirements, it came with a cost of restricting bank credit in the selected SSA economies. The estimated results also indicated that economic growth and inflation influenced the delivery of bank credit positively and significantly. The former result supported the assertion that economies exhibiting higher national incomes seemed to be driven by larger credit markets with greater degrees of financial deepening because of the economies of scale enjoyed in the organisation of

the supporting institutions (Djankov et al., 2007; Cottarelli et al., 2005). On the other hand, the latter finding, which was in line with Çatik and Karaçuka (2012), indicated that instead of the effect of the rising inflation discouraging customers from obtaining additional lending (see Djankov et al., 2007; Adesina, 2019), it promoted credit provision plausibly as the effect was outweighed by the expectations of macroeconomic stability that usually existed under relatively low-inflation environments.

5.4.2 Main Findings from the Granger Causality Models

The symmetric and asymmetric panel Granger causality results provided in Section 5.3.3 and Section 5.3.4, respectively, generally showed that long-run bidirectional or unidirectional causality existed between bank regulatory measures and bank credit in the context of selected SSA countries and their income groups. These findings supported the hypothesis that Granger causality could exist between institutions and economic performance measures (Law et al., 2013; North, 1981, 1990; Rosenberg & Birdzel, 1986). In the short run, the results indicated that there were one-way symmetric or asymmetric causal flows either from bank regulatory measures to bank lending or from bank lending to bank regulatory measures. The causal flows from bank regulatory measures to bank credit highlighted that bank lending responded to previous different reforms in bank regulation. Lastly, the causal flows from bank credit to bank regulatory measures were in support of the notion that past developments in bank lending influenced reforms in banking regulations (Deli & Hasan, 2017; Fratzscher et al., 2016; Kim et al., 2014).

5.5 Conclusion

This chapter presented the study's empirical findings including *i)* the linear and nonlinear impacts of bank regulatory measures, and their interaction with bank supervision, on bank credit using the dynamic panel ARDL model estimated through the CCEMG technique, *ii)* the threshold effects of bank regulatory measures on bank credit using the dynamic PTR model estimated through the GMM approach, and *iii)* the symmetric and asymmetric causal relationship between bank regulatory

measures and bank credit using the panel Granger causality models. In all these methods, relevant tests for model specification and diagnostics were undertaken to ensure the reliability of the estimated results.

There were four main findings under the models selected. First, under the linear panel ARDL models, bank entry barriers were found to significantly impact bank credit negatively in the long term in all selected SSA countries as well as low-income SSA economies. However, macroprudential policies had a negative and significant long-run impact on bank credit in middle-income SSA economies, but supervisory power mitigated those negative effects. Second, under the nonlinear panel ARDL models, it was established that various shocks to bank regulatory measures had affected bank lending differently. Third, under the PTR model, the threshold values of 62.8% and 76.5% for the stringency of banking entry barriers and capital regulations, respectively, were determined in the case of all selected SSA economies. The effect of the stringency of banking entry barriers on bank credit was found to be positive below its threshold value but negative above it, while that of capital regulation stringency was insignificant either below or above its threshold level. Lastly, the symmetric and asymmetric panel Granger causality results generally showed that long-run bidirectional or unidirectional causality existed between bank regulatory measures and bank credit in the context of selected SSA countries and their income groups, while various shocks to bank regulatory measures or bank credit had different short-run causal effects. The next chapter concludes the study and offers policy implications emanating from these main findings.

CHAPTER 6

CONCLUSION AND POLICY IMPLICATIONS

6.1 Introduction

This chapter presents the summary and conclusions from this study. It also provides policy implications emanating from the main empirical results of the study as well as limitations and areas for further research. After this introduction, Section 6.2 gives an overview of the study, while Section 6.3 presents the summary of empirical findings. Section 6.4 provides policy implications and recommendations. Lastly, Section 6.5 offers limitations encountered in this study and identifies areas for further research.

6.2 Overview of the Study

The explored theoretical and empirical literature highlighted that different possible channels existed on how bank regulatory measures and bank lending could influence each other. As a result, in establishing the empirical evidence on the nexus between bank regulation and bank credit in selected SSA economies and/or their low-income and middle-income groups, the study specifically aimed at achieving the following objectives:

i) To examine the linear and nonlinear impacts of bank regulatory measures on bank lending.

ii) To investigate whether the bank supervisory environment mitigates or enhances the effects of bank regulatory measures on bank credit.

iii) To assess the existence of threshold effects of bank regulatory measures on bank lending.

iv) To determine the direction of symmetric and asymmetric causality between bank regulatory measures and bank credit.

The study tested whether the following hypotheses held in the case of selected SSA economies and/or their low-income and middle-income groups:

i) Measures of bank regulation have negative effects on bank credit.

ii) Bank supervisory environment mitigates the impact of bank regulatory measures on bank lending.

iii) Threshold effects exist in the nexus between bank regulatory measures and bank credit.

iv) Bidirectional causality exists between measures of bank regulation and bank lending.

To address the objectives of this study and test its hypotheses, various econometric models were employed. First, the dynamic panel ARDL model estimated through the dynamic CCE method of Chudik and Pesaran (2015) was used to assess the linear and nonlinear impact of bank regulatory measures, and their interaction with bank supervision, on bank credit. Second, the dynamic PTR model estimated through the GMM approach as proposed by Kremer et al. (2013) was employed to analyse the threshold impacts of bank regulatory measures on bank credit. Lastly, the panel Granger causality model was used to determine the symmetric and asymmetric causal association between bank regulatory measures and bank lending.

6.3 Summary of Empirical Findings and Conclusion

First, the main empirical findings from the dynamic panel ARDL models that analysed the linear and nonlinear impact of bank regulatory measures, and their interaction with bank supervision, on bank lending, included:

i) Bank entry barriers were found to impact bank credit negatively in all selected SSA countries as well as low-income SSA economies, but supervisory power mitigated that impact. These findings were in line with the literature that

contends that banking entry barriers could limit bank credit by lowering competition and eliminating its efficiency benefits (Barth et al., 2004; Claessens & Klingebiel, 2001; Nickell, 1996). However, strengthening supervisory power managed to mitigate the negative effect of banking entry barriers by minimising moral hazard problems through monitoring and enforcement of regulations (Merrouche & Nier, 2017).

ii) Positive shocks to banking entry barriers had a long-run negative impact on bank lending. Nevertheless, in the short run, positive shocks to banking entry barriers affected bank credit positively, whereas negative shocks had a negative impact. These results showed that the benefit of experiencing more lending from the banks that prevailed in the cases of all selected SSA countries as well as low-income SSA economies was short-lived. It was possibly caused by the increase in the franchise value of banks as a result of tighter banking entry barriers (Keeley, 1990; Peltzman 1965).

iii) Positive shocks to restrictions on the mixing of banking and commerce as well as on the banking activities were found to promote bank credit in the long and short run, respectively, in low-income SSA countries. These findings were consistent with the asymmetric information theory, which contends that limits on the extent of ownership between banks, non-financial firms and non-bank financial firms or on the banking activities such as securities, insurance and real estate minimise conflict of interest and moral hazard problems and yields more prudent lending (see Boyd et al., 1998; John et al., 1994). Furthermore, the result on banking activity restrictions partly aligned with Amidu's (2014) finding that banking activity restrictions promoted bank credit delivery in the short run in SSA countries.

iv) Positive shocks to capital regulations were established to increase bank credit in the short run in low-income SSA economies. This was in accordance with the risk-absorption theory, which postulates that increasing the stringency of capital regulatory requirements promotes prudent lending by improving the

risk-bearing capacity of banks (see Kim & Sohn, 2017; Berger & Bouwman, 2009). Although this effect no longer existed in the long run, the results showed that negative shocks to capital requirements affected bank credit adversely in low-income SSA countries in the long run, possibly owing to the reduced risk-bearing capacity of banks, which hampered their capacity to provide more lending, particularly in times of crisis.

v) Macroprudential policies were found to have a negative long-run linear effect on bank lending in middle-income SSA countries, but the strength of bank supervision mitigated that effect. This result was similar to Carreras et al.'s (2018) finding and was in line with expectations as the literature postulated that its effect on bank credit should be countercyclical (Cerutti et al., 2017; Freixas, Laeven & Peydró, 2015; Drehmann & Gambacorta, 2012; Hanson et al., 2011).

Second, the main empirical results from the dynamic PTR model assessing the threshold effects of bank regulatory measures on bank credit in all selected SSA countries included:

i) The stringency of banking entry barriers was found to have a threshold level of 62.8%, with the effect of banking entry barriers on bank credit being positive below this value. Although this result tallied with Amidu's (2014) finding, it held only when banking entry barrier stringency was lower than the threshold value of 62.8%. However, when the stringency of banking entry barriers was higher than that threshold level, its effect on bank credit was negative. These results supported the theory of market structure. As contended by Keeley (1990), imposing banking entry barriers could enhance the market power and profitability of banks through the reduction in competition, thereby promoting more prudent lending. But, in line with Claessens and Klingebiel (2001), stringent banking entry barriers led to excessive reduction in competition and resulted in inefficiencies that forced banks to hike the costs of offering their services, thereby restricting the demand for credit.

ii) Capital regulation stringency was established to have a threshold level of 76.5%. Nonetheless, its coefficients below and above that threshold value were statistically insignificant. This finding neither supported the risk-absorption theory nor the financial fragility-crowding out hypothesis (see Kim & Sohn, 2017). However, this was contrary to the result obtained by Amidu (2014), who established that stringent capital regulatory requirements limited bank credit in SSA economies. Therefore, when controlling for the presence of nonlinear impacts, adjustments in the stringency of capital regulatory requirements did not influence bank credit just like in other empirical studies that employed linear techniques to modelling (see Fratzscher et al., 2016; Bridges et al., 2014; Barth et al., 2004).

Lastly, the main empirical findings from the panel Granger causality models used to examine the symmetric and asymmetric causal association between bank regulatory measures and bank lending included:

i) It was generally established that long-run bidirectional or unidirectional symmetric and asymmetric causality existed between bank regulatory measures and bank credit in the case of selected SSA countries and their income groups. These results supported the hypothesis that Granger causality could exist between institutions and economic performance measures (Law et al., 2013; North, 1981, 1990; Rosenberg & Birdzel, 1986).

ii) In the short run, one-way symmetric and asymmetric causal flows were found, either running from bank regulatory measures to bank lending or from bank lending to bank regulatory measures. The causal flows from bank regulatory measures to bank credit highlighted that bank lending responded to previous different reforms in bank regulation. Lastly, the causal flows from bank credit to bank regulatory measures were in support of the notion that past developments in bank lending influenced reforms in banking regulations (Deli & Hasan, 2017; Fratzscher et al., 2016; Kim et al., 2014).

6.4 Policy Implications and Recommendations

Based on the main empirical findings of this study, the following policy implications and recommendations were reached:

i) Inasmuch as adopting higher bank regulatory measures, especially banking entry barriers, might be recommended, policymakers should not adopt such reforms for their own sake, since too stringent banking regulations could have an adverse medium- to long-term effect on bank credit. Thus, there is a need to balance the stringency of bank regulation for the promotion of financing via increased bank lending and the achievement of resilience and safety of the banking systems.

ii) Policymakers should strengthen the supervisory power of central banks to mitigate the negative effects of banking regulation, particularly banking entry barriers. This would help to minimise moral hazard problems by enhancing monitoring and enforcing regulations.

iii) Regulators should take into consideration the fact that positive and negative shocks to bank regulatory measures do not yield similar impacts on bank credit. Thus, necessary care should be taken when either increasing or reducing the stringency of bank regulation to avoid unintended effects of such endeavours on bank lending.

iv) Regulatory authorities should take into account the presence of threshold impacts in the nexus between bank credit and bank regulatory measures, especially when determining the effectiveness of the latter on the former, since not doing so could result in biased estimates and lead to wrong policy conclusions.

v) Policymakers need to take into consideration not just the short-term but also the long-term causal effects of reforms aimed at enhancing bank regulation or lending since their past developments have a bearing on their current long-run paths. They should also be aware that positive and negative shocks to bank

regulatory measures have different causal effects. As a result, bank regulatory reforms should be well-targeted and well-designed for them to stimulate bank lending.

6.5 Limitations of the Study and Areas for Further Research

The encountered data availability constraints limited the study to focus on a panel of selected SSA economies and include only certain variables as controls. As more data become available in the future, it would be important to undertake single-country analyses and include more controls to determine whether the tested hypotheses in this study would still hold.

Moreover, the nature of the data on bank regulatory measures enabled the study to only determine their threshold effects on bank lending to support the existence of the nonlinear association between bank regulation and bank credit, without necessarily implying that such thresholds are optimal levels of bank regulation that are conducive for bank credit. As a result, future studies could include other relevant factors that would help in determining the optimal levels of bank regulation that are suitable for the promotion of bank lending.

Furthermore, the lack of sufficient frequency data on bank regulatory measures could not allow the use of Dumitrescu and Hurlin (2012) approach to panel causality. Therefore, future studies could adopt this technique or others to account for the possible existence of error cross-sectional dependence and heterogeneity within panel causality frameworks.

Lastly, the econometric approaches used in this study were only appropriate for analysing the existence of first-round effects in the nexus between bank regulation and lending. However, it would be interesting for future research work to incorporate the second-round effects when examining the association between bank regulation and lending to see if the observed effects would be reduced or exacerbated.

REFERENCES

Adesina, K.S. 2019. Basel III liquidity rules: The implications for bank lending growth in Africa. *Economic Systems*, 43(2): 100688. doi: 10.1016/j.ecosys.2018.10.002.

Admati, A.R., DeMarzo, P.M., Hellwig, M.F. & Pfleiderer, P. 2014. Fallacies and irrelevant facts in the debate on capital regulation. In C. Goodhart, D. Gabor, J. Vestergaard, & I. Ertürk (Eds.) *Central banking at a crossroads*. Europe and Beyond: Anthem Press, 33–50. Available at: http://www.jstor.org/stable/j.ctt1gxpd6m.6 [Accessed: 11 June 2021].

Ahmad, M., Rehman, A., Shah, S.A.A., Solangi, Y.A., Chandio, A.A. & Jabeen, G. 2021. Stylized heterogeneous dynamic links among healthcare expenditures, land urbanization, and CO_2 emissions across economic development levels. *Science of The Total Environment*, 753: 142228. doi: 10.1016/j.scitotenv.2020.142228.

Aiyar, S., Calomiris, C.W. & Wieladek, T. 2016. How does credit supply respond to monetary policy and bank minimum capital requirements? *European Economic Review*, 82: 142–165. doi: 10.1016/j.euroecorev.2015.07.021.

Akaike, H. 1974. A new look at the statistical model identification. *IEEE Transactions on Automatic Control*, 19(6): 716–723. doi: 10.1109/TAC.1974.1100705.

Akerlof, G.A. 1970. The market for “lemons”: Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics*, 84(3): 488–500. doi: 10.2307/1879431.

Akinci, O. & Olmstead-Rumsey, J. 2018. How effective are macroprudential policies? An empirical investigation. *Journal of Financial Intermediation*, 33: 33–57. doi: 10.1016/j.jfi.2017.04.001.

Amidu, M. 2014. What influences banks lending in sub-Saharan Africa? *Journal of Emerging Market Finance*, 13(1): 1–42. doi: 10.1177/0972652714534022.

Anginer, D., Bertay, A.C., Cull, R., Demirgüç-Kunt, A. & Mare, D.S. 2019. *Bank regulation and supervision ten years after the global financial crisis*. The World Bank Policy Research Working Paper No. 9044. doi: 10.1596/1813-9450-9044.

Arellano, M. & Bover, O. 1995. Another look at the instrumental variable estimation of

error-components models. *Journal of Econometrics*, 68(1): 29–51. doi: 10.1016/0304-4076(94)01642-D.

Asunka, B.A., Ma, Z., Li, M., Anaba, O.A., Amowine, N. & Hu, W. 2020. Assessing the asymmetric linkages between foreign direct investments and indigenous innovation in developing countries: A non-linear panel auto-regressive distributed lag approach. *South African Journal of Economic and management Sciences*, 23(1): 1–11. doi: 10.4102/sajems.v23i1.3496.

Ayadi, R., Arbak, E., de Groen, W. & Llewellyn, D. 2012. *Regulation of European banks and business models: Towards a new paradigm?* Brussels: Centre for European Policy Studies. Available at: https://ssrn.com/abstract=2098974 [Accessed: 28 August 2020].

Bahaj, S. & Malherbe, F. 2020. The forced safety effect: How higher capital requirements can increase bank lending. *The Journal of Finance*, 75(6): 3013–3053. doi: 10.1111/jofi.12958.

Baltagi, B.H. 2008. *Econometric analysis of panel data*. 6th edition. Chichester: John Wiley & Sons. Available at: https://link.springer.com/book/10.1007%2F978-3-030-53953-5#toc [Accessed: 17 September 2021].

Baltagi, B.H., Feng, Q. & Kao, C. 2012. A Lagrange multiplier test for cross-sectional dependence in a fixed effects panel data model. *Journal of Econometrics*, 170(1): 164–177. doi: 10.1016/j.jeconom.2012.04.004.

Baltensperger, E. & Dermine, J. 1986. *The role of public policy in insuring financial stability: A cross-country, comparative perspective*. Fontainebleau: INSEAD. Available at: https://flora.insead.edu/fichiersti_wp/Inseadwp1986/86-33.pdf [Accessed: 26 August 2020].

Banerjee, A. & Carrion-i-Silvestre, J.L. 2017. Testing for Panel cointegration using common correlated effects estimators. *Journal of Time Series Analysis*, 38(4): 610–636. doi: 10.1111/jtsa.12234.

Bank of Botswana. 2015. *Directive on the revised international convergence of capital measurement and capital convergence for Botswana*. Gaborone: Bank of Botswana. Available at: https://www.bankofbotswana.bw/sites/default/files/Directive-

on-the-Revised-International-Convergence-of-Capital-Measurement-and-Capital-Standards_0.pdf [Accessed: 22 January 2020].

Bank of Mauritius. 2014. *Guideline on scope of application of Basel III and eligible capital*. Port Louis: Bank of Mauritius. Available at: https://www.bom.mu/sites/default/files/Guideline_BaselII.pdf [Accessed: 22 January 2020].

Barth, J.R., Caprio, G. & Levine, R. 2001. *The regulation and supervision of banks around the world: A new database*. The World Bank Policy Research Working Paper No. 2588. doi: 10.1596/1813-9450-2588.

Barth, J.R., Caprio, G. & Levine, R. 2004. Bank regulation and supervision: What works best? *Journal of Financial Intermediation*, 13(2): 205–248. doi: 10.1016/j.jfi.2003.06.002.

Barth, J.R., Caprio, G. & Levine, R. 2008. Bank Regulations are changing: For better or worse? *Comparative Economic Studies*, 50(4): 537–563. doi: 10.1057/ces.2008.33.

Barth, J.R., Caprio, G. & Levine, R. 2013. Bank regulation and supervision in 180 countries from 1999 to 2011. *Journal of Financial Economic Policy*, 5(2): 111–219. doi: 10.1108/17576381311329661.

Basel Committee on Banking Supervision. 2013. *Basel III: The liquidity coverage ratio and liquidity risk monitoring tools.* Basel: Bank for International Settlements. Available at: https://www.bis.org/publ/bcbs238.htm [Accessed: 15 January 2020].

Basel Committee on Banking Supervision. 2014. *Basel III: The net stable funding ratio*. Basel: Bank for International Settlements. Available at: https://www.bis.org/bcbs/publ/d295.htm [Accessed: 15 January 2020].

Berger, A.N. & Bouwman, C.H.S. 2009. Bank liquidity creation. *Review of Financial Studies*, 22(9): 3779–3837. doi: 10.1093/rfs/hhn104.

Berger, A.N., Herring, R.J. & Szegö, G.P. 1995. The role of capital in financial institutions. *Journal of Banking & Finance*, 19(3–4): 393–430. doi: 10.1016/0378-4266(95)00002-X.

Berrospide, J.M. & Edge, R.M. 2010. The effects of bank capital on lending: What do we know, and what does it mean? *International Journal of Central Banking*, 6(4): 5–54. Available at: https://www.ijcb.org/journal/ijcb10q4a2.pdf [Accessed: 10 June 2021].

Blum, J. 1999. Do capital adequacy requirements reduce risks in banking? *Journal of Banking & Finance*, 23(5): 755–771. doi: 10.1016/S0378-4266(98)00113-7.

Boyd, J.H., Chang, C. & Smith, B.D. 1998. Moral hazard under commercial and universal banking. *Journal of Money, Credit and Banking*, 30(3): 426–468. doi: 10.2307/2601249.

Breusch, T.S. & Pagan, A.R. 1980. The Lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies*, 47(1): 239–253. doi: 10.2307/2297111.

Bridges, J., Gregory, D, Nielsen, M., Pezzini, S., Radia, A & Spaltro, M. 2014. *The impact of capital requirements on bank lending*. Bank of England Working Paper No. 486. doi: 10.2139/ssrn.2388773.

Buch, CM. & Prieto, E. 2014. Do better capitalized banks lend less? Long-run panel evidence from Germany. *International Finance*, 17(1): 1–23. doi: 10.1111/infi.12041.

Calem, P. & Rob, R. 1999. The impact of capital-based regulation on bank risk-taking. *Journal of Financial Intermediation*, 8(4): 317–352. doi: 10.1006/jfin.1999.0276.

Caner, M. & Hansen, B.E. 2004. Instrumental variable estimation of a threshold model. *Econometric Theory*, 20(05): 813–843. doi: 10.1017/S0266466604205011.

Carlson, M., Shan, H. & Warusawitharana, M. 2013. Capital ratios and bank lending: A matched bank approach. *Journal of Financial Intermediation*, 22(4): 663–687. doi: 10.1016/j.jfi.2013.06.003.

Carreras, O., Davis, E.P. & Piggott, R. 2018. Assessing macroprudential tools in OECD countries within a cointegration framework. *Journal of Financial Stability*, 37: 112–130. doi: 10.1016/j.jfs.2018.04.004.

Çatik, A.N. & Karaçuka, M. 2012. The bank lending channel in Turkey: Has it

changed after the low-inflation regime? *Applied Economics Letters*, 19(13): 1237–1242. doi: 10.1080/13504851.2011.619479.

Cerutti, E., Claessens, S. & Laeven, L. 2017. The use and effectiveness of macroprudential policies: New evidence. *Journal of Financial Stability*. 28: 203–224. doi: 10.1016/j.jfs.2015.10.004.

Chudik, A. & Pesaran, M.H. 2015. Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors. *Journal of Econometrics*. 188(2): 393–420. doi: 10.1016/j.jeconom.2015.03.007.

Cihak, M., Demirgüç-Kunt, A., Martinez Peria, M.S. & Mohseni-Cheraghlou, A. 2013. Bank regulation and supervision in the context of the global crisis. *Journal of Financial Stability*, 9(4): 733–746. doi: 10.1016/j.jfs.2013.10.002.

Claessens, S. & Klingebiel, D. 2001. Competition and scope of activities in financial services. *The World Bank Research Observer*, 16(1): 19–40. doi: 10.1093/wbro/16.1.19.

Clerc, L. (2008). Liquidity in a time of financial turbulences. *Financial Stability Review*, 11: I–VI. Available at: https://entreprises.banque-france.fr/sites/default/files/medias/documents/financial-stability-review-11_2008-02.pdf#page=11 [Accessed: 15 May 2021].

Colletaz, G. & Hurlin, C. 2006. *Threshold effects of the public capital productivity: an international panel smooth transition approach*. halshs-00008056. Available at: https://halshs.archives-ouvertes.fr/halshs-00008056 [Accessed: 13 September 2020].

Cottarelli, C., Dell'Ariccia, G. & Vladkova-Hollar, I. 2005. Early birds, late risers, and sleeping beauties: Bank credit growth to the private sector in Central and Eastern Europe and in the Balkans. *Journal of Banking & Finance*, 29(1): 83–104. doi: 10.1016/j.jbankfin.2004.06.017.

Crockett, A. 1996. The theory and practice of financial stability. *De Economist*, 144(4): 531–568. doi: 10.1007/BF01371939.

Deli, Y.D. & Hasan, I. 2017. Real effects of bank capital regulations: Global evidence. *Journal of Banking & Finance*, 82: 217–228. doi: 10.1016/j.jbankfin.2016.11.022.

Diamond, D.W. & Dybvig, P.H. 1983. Bank runs, deposit insurance, and liquidity. *Journal of Political Economy*. 91(3): 401–419. doi: 10.1086/261155.

Dincer, N. & Neyapti, B. 2008. What determines the '"legal"' quality of bank regulation and supervision? *Contemporary Economic Policy*. 26(4): 607–622. doi 10.1111/j.1465-7287.2008.00117.x.

Ditzen, J. 2018. Estimating dynamic common-correlated effects in Stata. *The Stata Journal: Promoting communications on statistics and Stata*, 18(3): 585–617. doi: 10.1177/1536867X1801800306.

Djankov, S., Mcliesh, C. & Shleifer, A. 2007. Private credit in 129 countries. *Journal of Financial Economics*, 84(2): 299–329. doi: 10.1016/j.jfineco.2006.03.004.

Drehmann, M. & Gambacorta, L. 2012. The effects of countercyclical capital buffers on bank lending. *Applied Economics Letters*, 19(7): 603–608. doi: 10.1080/13504851.2011.591720.

Dumitrescu, E.I. & Hurlin, C. 2012. Testing for Granger non-causality in heterogeneous panels. *Economic Modelling*, 29(4): 1450–1460. doi: 10.1016/j.econmod.2012.02.014.

Dunkman, W.E. 1933. *Qualitative credit control*. New York: Columbia University Press. Available at: https://dspace.gipe.ac.in/xmlui/bitstream/handle/10973/22267/GIPE-014096.pdf?sequence=3 [Accessed: 14 October 2020].

Eichengreen, B. 2008. Ten questions about the subprime crisis. *Financial Stability Review*, 11:19–28. Available at: https://blocnotesdeleco.banque-france.fr/sites/default/files/medias/documents/financial-stability-review-11_2008-02.pdf#page=29 [Accessed: 9 April 2020].

Engle, R.F. & Granger, C.W.J. 1987. Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55(2): 251–276. doi: 10.2307/1913236.

Enoch, C., Mathieu, P., Mecagni, M. & Kriljenko, J.C. 2015. *Pan-African banks: Opportunities and challenges for cross-border oversight*. Washington, DC:

International Monetary Fund. Available at: https://www.imf.org/en/Publications/Departmental-Papers-Policy-Papers/Issues/2016/12/31/Pan-African-Banks-Opportunities-and-Challenges-for-Cross-Border-Oversight-42781 [Accessed: 2 February 2020].

Fendoğlu, S. 2017. Credit cycles and capital flows: Effectiveness of the macroprudential policy framework in emerging market economies. *Journal of Banking & Finance*, 79: 110–128. doi: 10.1016/j.jbankfin.2017.03.008.

Flannery, M.J. 2014. Maintaining adequate bank capital. *Journal of Money, Credit and Banking*, 46(s1): 157–180. doi: 10.1111/jmcb.12085.

Forbes, K.J. 2019. Macroprudential policy: What we've learned, don't know, and need to do. *AEA Papers and Proceedings*, 109: 470–475. doi: 10.1257/pandp.20191056.

Fratzscher, M., König, P.J. & Lambert, C. 2016. Credit provision and banking stability after the great financial crisis: The role of bank regulation and the quality of governance. *Journal of International Money and Finance*, 66: 113–135. doi: 10.1016/j.jimonfin.2016.02.015.

Freixas, X., Laeven, L. & Peydró, J.L. 2015. *Systemic risk, crises and macroprudential policy*. Cambridge, MA: MIT Press. Available at: https://mitpress.mit.edu/books/systemic-risk-crises-and-macroprudential-regulation [Accessed: 16 March 2020].

Gambacorta, L. & Marques-Ibanez, D. 2011. The bank lending channel: Lessons from the crisis. *Economic Policy*, 26(66): 135–182. doi: 10.1111/j.1468-0327.2011.00261.x.

Global Economic Governance. 2019. *Case study countries: Basel II/III adoption (2019)*. Available at: https://www.geg.ox.ac.uk/project/case-studies [Accessed: 20 July 2020].

Goldenweiser, E.A. 1936. How can credit be controlled? *Proceedings of the Academy of Political Science*, 17(1): 3–9. Available at: https://www.jstor.org/stable/1172408 [Accessed: 30 August 2020].

Gómez, E., Murcia, A., Lizarazo, A. & Mendoza, J.C. 2020. Evaluating the impact of macroprudential policies on credit growth in Colombia. *Journal of Financial Intermediation*, 42: 100843. doi: 10.1016/j.jfi.2019.100843.

Granger, C.W.J. & Yoon, G. 2002. *Hidden cointegration*. (Working Paper No. 2002-02). San Diego: Department of Economics, University of California. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=313831 [Accessed: 23 May 2023].

Greenwood-Nimmo, M. & Tarassow, A. 2016. Monetary shocks, macroprudential shocks and financial stability. *Economic Modelling*, 56: 11–24. doi: 10.1016/j.econmod.2016.03.003.

Hansen, B.E. 1999. Threshold effects in non-dynamic panels: Estimation, testing, and inference. *Journal of Econometrics*, 93(2): 345–368. doi: 10.1016/S0304-4076(99)00025-1.

Hanson, S.G., Kashyap, A.K. & Stein, J.C. 2011. A macroprudential approach to financial regulation. *Journal of Economic Perspectives*. 25(1): 3–28. doi: 10.1257/jep.25.1.3.

Hatemi-j, A. 2012. Asymmetric causality tests with an application. *Empirical Economics*, 43: 447-456. doi: 10.1007/s00181-011-0484-x.

Hendrickson, J.M. & Nichols, M.W. 2001. How does regulation affect the risk taking of banks? A U.S. and Canadian perspective. *Journal of Comparative Policy Analysis: Research and Practice*, 3(1): 59–83. doi: 10.1080/13876980108412654.

Holly, S., Pesaran, M.H. & Yamagata, T. 2010. A spatio-temporal model of house prices in the USA. *Journal of Econometrics*, 158(1): 160–173. doi: 10.1016/j.jeconom.2010.03.040.

Hsieh, M.F. & Lee, C.C. 2020. Foreign bank lending during a crisis: The impact of financial regulations. *Economic Systems*, 44(3): 100791. doi: 10.1016/j.ecosys.2020.100791.

Hu, S. & Gong, D. 2019. Economic policy uncertainty, prudential regulation and bank lending. *Finance Research Letters*, 29: 373–378. doi: 10.1016/j.frl.2018.09.004.

Ibrahim, M. 2019. Capital regulation and Islamic banking performance: A panel evidence. *Bulletin of Monetary Economics and Banking*, 22(1): 47–68. doi: 10.21098/bemp.v22i1.1029.

Ibrahim, M.H. & Rizvi, S.A.R. 2018. Bank lending, deposits and risk-taking in times of crisis: A panel analysis of Islamic and conventional banks. *Emerging Markets Review*, 35: 31–47. doi: 10.1016/j.ememar.2017.12.003.

Im, K.S., Pesaran, M.H. & Shin, Y. 2003. Testing for unit roots in heterogeneous panels. *Journal of Econometrics*, 115(1): 53–74. doi: 10.1016/S0304-4076(03)00092-7.

Imbierowicz, B., Löffler, A. & Vogel, U. 2021. The transmission of bank capital requirements and monetary policy to bank lending in Germany. *Review of International Economics*, 29(1): 144–164. doi: 10.1111/roie.12500.

International Monetary Fund (IMF). 2011. *Macroprudential policy: What instruments and how to use them? Lessons from country experiences*. (WP/11/238). Washington, DC: International Monetary Fund. doi: 10.5089/9781463922603.001.

International Monetary Fund (IMF). 2013. *Key aspects of macroprudential policy*. Washington, DC: International Monetary Fund. Available at: https://www.imf.org/external/np/pp/eng/2013/061013b.pdf#:~:text=Macroprudential policy uses primarily prudential tools to achieve,on loan-to-value %28LTV%29 and debt- to-income %28DTI%29 ratios [Accessed: 13 May 2020].

International Monetary Fund (IMF). 2019. *Sub-Saharan Africa recovery amid elevated uncertainty*. Washington, DC: International Monetary Fund. Available at: https://www.imf.org/en/Publications/REO/SSA/Issues/2019/04/01/sreo0419 [Accessed: 13 May 2020].

Ivashina, V. & Scharfstein, D. 2010. Bank lending during the financial crisis of 2008. *Journal of Financial Economics*, 97(3): 319–338. doi: 10.1016/j.jfineco.2009.12.001.

John, K., John, T.A. & Saunders, A. 1994. Universal banking and firm risk-taking. *Journal of Banking & Finance*, 18(2): 307–323. doi: 10.1016/0378-4266(94)00037-9.

Kao, C. 1999. Spurious regression and residual-based tests for cointegration in panel

data. *Journal of Econometrics*, 90(1): 1–44. doi: 10.1016/S0304-4076(98)00023-2.

Kashyap, A.K., Stein, J.C. & Hanson, S. 2010. An analysis of the impact of 'substantially heightened' capital requirements on large financial institutions. *Booth School of Business, University of Chicago, mimeo*, 2, 1-47. Available at: https://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.361.533&rep=rep1&type=pdf [Accessed: 11 June 2021].

Keeley, M.C. 1985a. The regulation of bank entry. *Economic Review (Federal Reserve Bank of San Francisco)*, 3: 5–13. Available at: https://econpapers.repec.org/article/fipfedfer/y_3a1985_3ai_3asum_3ap_3a5-13.htm [Accessed: 11 August 2020].

Keeley, M.C. 1985b. Bank entry and deregulation. *FRBSF Economic Letter*, August 23. Available at: https://fraser.stlouisfed.org/files/docs/historical/frbsf/frbsf_let/frbsf_let_19850823.pdf [Accessed: 11 August 2020].

Keeley, M.C. 1990. Deposit insurance, risk, and market power in banking. *The American Economic Review*, 80(5): 1183–1200. Available at: https://www.jstor.org/stable/2006769 [Accessed: 11 August 2020].

Kim, D. & Sohn, W. 2017. The effect of bank capital on lending: Does liquidity matter? *Journal of Banking & Finance*, 77: 95–107. doi: 10.1016/j.jbankfin.2017.01.011.

Kim, H., Park, M. & Suh, H. 2014. What forms and reforms banking regulations? A cross-national study. *Emerging Markets Finance and Trade*, 50(6): 72–89. doi: 10.1080/1540496X.2014.1013873.

Kim, K.N. & Katchova, A.L. 2020. Impact of the Basel III bank regulation on US agricultural lending. *Agricultural Finance Review*, 80(3): 321–337. doi: 10.1108/AFR-11-2019-0124.

Kim, S. & Oh, J. 2020. Macroeconomic effects of macroprudential policies: Evidence from LTV and DTI policies in Korea. *Japan and the World Economy*. 53: 100997. doi: 10.1016/j.japwor.2020.100997.

Klingelhöfer, J. & Sun, R. 2019. Macroprudential policy, central banks and financial stability: Evidence from China. *Journal of International Money and Finance*, 93: 19–41. doi: 10.1016/j.jimonfin.2018.12.015.

Košak, M., Li, S., Lončarski, I. & Marinč, M. 2015. Quality of bank capital and bank lending behavior during the global financial crisis. *International Review of Financial Analysis*, 37: 168–183. doi: 10.1016/j.irfa.2014.11.008.

Kouton, J. 2019. The asymmetric linkage between energy use and economic growth in selected African countries: Evidence from a nonlinear panel autoregressive distributed lag model. *Energy Economics*, 83: 475–490. doi: 10.1016/j.eneco.2019.08.006.

Kremer, S., Bick, A. & Nautz, D. 2013. Inflation and growth: New evidence from a dynamic panel threshold analysis. *Empirical Economics*, 44(2): 861–878. doi: 10.1007/s00181-012-0553-9.

Kremers, J.J.M., Ericsson, N.R. & Dolado, J.J. 1992. The power of cointegration tests. *Oxford Bulletin of Economics and Statistics*. 54(3): 325–348. doi: 10.1111/j.1468-0084.1992.tb00005.x.

Kuha, J. 2004. AIC and BIC: Comparisons of assumptions and performance. *Sociological Methods & Research*, 33(2): 188–229. doi: 10.1177/0049124103262065.

Laeven, L. & Valencia, F. 2013. Systemic Banking crises database. *IMF Economic Review*. 61(2):225–270. doi: 10.1057/imfer.2013.12.

Law, S.H., Lim, T.C. & Ismail, N.W. 2013. Institutions and economic development: A Granger causality analysis of panel data evidence. *Economic Systems*, 37(4): 610–624. doi: 10.1016/j.ecosys.2013.05.005.

Law, S.H., Ng, C.H., Kutan, A.M. & Law, Z.K. 2021. Public debt and economic growth in developing countries: Nonlinearity and threshold analysis. *Economic Modelling*, 98: 26–40. doi: 10.1016/j.econmod.2021.02.004.

Le Gall, F., Daumont, R. & Leroux, F. 2004. *Banking in Sub-Saharan Africa: What went wrong?* (WP/04/55). Washington, DC: International Monetary Fund. doi: 10.5089/9781451847659.001.

Levin, A., Lin, C.F. & Chu, J..-S. 2002. Unit root tests in panel data: asymptotic and finite-sample properties. *Journal of Econometrics*. 108(1): 1–24. doi: 10.1016/S0304-4076(01)00098-7.

Li, H., Liu, H. & Veld, C. 2019. The effects of bank regulation stringency on seasoned equity offering announcements. *Journal of International Money and Finance*, 91: 71–85. doi: 10.1016/j.jimonfin.2018.11.001.

Lim, C., Columba, F., Costa, A., Kongsamut, P., Otani, A., Saiyid, M., Wezel, T. & Wu, X. 2011. *Macroprudential policy: What instruments and how to use them? Lessons from country experiences*. (WP/11/238). Washington, DC: International Monetary Fund. Available at: https://www.bookstore.imf.org/books/title/macroprudential-policy-what-instruments-and-how-to-use-them-lessons-from-country-experiences [Accessed: 14 July 2020].

Llewellyn, D.T. 1999. *The economic rationale for financial regulation*. FSA Occasional Series 1. London: Financial Services Authority. Available at: https://www.researchgate.net/profile/David-Llewellyn-4/publication/247849804_The_Economic_Rationale_for_Financial_Regulation/links/53e3573d0cf23a7ff7493f9c/The-Economic-Rationale-for-Financial-Regulation.pdf [Accessed: 25 June 2020].

Loevinger, L. 1966. Regulation and competition as alternatives. *The Antitrust Bulletin*, 11:101–139. Available at: https://heinonline.org/HOL/PrintRequest?collection=journals&handle=hein.journals/antibull11&div=6&print=section&format=PDFsearchable&submit=Print%2FDownload&id=113 [Accessed: 5 October 2020].

Maddala, G.S. & Wu, S. 1999. A Comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and Statistics*, 61(S1): 631–652. doi: 10.1111/1468-0084.0610s1631.

Mahembe, E.E. & Odhiambo, N.M. 2016. Does foreign direct investment cause economic growth? A dynamic panel data analysis for SADC countries. *International Journal of Emerging Markets*, 11(3): 316–332. doi: 10.1108/IJOEM-06-2014-0084.

Mambo, L.P. 2015. *Impact of Basel II implementation: A case study on Zambia*.

Harare: Macroeconomic and Financial Management Institute of Eastern and Southern Africa. Available at: http://mefmi.org/mefmifellows/wp-content/uploads/2016/10/Impact-of-Basel-II-Implementation_-A-Case-of-Zambia_Lyness-Mphiri-Mambo.pdf [Accessed: 18 September 2020].

Martynova, N. 2015. *Effect of bank capital requirements on economic growth: A survey*. De Nederlandsche Bank Working Paper No. 467. doi: 10.2139/ssrn.2577701.

Mawejje, J. & Odhiambo, N.M. 2022. The determinants and cyclicality of fiscal policy: Empirical evidence from East Africa. *International Economics*, 169: 55–70. doi: 10.1016/j.inteco.2021.12.001.

Mecagni, M., Marchettini, D. & Maino, R. 2015. Banking in sub-Saharan Africa: Key features and challenges. In J. Stijns & D. Revoltella (Eds.). *Recent trends in banking in sub-Saharan Africa: From financing to investment*. Luxembourg: European Investment Bank, 9–38. Available at: https://www.academia.edu/download/77769167/834027615.pdf#page=14 [Accessed: 16 December 2020].

Merrouche, O. & Nier, E. 2017. Capital inflows, monetary policy, and financial imbalances. *Journal of International Money and Finance*, 77: 117–142. doi: 10.1016/j.jimonfin.2017.05.004.

Mlachila, M., Cui, L., Jidoud, A., Newiak, M., Radzewicz-Bak, B., Takebe, M., Ye, Y. & Zhang, J. 2016. *Financial development in sub-Saharan Africa*. Washington, DC: International Monetary Fund. doi: 10.5089/9781475532401.087.

Mohammadi, H. & Parvaresh, S. 2014. Energy consumption and output: Evidence from a panel of 14 oil-exporting countries. *Energy Economics*, 41: 41–46. doi: 10.1016/j.eneco.2013.11.002.

Moosa, I.A. 2015. *Good regulation, bad regulation*. London: Palgrave Macmillan UK. doi: 10.1057/9781137447104.

Moscone, F. & Tosetti, E. 2010. Health expenditure and income in the United States. *Health Economics*, 19(12): 1385–1403. doi: 10.1002/hec.1552.

Neyapti, B. & Dincer, N.N. 2014. Macroeconomic impact of bank regulation and

supervision: A cross-country investigation. *Emerging Markets Finance and Trade*, 50(1): 52–70. doi: 10.2753/REE1540-496X500103.

Nickell, S.J. 1996. Competition and corporate performance. *Journal of Political Economy*. 104(4): 724–746. Available at: http://www.jstor.org/stable/213888 [Accessed: 13 August 2020].

Niehans, J. 1983. Financial innovation, multinational banking, and monetary policy. *Journal of Banking & Finance*, 7(4): 537–551. doi: 10.1016/0378-4266(83)90011-0.

North, D.C. 1981. *Structure and change in economic history*. New York: Norton.

North, D.C. 1990. *Institutions, institutional change and economic performance*. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511808678.

Nyantakyi, E.B. & Sy, M. 2015. The banking system in Africa: Main facts and challenges. *Africa Economic Brief*, 6(5): 1–16. Available at: https://www.mfw4a.org/publication/banking-system-africa-main-facts-and-challenges [Accessed: 20 August 2019].

Odhiambo, N.M. 2017. CO_2 emissions and economic growth in sub-Saharan African countries: A panel data analysis. *International Area Studies Review*, 20(3): 264–272. doi: 10.1177/2233865917715943.

Odhiambo, N.M. 2020. Financial development, income inequality and carbon emissions in sub-Saharan African countries: A panel data analysis. *Energy Exploration & Exploitation*, 38(5): 1914–1931. doi: 10.1177/0144598720941999.

Odhiambo, N.M. 2021. Bank-based financial development and foreign direct investment in sub-Saharan African countries: A dynamic causal linkage. *Journal of Sustainable Finance & Investment*. [In press]. doi: 10.1080/20430795.2021.1879561.

Osei-Assibey, E. & Asenso, J.K. 2015. Regulatory capital and its effect on credit growth, non-performing loans and bank efficiency. *Journal of Financial Economic Policy*, 7(4): 401–420. doi: 10.1108/JFEP-03-2015-0018.

Osei, M.J. & Kim, J. 2020. Foreign direct investment and economic growth: Is more financial development better? *Economic Modelling*, 93: 154–161. doi: 10.1016/j.econmod.2020.07.009.

Oyebowale, A.Y. 2020. Determinants of bank lending in Nigeria. *Global Journal of Emerging Market Economies*, 12(3): 378–398. doi: 10.1177/0974910120961573.

Patrick, H.T. 1966. Financial development and economic growth in underdeveloped countries. *Economic Development and Cultural Change*, 14(2): 174–189. Available at: https://www.jstor.org/stable/1152568 [Accessed: 19 September 2020].

Pedroni, P. 1999. Critical values for cointegration tests in heterogeneous panels with multiple regressors. *Oxford Bulletin of Economics and Statistics*, 61(s1): 653–670. doi: 10.1111/1468-0084.0610s1653.

Pedroni, P. 2004. Panel cointegration: Asymptotic and finite sample properties of pooled time series tests with an application to the PPP hypothesis. *Econometric Theory*, 20(3): 597–625. doi: 10.1017/S0266466604203073.

Peltzman, S. 1965. Entry in commercial banking. *The Journal of Law and Economics*, 8: 11–50. doi: 10.1086/466606.

Pesaran, M.H. 2004. *General diagnostic tests for cross section dependence in panels*. CESifo Working Paper No. 1229. Munich. Available at: http://hdl.handle.net/10419/18868 [Accessed: 25 November 2021].

Pesaran, M.H. 2006. Estimation and inference in large heterogeneous panels with a multifactor error structure. *Econometrica*, 74(4): 967–1012. doi: 10.1111/j.1468-0262.2006.00692.x.

Pesaran, M.H. 2007. A simple panel unit root test in the presence of cross-section dependence. *Journal of Applied Econometrics*, 22(2): 265–312. doi: 10.1002/jae.951.

Pesaran, M.H. 2021. General diagnostic tests for cross-sectional dependence in panels. *Empirical Economics*, 60(1): 13–50. doi: 10.1007/s00181-020-01875-7.

Pesaran, M.H, Shin, Y. & Smith, R.P. 1999. Pooled Mean group estimation of dynamic heterogeneous panels. *Journal of the American Statistical Association,* 94(446): 621–634. doi: 10.2307/2670182.

Pesaran, M.H., Ullah, A. & Yamagata, T. 2008. A bias-adjusted LM test of error cross-section independence. *The Econometrics Journal*, 11(1): 105–127. doi: 10.1111/j.1368-423X.2007.00227.x.

Polizzi, S., Scannella, E. & Suárez, N. 2020. The role of capital and liquidity in bank lending: Are banks safer? *Global Policy*, 11(S1): 28–38. doi: 10.1111/1758-5899.12750.

Republic of Ghana. 2016. *Ghana Deposit Protection Act 2016 Act 931*. Available at: https://gdpc.gov.gh/site/statutes/ghana-deposit-protection-act [Accessed: 20 February 2020].

Republic of Namibia. 2018. *Promulgation of Namibia Deposit Guarantee Act, 2018 (Act No. 16 of 2018), of the Parliament*. V. No. 6806. Available at: https://www.lac.org.na/laws/2018/6806.pdf [Accessed: 20 February 2020].

Republic of Zambia. 2014. *Islamic Finance Guidelines - Government Gazette Vol. XLX No. 82*. Available at: https://www.boz.zm/53_IslamicFinanceGuidelines.pdf [Accessed: 20 February 2020].

Repullo, R & Suarez, J. 2013. The procyclical effects of bank capital regulation. *Review of Financial Studies*, 26(2): 452–490. doi: 10.1093/rfs/hhs118.

Revelo, J.D.G., Lucotte, Y. & Pradines-Jobet, F. 2020. Macroprudential and monetary policies: The need to dance the Tango in harmony. *Journal of International Money and Finance*, 108: 102156. doi: 10.1016/j.jimonfin.2020.102156.

Richter, B., Schularick, M. & Shim, I. 2019. The costs of macroprudential policy. *Journal of International Economics*, 118: 263–282. doi: 10.1016/j.jinteco.2018.11.011.

Rochet, J.C. 2008a. Liquidity regulation and the lender of last resort. *Financial Stability Review*, 11: 45–52. Available at: https://abc-economie.banque-france.fr/sites/default/files/medias/documents/financial-stability-review-11_2008-02.pdf#page=55 [Accessed: 17 February 2021].

Rochet, J.C. 2008b. Capital requirements and the behavior of commercial banks. In J.C. Rochet (Ed.). *Why are there so many banking crises? The politics and policy of bank regulation*. Princeton: Princeton University Press, 227–257. doi: doi:10.2307/j.ctt7sxbq.12.

Rosenberg, N. & Birdzel, L. 1986. *How the west grew rich: The economic*

transformation of the industrial world. New York: Basics Books.

Salisu, A.A. & Isah, K.O. 2017. Revisiting the oil price and stock market nexus: A nonlinear Panel ARDL approach. *Economic Modelling*, 66: 258–271. doi: 10.1016/j.econmod.2017.07.010.

Santos, J.A.C. 2001. Bank capital regulation in contemporary banking theory: A review of the literature. *Financial Markets, Institutions and Instruments*, 10(2): 41–84. doi: 10.1111/1468-0416.00042.

Schiavo, S. & Vaona, A. 2008. Poolability and the finance-growth nexus: A cautionary note. *Economics Letters*, 98(2): 144–147. doi: 10.1016/j.econlet.2007.04.015.

Schooner, H.M. & Taylor, M.W. 2010. Sources of financial regulation. In H.M. Schooner & M.W. Taylor (Eds.). *Global bank regulation: Principles and policies*. San Diego: Elsevier, 73–88. doi: 10.1016/B978-0-12-641003-7.00007-6.

Schwarz, G. 1978. Estimating the dimension of a model. *Annals of Statistics*, 6(2): 461–464. Available at: https://www.jstor.org/stable/2958889 [Accessed: 29 March 2021].

Sharpe, S.A. 1995. *Bank capitalization, regulation, and the credit crunch: A critical review of the research findings*. Available at: https://www.researchgate.net/profile/Steven-Sharpe/publication/5035434_Bank_Capitalization_Regulation_and_the_Credit_Crunch_A_Critical_Review_of_the_Research_Findings/links/0046353c99ca461500000000/Bank-Capitalization-Regulation-and-the-Credit-Crunch-A-Cr [Accessed: 11 May 2020].

Shaw, M., Chang, J. & Chen, H.J. 2013. Capital adequacy and the bank lending channel: Macroeconomic implications. *Journal of Macroeconomics*, 36: 121–137. doi: 10.1016/j.jmacro.2012.12.001.

Shin, Y., Yu, B. & Greenwood-Nimmo, M. 2014. Modelling asymmetric cointegration and dynamic multipliers in a nonlinear ARDL framework. In R.C. Sickles & W.C. Horrace (Eds.). *Festschrift in Honor of Peter Schmidt*. New York, NY: Springer, 281–314. doi: 10.1007/978-1-4899-8008-3_9.

Spong, K. 2000. *Banking regulation: Its purposes, implementation, and effects*. 5th edition. Kansas City: Federal Reserve Bank of Kansas City. Available at: https://www.kansascityfed.org/publicat/bankingregulation/RegsBook2000.pdf [Accessed: 29 October 2020].

Stiglitz, J.E. & Weiss, A. 1981. Credit rationing in markets with imperfect information. *The American Economic Review*, 71(3): 393–410. Available at: https://www.jstor.org/stable/1802787 [Accessed: 2 July 2020].

Sum, K. 2016. *Post-crisis banking regulation in the European Union*. Cham: Springer International Publishing. doi: 10.1007/978-3-319-41378-5.

Thakor, A.V. 2014. Bank capital and financial stability: An economic trade-off or a faustian bargain? *Annual Review of Financial Economics*, 6(1): 185–223. doi: 10.1146/annurev-financial-110613-034531.

Thakor, A.V. 1996. Capital requirements, monetary policy, and aggregate bank lending: Theory and empirical evidence. *The Journal of Finance*. 51(1): 279–324. doi: 10.1111/j.1540-6261.1996.tb05210.x.

The IFRS Foundation. 2019. *Who uses the IFRS standards?* Available at: https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/ [Accessed: 20 July 2020].

Thornton, J. & Tommaso, C. 2020. Liquidity and capital in bank lending: Evidence from European banks. *Finance Research Letters*, 34: 101273. doi: 10.1016/j.frl.2019.08.021.

Tillmann, P. 2015. Estimating the effects of macroprudential policy shocks: A Qual VAR approach. *Economics Letters*, 135: 1–4. doi: 10.1016/j.econlet.2015.07.021.

Tiwari, A.K., Apergis, N. & Olayeni, O.R. 2015. Renewable and nonrenewable energy production and economic growth in sub-Saharan Africa: A hidden cointegration analysis. *Applied Economics*, 47(9): 861-882. doi: 10.1080/00036846.2014.982855.

VanHoose, D. 2007. Theories of bank behavior under capital regulation. *Journal of Banking & Finance*, 31(12): 3680–3697. doi: 10.1016/j.jbankfin.2007.01.015.

Wald, A. 1943. Tests of statistical hypotheses concerning several parameters when

the number of observations is large. *Transactions of the American Mathematical Society*, 54(3): 426–482. Available at: https://www.jstor.org/stable/1990256 [Accessed: 3 February 2020].

Wang, Y. & Liu, Q. 2006. Comparison of Akaike information criterion (AIC) and Bayesian information criterion (BIC) in selection of stock–recruitment relationships. *Fisheries Research*, 77(2): 220–225. doi: 10.1016/j.fishres.2005.08.011.

Westerlund, J. 2007. Testing for error correction in panel data. *Oxford Bulletin of Economics and Statistics*, 69(6): 709–748. doi: 10.1111/j.1468-0084.2007.00477.x.

Wooldridge, J.M. 2002. *Econometric analysis of cross section and panel data*. Cambridge: MIT Press.

Yi, X., Liu, S. & Wu, Z. 2022. What drives credit expansion Worldwide?—An empirical investigation with long-term cross-country panel data. *International Review of Economics & Finance*, 80: 225–242. doi: 10.1016/j.iref.2022.02.066.

Zhang, L. & Zoli, E. 2016. Leaning against the wind: Macroprudential policy in Asia. *Journal of Asian Economics*, 42:33–52. doi: 10.1016/j.asieco.2015.11.001.